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Strengthening Supply Chain for Post COVID-19 Food Security: An Exploratory Research Review

Harianto[1], Feryanto[2], Herawati[2], and Amzul Rifin[1*]

[1]Professor and lecturer, Department of Agribusiness, Faculty of Economics and Management, IPB University, Bogor, Indonesia.
[2]Lecturer, Department of Agribusiness, Faculty of Economics and Management, IPB University, Bogor, Indonesia.
[*]Corresponding author
Email addresses: harianto@apps.ipb.ac.id, feryanto.ipb@apps.ipb.ac.id, hera@apps.ipb.ac.id, amzul@apps.ipb.ac.id.

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ABSTRACT

COVID-19 has had a significant impact on food supply chains at both domestic and global levels. At the same time, Indonesia's food security index experienced a significant decline. This study presents an exploratory approach-based research review aiming at identifying problems occurring along food supply chain post COVID-19 pandemic, and at examining possible policies, studies and research needed to improve food security. In addition to relevant previous studies, the authors analysed data from the Indonesian Central Statistics Agency (BPS) and Bank of Indonesia (BI). A number of problems and issues pertinent to Indonesia's food supply chain that may adversely affect food security are identified and a post COVID-19 "exit strategy" to strengthen food supply chain is explored.

Keywords: Food supply chain, food security, post COVID-19 pandemic.

INTRODUCTION

Increasing food security is a manifestation of the mandate of the state law number 18 of 2012. The law defines food security as "the condition of fulfilling food for the state to individuals, which is reflected in the availability of sufficient food, both in quantity and quality, safe, diverse, nutritious, equitable and affordable and does not conflict with the religion, beliefs and culture of the community, in order the person to be able to live a healthy, active and productive life in a sustainable manner". The definition in the law is also in accordance with the definition formulated by FAO, where in the definition of food security there are four dimensions of food security in it, namely availability, affordability, utilization, and

sustainability. Food availability is achieved when sufficient quantities of food are consistently available for all individuals in a country. Food availability is determined by the level of food production, stock levels and net imports.

Availability of adequate food does not automatically guarantee that every individual or household has their food needs met. Concerns about insufficient food access have resulted in a greater policy focus on income, expenditure, markets and prices in achieving food security goals. Food utilization is generally understood as the way the body utilizes various nutrients in food. Adequate intake of energy and nutrients by individuals is the result of quality, safe and diverse feeding practices, combined with good biological utilization of the food consumed. Even though the availability and intake of food is sufficient today, a person or household will be categorized as food insecure if they do not have adequate access to food on a regular basis. The COVID-19 pandemic and disruption of domestic and global food supply chains can disrupt the sustainability of food security.

The top three of United Nations Sustainable Development Goals (SDGs) are the elimination of poverty (SDG 1), the eradication of hunger (SDG 2), and good health and well-being (SDG 3). These three goals are likely to be increasingly difficult to meet in the wake of the COVID-19 crisis (Lau et al., 2020; Poppick, 2020). The Global Report on the Food Crisis 2020 predicts that conflict or war, extreme weather, economic shocks and COVID-19 are expected to be the main drivers of food insecurity. Naidoo and Fisher (2020) argue that COVID-19 threatens all 17 sustainable development goals proclaimed by the UN. The joint statement of FAO, IFAD, World Bank, and WFP further emphasizes that the pandemic has already affected the entire food system. At both domestic and international levels there is an urgent need to develop approaches that can integrate food systems, food supply chains, and value chains (Khoo & Knorr, 2014; Knorr & Watzke, 2019).

During the COVID-19 pandemic, Indonesia experienced a decline in its food security

index. Based on data from the Global Food Security Index (GFSI), issued by The Economist – Intelligent Unit, in 2020 Indonesia's GFSI score was 61.4, and dropped to 59.2 in 2021. The declining GFI score caused Indonesia's food security rating to drop from 65 to 69 out of 113 countries listed in the GFSI. In 2020, Indonesia's food security position was still ranked 62, so that within two years Indonesia has experienced a 7-level decline in its food security rating.

