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Building resilient food system amidst COVID-19: Responses and lessons from China

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ABSTRACT

CONTEXT: The COVID-19 pandemic continues to spread over the world and has heightened concerns over global food security risks. As the first country hit by COVID-19, China has adopted a series of stringent mitigation policies to contain the spread of virus. This has led to food system disruptions due to restrictions on labor and interruption of transport, processing, retailing, and input distribution.

OBJECTIVE: The objective of this contribution is to report evidence for initial impacts and resilience of China’s food system amid the COVID-19 pandemic and to discuss government’s responses as well as long-term efforts that promoted resilience.

METHODS: We reviewed a range of publications, government released reports and official information, blogs, and media articles, and whenever possible, we complemented this qualitative information with quantitative data from China’s National Bureau of Statistics and finally empirical data obtained from a simulation study.

RESULTS AND CONCLUSIONS: We identified China’s earlier responses in each key food system activities including ensuring effective logistics of agricultural products and inputs, supporting production and processing, matching supply with demand, and mitigating consumer’s income loss. In particular, innovative information and communications technology (ICT) applications along the food system had been highlighted. Coupled with China’s long-term efforts in investing in agriculture, building emergency response systems, and adopting governor’s responsibility mechanisms, there has been little panic in the food system with largely sufficient supplies and stable prices. In the second quarter of 2020, after registered negative growth in the first quarter, primary agriculture grew by 3.4% and the negative growth of livestock production was narrowed significantly by 8.7 percentage points. Food prices rose by a modest 0.6% and returned to normal after a surge in February 2020.

SIGNIFICANCE: We expect that China’s experiences on building resilient food systems could improve understanding of the challenges posed by COVID-19 from a retrospective perspective and provide lessons to other countries that are experiencing disruptions in the food systems worldwide. The lessons are also important for strengthening the resilience of food systems over longer time horizons.

1. Introduction

The COVID-19 pandemic continues to spread over the world and has heightened concerns over global food security risks (FSIN, 2020; Torero, 2020). Around the world, many countries have imposed stringent mitigation policies to contain the spread of the virus, lockdown measures and business closures have posed unprecedented challenges on the economy. According to IMF’s economic outlook in June, the global economy is projected to contract sharply by –4.9% in 2020, much worse than that during the 2008–09 financial crisis (IMF, 2020). The combined impacts of COVID-19, its suppression measures and subsequent global recession could disrupt the functioning of food systems, resulting in an increase of the number of people who are hungry and poor, posing significant risks to food and nutrition security (FAO, 2020a).

Even before COVID-19, there was an urgent call for an inclusive food system to address food security and nutrition. 135 million people of 55 countries and territories faced acute food insecurity in 2019 as the number was the highest in the four years (FSIN, 2020). Global grain markets remain well supplied and prices are stable as of the beginning of December, about 10% higher than their January 2020 levels (FAO, 2020b).
The primary risks to food security are at the country level as the combined impacts of covid-19 disruptions and other shocks affecting food production are creating strong tensions and risks in many countries. Rapid phone surveys done by the World Bank in a number of countries confirm the widespread impact of COVID-19 on household incomes and food and nutrition security (World Bank, 2020a). All elements of the food system are affected, from primary supply, to processing, to trade as well as national and international logistics systems, to intermediate and final demand (Schmidhuber et al., 2020).

On the supply side, logistics disruptions have reduced the availability of workers and agricultural inputs such as seeds, animal feeds and fertilizers for farm production. Labor-intensive products such as fruit and vegetable are expected to experience larger impacts due to limits on the mobility of people. For example, a number of major European agricultural producers, including France, Germany, Italy, Spain and Poland’s agricultural sectors faced labor shortages due to border closures that prevent seasonal migrant workers coming to farms (ILO, 2020). Lockdown and travel restrictions also disrupted the movement of inputs to processing facilities and retail markets, affecting the transit of perishable products. Processing businesses and food markets are unable to operate or operate at reduced capacity as a result of COVID-19 outbreak clusters among workers and social distancing measures.

