COVID-19, Agriculture, and Food Security in Indonesia

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ABSTRACT
COVID-19 pandemic has significantly impacted every part of human life, both economic and non-economic, including agriculture. As a country where many people still rely on agriculture, Indonesia faces a complicated situation if the pandemic continues because food production will be affected. Indonesia announced its first COVID-19 case in March 2020; in response to this, the government applied limitations on economic and non-economic activities. These actions slowed the commercial and industrial sectors, and many people lost their jobs, with middle- and low-income citizens being the hardest hit. The situation presents a high risk for food security due to the decrease in purchasing power and food supply chains not being able to run normally. This study aims to arrange food security strategies post-COVID-19 pandemic. This paper presents, to overcome the food-security issue after COVID-19 in Indonesia, emergency strategies such as controlling food price and providing subsidies for farmer are needed. And long term strategies such as making the food supply chain more effective and increasing food diversification also required. All people and parties need to participate in every relief program for any program to fight the COVID-19 pandemic to succeed.

Keywords
agriculture, COVID-19, food security, Indonesia, strategies

1. Introduction
The end of 2019 marked the arrival of a dangerous novel coronavirus (COVID-19). The virus spread rapidly, and no medicine or vaccine can yet cure this disease (Suman et al., 2020; Sun et al., 2020). Due to fast growth in many countries, the World Health Organization (WHO) announced in March 2020 that COVID-19 was a global pandemic (Paital et al., 2020; Pung et al., 2020). Although efforts have been made by many parties to fight the pandemic, the outbreak continues growing quickly because the world was not ready for this kind of pandemic (Sun et al., 2020).

Social distancing, or physical distancing, is believed to be an effective method for preventing the virus’s spread. Implementation has including closing schools, factories, and places of prayer (Mboera et al., 2020; Paital et al., 2020; Quadri, 2020). Cooperation required all parties, including individuals, to stay healthy and stay at home (Gasmi et al., 2020). The COVID-19 pandemic has provoked stress, panic, and anxiety about health; therefore, people have been advised to stay at home (Ahmed et al., 2020; Kar et al., 2020). However, not everybody agrees with this method, and there have been protests in some countries against social distancing orders because not everybody can work under these conditions (Herren, 2020).

In areas where COVID-19 cases have increased drastically, lockdowns have been implemented to prevent the virus from further spreading (Jribi et al., 2020; Mandal and Pal, 2020; Paital, 2020). Wuhan, China, where COVID-19 originated, successfully implemented lockdown to quash its outbreak. But such a method is more complicated for countries that are economically weaker and demographically different; such countries won’t sacrifice the...
By implementing a lockdown. Instead, they have used social distancing to prevent the virus from spreading at a fast rate (Mboera et al., 2020).

The COVID-19 pandemic has heavily impacted human life; daily life has become difficult, especially for those who live in the lockdown area (Fry-Bowers, 2020; Qarnain et al., 2020). Kar et al. (2020) and Nicola et al. (2020) agree that limiting social activities, enforcing self-isolation, and travel bans have caused many people to lose their jobs. Additionally, food supply has become uncertain due to panic buying.

Economic and non-economic losses are faced by all sectors (Chakraborty and Maity, 2020; Lal et al., 2020; Mukiibi, 2020). Economic conditions since the pandemic began have been uncertain; many companies have said that they can only survive for a short period (Greenville et al., 2020). To balance costs, many employers cut their staff (Fry-Bowers, 2020). Predictions regarding the end of the pandemic are difficult to make due to the many considerations, such as the dynamic of the spread, human mobility, individual protection measures, and transmission rates (Cássaro and Pires, 2020). Tomar and Gupta (2020) and Tuli et al. (2020) recognized prediction as only accurate within a certain range and no more than a useful tool for administrators and health officials.

Agriculture has been one of the sectors most affected by the pandemic (Wang et al., 2020). The industry is essential for food security, which means the pandemic has also affected food security more generally. However, even before the pandemic, food security was a major issue for many countries, especially developing countries; thus, the pandemic has magnified the issue (Thow et al., 2019).

