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Food security policy during the covid-19 pandemic in Indonesia

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ABSTRACT
Background: The Covid-19 pandemic, which began in early 2020, had a significant impact on various sectors, including the food sector in Indonesia. Food, as a basic human necessity, became a strategic commodity vulnerable to crises during the pandemic. Food policy in Indonesia encompasses subsystems of availability, distribution, and consumption, which affect the stability of supply and access to food. Given the pandemic, the importance of sustainable policy interventions to maintain food security has become crucial. **Methods**: This study employs a literature review method by collecting, reviewing, and synthesizing various literature from relevant sources. The literature search was conducted systematically through academic databases, focusing on food policy during the pandemic within the environmental science paradigm, including ecosystems, socio-cultural characteristics, and the interrelationship between food, energy, water, and ecological footprint. **Findings:** The study reveals that the government played a crucial role in maintaining food stability during the Covid-19 pandemic. The government must ensure that all food subsystems, from production to consumption, function optimally. A strong synergy between the government, private sector, and community is required to address potential food crises. Additionally, the stability of agroecosystems is also vital for sustaining agricultural production. **Conclusion**: Food policy during the pandemic should focus on sustainability and involve various stakeholders. The government needs to coordinate policy processes that encompass the entire food supply chain, from farmers to consumers, to ensure stable food security. **Novelty/Originality of this article:** The analysis of food policy during the pandemic with an ecological approach highlights the importance of integrating policies, communities, and agricultural ecosystem sustainability.

KEYWORDS: agroecosystem; food policy; food security.

1. Introduction

The emergence of the Coronavirus in early 2020 stunned the public. The World Health Organization (WHO) proclaimed Covid-19 a global pandemic in March 2020, citing the increasing number of cases and rapid spread. On March 2, 2020, Indonesia's President formally confirmed the existence of Covid-19. Since then, cases have started to surface and rise swiftly. Covid-19 has not only become a health crisis, but it has also had an impact on other sectors of the economy, including agriculture.

Agriculture is intimately linked to food, which is a basic human requirement. Food is a critical and strategic commodity in Indonesia, therefore its fulfillment is a shared obligation between the government and the society. According to Food Law No. 7 of 1996, the government is responsible for regulation, direction, control, and monitoring, whereas the

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community is responsible for the production process, provision, commerce, distribution, and as consumers with the right to enough food.

The COVID-19 pandemic has had a profound impact on food policy. In Indonesia, food security and related policies are extremely sensitive during the development process. The food policy system has three major subsystems: availability, distribution, and consumption. Each of these subsystems indicates supply stability, public access to food, and food consumption. During the epidemic, food policies and attempts to ensure food security were priority to avoid a disaster.

Between 1973 and 1975, Indonesia had a food crisis caused by the El Niño event. Rice imports were essentially nonexistent between April 1973 and January 1974, pushing Indonesia closer to self-sufficiency. Large-scale crop failures caused a spike in food costs, harming both farmers and consumers. This crisis highlighted the significance of suitable policies, such as investment in the agricultural sector, import regulation, and social protection, that are also crucial during the COVID-19 epidemic.

In light of this, food, as a basic human necessity, necessitates government intervention during pandemics. This article will identify and analyze food policy during the pandemic using an environmental science method, which will include an awareness of ecosystems, socio-cultural components of the community, the interconnectedness of food, energy, and water, and *ecological footprint*.

2. Methods

This article uses the literature review research approach. This method entails obtaining, examining, and synthesizing relevant literature from numerous sources published in the important topic of research. The initial stage entails doing a systematic search in academic databases and other informative sources using keywords related to the research topic. The literature is then carefully selected using predetermined inclusion and exclusion criteria, with an emphasis on the quality, relevancy, and uniqueness of the content. After selecting the literature, an in-depth study of the text is performed to uncover noteworthy patterns, trends, and results. This method also includes categorizing literature to organize information based on pertinent themes or concepts. The literature review method's strengths and limitations are also assessed to guarantee that the analysis results are valid and reliable.

3. Results and Discussion

Food security policies are designed to assure the availability of staple foods. During the pandemic, one type of intervention was to provide agricultural inputs such as fertilizers, high-quality seeds, and insecticides, as well as collateral-free lending programs for farmers. These collateral-free loans can be administered with the help of Village-Owned Enterprises (BUMDes).