The GFSI index is formulated based on four dimensions of food security, namely affordability or accessibility, availability, quality and safety, and natural resources & resilience. If the GFSI Indonesia in 2021 is compared with the GFSI in 2020, it can be seen that there is a decrease in the affordability aspect, while the other three aspects increase, especially the availability aspect. In the affordability aspect group, the food cost component showed an increase in costs, an increase in the population below the global poverty line, and a low market access and agricultural financial services component, which is a score of 59 out of the best condition score of 100. The low market access score was probably not only caused by various food import tariff policies that have been set but were also influenced by the efficiency of the food supply chain.

The biggest challenge for food security in the future, especially after the pandemic subsides and passes, is not expected to come from food availability, but from the declining aspects of food accessibility (Luckstead et al., 2021) and the increasing importance of food quality and safety aspects (Djekic et al., 2021; Molaee-aghaee & Alikord, 2021; Aday & Aday, 2020). The COVID-19 pandemic has caused the purchasing power of the population to decline as a result of falling income levels and rising food prices. The increase in food prices during the pandemic was caused by the disruption of the food supply chain due to a decrease in the activity of moving people and goods. The number of companies closing and increasing unemployment will lead to increased food insecurity, and the segments of the population most severely affected by the pandemic are usually low-income households (Laborde et al, 2020;

Lau et al., 2020). The COVID-19 pandemic has had a major impact on food systems, and may not function properly (Darnhofer, 2020), and it opens up opportunities for transformative public policies aimed at building more sustainable food systems, as well as enabling innovation. food systems that emerged during the pandemic to be maintained and developed (Hobbs, 2020). At the same time, the crisis caused by the pandemic provides an opportunity for redesigning the food supply chain to make it more resilient and sustainable.

This study aims to analyse the problems faced by the food supply chain and efforts to increase the role of the national food supply chain in strengthening food security. The novelty of this research is to map the problems faced by the food supply chain in the context of strengthening food security to face the era after the COVID-19 pandemic has passed. As far as the authors knowledge, there has been no research to explain what efforts or policies are needed in the future to strengthen the food supply chain to be able to face future shocks, in addition to increasing food security. This research is also highly relevant, because the Indonesian government has just established a new food agency, namely the National Food Agency (NFT) or *Badan Pangan Nasional*. The results of this study are expected to enrich the knowledge of NFS that is intended for the formulation of public policies in the food sector.

METHODS

This research can be categorized as an exploratory-research. Explorative research is carried out if the phenomenon, namely the group, process, activity, or situation being studied does not yet have a sufficient scientific knowledge base. So that certain phenomena can be explored effectively, researchers use a flexible approach in searching for data and an open mind in finding and analysing them (Stebbins, 2021). An exploratory approach is needed to formulate problems and provide suggestions for directions or topics that need to be researched in the future, or suggestions on future policy directions that need to be studied more deeply. Through

this exploratory study, it is hoped that the research directions and policies needed to strengthen the accessibility aspects of food security can be identified when the COVID-19 pandemic has passed.

The data and information employed in this study were sourced from literature searches and from searches for data published by government agencies or data from the mass media. The literature search was carried out on the results of previous research that had been published through various scientific journals or technical reports on the results of the study. In this study, the literatures studied were those published in journals or research reports published after 2012. In that year, Presidential Decree number 26 concerning the Blueprint for the National Logistics System was issued. Journal manuscripts or technical reports submitted for review must have at least one of the following themes: (1) food supply chain management, (2) the effect of COVID-19 on the food supply chain, (3) the effect of global market changes on the food supply chain. food supply, (4) agricultural food supply chain, (5) influence of government policies on food supply chain, (5) effect of COVID-19 on consumption patterns and consumer preferences, and (6) effect of COVID-19 on food and agribusiness sectors.