Although many researchers are fighting against COVID-19, many of them have focused on pandemic prediction, impacts, and potential medicines (Ahmar and del Val, 2020). Little has been understood about the relationship between COVID-19, agriculture, and food security, especially in Indonesia. Therefore, this paper investigates strategies regarding food security and agriculture in Indonesia, which have been severely affected by the pandemic. As Coccia (2020) stated, learning from the COVID-19 pandemic can help develop proactive strategies to counter socio-economic problems caused by this and future pandemics.

2. COVID-19 in Indonesia

Geo-environmental conditions have played a substantial role in COVID-19’s growth, with some researchers suggesting that countries with warmer climates have demonstrated slower growth (Asyary and Veruswati, 2020; Coccia, 2020; Gupta et al., 2020; Jahangiri et al., 2020; Tomar and Gupta, 2020; Tosepu et al., 2020). Indonesia is different; with the fourth-biggest population in the world, the virus’ spread is likely fast due to the dense populations in some regions (Djalante et al., 2020). Although Indonesia’s government officially announced the country’s first confirmed case on 2 March, 2020, some experts believe the first case had already appeared (Mikaberidze, 2020; Tosepu et al., 2020). The government has made its data open to the public through the website “covid19.go.id”. This website shows that, by 22 June 2020, there had been 46,845 confirmed cases (including 18,735 recovered and 2,500 dead). The government formed the Coronavirus Disease Response Acceleration Task Force by issuing President Decree No. 7 (2020). These measures support the contention of Shammi et al. (2020) that transparency and good governance are important in fighting the pandemic.

There is a different approach to the pandemic for developing countries such as Indonesia and Brazil. They cannot sacrifice the economy by implementing a lockdown and are more focused on how the country can keep its people eating and working rather than how they can avoid infections (Kar et al., 2020; Mukiibi, 2020). Kirby (2020) stated that developing countries with low incomes have had difficulty handling the pandemic at scale.

The handling of the COVID-19 pandemic in Indonesia has been quite dynamic. Although not applying complete lockdown, some local governments have applied Pembatasan Sosial Berskala Besar (PSBB: Large-Scale Social
Restriction), using the central government’s Government Regulation No. 21 (2020). This approach has included closing schools and work, limiting religious activities, and limiting activities in public spaces. The government also issued President Decree No. 11 (2020), in response to the COVID-19 Health Emergency, stating that all people and parties needed to cooperate to handle the pandemic. Mismanagement, miscommunication, and miscoordination, which are generally common, needed to be avoided for the handling of the pandemic to be successful.

Tuli et al. (2020) predicted that COVID-19 would grow around the world. Therefore, quick and effective actions were required. International experts have expressed concern about Indonesia’s ability to overcome the pandemic because the government has not been fully open with its data, and regulations might not have matched the action required to handle the pandemic (Asyary and Veruswati, 2020). Nonetheless, issuing regulations that can enforce pandemic handling can aid in the fight against COVID-19 (Bellizzi et al., 2020). Regarding information transparency, data from the Indonesian government has improved. The data can be accessed through the internet “covid19.go.id” by anybody; this echoes (Chen et al., 2020), who stated that social media could be used to not only spread information regarding COVID-19 cases but also inform the programs helping to prevent the disease, meaning people can participate or protect themselves. This method also can be used to counter hoaxes surrounding COVID-19.