On the demand side, the pandemic has affected food demand through lowered income and rising unemployment, as well as mobility to groceries, restaurants, and other retail stores. Surveys suggest reducing food expenditures and declining nutrient density of diets, as people buy more grains and staples to replace more expensive goods like meat and produce (Hirvonen et al., 2020; Rozelle et al., 2020). At the same time, consumer demand is reported to shift towards food consumed at home, with a sharp decline in restaurant reservations and a soar in retail demand for frozen and packaged foods, requiring important changes in the way food supply chains operate (OECD, 2020a). This is particularly challenging for local farmers who are more likely to rely on open markets and catering, as closures of schools, restaurants and other public catering reduced their ability to sell their products in local markets. Another concern relates to panic buying and hoarding driving up prices of certain goods at the onset of lockdowns. There has been a movement of some countries to put up export restrictions, which would limit global supply and push up food prices of staple foods if others follow suit. But these issues are being resolved, as currently, only 2 countries have active bans in place, representing little of the share of global food trade (Laborde et al., 2020).

Despite these observations, there is much unknown about the functioning of food systems after the early economic lockdown phase, when the economy returns to normal. Given the currently widely held perception that China is a few months ahead in dealing with COVID-19, an analysis of the measures China has pursued to ensure food supply and distribution could be helpful to understand the possible situation and policy options in other countries. As the first country hit by COVID-19, China has adopted a series of stringent mitigation policies to contain the spread of virus. Such policies include an early mandatory lockdown, the suspension of public transportation, and travel restrictions. On January 23, 2020, the mandatory lockdown was first imposed on city of Wuhan when a total number of 444 infected cases were reported in Hubei province. The lockdown was accompanied by travel restrictions for citizen entering and leaving the city. Soon, travel restrictions and restrictions on people’s movement were imposed in most cities, and the first response was the highest level public health emergency put in order by local governments across country. China is also the first country to bring the spread of COVID-19 under control. By early March, China has gradually reopened the economy. China appears to slowly be getting back to normal and its food system has shown signs of resilience. In the second quarter of 2020, the agriculture, manufacturing, and service sectors all registered positive GDP growth. Even in the most impacted fields such as hospitality and livestock production, the negative growth has narrowed significantly. Food prices have also remained stable overall, indicating stable food markets and production despite the pandemic.

This communication aims to examine the impact of the disruptions of COVID-19 and restriction measures on the food system using China’s latest data of the first 2 quarters of the year, followed by a description of China’s practices to build more resilient food systems in response, as well as the way forward from China’s lessons. As more countries have implemented similar lockdown interventions, challenges that China had experienced are likely to emerge in other places of the world. There is little formal analysis on lessons learned from country’s COVID-19 crisis responses on food system. Although several special issues are expected to be available in the coming months, most of the information available at the time of writing is on impacts of the health crisis and containment measures and potential mechanisms to mitigate the impacts (Adhikari et al., 2021; Kumar et al., 2021). A few papers focused on interventions that respond to specific component of the food system, such as seed systems, agricultural production, and trade (Sperling, 2020; Gong et al., 2021; Amjath-Babu et al., 2020; Pu and Zhong, 2020; Chen and Mao, 2020). We expect that China’s experiences could improve understanding of the challenges posed by COVID-19 from a retrospective perspective and provide lessons to other countries that are experiencing disruptions in the agri-food system.

2. Methods

2.1. Concept

To develop a framework for assessing the impacts of COVID-19 as well as identifying lessons from China’s mitigation efforts, in this section we first define the scope of food system. Food systems comprise all the processes involved in keeping us fed and the associated regulatory institutions and activities. It is a dynamic complex system which is constantly changing in response to a myriad of exogenous and endogenous drivers: demographic shifts, economic growth, changing patterns of consumer lifestyles and demand, shifts in trade patterns and investment, new technology, changes in the natural environment, and more (FAO, 2020b). Beyond this all-embracing definition, there is a wide-ranging literature on food systems and nearly all contain the functioning of a food supply chain through which raw materials and inputs are turned into edible food products that are consumed by end-users. In this paper we identified key food system activities in a conventional manner, including producing, processing and packaging, distributing and retailing, and consuming food, the first three of which constitute the food supply chain (Erickson, 2008).