Selection of key words and database was the first step in data collection. Three databases, namely Google Scholar, Science Direct, and Proquest, were used in the literature search. The articles studied are in the open access category. The key words used in the search for research articles in the Indonesian context are: "Indonesia", "smallholder farm", "*usahatani*", "food production", "*produksi pangan*", "food supply chain", "*rantai pasok pangan*", "marketing channel", "*saluran pemasaran*", "food security", "*ketahanan pangan*", "food safety", "*keamanan pangan*", "food contamination", "COVID-19", "pandemic", "poverty", "*kemiskinan*", "globalization", "*globalisasi*", "climate change", and "*perubahan iklim*", and combination of these keywords. The literature search was also carried out using the snowball method, namely the discovery of literature from literature references that are being

reviewed by researchers.

In addition to literature search, this research also utilizes secondary data. Secondary data comes from the National Statistics Agency (BPS) and the Central Bank of Indonesia (BI). The information obtained from the analysis of secondary data was expected to be able to clarify the description obtained from the literature review. This research also took advantage of news from the mass media, especially those that report problems faced by the actual food supply chain that occurred when the government implemented a strict lockdown policy, or travel restrictions, in the early days of the peak of the COVID-19 pandemic.

Basic concepts. Efficient food supply chains are important factors that determine the accessibility of individuals or households or consumers to food. The actors along the food supply chain determine the food that reaches consumers is quality, safe and sustainable food. An efficient and resilient food supply chain is a food supply chain that is able to deliver food to consumers at competitive costs, so that all actors along the supply chain can benefit and consumers will be satisfied.

The food supply chain basically refers to the process that describes how food originating from farmers, or producers producing primary products, arrives ready for consumption, or is termed from farm to fork. The process includes production, processing, distribution, to consumption. Physically, food moves systematically from the production location (field, cage, pond or sea) until the food is ready to be eaten. Meanwhile, money flows in the opposite direction from consumers to farmers or primary product producers, where money is given to people who work and contribute along the food supply chain. Each step in the process requires resources, human resources, natural resources, and/or capital. The food supply chain consists of parts that are connected to one another in a continuous process, so that if there is a change in one part, the performance of the supply chain as a whole will be affected, and this is manifested

in the form of changes in the quantity and quality of the product, and price changes.

The food supply chain is a complex system, and the easiest way to analyse it is to trace the supply chain from production to production (Hill, 2002):

1. Production: Food supply starts from the level of farmers, breeders, fishermen, or producers of primary commodities. Producers of primary food products, or harvested products, are small-scale farmers or large and medium-sized companies. The cultivation technology used ranges from traditional to modern technology. The products they produce are generally not uniform and vary in terms of variety and quality.
2. Handling and storage: When the product have been harvested, the product will be treated to ensure that the product is suitable for further processing. For example, sweet potatoes need to be washed and cleaned before being stored, or sent to the market or sent to processing plants.
3. Processing and packaging: Food products must meet the eligibility requirements for consumption, before moving to the packaging stage. The product undergoes a sorting and grading process based on certain standards, or the product enters the processing plant and undergoes a change in shape. The product is then packaged before entering the next food supply chain stage.
4. Distribution: The packaged product is then shipped to the final consumer market or spread to other segments of the food industry. Usually, food ends up in the market but can spread to other segments of the food industry. Most of the time food products are transported by car, boat, or by air transport. The distance between the producers of primary products to the final consumers will determine the size of the environmental footprint of food production, which is commonly referred to as the "food print". The longer the process that goes through the product from farmers or producers of primary products to consumers, the

bigger the "food print" it produces and the more unsustainable the food supply chain is from an environmental aspect.

The food supply chain is generally grouped into two categories, namely the fresh food supply chain and the processed food supply chain (Zuubier, 2016). However, in these two supply chain groups, basically the product reaches the consumer through the same process, only differing in the degree of intensity of product treatment and the details. The supply chain processes and stages as mentioned above become the framework of this research. In the context of food security, stages in the food supply chain can be used to identify various problems and challenges that can hinder the accessibility of individuals or households to sufficient, safe and nutritious food.