Individual health characteristics, including habits, immune system, age, and sex, are important factors in the capacity to fight COVID-19 (Coccia, 2020). However, health support facilities are also very important for handling and fighting the pandemic. Lai et al. (2020) saw the increase in confirmed COVID-19 cases proving the lack of healthcare facilities. Figure 1 shows that hospitals and ventilator distribution in Indonesia are still centered on the island of Java. Although confirmed cases are concentrated in Java, the risk for other regions is the same.
Table 1: Government stimulation to save economic sectors

| FIRST STIMULATION PROGRAM | SECOND STIMULATION PROGRAM |
|---------------------------|-----------------------------|
| “Focus on the economic sectors that can stimulate business, especially the tourism and accommodation sectors.” | “Focus on fiscal and non-fiscal programs supporting the acceleration of export-import for goods supporting the fight against COVID-19.” |
| Pre-work card (Kartu Prakerja) | Relaxation of Article 21 Income Tax (PPH 21) |
| Basic food card | Relaxation of Article 22 Income Tax (PPH 22 Import) |
| Housing | Relaxation of Article 25 Income Tax (PPH 25) |
| Incentive for foreign tourists | Value Added Tax (VAT) restitution accelerated |
| Incentive for local tourists | Simplification or reduction of Trade Restrictions and Prohibitions (Lartas) for export |
| Aviation fuel price implementation | Simplification or reduction of Trade Restrictions and Prohibitions (Lartas) for import |
| Incentive for local tourism | Accelerating Export-Import for reputable traders |
| Tax price for hotel and restaurant | Accelerating Export-Import through the National Logistics Ecosystem |

Source: Ministry of Coordinator of Economic Affairs, Republic of Indonesia (2020)

The Indonesian government, through President Instruction No. 4 (2020), and President Decree No. 9 (2020), has taken actions against COVID-19: (1) incentives for medical staff fighting on the front line against the virus; (2) compensation for those who have lost loved ones as a result of COVID-19; (3) through the Coronavirus Disease Response Acceleration Task Force, imports of medical instruments (personal protective equipment, medical masks, and rapid test kits), creation of an emergency hospital and isolation camps on Sebaru, Seribu, and Galang Islands. Additionally, given the COVID-19 pandemic has made the economy uncertain (Greenville et al., 2020), Indonesia has introduced two economic stimulation programs (see Table 1). First stimulation focus on economic sector especially tourism and accommodation sector where these sectors play important role in micro economic. Meanwhile the second stimulation focus on fiscal and non-fiscal program, especially to support the fight against COVID-19.

Additionally, the government has been considering applying a program called “New Normal” to support people and get the economy moving again; this involves people returning to normal activity while applying health protocols such as wearing masks, keeping a distance from others, and keeping clean (Adjie, 2020). This approach would only be applied in areas where the number of confirmed cases is low. To this end, the president instructed the Coronavirus Disease Response Acceleration Task Force to coordinate with local governments (Cabinet Secretary of Republic of Indonesia, 2020).

3. Agriculture in Indonesia

3.1 An overview

Agriculture represents the livelihood of many Indonesia people, especially in rural areas. This sector has been able to survive because it is deeply rooted in the lives of some Indonesian people. A high skill level is not needed, and many involve workers who can be employed (Susanto et al., 2017). Unfortunately, especially for young people, agriculture has been deprioritized. Young people tend to work in industrial or service sectors that provide higher income and greater prestige (Mayuzumi, 2020). Indonesia has also been facing the ageing farmer problem inflicting many countries in Asia (Rigg et al., 2019), Thailand also having same problem with ageing farmers (Saifyut et al., 2017). Ageing farmers make adoption of new technologies or innovations difficult to be achieved. Leite et al. (2019) stated that age affected a farmer’s decision regarding whether or not to adopt a technology or innovation.
As in many countries, Indonesia's staple food is rice; additionally, more than 50% of calories consumed worldwide come from wheat, rice, and maize (Altieri and Nicholls, 2020; Shiferaw et al., 2013). Accordingly, rice-production stability is very important, especially for developing countries such as Indonesia (Shiferaw et al., 2011). Figure 2 shows that rice is the most produced crop in Indonesia and that, between 2014 and 2018, rice production gradually increased. As a staple food for the majority of people in Indonesia, rice has been the main crop for a long time; furthermore, production grew significantly when the government implemented the green revolution in the 1980s. In that period, food self-sufficiency was achieved. However, the program had some negative effects, including decreased land fertility and environmental degradation due to the overuse of chemical fertilizers and pesticides (Djurfeldt, 1972).