Resilience is variably defined in the literature across different domains and is highly contextual depending on different policy spaces and organizational objectives (Tendall et al., 2015). According to the Intergovernmental Panel on Climate Change (IPCC), resilience is “the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation” (Barro et al., 2014). The FAO defines resilience as “the ability to prevent disasters and crises as well as to anticipate, absorb, accommodate or recover from them in a timely, efficient and sustainable manner” (FAO, 2018). More specifically, the definition includes the capacity of a household to bounce back to a previous level of well-being (for instance food security) after a shock. The definitions cover both the ability to respond to and cope disturbances and retain the same functions, and the idea of adapting and transforming the system in response to the evolving risk environment in the long term. In section 4, we examined the mitigation efforts to recover in each key food system activities identified above—from production to processing and distribution, and to consumers, and in section 5, we aim to generate key lessons on how resilience can be increased in the long term.
2.2. Data description

This study combines both qualitative and quantitative information to describe and analyze the disruptions and recovery of China’s food system following the COVID-19 lockdown initiated in January 2020. Sources of information used for these descriptive analyzes include data from China’s National Bureau of Statistics, publications, government released reports and official information, blogs, media articles and finally empirical data obtained from a simulation study (Zhang et al., 2020a, 2020b) to gauge the likely economic impacts of the pandemic and the control measure put in place on China’s food system.

We referred to the indicators that measure different components of the food system as shares in a country’s total GDP. In 2019, the food system accounted for about 15.2% of total GDP and 32.6% of total employment in China and is identified as a “ballast stone” for the economy (CAAS, 2020). The following sectors and subsectors are considered as components of the food system: (1) traditional primary agriculture— all crops, livestock, forestry and fishing makes up 7.7% of total GDP; (2) Food processing, which is a manufacturing subsector and includes some non-food manufacturing sectors that directly use agricultural raw materials as intermediates, accounts for 3.6% of GDP; (3) Value-added production of inputs used directly by farmers and agro-processors (e.g., fertilizer and banking services) accounts for 1.8% of GDP; (4) Value-added of domestic transportation and trade activities (retailing and wholesaling) associated with the movement of agri-food products between farms, firms and final points of sale (markets) accounts for 1.1% of GDP; and finally, (5) value-added of food services sector and a portion of the value-added in the hotels and accommodation sector accounts for 1% of GDP.

3. China’s food system: Disruptions and recovery

Since the outbreak of COVID-19 in January 2020, both the central and local governments in China have taken unprecedented measures to contain the epidemic. A Central Leadership Group for Epidemic Response and the Joint Prevention and Control Mechanism of the State Council was established. President Xi Jinping requested the prevention and control of the COVID-19 outbreak to be the top priority of government at all levels. China has been successful in containing the spread of the virus by imposing lockdowns relatively early and then transitioning to a testing-based strategy, accompanied by public information campaigns to encourage precautionary behavior (World Bank, 2020b). The government has managed to contain the outbreaks swiftly with new cases from Beijing’s Xinfadi wholesale market to Qingdao city in East China’s Shandong Province. It is unlikely that China will see any large-scale resurgence of the disease given its relatively mature experience on dealing with potential outbreaks (Global Times, 2020).

With stringent mitigation policies to bring the COVID-19 spread under control, a large part of Chinese economy and business activities were shut down in late January and whole February. According to China National Bureau of Statistics, China’s economy dropped by 6.8% in the first quarter of 2020 (NBS, 2020a). The per capita disposable income of residents falls by 3.9% nationwide in the first quarter (NBS, 2020a). Many industries associated with the food system such as manufacturing, trade, transportation, and hotel and catering are hit hard due to the social distancing and other restrictive policies to prevent the spread of virus.