RESULTS AND DISCUSSIONS

Impacts of COVID-19 pandemic on food supply chain

The COVID-19 pandemic has brought significant problems to food supply chains in various countries (Hobbs, 2020: Rizou et al., 2020; Laborde et al, 2020). This problem was caused by the characteristics of the spread of SARS CoV-2 which relies on interactions between humans. Table 1 shows that the impact of reducing human interaction on agriculture was mainly the disruption of the product supply chain from the farmer level to the retail level. The supply chain was experiencing disruption due to restrictions on the movement of goods between regions within the country. The reduced means of transportation caused agricultural products from production centers to experience obstacles to reach the consumer level. Perishable agricultural products, such as horticultural products and vegetables, experienced a decrease in prices at the farm level and an increase in prices at the retail level. The condition of widening marketing margins due to the Covid-19 pandemic was also experienced by agricultural products in China (Zhou et al, 2020). The marketing margin for agricultural products was widening between the farmer level and the consumer level due to the increase in marketing costs.

Table 1
Problems Faced by The Food Sector During The COVID-19 Pandemic in Selected Countries

India (Urumugam *et al*, 2020)	United States (Tanger, 2020)	China (Huang, 2020)	Indonesia (Ikhsan & Virananda, 2021)
• Government interruption of grain purchases. • Reduced purchases by collectors. • Reducing the availability of labor for harvest. • Declining the availability of transportation services. • Increasing barricades for transporting agricultural products between regions. • Closure of various retail markets for agricultural products.	• Declining the availability of labor at farm level. • Decreased demand for agricultural products (domestic and international). • Decreased availability and access to farm credit. • Disruption of food supply chain. • Disruption to the market at the retail level.	• Restrictions on transportation between regions. • The difference between retail prices and prices at the farm level was widening. • Difficulty in obtaining agricultural labor between regions, which results in disruption of land cultivation and planting. • Disruption of supply of agricultural inputs.	• Disruption of the food supply chain due to strict health protocols, especially the transportation of people and goods from the red zone area category. • Disruption of the food supply chain on the downstream side, especially in traditional markets or wet markets. • Decreased demand for foodstuffs (by restaurants, hotels, and processing industries).

In India, where the marketing of agricultural products is mostly done by the government or has great support through government policies, was experiencing serious problems during the COVID-19 pandemic. The increasingly limited fiscal capacity due to the large budget allocation to overcome the pandemic, had resulted in the reduced ability of the country to absorb agricultural products. The decline and delay in purchasing agricultural food products by the government had made it difficult for farmers to sell their agricultural products.

Different conditions occur in Indonesia, especially in food commodities. During the COVID-19 pandemic, the government successfully managed to stabilize prices for basic food, especially rice. Food prices were relatively under control so that the inflation rate can also be suppressed. Based on data published in the Official Statistics Gazette - Central Statistics

Agency, rice prices at all levels in April 2022 did not show a significant difference compared to prices in April 2019. The success of the Indonesian government in stabilizing rice prices in the midst of the COVID-19 pandemic it could also be seen from the rice marketing margin which has remained relatively unchanged from conditions before and during the COVID-19 pandemic. This stabilization of food prices is especially needed for areas that are relatively isolated from production centers, so that disruption to the food supply chain will not adversely affect the welfare of residents in border or remote areas of Indonesia (Mulyo et al., 2018).

Table 2
Rice marketing margin April 2019 and April 2022

Description	April 2019	April 2022
Price of wet paddy (GKP) at farm level (IDR/Kg)	4357	4369
Price of wet paddy at rice mill (IDR/Kg)	4446	4481
Price of premium rice at rice mill (IDR/Kg)	9465	9577
Price of premium rice at wholesaler (IDR/Kg)	12019	12164
Marketing margin from farm to rice mill (%)	2.04	2.56
Marketing margin from rice mill to wholesaler (%)	26.98	27.01
Marketing margin from farm to wholesaler (%)	175.85	178.41

Source: Central Statistics Agency, 2022 (processed)

The data used to calculate marketing margin was sourced from the Official Statistical Gazette published by the Central Statistics Agency (BPS). The data was obtained by BPS through a food price survey conducted in 31 provinces in Indonesia. Based on the processed results presented in Table 2, it appears that the marketing margin of rice or rice tends to increase between conditions when there was no pandemic and conditions when the Covid-19 pandemic is still in progress. The decline in marketing margins may be due to the decline in profit margins taken by actors along the marketing chain as a response to weakening purchasing power at the consumer level. During the pandemic, when the movement of people was restricted, the movement of basic goods was not subject to restrictions. Vehicles that transport food, such as rice, can still move freely between regions.