Another popular source of carbohydrates for Indonesia people is maize and cassava. Figure 2 shows these crops also demonstrate high levels of production. Soybean, peanut, mungbean, and sweet potato are secondary crops usually planted after the rice has been planted. Crop availability is needed by society because many local foods use these crops as principal or supplementary ingredients.

Nonetheless, as Figure 3 shows, rice and soybeans are imported into Indonesia to fulfil domestic demand or to secure domestic food stock. Although rice production is high, imports are still necessary to meet domestic requirements and/or more to political issues regarding with government policies. Meanwhile, average soybean demand in Indonesia is about 2.3 million tons per year, and domestic production is less than 1 million tons per year; therefore, soybeans are imported (Ningrum et al., 2018). Dependence on imported soybeans to meet demand stems from the past: soybeans are used to produce tempe and tahu, products that are cheap and rich in protein and whose consumption has become a tradition, resulting in increased demand with the population increase.
3.2 Agriculture post-COVID-19

The COVID-19 pandemic has made agriculture in Indonesia more difficult, compounding existing problems such as climate change and regulations not supporting agriculture, such as importing rice during harvest in Indonesia (Mukiibi, 2020). The pandemic has heavily impacted the economic sector, with consequences for individuals, businesses, and whole industries, including the agriculture sector (De Vito and Gómez, 2020; Laing, 2020). Meanwhile agriculture has become a significant sector for surviving the pandemic because it plays an important role in the supply of food (Nicola et al., 2020).

Due to past mismanagement, contemporary agriculture relies on external inputs such as fertilizers and pesticides. This makes agriculture more at risk from pest attacks, climate change, and pandemics (Altieri and Nicholls, 2020). During the pandemic, stock availability and accessibility, in terms of price, became uncertain, conditions that had the potential to force farmers to stop production, affecting food supply. Employee shortage also happen in agriculture sector (Greenville et al., 2020). Malaysia and Thailand are facing the same problem (Chu, 2020; Sihlobo, 2020).

For the agriculture sector to survive and continue supplying enough food, farmers’ awareness of risk management methods needs to improve (Avvisati et al., 2019). To prevent the spread of COVID-19, social distancing was implemented. Following such guidelines has proved difficult for farmers who are commonly uneducated, work in fields, and live in rural areas (Mukhopadhyay, 2020). The pandemic has made farmers already living below the poverty line more vulnerable. Farmer poverty in developing countries is affected by farm size, crop productivity, and demographic factors (Hussain et al., 2006). To secure the food supply, especially during the...
pandemic, the government needs to support farmers. Mukhopadhyay (2020) described India supporting its farmers with compensation for lost crops and by purchasing unsold agricultural produce. In addition to these emergency strategies to save farmers, Lele and Goswami (2020) suggested that input subsidy and investment could help. Furthermore, after the initial impact of the pandemic, farmers have been confused regarding which crops can be sold during this pandemic (Benton, 2020) and, upon returning to work, employee shortage has presented further issues, especially due to people staying home to prevent getting infected by COVID-19 (Greenville et al., 2020). Optimizing the familial or community workforce is one possible strategy to counter this situation. It is worth noting that agricultural activities commonly empower women, especially in the rural areas of developing countries. Wenham et al. (2020) stated that the possibility of COVID-19 infection did not differ by sex; therefore, women have to be vigilant, and efforts to educate farmers’ families regarding COVID-19 should involve women. Greenville et al. (2020) stated that the pandemic first affected the global market and then the local market. Considering that food is a primary need for all people, the agriculture problem is not about consumption but the price. In India, for example, there is surplus production in some areas, but problems regarding sales (Mukhopadhyay, 2020).

Some regions in Indonesia have faced water shortage, especially during the dry season. Before the pandemic, Indonesian agriculture already faced water problems due to climate (Daghagh et al., 2020). But, during the pandemic, this has produced additional dilemma: on the one hand, water is needed for farming, and on the other hand, water is needed to clean bodies and wash hands. This condition can lead the agriculture face more water shortage (Bellizzi et al., 2020).

