International Journal of
Economics Development Research, Volume 5(2), 2024
pp. 1153-1167

Ten Recommendations for Food Security Policy Using Bibliometric Analysis Based on Scopus Database

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Abstract:

The deterioration of the global food system during COVID-19 particularly in terms of sporadic closures of food processing facilities with adverse consequences for food security and increasing the risk of hunger.The impetus for creating food security arises from the central role of food in human life. One effort to achieve this is through the concept of food self-sufficiency, as a country's ability to meet food needs from domestic production. The preparation of this article utilizes descriptive bibliometric analysis which focuses on literature data banks. Bibliometrics is a quantitative method applied to explore research domains through meta data on articles provided in bibliographic database platforms,This article was written only using the Scopus database. Meta data performed by bibliometrics includes publication titles, keywords, abstracts, and citation notes. This article produces 10 recommendations that need to be carried out by a government, one of which is transforming the food system into an important step to overcome vulnerabilities in the system and increase overall food security.

Keywords: *Bibliometric Analysis, Food Security, Food System Transformation*

Submitted: 5 May 2024, Accepted: 21 May 2024, Published: 10 June 2024

1. Introduction

The global food system is a complex structure that has developed through centuries of social, cultural, economic and technological evolution(Savary et al., 2020). The main outcome is a diet that is accessible to people through the food system; the livelihoods of people involved in the food system; and the environmental impact of the food system(Harris et al., 2020). Even though globalization continues to increase, this structure shows diversity that still reflects its local history. Although complex, this system exhibits strength and toughness in some aspects, but can also appear fragile in certain parts. In facing various crises such as conflict, environmental disasters, global food price crises, economic downturns, and disease pandemics, humans reflect the challenges facing the global food system. An approach to understanding this system can be done by reviewing a number of components that

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contribute to food security. These stages include production, storage, transportation, economic access, and consumption.

Another perspective identifies three main components in the food system, namely the food supply chain, the food environment, and consumer behavior. Driving factors such as biophysical and environmental, innovation and technology, policy and economic, sociocultural, and demographic influence the dynamics of this system. A combined approach provides a more comprehensive understanding, including food production, consumption processes, and factors that influence diet. The food production system, as the first part of this system, forms a very diverse mosaic of production units throughout the world. This includes large-scale commercial farming in Northern countries with a high degree of mechanization to small-scale farming in Southern countries with a large labor force and crop diversity.

On the food consumption side, the comparison between “staple” foods and “nutritious” foods is key, with grains representing staple foods that are easy to transport, and nutritious foods that are more diverse and difficult to transport. By involving many components and processes that operate at various spatial scales and have different temporal characteristics, the global food system exhibits complex dynamics. It is important to consider the ongoing interactions between human, agricultural and environmental needs to develop effective solutions to future challenges, including the food crisis.

In the realm of food production, we encounter a variety of production units stretching from large-scale commercial farms in Northern countries equipped with a high degree of mechanization to small-scale farms in Southern countries involving large labor forces and high crop diversity. This diversity reflects local adaptation to different economic, social, and environmental conditions around the world. On the consumption side, the comparison between "staple" food and "nutritious" food is key to understanding the dynamics of this system. Grains represent staple foods that are easy to transport, store, and trade, whereas nutritious foods are more varied and difficult to transport, implying more complex supply chains.

The global food system consists of various components and processes that operate at different spatial and temporal scales. COVID-19 has had no immediate impact on the food system, except for sporadic closures of food processing facilities with adverse consequences for food security and increasing the risk of hunger (Devereux et al., 2020). The COVID-19 pandemic provides a clear illustration of how adaptation to system stress varies over time, depending on geographic and economic context. Small rural farming communities may respond more quickly than complex global economic structures. To overcome future challenges, especially the food crisis, a holistic understanding of the direct impacts on human needs, agriculture and the environment is needed. The interconnection between food production systems, consumption supply chains, and environmental aspects needs to be integrated in sustainable solutions. This includes increasing production efficiency, sustainable management of natural resources, and building food systems that are responsive to changing global contexts. Synergy between various stakeholders, including governments, producers,

consumers, and non-government organizations, is needed to achieve effective and sustainable solutions.