The policy that exempts the transportation of basic commodities seems to have succeeded in suppressing food price fluctuations at various marketing levels. The government's

success in stabilizing rice prices during the COVID-19 pandemic is one of the supporting factors for economic stabilization at the household level. Rice is still an important food ingredient, especially for low-income people (Hafizah et al, 2020). Table 2 implicitly shows that the food supply chain, in this case rice, tends to be too long. This can be observed from the very large marketing margins from farmers to the wholesale level, which are 175% and 178% respectively of the price at the farm level before and after COVID-19.

What happened to the price of rice did not mean that all agricultural commodities did not experience problems along their supply chains. Disturbances in the supply chain were mainly experienced by perishable horticultural commodities. Based on data collected from news in the mass media, it can be seen that vegetable farmers were experiencing price pressures during the COVID-19 pandemic. Observations of the mass media of Pikiran Rakyat.com in May 2020, vegetable farmers in Lembang - West Bandung Regency had difficulty selling their products due to restrictions on community activities outside the home. Due to restrictions on market operating hours, the stalls were only open half a day. Vegetable farmers were not free to sell their products. The selling price of curly chilies, which were usually sold at Rp. 30000, had dropped to Rp. 7000 per kilogram. A similar condition was observed by the contributors of the Bisnis.com mass media in various traditional markets in August 2020 in the city of Bandung. The traders in the traditional market said that the prices of various vegetables had fallen. The price of tomatoes, which usually sell for Rp. 10000, has dropped to Rp. 5000 per kilogram. Likewise, the price of cayenne pepper fell to Rp. 24000 per kilogram from the usual price of Rp. 40000 per kilogram. The area of Bandung and its surroundings is one of the most important vegetable centers in West Java. Market conditions in Bandung area were also expected to describe the market conditions in vegetable production centers in other provinces. For example, the news that was reported by Antara in September 2020 which told about the decline in the price of cabbage at the farmer level in Plaosan, Magetan Regency, from around Rp. 4000 to

around Rp. 1500 per kilogram. The similar condition of falling prices for agricultural products also appears to have occurred in the retail market of agricultural products in India and the United States (Table 1).

Food supply chain structure and issues

Indonesia's food demand in the future is expected to continue to increase. Population growth and increase in income are two important variables that can drive the increase in demand. The increase in the household's income has also led to increased consumer demands for quality and varied food products. On the supply side, food availability can be met from domestic and foreign production. Food imports are carried out if domestic food production is estimated to be insufficient or the type of food is not produced by farmers in Indonesia. The risk on the supply side tends to increase. Climate change has a major impact on the certainty of food production at the domestic and global levels. Increased tensions between countries, such as Russia's invasion of Ukraine, and the political and economic rivalry of major powers, have brought uncertainty to the global food market.

The increasing risk and uncertainty on the supply and demand sides of food market, encourage the need to strengthen food supply chain to become not only more efficient but also has high flexibility. A supply chain that has resilience is a supply chain that is able to adapt to changes in its external and internal environment. The resilience of the food supply chain from producers to consumers of course depends on the actors involved along the supply chain, as well as on institutional developments and the technology they apply. The food supply chain, especially perishable ones, is more complex than the supply chain, for example, of the furniture industry or automotive and electronic products (La Scalia et al., 2016). Supply chain management in developing countries is relatively more difficult than in developed countries. Food farmers generally have a small scale, the number of products marketed is small, the quality of the product is diverse, and the locations are scattered, so that the cost of intermediaries

becomes expensive.