Susanto et al. (2017) stated that farmer health must also be considered by any relief programs. Disasters affect farmers’ mental lives; as a low-income group, farmers are easily stressed by changes to agricultural production (Yazd et al., 2020). Farmers need to be approached to ease their concerns and help them adapt to the pandemic conditions. This approach would be made more difficult if farmers had also lost their financing. Emerton and Snyder (2018)
suggested that farming decisions are usually affected by economic factors; thus, if the government created a relief program, adapting would be easier. Approaching farmers can also help determine the farmer's needs and preferences (Lakitan et al., 2018); this can be used to improve resistance to disaster by enabling increase of farmers’ entrepreneurial skills. Etriya et al. (2019) proved that farmers who possess entrepreneurial skills are farming better than other farmers, and, accordingly, Indonesia’s Ministry of Agriculture has outlined strategies for the agriculture sector to overcome COVID-19 (as seen in Figure 4). Government more focus on how Indonesia can provide enough food for all people. For comparison in neighbouring country like Malaysia, the government provided RM 40 Million for small medium enterprises (SMEs) involved in food production and agriculture (Shah et al., 2020).

4. Food security in Indonesia

4.1 An overview

Food security comprises three components: food accessibility, food availability, and food utilization. Food accessibility means everybody can access food; this component considers pricing and supply chains. Food availability describes food being available for everybody; this component considers agricultural production and storage and, when local production is insufficient, food imports (Douglas, 2009; Grote, 2014; Ho et al., 2018; Kharisma and Abe, 2020). Food utilization refers to people consuming adequately nutritious food.

The Food and Agriculture Organization (FAO) defines food security as the condition where, economically and physically, everybody always has sufficient, safe, and nutritious food (FAO, 1996). Headey and Ecker (2013) stated that the ideal food security indicators are calories, poverty, and dietary diversity. Food security is a global concern (Wahlqvist et al., 2012) and is a challenge for many middle- and low-income countries, including Indonesia (Thow et al., 2019). Self-production and imports are methods for filling domestic food needs. Reliance solely upon imported food presents a big problem in the future; as food prices increase globally, middle- and low-income countries will be increasingly unable to afford to buy food from other countries (Funk and Brown, 2009), leading to steep domestic food prices caused by heavily imported food (Svanidze et al., 2019).

Table 2: Food security index for 34 provinces in Indonesia

| Priority | Index          | Province                                                                           | Total |
|----------|----------------|------------------------------------------------------------------------------------|-------|
| 1        | <= 37.61       | West Papua and Papua                                                               | 2     |
| 2        | > 37.61 – 48.27| Kep. Bangka Belitung, West Kalimantan, Maluku, and East Nusa Tenggara              | -     |
| 3        | > 48.27 – 57.11| West Nusa Tenggara, Riau, Bengkulu, West Sulawesi and Kepulauan Riau              | 4     |
| 4        | > 57.11 – 65.96| East Java, North Kalimantan, Central Kalimantan, Lampung, North Sumatera, South   | 5     |
|          |                | Sumatra, Gorontalo, Jambi, Central Sulawesi, Jakarta, North Maluku, and Aceh      |       |
| 5        | > 65.96– 74.40 | Bali, Yogyakarta, North Sulawesi, Central Java, South Sulawesi, Southeast Sulawesi,| 12    |
|          |                | East Kalimantan, West Java, West Sumatra, South Kalimantan, and Banten            |       |

Source: Food Security Bureau, Republic of Indonesia (2020)

Although food security is in a race against population growth, Grote (2014) and Goyal (2012) showed that population pressure, poverty, land degradation, and unstable environments had pushed food security further out of
reach. This has been compounded by climate change and natural disasters (Cai et al., 2020). Douglas (2009) stated that agricultural development, people's purchase ability, regional accessibility, and social, psychological, behavioral, political, and economic stability are factors affecting food security.