Disruptions to the food system have become a focus of attention due to the COVID-19 pandemic (Harris et al., 2020). The pandemic that has spread in Indonesia since March 2020 has not only harmed the health sector, but also hit several important sectors, including the agricultural sector which is the backbone of people's lives. The impact of this pandemic is being felt in several aspects of Indonesia's food security, resulting in serious challenges that need to be addressed immediately. First of all, food production trends were affected by the pandemic, causing a decline in productivity especially in younger crops. Along with this, food distribution capacity in Indonesia is also affected, resulting in limitations in distributing food supplies to various regions. Trade restrictions caused by the pandemic have also hurt the flow of food trade throughout the country.

The drought crisis is also a real impact of this pandemic, creating a shortage of food production, especially rice, which is a staple food source for most of the population. In addition, climate change triggered by the pandemic has led to the termination of employment and income for formal workers, exacerbating the food crisis.

To overcome this challenge, deep changes need to be made in the food and agricultural governance system. The policy recommendations issued provide insight into reforming Indonesia's food and trade policies, investing capital to support diversification of food supplies, easing food trade flows, and increasing cooperation with other countries to ensure regional food security. Apart from that, public awareness is also key in dealing with this situation. Planting and food management efforts at the individual level can help maintain access to food, reducing pressure on food supply chains affected by the pandemic. In this challenging situation, collaboration between government, the private sector and society is essential to achieve effective and sustainable solutions.

2. Theoretical Bakground

Food security, which is realized in the Sustainable Development Goals (SDGs), especially Zero Hunger, is the main focus(National Food Agency, 2023).The definition of food security describes a condition where every individual has access, both physically and economically, to food that is safe and nutritious enough to meet their food needs and preferences.(Perum BULOG, 2014). In the context of food security, four main dimensions are identified: food availability, food access, utilization, and stability(Agaptus Nwozor et al., 2019). The importance of meeting these four dimensions simultaneously is the key to achieving optimal food security.
The impetus for creating food security arises from the central role of food in human life. One effort to achieve this is through the concept of food self-sufficiency, which is defined by the Food and Agriculture Organization as the ability of a country to meet its food needs from domestic production.(Andreas Budi Rahutomo et al., 2023). Even though food self-sufficiency cannot guarantee absolute food security, this concept is

still closely related to all aspects of food security. The focus of food self-sufficiency lies on supplies and components related to the availability of food security, ensuring that the country has adequate capacity to produce food in sufficient quantities to meet its domestic needs.(Andreas Budi Rahutomo et al., 2023). The concept of food self-sufficiency is the basis for supporting efforts to achieve sustainable and effective food security.

This article focuses on a literature review of previous research literature exploring Food Estate programs in various parts of the world as a response to the threat of a food crisis(Ali Zainal Abidin Alaydrus, 2023). Analysis of the literature review highlights the existence of injustice, non-participation of local communities in decision making, lack of socialization, inappropriate salaries, and lack of agricultural technology training as the main challenges in implementing this program. The results of this research provide a critical view of the impact of the Food Estate program on environmental and socio-economic aspects.

The literature review indicates the need for a review of this program by the government with special attention to local communities and land characteristics. In dealing with environmental and socio-economic problems, integrated and sustainable planning is needed that involves all relevant parties. Synergy between government, society and the private sector is key in strengthening the sustainability of the Food Estate program and increasing its effectiveness in achieving food security goals(Ali Zainal Abidin Alaydrus, 2023). It is hoped that collaborative efforts involving various stakeholders can create holistic solutions and provide a more efficient response to global challenges related to food security. In this way, the implementation of the Food Estate program can be more targeted and support sustainable development economically, socially and environmentally(Ali Zainal Abidin Alaydrus, 2023)