The structure and characteristics of the food supply chain in Indonesia of course depend on whether the product is perishable or non-perishable product, or whether the product is primarily dedicated to farm household own consumption or a product that is entirely intended to serve the market, or whether the product is generally consumed directly by consumers without the need for further processing or the product needs to undergo a transformation process before it reaches the final consumer. In this study, the differences in supply chain from product aspect and degree of commercialization were not identified in detail, but as the background for formulating supply chain problems and issues in general.

Although the position of farmers in the food supply chain is the most important, but at the same time the farmers have the weakest bargaining power compared to other actors along the supply chain. Farming is carried out on a small scale and the products sold to the market are also very small compared to the size of the market, so that farmers are always in a price taker position. The resulting product often varies between farmers and between seasons. Consistency in maintaining quality standards is relatively low. Locations for food farming tend to be scattered and the quality of rural infrastructure is still far behind compared to urban areas. The various conditions faced at the farm level cause the intermediary costs to be borne by collectors, both local and inter-regional collectors, to be high. This high intermediary cost is often transmitted in the form of low selling prices obtained by farmers, especially if the product is perishable, farmers do not have proper product storage areas, or farmers must immediately pay installments on money loans from financial institutions.

Table 3
Commonly known food supply chain actors and issues

Aspects of FSC	Actors	Issues
Production	Farmers, suppliers of agriculture inputs, financial institutions	• Lack of skill or capacity in combining inputs for optimal harvest. • Under-developed farm technology. • Inability or limitation in determining the most feasible planting or harvesting schedule. • Consistency of low choice of plant varieties, or frequent changes of crop types, especially in horticultural farming. • Excessive use of chemical pesticides and fertilizers.
Handling & storage	Farmers, collectors, wholesalers, cooperatives SOEs	• Low knowledge of grading and quality standards. • Decreased product quality due to improper handling and storage of products. • Lack of standardized storage facilities, especially in production centers. • Farmers tend to sell their products directly after harvesting.
Processing & packaging	Collectors, wholesalers, cooperatives, food processors, SOEs	• The packaging technology is still low, especially for fresh produce. • The location of food processors is far from the location of farmers, so transportation costs are high. • The rules of product quality standards are often not complied with.
Distribution	Collectors, wholesalers, food processors, cooperatives SOEs, retailers	• Long distribution channels, eg products from farmers to local markets often pass through more than one middlemen level. • High logistics costs due to the low performance of ports and transportation infrastructure, especially for areas outside Java and remote and underdeveloped areas. • Non-competitive market structure and weak bargaining position of farmers. • The absence of market information that is transparent, easily accessible to all market participants, and is real time. • High transaction costs due to unclear product standards and weak compliance with established regulations. • Lacking of supporting factors or enablers, such as the quality of human resources, and physical and institutional infrastructure. • Although the final product of farm produce consumed by consumers without undergone transformation or processing, the price of the product at the farm level is much lower than the price at the retail level.

The COVID-19 pandemic has changed the function and characteristics of food systems around the world. The rapid spread of the SARS-COV 2 virus with all its consequences has shaken the behavior of actors in the food system, from providers of production supplies, farmers

and food producers, processing and logistics industries, to consumers (Guicide et al., 2020). Commonly known weaknesses and problems that exist along the food supply chain, as presented in Table 3, can certainly exacerbate the negative impact of the COVID-19 pandemic. To be able to return to normal conditions, such as before the pandemic, it is necessary not only to repair but also to take anticipatory steps so that the food supply chain contributes significantly to strengthening food security in the future.