Using a Social Account Multiplier (SAM) multiplier model, Zhang et al. (2020a, 2020b) finds that China’s agri-food sector is significantly hit by COVID-19 during lockdown, the economic cost of COVID-19 and mitigation measures is equivalent to about 7% of the system’s value added and more than 9% of its employment in the first quarter of 2020 compared with 2019, the system is expected to recover and turn to positive growth of 0.7% since the second quarter of 2020. Different sectors and products have experienced heterogenous impacts at different stages of the supply chain. According to NBS’s first quarter data, the negative effect on primary agricultural sector is relatively modest, falling by 2.8% from 2019 (NBS, 2020a). More concerns were on supply of fertilizers, pesticides and other inputs with spring planting on the horizon. According to the China Seed Association (CSA), the pandemic adversely affected the production and operation of more than 90% of seed enterprises. More than 75% of enterprises face transportation challenges (CSA, 2020). However, China managed to have a smooth spring planting and the value added of crop farming grew by 3.5% year on year in the first quarter (NBS, 2020b), while the pandemic had a more significant impact on the output of livestock products which fell by 19.5% (NBS, 2020c). The recorded impact on livestock sector is mainly from lockdown measures and mobility controls, as many production firms reported short of inputs and insufficient workers after the Spring Festival holiday. According to a survey of the enterprises conducted by the China Agricultural University in early February, the price of corn used for feed was risen by more than 100 yuan/ton, and the feed stocks of companies could only be available for a period of 3–4 days. The distribution of livestock products was also disrupted due to restrictions on live poultry and swine trading with the concern that they might be potential epidemic transmission channels. Businesses relying on physical space and shops, such as traditional food markets and restaurants were particularly hit hard. Wholesales and retails, and hotels and restaurants, the most labor-intensive food service sectors, experienced an unprecedented decline in output in the first quarter: 17.8% for retails and wholesales and 35.3% for hotels and restaurants (NBS, 2020b).

In the first quarter of 2020, food prices rose by a modest 0.6%, and the price of vegetables has returned to normal after a surge in February (NBS, 2020a). In February, China’s consumer price index, a gauge of inflation, went up 5.2% year on year, of which food prices surged 21.9%, largely due to pork price hikes triggered by lasting impacts of the African Swine Fever on hog production. On a month-on-month basis, national consumer prices rose 0.8%, while food prices increased 4.3%, led by an uptick in the prices of fresh vegetables and meat. However, in March, both the consumer price index and food prices index declined on a month-on-month basis, which fell 1.2% and 2.7%, respectively. Grocery store shelves have been replenished over time and the impact on price is suggested modest despite sporadic reports of stockpiling behaviors in isolated locations.

China is one of few countries in the world to show early sign of economic recovery. Although the GDP growth rate of China was still negative at −1.9% in the first six months of 2020 compared with the same period of 2019, China’s economy showed restorative growth with GDP growth rate of 3.2% in the second quarter (NBS, 2020b). As China appears to slowly be getting back to normal, negative impacts of control measures on the food supply chain from production, processing, distribution, and sales perspectives are believed to be short-term and could be eliminated with relaxing the control measures for food transportation (Li et al., 2020). From NBS data on the second quarter, the food system seems to have continued to show signs of resilience to absorb, respond to, and recover from the COVID-19 shock. In order to provide a better illustration of the restorative growth, the impact channels and the recent economic performance of different sectors in the food system since the COVID-19 outbreak in the first two quarters are summarized in Table 1.

In the second quarter of 2020, the agriculture, manufacturing, and service sectors all registered positive GDP growth. Primary agriculture grew by 3.4% year on year. The livestock production fell by 10.8% but the negative growth of which was narrowed significantly by 8.7 percentage points compared with that of the first quarter. Manufacturing and service sector were recovered in the second quarter but the first six months of growth was still negative: value added of wholesales and retails, hotels and restaurants, and manufacturing sector in total contracted by 8.1%, 26.8% and 1.4% in the first half of 2020, respectively, comparing to the same period of 2019 (NBS, 2020b).

As shown in Table 1, the recovery differs across different components of the food system. For example, primary agriculture is less affected while accommodation and restaurants sector still need more time to
have a full recovery. China’s pig industry, before hit by the COVID-19 pandemic, has already experienced an epidemic of highly contagious and untreatable African swine fever, thus restoring the capacity is difficult in the short term. Lockdown measures and other COVID-19-related disruptions lead to loss in employment opportunities and income generation, pushing vulnerable population into poverty and hunger. While these challenges and stresses remain, the food system in China demonstrated resilience in the face of COVID-19. Government has adopted a variety of policies and these responses have helped facilitate the recovery of economic sectors and the functioning of supply chains.

4. Lessons from China: Policy responses

From the early stage of the outbreak, Chinese government issued multiple notices covering a series of policies to provide immediate support and mitigate disruptions in the food system through coordination of multiple ministries (see Fig. 1 below). These policies can be divided into several categories on ensuring logistics, ensuring production, matching supply with demand, and market monitoring.