3.1 Ecosystem

Agricultural land is essential for the production of staple foods. This land forms an ecosystem, which is made up of both abiotic and biotic components. According to Law No. 32 of 2009 on Environmental Protection and Management, an ecosystem is a collection of environmental elements that interact to promote balance, stability, and production in the environment. An agroecosystem, or agricultural ecosystem, is a human-managed ecosystem that produces agricultural products. Agroecosystems encompass wetland agriculture (rice paddies), dryland agriculture (plantations), forestry, animal husbandry, and fisheries.

Water, air, temperature, soil, sunlight, salinity, and salt content are examples of agroecosystem's abiotic components. An agroecosystem's biotic components, on the other hand, include producers (such as plants), consumers (which eat plants and animals), and

decomposers (such as microorganisms, plants, and animals). Specific plant species typically dominate agroecosystems. Fertilizers, insecticides, and irrigation water are all important sources of nutrients and water for plants. The balance of interactions between biotic and abiotic components in the agricultural ecosystem determines the viability of agricultural production.

In terms of food production during the Covid-19 pandemic, rice supplies were expected to last until August 2020, with a projected yield of 12.4 million tons from March to May 2020. However, Indonesia faced shortages of other basic items such as garlic, meat, and sugar. Rice and corn stocks are expected to last three to four months. Given that key goods, such as garlic and beef/buffalo, rely on imports, extra attention is required, particularly as supplies are predicted to last only until May 2020, during the Idul Fitri celebrations. Government measures to handle future food supply shortfalls are critical. For further details, please refer to Table 1.

Table 1. Estimated Stock and Food Requirements for March-May 2020 (in tons)

Commodity	Estimated Stock for March - May 2020	Estimated Demand for March - May 2020	Estimated Final Stock for May 2020
Rice	15,9 million	7,6 million	8,3 million
Shallots	588 thousand	347 thousand	241 thousand
Garlic	86 million	151 thousand	Deficit of 65 thousand
Large chilies	311 thousand	278 thousand	33 thousand
Bird's Eye Chilies	327 thousand	258 thousand	69 thousand
Chicken Meat	1,1 million	881 thousand	219 thousand
Beef	183 thousand	202 thousand	Deficit of 19 thousand
Granulated Sugar	987 thousand	708 thousand	279 thousand
Corn	10,3 million	6 million	4,3 thousand

(Source: Hirawan & Verselita, 2020)

Hirawan and Verselita (2020) indicated that if domestic food production fails to meet demand, the government may have to import food items. Several commodities, including cattle, dairy products, grains, oil, and sugar, were stagnant between July 2019 and March 2020.

Climate change, changes in economic development priorities, and the failure to attain food self-sufficiency—particularly in satisfying the needs for carbs, proteins, fats, vitamins, and minerals—have left Indonesia reliant on imports (Syaifullah, 2008). Under normal circumstances, Indonesia already struggles to meet its food needs, which has been compounded by the Covid-19 outbreak (Sudaryanto & Suharyono, 2020). Employment in the agricultural sector is expected to fall by 4.87%, while domestic agricultural supply will fall by 6.20%. Agricultural imports are forecast to fall by 17.11%, while import prices will rise by 1.20% in 2020 and 2.42% in 2022 (Amanta & Aprilianti, 2020). Reduced domestic supply and imports may result in food shortages and price inflation.

During the pandemic, food imports faced significant disruptions as several countries imposed export restrictions to prioritize their domestic needs. In February 2020, Indonesia managed to import only 23,000 tons of garlic from China, a stark contrast to the 583,000 tons imported in the previous year. This sharp decline highlights the impact of the pandemic on trade flows. A similar pattern was observed in fruit imports, where Indonesia experienced a substantial reduction of 78.88%, with the import value dropping from USD160.4 million to USD33.9 million (Budiyanti, 2020).

According to Rozaki (2020), there are two techniques to ensuring food security during a pandemic: proactive adaptation and planned adaptation. Proactive adaptation entails crisis-related strategies such as food importation and local resource optimization. Increasing local food production is critical for improving food security by lowering reliance on imported foods (Ikhsan & Virananda, 2021). Support for local manufacturing becomes critical, especially given limited activities and mobility.