Future needs in post COVID-19

Until now, the World Health Organization (WHO) has not stated that the world has passed the COVID-19 pandemic or has begun to enter an endemic period. However, governments in various countries have begun to loosen and even abolish various restrictions that have been limiting movement and interaction between residents. It is feared that loosening-up the restriction will complicate the process of ending the pandemic (Ruktannonchai et al., 2020). The movement of goods or products between countries has relatively recovered. Because the COVID-19 pandemic subsided, food prices on the international market experienced a sharp increase. The recovering economy causes the demand for food to increase, especially in developed countries, so that food prices increase. The increase in food prices is not only caused by an increase in food demand, but also due to the increasingly strong influence of energy prices on food prices (Taghizadeh-Hesary et al., 2019; Ngare & Derek, 2021), as well as the disruption of global food supply chains due to the invasion Russia to Ukraine, as shown by the FAO price index where the price of wheat in March 2022 increased by 19.7%. Food prices on the world market are estimated to be increasingly unstable and tend to move upward.

Prices of staple food, such as rice, were relatively stable (Table 2) before the COVID-19 pandemic or when the pandemic had started to subside. The stability of the rice price was due to the success of the government's policy of stabilizing rice prices rather than the market mechanism, because at the same time the price of rice in the international market increased.

Rice production was relatively undisturbed during the pandemic, and the government had sufficient stock in the BULOG (food logistic SOE) warehouse.

The policy of stabilizing rice prices basically relies on the government's ability to influence rice prices at the retail level through stock instruments at a government-owned company, namely BULOG. When prices in the retail market increase, the government can intervene in the market by selling rice stocks. If the amount of rice production in the country decreases and the stock of rice is estimated to be insufficient to prevent price increases, then BULOG is mandated to import rice from abroad. On the other hand, when the price in the market decreases, which is also followed by a decrease in the price of grain at the farmer level, BULOG is tasked with purchasing rice at the farmer level or at the rice mill level.

This policy of stabilizing rice prices has a negative influence on BULOG's financial performance. Based on the results of calculations on financial indicators whose data is obtained from BULOG's annual financial reports, it can be seen that BULOG bears a large debt burden. The indicators of ratio liability to assets, liability to capital, and liability to fixed assets in 2020, for example, are 57.96, 152.74, and 329.41, respectively. The debt borne by BULOG is very large compared to its assets, capital or fixed assets, meaning that financially BULOG is a company that has a very high financial risk. However, because BULOG is a state-owned company (SOE) whose shares are fully controlled by the government, it still has no difficulty in obtaining loan funds, especially loans from banks whose majority shares are also owned by the government.

Table 4
Price Variability at The Retail Level Before The COVID-19 and During COVID-19 Pandemic for Selected Commodities

Commodity	Coefficient of Variation (%)		
	Before COVID-19	During COVID-19	Percentage change (%Δ)
Chicken	1.1	3.6	2.5
Eggs	1.0	3.2	2.2
Red Chili	5.6	13.2	7.6
Vegetable oil	1.2	2.0	0.8
White sugar	3.5	4.2	0.7
Rice	1.3	0.5	-0.8

Source: PIHPS - Central Bank of Indonesia (BI), 2022 – processed

Other food commodity price policies did not produce the same level of success as the rice price policy (Table 4). Price variability is measured by coefficient of variation (CV), so that the variability of each commodity in the retail market can be compared. The low success of the non-rice food commodity price policy occurred in conditions where the government did not have stock that can be used to intervene. Variations in cooking oil prices in Table 4 were generally relatively stable, because the cooking oil industry tends to have an oligopolistic structure in which the market is dominated by a small number of producers. The success of food price policies is not only determined by the accuracy of predicting future food market conditions, both domestic and international markets (Gouel, 2013), but also depends on the speed and flexibility of public budget allocations for financing, which in the case of Indonesia is determined by the government and as well as the legislative body (DPR). Lessons learned during the COVID-19 pandemic show that various countries are increasingly relying on food supplies originating from domestic production (Cullen, 2020; Kumar et al., 2021), so that food price stabilization policies can no longer depend on their success on international market supplies.