4.1. Ensuring effective logistics

To ensure effective logistics of agricultural products and inputs, the Ministry of Agriculture and Rural Affairs (MARA), Ministry of Transport (MoT), and Ministry of Public Security jointly issued a notice on January 30 urging relevant departments to coordinate to ensure effective logistics for agricultural products and materials. MARA and MoT jointly announced a “green channel” policy for fresh agricultural products and prohibited unauthorized roadblocks for vehicles transporting agricultural products and inputs, namely, (i) newborn livestock, day-old chicks, and breeding animals; (ii) feedstuffs and feed ingredients to ensure adequate animal feed supply; and (iii) livestock products (beef, poultry, eggs and milk). The use of e-commerce and delivery companies is another important means to achieve effective logistics for consumers. As lockdown measures led to a huge spike in demand for home delivery of fresh groceries, e-commerce companies in China announced an in-app
feature for contactless delivery, allowing a courier to leave an order in a convenient spot for customer pick-up, without person-to-person interaction. The use of these delivery platforms has helped resolve logistical challenges, while minimizing the potential risk of infection from visiting crowded food markets.

China also applied a pair-wise aid model to coordinate and mobilize resources. The pair-wise aid model, in which relatively wealthy provincial governments use their resources to directly aid a disaster-stricken county on a one-to-one basis, was a significant institutional innovation and proved successful during the Wenchuan Earthquake (Chen and Hsu, 2016). The National Health Commission paired 16 donor provinces with counterpart cities affected by COVID-19 in Wuhan during the lockdown period to offer direct food transport, and also aid of medical supplies and other necessities. This mechanism enables direct communication between donors and recipients about specific needs and simplifies lengthy and redundant administrative procedures.

4.2. Ensuring normal function of production and processing

Policies on ensuring production include differentiating mobility limits in accordance with local risk levels, promoting work resumption of essential input enterprises, providing financial supports and guidance services (Pei and Ni, 2020). To address labor shortages in farm production, mobility limits are differentiated according to local risk levels. Production activities can be fully resumed in low risk areas, while in areas with higher risk, production activities are limited and resumed in a more cautious manner with necessary epidemic control measures in place. As large numbers of migrant workers who returned to their hometowns for the New Year break were trapped there by quarantine measures, local governments are encouraged to promote local employment of those migrant workers in agricultural production.

With spring planting on the horizon, MARA published a Notice to support spring planting specifying incentives for farmers to conduct their farming activities using the required disease prevention measures, field management of crops, and farm mechanization (MARA, 2020). In the face of social distancing requirements, online channels were used to provide technical services to guide and support farmers’ production. For example, MARA opened a “Spring Planting Online Service Station” to provide live streaming classes and technical posts on websites and social media platforms.

To restore production in livestock sector, which has been significantly impacted, MARA and two other central ministries jointly published an Urgent Notice on addressing practical difficulties, targeting shortages of animal feed and product sales. The Notice called for promoting the resumption of operation of feed production, slaughtering and meat processing enterprises; ensuring smooth delivery of animal feed, breeding animals, meat, dairy products, seafood; and providing incentive measures to support livestock farming (MARA, NDRC and MoT, 2020). Feed production and slaughter enterprises are required to accelerate production in order to restore and increase the effective supply of livestock and poultry products. The government also introduced financial supports for food production to prevent the decrease in the credit balance of agricultural-related enterprises and reduce their financing costs. The Agricultural bank of China has strengthened their services to support 349 key enterprises with stable production and supply of agricultural products, with a loan balance of 41.4 billion yuan. The burden on agricultural enterprises are also mitigated by reducing or delaying the payment of their taxes, reducing their rent, and delaying their payment of social insurance premiums.