Food security is unevenly distributed in Indonesia (see Table 2). In 2019, the Indonesian Ministry of Agriculture stated that two provinces in Indonesia, Papua, and West Papua, have a low food security index and development there should be considered priority-1. Four provinces are considered priority-3: East Nusa Tenggara, Maluku, West Kalimantan, and Bangka Belitung Islands (Food Security Bureau, Republic of Indonesia 2020).

4.2 Food security post-COVID-19

In Indonesia, food security can be considered in terms of rural and urban areas. Based on research by (Kharisma and Abe, 2020), in the period before the pandemic hit Indonesia, 27.4% Indonesian people in an urban area were at a level of insecurity; this has undoubtedly increased due to the pandemic. Anderson et al. (2013) found that Indonesian self-sufficiency in 2004 was 0.95; in 2030, it is predicted to be 0.83. Under normal conditions, Indonesia cannot meet demands for self-sufficiency; thus, it is even more incapable under COVID-19 conditions. Figure 3 showed that Indonesia was still importing food from overseas, especially rice and soybeans, to fill domestic demand and secure national food needs. Greenville et al. (2020) stated that for a country that is not self-sufficient, such as Indonesia, food exports need to be stopped to focus on filling domestic food demand. Learning from Vietnam, they banned the rice export, and Thailand has banned the export of chicken eggs (Shaharudin, 2020). Meanwhile, Figure 2 shows the production of food products, indicating that rice production is increasing, and in Figure 3 shows the import and consumption of rice in Indonesia where government still importing food for fulfilling and/or securing food stock. Food shortage can drive food insecurity, leading to people receiving less nutrition and lower immunity, conditions which make people more susceptible to COVID-19 (Fry-Bowers, 2020).

Additionally, the pandemic has caused unemployment everywhere, leading people to lose their income and increasing food insecurity (Fry-Bowers, 2020; Kharisma and Abe, 2020). Food insecurity is most felt by people in lower socioeconomic classes, especially women and children. It is clear that, for the benefit of future generations, food security must be acquired (Douglas, 2009). Food security can be approached through regulating food production, implementing family planning programs, integrating food systems, and considering the environment (Wahlqvist et al., 2012). Efficiency in terms of food marketing also needs to be considered (Anderson et al., 2013). Additionally, Indonesia requires supporting activities such as research regarding food production, farmer incomes, and sustainable agriculture (Devaux, Kromann, and Ortiz, 2014).

Food-security adaptations arising from COVID-19 need to be enacted as soon as possible by considering all possible short-and-long-term impacts. The WHO has stated that COVID-19 may never disappear (Millard, 2020). The Indonesian president’s response to that statement was to encourage people to go back to work under “new normal” conditions. This encouragement made people feel safe working again, enabling the economy to regenerate. Although some experts have said that this action risks further COVID-19 spread, many people have returned to normal activities while following health protocols (Adjie, 2020).

Ho et al. (2018) and Stephens et al. (2020) have stated that food demand during the pandemic would not be easy to fill; thus, a food crisis could arise if no measurements are applied. There are two suggested forms of adaptation: proactive adaptation and planned adaptation. Proactive adaptation refers to actions for overcoming the crisis, including importing food and optimizing local resources. Planned adaptation refers to actions that are prepared for future benefits, such as increasing local food production and food-production diversification. Efforts to increase local food production are necessary for food security. Indonesia would be strengthened by relying on local
production rather than imported food (Bishwajit et al., 2013). Furthermore, agricultural success is affected by land conditions and amount and quality of inputs such as fertilizer, seed, and pesticides (Funk and Brown, 2009); thus, regulation regarding supporting local production is essential, especially during this pandemic, where goods circulation is abnormal or complicated by limited governmental activity (Herren, 2020).

Local production can be increased not only agriculturally but also in the context of individual properties; houses in rural areas in Indonesia commonly have a yard that can be filled with fruit-bearing plants. Using the yard to plant food crops for self-consumption can support the food security program at the grassroots level. In this way, both farmers and non-farmers can participate in fulfilling domestic food demands (Abdoellah et al., 2020; Helm D, 2020).