3. Methodology

The preparation of this article utilizes descriptive bibliometric analysis which focuses on literature data banks. Bibliometric analysis itself can be interpreted as a research evaluation method that relies on previous written work(Ellegaard & Wallin, 2015). The aim of using bibliometric analysis is to understand the relationship and influence of journal citations through a quantitative approach to literature data banks. Bibliometric analysis functions to determine the exponential increase in the volume of scientific documents that have been published in various research disciplines which enables a comprehensive understanding of the field by identifying key scientific contributors, trusted sources, research patterns, new trends, and promising topic opportunities for exploration in future(Gutiérrez-Salcedo et al., 2018). Bibliometrics is a set of quantitative methods applied to explore research domains through meta data on articles provided in bibliographic database platforms, namely Scopus, Web of Science Core Collection(Gutiérrez-Salcedo et al., 2018), but in writing this article only used the Scopus database. Meta data performed by bibliometrics includes publication titles, keywords, abstracts, and citation notes. The main procedures carried

out in bibliometrics to explore the research domain are performance analysis and science mapping.

Performance analysis provides a means to measure academic output and assess productivity, quality and scientific impact by identifying the main contributors, namely authors, countries and organizations in order to find reliable sources of academic publications.(Garcia-Buendia et al., 2021). The aim of scientific mapping is to detect the conceptual and intellectual structure of a research field, recognize patterns that have the potential to provide insight and visualize significant changes over time in a large body of literature.(Darko et al., 2020).

Research Design

Research design steps in determining approaches and software for bibliometric analysis. In line with the objectives and sub-objectives of the research, the bibliometric approach applied in this research is co-authorship, co-occurrence, citation and co-citation analysis as well as the bibliometric aggregation and ranking approach which functions to evaluate academic performance.

a. Co-authorship is a quantitative analysis that examines authors, countries, author affiliations and collaboration patterns carried out to build the social structure of a research field based on jointly compiled publications.(Aria & Cuccurullo, 2017). This social structure is visualized in a "collaboration network".
b. Co-occurrence is a quantitative analysis method that calculates how often a term appears in more than one article in a database. The aim of this method is to form a conceptual knowledge structure in a research domain and highlight its main areas(Aria & Cuccurullo, 2017). This conceptual structure is visualized in a “conceptual network”.
c. Citation analysis is a quantitative analysis method that utilizes citation counts to evaluate the degree of similarity between publications, authors, organizations, or sources of information(Aria & Cuccurullo, 2017).

Co-citation analysis is a quantitative analysis method that utilizes the number of publications in which references, authors, or sources are co-cited to assess the quality or impact of those publications. Building interconnection relationships and developing intellectual knowledge structures in the research field(Chen, 2006; Wen et al., 2021). This intellectual structure is represented in the form of an “Intellectual Network.” Two articles are considered to be cited together if they are mentioned in a third article.

Some software is available with varying levels of strengths, weaknesses, and availability. In this research, VOSviewer, Biblioshiny, and CiteSpace were used, all of which can be accessed for free. The selection of VOSviewer was based on its ease of use and ability to manage large-scale data, as well as its ability to produce clear bibliometric visualizations(McAllister; et al., 2022; van Eck & Waltman, 2010). Co-authorship, co-occurrence, and citation analysis functions are used to map scientific collaborations, describe publication keywords, and identify top sources. Biblioshiny, as a web interface, uses the functions of the R tool Bibliometrix introduced by Aria and Cuccurullo(Aria & Cuccurullo, 2017). This tool is used to map thematic evolution

and trending topics in research. CiteSpace was chosen to perform reference co-citation analysis because it not only groups publications based on co-cited references, but also assigns a label to each group that describes its nature. Therefore, its strongest feature lies in the analysis of citations along with references(Chen, 2006).