4.3. Ensuring effective distribution of food

To address unmarketable supplies of agricultural products due to closures of schools, restaurants and other public caterings, MARA has organized 3 online meetings with participants from both production and sales bodies to facilitate supply-demand matching and managed to promote sales amount of 690 million yuan. MARA has invested in building an online public service platform and aimed to normalize the use of this platform as a long-term mechanism to assist matching agricultural production with sales, especially for products in poorer areas. The government has used close public-private partnership and collaborated with e-commerce enterprises to help more farmers promote their sales with online stores and livestreaming. Major e-commerce platforms have set special channels for agricultural products from epidemic hit areas. The platforms give priorities to perishable products and most affected farmers when pushing information to consumers. E-commerce enterprises also set up targeted funds to support sales of agricultural products. For example, Pinduoduo provided 500 million yuan of special subsidies to purchase unsold agricultural products at a price higher than the average market price to support the income of small farmers, and at the same time, offer vouchers and discounts to encourage consumers to buy these products. China has implemented the emergency mechanism to require all levels of governments to closely monitor food prices and strengthen market supervision of operating entities such as community stores, wholesale markets, and large chain supermarkets to prevent speculation. MARA has developed the National Agricultural and Rural Response to Coronavirus Epidemic Data Service Platform that utilizes big-data to monitor all aspects of market. It gathers data from 6 key topics, namely, national epidemic prevention policies, local new cases, spring production information, market operation, rural area situation, and public opinions.

4.4. Ensuring consumer resilience

In addition to market monitoring to prevent the onset of consumer panics, China also rolled out relief and stimulus packages to address the consumer’s income loss. Economic shocks caused loss of demand and revenue for producers and agri-businesses, due to inhibited production capacity, limited market access, and lack of labor on the supply side, and loss of income, reduced business and consumer confidence on the demand side (OECD, 2020b). China provides policy support to alleviate shortages of cash flow and financial liquidity, in order to facilitate continued production and people’s access to adequate food and nutrition. Authorities first moved to provide support to small and medium sized enterprises (SMEs), which are most vulnerable to economic downturns. The People’s Bank of China launched a special-purpose relending program that by late February provided $114.8 billion in discounted financing to designated banks, which they could then relend to eligible companies of their choice. Policies of reducing taxes and fees that should have expired before June in the initial announcement, including cutting value-added taxes (VAT) of small-scale taxpayers, waiving VAT concerning services in public transportation, catering and accommodation, will be extended until the end of the year. Utilities are required to lower the price of electricity to reduce the cost associated with the resumption of production. Financial authorities also encouraged banks to reduce interest rates, increase debt rollovers and renewal loans to keep SMEs afloat. The Agricultural Bank of China provided credit support with an emphasis on SMEs and farming enterprises. The bank also implemented a raft of other measures, including streamlining loan procedures, reducing service fees, and deferring repayment of loans to aid the companies that were severely impacted by the COVID-19 outbreak.

5. Concluding remarks: Building resilience in the long term

The COVID-19 pandemic significantly disrupted China’s food system through primary agricultural sector, inputs, food processing, retailing and wholesaling, and food services. With government’s long-term investments on ensuring food security and swift policy responses during the pandemic, there is cautious optimism that China’s food system has demonstrated the ability to withstand and recover from disruptions. In this communication, we provide an overview of China’s long-term policy design and successful strategies to ensure food security and promote economic resilience.
policies towards food security and immediate responses amidst the COVID-19. Of course, food system is not uniform around the world, and the differences are quite broad. Although the pandemic has varying impacts on different sectors and different countries, government responses to the pandemic have been broadly similar in terms of the implementation of curfews, travel restrictions and lockdowns. Although the impact these measures have on the ability of governments to ensure the functioning of food system is different, policy responses from China are broad and could offer the following insights for other countries towards resilient food systems that are able to meet challenges brought by the COVID-19 pandemic and beyond in the long term.

Firstly, use of innovative methods to ensure normal function of food supply chains. China offers a good model of keeping the flow of food during the epidemic by, for instance, opening a “green channel” for fresh agricultural products and banning unauthorized roadblocks. Innovative methods of online platforms and e-commerce enterprises have played an important role in each segment of China’s food supply chain. Online platforms using big data techniques assisted the government in monitoring and sharing market information. Technical services to farmers’ production were provided through innovative ICT applications such as livestreaming videos and social media posts. Local governments, industrial associations and farmers use online stores and livestreaming events to promote the sale of agricultural products. In terms of logistics, contactless delivery service offered by delivery companies helped to meet consumers’ increased demand for home delivery of groceries while addressing safety concerns. And as more actors are using these new models, the importance of new innovations has been recognized by the government and the digitalization of food supply chain can be further explored with long-term strategies for e-commerce businesses.