Another way of supporting local food sufficiency is through food diversification. People should diversify their food consumption to reduce dependence on a single food product. Through food consumption diversification, farming systems can also diversify (Herren, 2020; Juhro and Iyke, 2019; Shiferaw et al., 2013).

Additionally, planting only one crop makes a farm more vulnerable to pests, weeds, and disease, increasing dependence on chemicals (Altieri and Nicholls, 2020). However, information and mechanization regarding farm-level production are needed to support food-and-farming-system diversification (Masters et al., 2015). Thus, technological development is necessary to support local food production (Adenle et al., 2019).

In Indonesia, rice is not the universal staple food; in some regions, the staple foods are maize, cassava, and sago. This indicates that food diversification has potential in Indonesia. Altieri and Nicholls (2020) stated that many countries around the world failed to reach food security because they don’t do much on food diversification. This suggests local traditions and wisdom need to be considered in the context of food security (Myers et al., 2014).

Flood (2010) stated that harvest lost, retail loss, and home waste are food-security issues; these aspects represent positive sides of the pandemic in terms of food security. People want to save as much money as much as they can, making them more aware of food waste and leading to strategies for using everything that has been purchased (Jribi et al., 2020). Awareness of avoiding food waste during the pandemic has increased because many people have lost their job and cannot eat at the same level as before the pandemic (Grote, 2014). This awareness can support efforts to increase food security.

Even though Indonesia hasn’t applied strict lockdown measures to minimize the spread of COVID-19, but some regions have applied PSBB or limited certain activities. Food production is commonly centered on particular regions, with other regions importing that food. However, limitations on economic and non-economic activities have impacted the food-supply chain (Herren, 2020; Mukhopadhyay, 2020; Helm D, 2020). Lassa et al. (2019) stated that every food system is impacted by the disaster. A quick response to this problem is required to simplify the food-supply chain (Shokrani et al., 2020).

Supply-chain problems affect the market system and food price (Tadesse et al., 2014). The market needs to be monitored to control food prices and keep food accessible for all people; in other words, to reach food security (Svanidze et al., 2019). Figure 5 shows fluctuations in the price of rice in Indonesia during the pandemic. The fluctuation was insubstantial in some regions; however, if the pandemic continues, increases cannot be avoided. Different price in each region is caused by the supply chain system, other cause is US Dollar rate (Tadesse et al., 2014). West Nusa Tenggara shows the lowest average price; meanwhile, regions such as Central Kalimantan show a significant increase. Although West Sumatra’s price is above the national level and quite high compared to other regions, there hasn’t been a substantial increase. On Java, Jakarta has the highest price, followed by West Java, Central Java, and East Java. This is caused by living expense in these areas are quite higher than other areas.

The government plays an important role in protecting the price and system through regulations (Lele and Goswami, 2020). Food security is closely related to trade, demand, and price (Sulser et al., 2011). Problems arising...
from agriculture and the food-supply chain are widespread food shortage and sharp price increases (Altieri and Nicholls, 2020), serious problems for food security (Savary et al., 2012). Before the pandemic, increasing food prices were already a big problem; thus, the arrival of the pandemic and associated unemployment meant the food-price fluctuations had a great impact (Flood, 2010). Stark price rises have been triggered by the perception that food will be scarce, leading to panic buying (Benton, 2020), forcing governments to find suitable short- and long-term strategies (Anderson et al., 2013).

The balance between food supply and demand in recent decades has not been ideal and has been worsened by the pandemic (Savary et al., 2012). Importing food is one solution to meeting demand. But, as Mukibi (2020) and Sulser et al. (2011) suggested, broad food imports make countries dependent on imported food. Limitations on exports and imports during the pandemic applied have meant that countries relying on imported food are more vulnerable to food insecurity due to difficulties importing food.