4. Empirical Findings/Result and Discussion

Volumes and Annual Growth

The data taken from this research were 359 documents. The documents used were mostly final articles (n=353; 98.3%) and articles in the media (n=6; 1.7%). The country with the most publications is the United States with the number of publications n=130; 36.2%) were article documents followed by the UK with (n=85; 23.6%) article documents and the Netherlands (n=49; 13.6%) with article documents (Figure 1). The average annual number of publications was 71.8 documents. There was an increase in the number of annual publications in the 2018-2023 period, showing a sharp increase in 2021 as many as (n=79; 22%) of published article documents. And the lowest publication in the 2018-2023 period occurred in 2018, namely (n=48; 13.4%) documents (Figure 2).

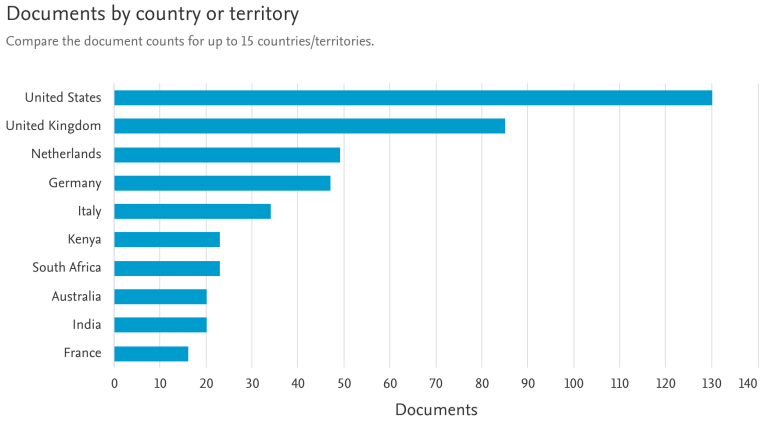

Figure 1. Documents by Country or Territory

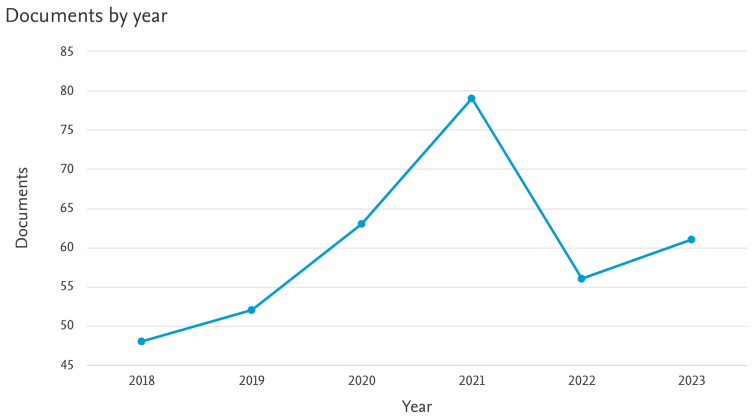

Figure 2. Documents by Year

Fields of Study and Keywords That Appear Most Frequently

The documents taken come from a social science field of study, so that this research focuses on food estate from a social science perspective. Figure 3 is a network visualization map of the keywords "food estate", "food security" and "food policy" published in the 2018-2023 time period. There are (n=8067) network nodes in these three keywords. The network visualization map of terms in the title/abstract of the document taken includes 190 terms distributed into different groups (colors). Closely related terms have the same color. The map shows five different clusters. The biggest theme (Red Cluster = there are 61 terms) focuses on food policy, food supply, food system and government. The second research theme (Green cluster = there are 38 terms) which includes examining food security outcomes, rice, postharvest loss, maize yield and harvest. The third research theme (Blue cluster = there are 31 terms) includes agricultural production, food crisis, food prices, nutrition outcomes and farm household. The fourth theme (yellow cluster = there are 30 terms) includes studies of food availability, fruit, nonfarm employment and vegetables. The fifth theme (Purple cluster = there are 30 terms) which discusses calcium, calories, diet, nutrients and vitamins. Figure 4 is a visualization map using Vosviewer software.