Meanwhile, planned adaptation refers to activities designed to provide long-term benefits, such as diversifying food production. The government and community can

diversify agricultural products to lessen reliance on imported goods and a single type of food product. The agriculture industry can benefit from diversifying food consumption (Sudaryanto & Suharyono, 2020). Food production diversification can be accomplished by creating contemporary agriculture, such as smart farming, utilizing screen houses for off-season horticultural commodities, encouraging farmer corporations, and establishing food estates to improve the production of staple foods such as rice and corn. (Rachmawati, 2020).

3.2 The Socio-Cultural Characteristics of the Community

Food security policies focus on maintaining the supply of staple foods. At the community level, the people of Indonesia have efforts to achieve food security within their environment. This can be seen in the traditional wisdom of the Subak practice in Bali, which manages water resources for agriculture. Besides the socio-cultural characteristics of the community, this is an example of the food-water nexus to realize sustainable development. Traditional wisdom is part of ethics and morality, which helps individuals answer moral questions regarding what should be done and how to act in relation to the management of the environment and natural resources (Widarmanto, 2018 in Astriani et al., 2020).

Subak is a traditional irrigation system that is believed to have existed since the establishment of rice fields in Bali before the 9th century (Astriani et al., 2020). The regulation of Subak can be seen in the awig-awig (basic regulations) related to water (indik toya), the sources of water, and water structures such as empelan (dams), tembuku aya (primary water distribution structures), and the water structures for individual members (tembuku pengalapan). The cost of constructing water structures is covered by Subak members and external assistance, while maintenance is carried out by the members. Water shortages are managed by rotating water distribution as regulated by the Prajuru Subak, and members who do not receive water are required to plant secondary crops. All rules are diligently followed by the members, reflecting that the community in Bali has made efforts to achieve food security in ways that are unique to their culture.

The Covid-19 pandemic has significantly altered food distribution practices, with a notable shift toward modern marketplaces and online platforms. In March 2020, there was a 78% surge in the number of e-commerce platforms, reflecting the growing reliance on digital markets. Notably, food and beverage products made up 27.85% of total sales, highlighting the increasing demand for these essentials through online channels. The emergence of e-commerce platforms such as Sayurbox, Simbah, Limakilo, and Agripedia has further accelerated the growth of online food sales, providing consumers with more convenient access to fresh produce and other food items.

During the epidemic, internet food transactions became popular not just among high-income consumers, but also among middle- and low-income consumers. Although official data on the rise of food e-commerce is not yet available, the increasing number of website visitors and social media followers suggests a strong trend in Indonesian food e-commerce.

Table 2. Daily Page Views of Websites and Social Media Followers of E-commerce Food Sales

E-commerce Platform	Daily Page Views	Instagram Followers
Lima Kilo	298	2.772
Keranjang Sayur	402	34.900
Kecipir	472	7.287
Regopantes	736	11.400
Tani Hub	1.276	21.100
Sayur Box	6.648	228.000
Agromaret	15.152	1.600

(Source: Fikri, 2020)

According to Apriadi and Saputra (2017), marketplace-based e-commerce platforms enable farmers to sell agricultural products directly to consumers. This reduces the distribution chain, which has the potential to boost farmers' profits. Marketing using this platform is thought to be more efficient than traditional shopping in real markets.

Djaenuddin and Permani (2020) observed that during the Covid-19 pandemic, customers concentrated more on purchasing basic items and health products, avoiding in-person shopping, adopting digital payment methods, and lowering overall spending.

In addition to increasing the usage of online food purchasing systems, the community has been working to improve food security by cultivating crops at home. Various methods are used, including traditional soil-based home gardens and hydroponics. Urban farming is growing more popular in cities, not just to meet food demands but also to promote a healthy and green atmosphere. This technique allows both farmers and non-farmers to contribute to domestic food supply (Ikhsan & Virananda, 2021), as well as develop agroecosystems at the household level.

3.3 Food-Energy-Water Nexus

The food-energy-water nexus is interconnected in addressing climate change and achieving sustainable development. The food-energy-water nexus both influences and is influenced by other sectors, such as economic, social, political, and environmental conditions (Purwanto et al., 2021). Figure 2 illustrates the WEF nexus framework, describing the complexity of the food-energy-water nexus with water availability as the primary factor, along with a system that considers the importance of sustainable development actions, global trends, and government interventions. An example of the food-energy-water nexus can be seen in food security programs, which require water through irrigation development, while energy security programs may need water to power electricity-generating turbines or require biomass or other agricultural commodities, which in turn affects the achievement of food security programs (Nugroho, 2020).