The Indonesian Bureau of Logistics (BULOG) is a government-owned company that controls food stock, distribution, and price. The agency operates around the country and has been able to manage food supply and control prices during the pandemic (Rosana FC, 2020). Hasegawa and Matsuoka (2013) stated that mitigating disaster risks is essential for overcoming the pandemic, including planning emergency and long-term strategies. To keep within the response budget, the targets of relief actions can be focused.

### 4.3 Food security strategies post-COVID-19

Post-COVID-19 food-security strategies should be long-term considerations, and they should be supported by regulations (Shiferaw et al., 2011; Sullivan-Wiley and Short, 2017). Those strategies must be based on current and
future perspective. Based on above review, SWOT (Strength, Weakness, Opportunity, and Threat) analysis of agriculture and food security in Indonesia post-COVID-19 had been done (as seen in Figure 6). The strengths are agriculture is deeply rooted in society, number of farmers, and government fund for COVID-19 impact recovery that can be used for agriculture sector too. The opportunities are food demand is stable, local production is being concerned, and agriculture become main sector during pandemic. The weaknesses are depending on external output, often importing food, food waste culture, and less in food diversification. Meanwhile for the threats are food price hikes, increasing of agricultural input, and supply chain is disturbed.

From SWOT analysis (Figure 6), the strategies can be made, Figure 7 presents a review and demonstration of the recommended strategies for the Indonesian government to secure Indonesia's food security after the pandemic. These strategies are divided into emergency strategies and long-term strategies. Emergency strategies are conducted as proactive actions against the pandemic. Long-term strategies, however, are planned adaptations (Ho et al., 2018). Both strategies show that the BULOG’s role is quite important in implementing emergency and long-term strategies for managing food stock, distribution, and price. Nonetheless, an investigation into the public sector is needed to support the strategies outlined (Shiferaw et al., 2013).

Emergency strategies include controlling food prices, regulating food distribution during PSBB, increasing food-waste awareness, compensating or providing subsidies for farmers, buying unsold agricultural products, minimize unnecessary food imports, optimizing the BULOG’s role in releasing food stock, and increasing dietary awareness to increase immunity. Long-term strategies include optimizing the BULOG’s role in stabilizing food prices, making the supply chain more effective, increasing agricultural production support through subsidies,
compensation, and input price controls, diversifying farming systems and products, increasing food diversification, optimizing the BULOG’s role in controlling food stock, minimizing imports, and educating the population regarding food utilization.

For the success of these programs, regulation must be followed by providing broad access to the public, especially farmers (Covey et al., 2020). Extension activities can contribute to the spread of relief programs to farmers (Hasibuan et al., 2019). However, although regulation and action against COVID-19 are required as soon as possible, the government should not rush such processes (Resosudarmo et al., 2019).

5. Conclusion

The COVID-19 pandemic has affected all aspects of human life, both economic and non-economic, including agriculture. As a country that puts agriculture in a strategic position, Indonesia has been heavily impacted by this pandemic. The rise of input price during pandemic makes farmers facing difficult situations. As response to COVID-19, Ministry of Agriculture, Republic of Indonesia issued some strategies that more focus on how the government can fulfill food for all people. Food security after this pandemic is tough work, based on SWOT analysis, Indonesia can apply two strategies: emergency strategies and long-term strategies. Emergency strategies include controlling food prices, regulating food distribution during PSBB, raising food-waste awareness, compensating or subsidizing farmers, buying unsold agricultural products, minimizing unnecessary food imports, optimizing the BULOG’s role in releasing food stock, and increasing dietary awareness to increase immunity. Long-term strategies include making the supply chains more effective, supporting agricultural production through subsidies, compensation, and input price controls, diversifying farming systems and products, and optimizing the BULOG’s role in the areas of food-
price stabilization, food stock control, import minimization, and education on food utilization. Both types of strategies are very important for securing Indonesia’s food security post-COVID-19. Although WHO has stated that COVID-19 might never disappear completely, by applying health protocols, farmers and people have been able to return to activities that can regenerate economic growth and securing food security.

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