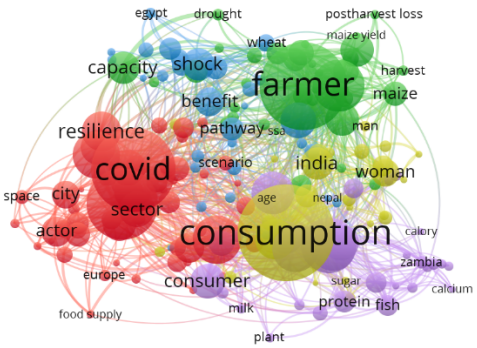

Figure 3. Network Visualization Map of Keyword

Ten Most Productive Journals

Documents taken from 2018-2023 show the ten most productive journal authors. The first rank is Harris J. with (n=5) published documents, followed by Nisbett, N. with (n=5) documents and Drimie, S. with (n=4) published documents. Figure 5 is the top ten document publications.

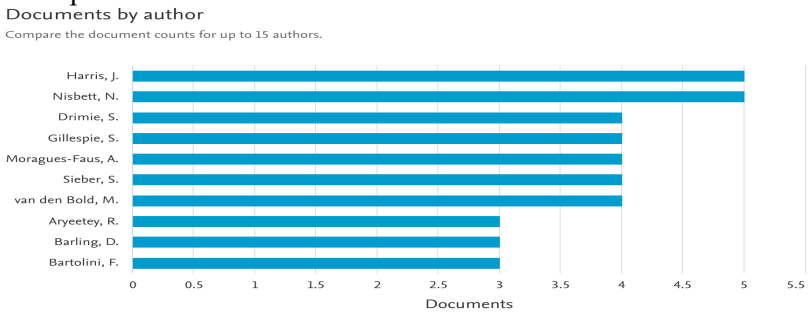

Figure 4. Documents by Author

Ten Journals With The Highest Affiliation

The documents taken contain the top ten affiliations with various institutions. The first most affiliated ranking is Wageningen University & Research with (n=36) affiliated documents, next is the International Food Policy Research Institute with (n=21) affiliated documents, the third most affiliated is the Institute of Development Studies, Brighton with (n=14) Michigan State University's fourth most affiliated and affiliated documents with (n=11) affiliated documents. Figure 6 is the document affiliation ranking.

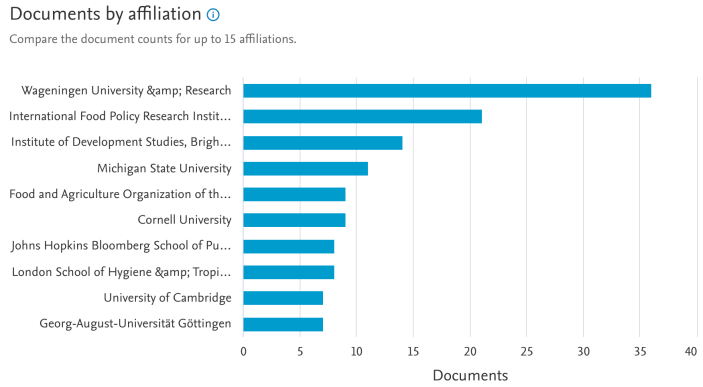

Figure 5. Documents by Affiliation

Journals Based on Scientific Disciplines

In this research there are various disciplines participating which emphasize the multidisciplinary nature of Food Estate, Food Security and Food Policy. The scientific disciplines involved in this research are Social Sciences with published documents, namely (n=359; 36.3%), followed by Agricultural and Biological Sciences (n=359; 36.3%) published documents, Economics, Econometrics and Finance disciplines published documents (n=135; 13.7%) and Environmental Science (n=135; 13.7%) published documents. Figure 7 is the percentage of publications from each scientific discipline.