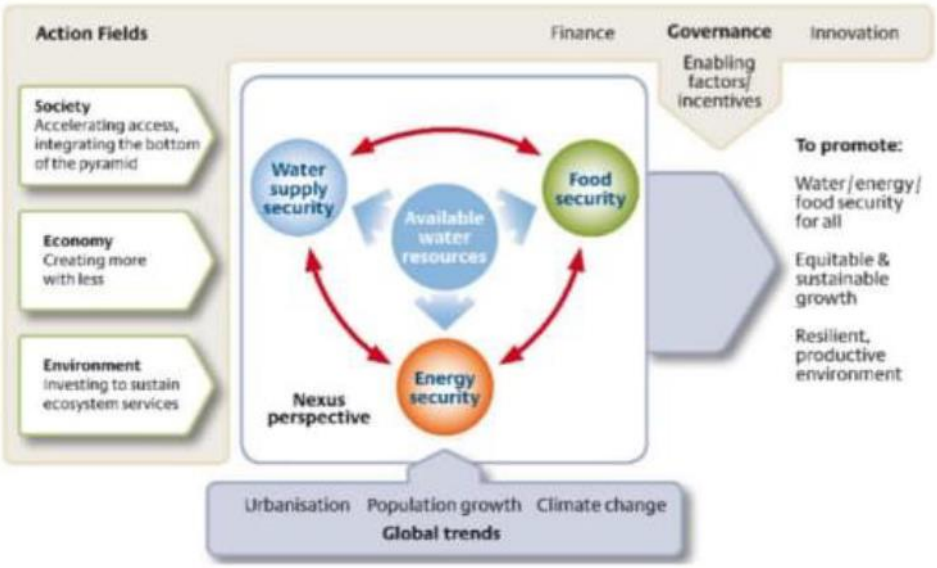

Fig. 2 The Nexus Framework of Food, Energy, and Water (adapted from Hoff)
(source: Purwanto et al., 2021)

According to the National Mid-Term Development Plan (RPJMN) 2020-2024, the relationship between food and water is represented in water resource management with the goal of promoting food security. This is accomplished by the execution of priority projects, such as the construction of 18 multipurpose reservoirs. This initiative, carried out by the Ministry of Public Works and Housing (KemenPUPR) and the private sector, supplies water to 51 premium irrigation systems, increasing food security by 20%. Presidential Regulation No. 109 of 2020, the third modification to Presidential Regulation No. 3 of 2016 on the Acceleration of National Strategic Projects (PSN), contains 148 dams and nine irrigation network development projects. The construction of dams and the installation of irrigation networks are intended to boost agricultural production and aid economic

recovery following the COVID-19 epidemic. Adequate irrigation is critical for agricultural land, because water shortages can limit production. (Irawan, 2020).

The RPJMN 2020-2024 prioritizes the development of renewable energy based on palm oil, demonstrating the relationship between food and energy. This project seeks to boost the share of renewable energy in the national energy mix to 23%. The Ministry of Agriculture, Ministry of Energy and Mineral Resources (ESDM), BPDPKS, and State-Owned Enterprises (SOEs)/private sector are all participating in its implementation. The utilization of palm oil as a renewable energy source has the potential to boost economic growth and promote sustainability. Palm oil, from both large and smallholder plantations, is an important plantation product (BPS, 2020). Research on the use of palm oil wastewater as a new renewable energy source in Kotawaringin Timur Regency (Alkusma et al., 2016) and the use of wastewater in palm oil mills (Pasaribu et al., 2021) supports palm oil as an energy source.

3.4 Ecological Footprint

The ecological footprint is a concept that involves estimating the flow of energy and material cycles from/to the economy and turning them into land or water areas (Rees et al., 1996; Dapas, F., 2015). Food regulations and community efforts to procure food during the COVID-19 epidemic have environmental repercussions, including waste and carbon emissions.