Secondly, targeted policies to support businesses and households. China has adopted series of policies to support agro-food businesses including tax cuts, fee exemptions, credit support, cost reductions and subsidies. While financial support to agri-businesses should help ensure food system functioning, economy shutdowns are likely to continue to affect rural households, requiring additional targeted support for rising unemployment and declining income. In countries like China, sufficient food stocks and response measures helped to keep food availability and market prices steady. But loss of employment and income may lead to drastic reductions in food and nutrition, especially for vulnerable groups. Therefore, people’s ability to purchase food, not food availability, seems to be the biggest threat to food security. Social safety nets are needed to protect those who are the most affected and most vulnerable (Fan et al., 2020). In the case of a food crisis based on previous experience in 2008, countries with reasonably well-established safety-nets for vulnerable populations were better prepared to manage the food crisis. Safety nets, which could be in the form of cash or in-kind transfers, should be accompanied by interventions by health and nutrition officials; investing in the health and nutrition of vulnerable populations could lower the mortality rate of diseases such as COVID-19, given that nutritional levels and mortality rates are intricately linked. Social safety nets are also crucial in the post-epidemic period to drive reconstruction efforts.

Third, increasing and prioritizing investments to build resilient food system. China has prioritized adequate food supplies and food security as a top development goal. Over the years, a significant number of efforts have contributed to build the resilience of China’s food system. As efforts continue to prioritize the improvement of agricultural productivity and the promotion of rural development, agricultural expenditure in China expanded rapidly in the 2000s, far exceeding the growth rate of total government expenditure and surpassing other major developing economies in Asia (Yi et al., 2014). The Chinese government has established a national strategy on food security featuring food self-sufficiency and absolute security of staple food based on domestic grain production. China has implemented farmland protection system and a strategy of sustainable farmland use and innovative application of agricultural technology to increase farmland productivity. According to China’s white paper on food security (SCIO, 2019), China’s food storage facilities continue to modernize, and logistics capacity has increased markedly. All major channels of food logistics have been integrated to form a multimodal transport network composed of highways, railways and waterways.

Over the years, China has built emergency response systems characterized by strategic food reserves with secured storage and releasing the reserve to the market in response to food shortages and price hikes. Emergency food reserves for 10–15 days are available in large and medium-sized cities (SCIO, 2019). A network of emergency reserves, processing, supply outlets, emergency distribution centers, and emergency storage and transportation enterprises is in place to supply subdistricts and communities in urban and rural areas. In early February, the emergency system reshuffled food reserves of meat, rice, flour and edible oils to coronavirus-hit Hubei Province and its capital Wuhan to ensure food security and price stability. In addition, the “Food Basket” Mayor Responsibility Mechanism (FBMRM) and the Provincial Governor’s Grain Responsibility System (PGGRS) also played an important role in ensuring stable production and supply of agricultural products. Introduced in 1988, the FBMRM mandates mayors to be responsible for ensuring food production and supply in their cities. While the PGGRS was issued in 2014 and defines the responsibilities of provincial governors in ensuring food security in terms of production, circulation and consumption in their provinces. Cities are assessed by a working group composed of relevant state departments every two years on their performance in maintaining food security, thus there’s an increased awareness in local governments. The two mechanisms ensured food supplies for fresh produce and meat in local places, combined with emergency food reserve system, when the COVID-19 pandemic hit, cities were able to adapt and meet the need.

Similar pressures on the food system such as zoonotic diseases and climate change are expected to become more common in the future due to high population density and a greater global connection (Alirio et al., 2011; Bhunnoo, 2019), calling for a need for greater investments to build more resilient food systems to avoid future events like COVID-19 turning into food and nutrition crisis, along with immediate responses to mitigate short term disruptions (Bakalis et al., 2020). Strategic grain reserve experienced a welcome rise after the 2008 crisis with the goal of maintaining domestic food prices and has not been mentioned for some time (FAO-OECD, 2011). The costs of reserves and storage and operation can be hard to afford for some countries. The cost-effectiveness of maintaining reserves is also in debate with food losses and spoilage due to operational practices, while the evidence from China shows that strategic food reserves can serve as a useful policy tool to provide a key level of defense against food insecurity and undernutrition in times of emergencies. As such, investing in food system towards a more resilient future needs to be guided by data and analysis aiming at identifying gaps, trade-offs between measures and context-specific opportunities and strategies in post COVID-19 recovery.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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