COVID-19 affects consumer habits not only in the choices of types of food consumed, but also in shopping behavior to meet their food needs (Baker et al., 2020). The COVID-19 pandemic has had a positive effect on increasing consumer awareness of nutrition and food

safety and its impact on health (Min et al., 2020; Meixner & Katt, 2020). It is estimated that the positive impact of the COVID-19 pandemic on awareness of the importance of nutritional value and food safety will continue in the future, and can become a benchmark for assessing the performance of the food supply chain, namely how far the supply chain is able to provide food that has high nutritional value and safe in the hands of consumers. The food supply chain, which has been making adjustments to market signals from the production side (upstream), in the future will be increasingly determined by changes in consumer preferences (downstream). The food supply chain is expected to be more flexible to adapt to changes that occur not only on the production side but even more so with changes on the consumption side (Kita et al., 2017).

A possible "exit strategy"

Based on the problems faced by the food supply chain before and during the COVID-19 pandemic, and supported by the results of various studies published in journals and technical reports, it is possible to identify an "exit strategy" from COVID-19 pandemic that needs to be met in the future to strengthen the food supply chain, and at the same time increasing food security:

a) Creating a conducive environment for farmers or food producers to be able to sell directly to the market at the consumer level (Cullen, 2020). Policies are needed that can eliminate various barriers to local food distribution as well as policies to support the management of e-commerce platforms for farmers, and increase opportunities for farmers and food producers to improve their skills in selling their products online (Little & Sylvester, 2022). Based on the results of McKinsey & Company research submitted by Tonby (2020), technology application will determine how business and society are able to respond to various risks that arise from large-scale environmental changes, such as the COVID-19 pandemic.

b) Increase collaboration and cooperation among food stakeholders with the central government and local governments to create a food emergency response framework and mechanism. There needs to be a communication network among food stakeholders to exchange information about various obstacles that occur along the food supply chain and joint efforts that can be made to overcome them, as well as strengthen social assistance programs for poor households to improve their food security (Kumar et al., 2021).

c) There is a need for in-depth studies or research aimed at: (a) Understanding the dynamics and psychology of food choice and intake during and after a pandemic and its effects on long-term food behavior; (b) diversification of product sales channels and methods (intermediaries, processing businesses, wholesalers and retailers, own sales outlets, including online stores; (c) developing interdisciplinary food systems and value chain integration approaches; (d) exploration of needed food supply chain models capable of increasing national self-sufficiency, expanding supply chains, and incorporating rapid tracking and tracking systems; (e) conduct a study of the food supply chain that allows the delivery of products quickly, with clear information, guaranteed quality and safety, and is able to significantly reduce food waste.

The government through Presidential Regulation number 66 of 2021 officially established the National Food Agency (NFA). The task given to the NFA is to carry out government duties in the food sector, where strengthening food security is one of its functions. The NFA functions, among others, as a coordinating agency, formulating, and determining various policies in the food sector, such as food availability, stabilization of food supply and prices, food insecurity and nutrition, food diversification, and also food safety.

NFA also has the function of implementing the procurement, management, and distribution of government food reserves through SOEs in the food sector. NFA has an important task and position in strengthening the food supply chain in order to increase the

accessibility of the population to food. As a public institution mandated in the food sector, the NFA can become a coordinating agency and increase cooperation among actors along the food supply chain, so that a food supply chain can be built that is not only efficient, flexible, and resilient, but also effective in moving food from producers to consumers in a dynamic economic, social, and political environment.

CONCLUSION

The COVID-19 pandemic has affected the food supply chain in Indonesia. The price of food has become increasingly variable, except for staple food which have so far received various government policy intervention. The period of turbulence caused by the impact of the COVID-19 pandemic has shown that short food supply chains benefit consumers as well as producers, for both economic and social institutional reasons.

The question of how to effectively implement the idea of bringing consumers closer to producers and how to improve food quality and safety and the sustainability of food systems, requires further study and evaluation. Along with the increasing demands to strengthen food security on the one hand, and on the other hand the increasing risks arising from external changes, such as war and climate change, a food chain that is not only efficient, but also flexible and resilient is needed. The newly formed National Food Agency can serve as the lead agency as well as the coordinator for the studies and formulation of policies needed to strengthen the food supply chain that is able to support the improvement of food security in Indonesia.

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