Government instructions to work from home, maintain physical distance, and limit activities have impacted the food supply chain. During the COVID-19 pandemic, all food supplies must follow manufacturing norms to assure food quality and safety, especially in infected areas (Hirawan & Verselita, 2020). This has resulted in excess supply in some food warehouses and distribution centers, lowering food costs and increasing food waste for perishable commodities (Ikhsan, 2021). Food waste can lead to increased emissions. In the 2000-2009 forecasts, food waste generated a total of 1,702.9 Mt CO2 equivalent emissions, with an average yearly contribution equal to 7.29% of Indonesia's greenhouse gas emissions and a loss of around 107-346 trillion rupiah every year (Bappenas, 2020).

Plastic waste has increased dramatically, in addition to food waste. According to Suryani (2020), the COVID-19 epidemic caused an increase in home plastic trash from 1-5 to 5-10 grams per person daily. Single-use plastic food packaging accounts for the vast majority of plastic trash. To reduce food waste from interrupted food distribution, measures include optimizing targeted funding for food infrastructure improvements, supporting the establishment of food distribution platforms, and controlling food loss waste to enable a circular economy. (Bappenas, 2020).

Although digital or online transactions via e-commerce are more convenient and profitable for food production, food distribution remains difficult due to transit limitations in PSBB and red zones, as well as checkpoints and permit requirements. Odd-even policies and market closing hours have a considerable impact on food distribution. Hirawan and Verselita (2020) emphasize that food commodities carried by land, sea, and air require specific consideration before being distributed across regions. Food must be sanitized before it is delivered to merchants or customers, and Indonesian logistics personnel must wear standard Personal Protective Equipment (PPE) such as masks, gloves, sterile uniforms, and hand sanitizers (Hirawan and Verselita, 2020). Furthermore, certification of daily inspection clearance is essential, especially during regional quarantine periods, and distribution must still be implemented. (Hirawan & Verselita, 2020).

The disruption of distribution caused by truck limitations in PSBB and red zones has had a favorable environmental impact. COVID-19 activity limits adopted in several nations have resulted in CO2 emissions reductions of up to 17%. The transportation and industrial sectors, particularly motor vehicles and commercial manufacturing units, accounted for about half (43%) of the global pollution decrease during the peak of the shutdown. (Suryani et al., 2020).

In Indonesia, Suryani et al. (2020) reported a significant reduction in emissions, with the maximum decrease reaching 18.2%. Notably, the level of NO2 gas in Jakarta dropped by approximately 40% compared to the levels observed during the previous year, indicating a substantial improvement in air quality. Indriyaningtyas et al. (2021) further elaborated on the concentration levels of carbon monoxide (CO) in DKI Jakarta. During the implementation of the PSBB (Large-Scale Social Restrictions) policy from April 10 to June 4, 2020, there was a noticeable decrease in the average CO concentration, which was recorded at 0.0769 mol/m^2, as well as a reduction in the total concentration, which amounted to 19.673 mol. These findings highlight the environmental impact of the PSBB policy on air pollution levels in the capital city.

4. Conclusions

The conclusions and recommendations are as follows: The government plays a crucial role in establishing food policies during the COVID-19 pandemic with a focus on sustainability. It is essential for the government to facilitate the food policy process from farmers to consumers to ensure food security stability, requiring coordination and synergy between the government, private sector, and community. The stability of agricultural ecosystems (agroecosystems), involving the interaction of biotic and abiotic components, is vital for the sustainability of agricultural production. All stakeholders, including the government, private sector, and community, must be involved in achieving food security in Indonesia. The community can adapt and be creative in meeting food needs through initiatives such as smart farming, urban farming, and the use of applications for online food shopping as alternative marketing strategies. The government has prioritized projects in the 2020-2024 National Medium-Term Development Plan (RPJMN) that address the interconnection between food, water, and energy, including the construction of multipurpose reservoirs and the development of renewable energy sources like green fuel from coconut and mustard plants. Policies during the COVID-19 pandemic, such as social distancing, large-scale social restrictions (PSBB), and transportation limitations, have impacted the environment. Positive effects include reduced carbon emissions, while negative effects include an increase in plastic waste from food packaging. To address these issues, it is recommended to intensify the 3R (reuse, reduce, and recycle) program in waste management from households to broader waste management systems.

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Author Contribution

R. M. I., conceived and designed the study, performed the experiments, analyzed and interpreted the data, contributed reagents/materials/analysis tools, wrote the paper, prepared figures and/or tables, reviewed drafts of the paper and approved the final draft.

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