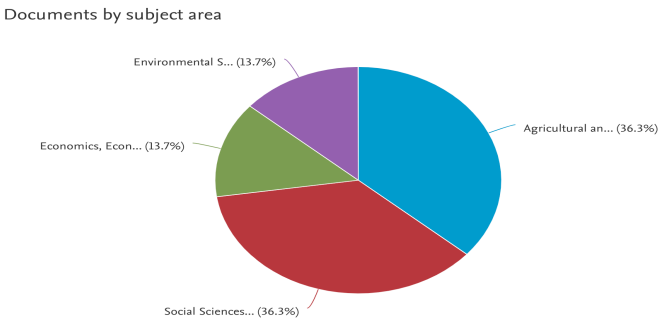

Figure 6. Documents by Subject Area

Discussion

This research aims to provide a general overview of research activities on Food Security, Food Estate and Food Policy which are important study topics for governments, international non-governmental organizations, policy makers, food

technologists, food and agriculture experts and climate experts. This study shows a real growth in the number of publications in the last half decade with quite large international research collaborations. In this research, there are journals that have the highest number of citations which show a trend of increasing urgency regarding Food Security, Food Estate and Food Policy.

Table 1. Journal Publications with the Most Citations

No.	Document Title	Authors	Source	Year	Citations
1	Conceptualizing COVID-19's impacts on household food security	Devereux, S., Bené, C., Hoddinott, J.	Food Security, 12(4), pp. 769–772	2020	244
2	Food system disruption: initial livelihood and dietary effects of COVID-19 on vegetable producers in India	Harris, J., Depenbusch, L., Pal, AA, Nair, R.M, Ramasamy, S	Food Security, 12(4), pp. 841–851	2020	147
3	COVID-19 and Pacific food system resilience: opportunities to build a robust response	Farrell, P., Thow, AM, Wate, J.T, Eurich, J.G, Andrew, N.L	Food Security, 12(4), pp. 783–791	2020	113
4	Global food waste across the income spectrum: Implications for food prices, production and resource use	Lopez Barrera, E., Hertel, T.	Food Policy, 98, 101874	2021	107
5	Mapping disruption and resilience mechanisms in food systems	Savary, S., Akter, S., Almekinders, C., Waddington, S., Watson, D.	Food Security, 12(4), pp. 695–717	2020	99
6	The impact of COVID-19 related 'stay-at-home' restrictions on food prices in Europe: findings from a preliminary analysis	Akter, S.	Food Security, 12(4), pp. 719–725	2020	95
7	Pollination ecosystem services: A comprehensive review of economic values, research funding and policy actions	Porto, RG, de Almeida, R.F, Cruz-Neto, O., Perez, CA, Lopes, A.V	Food Security, 12(6), pp. 1425–1442	2020	91
8	Reducing food loss and waste: Five challenges for policy and research	Cattaneo, A., Sánchez, MV, Torero, M., Vos, R.	Food Policy, 98, 101974	2021	87
9	The contribution of fisheries and aquaculture to the global protein supply	Boyd, C.E, McNevin, A.A, Davis, R.P	Food Security, 14(3), pp. 805–827	2022	85
10	COVID-19 and food security: Panel data evidence from Nigeria	Amare, M., Abay, K.A, Tiberti, L., Chamberlin, J.	Food Policy, 101, 102099	2021	83

The journal with the most citations is the journalConceptualizing COVID-19's impacts on household food securitywhich was published in 2020 with a total of 244 citations, then the journal with the second most citations was the journal Food system disruption: initial livelihood and dietary effects of COVID-19 on vegetable producers in India which was cited with 147 citations and was published in 2020, the third position journal the most cited ones areCOVID-19 and Pacific food system resilience:

opportunities to build a robust responsewith a total of 113 citations and was published in 2020.

Food security is an important aspect in the stability of the country, this is because food security has a wide network of implications ranging from food price stability, food quality, health impacts to community welfare. The Covid 19 pandemic requires the country to stabilize its food storage in the face of the crisis. The unexpected emergence of a pandemic means that every country must be able to maintain food safety. Apart from that, the pandemic also weakens food security, both directly by disrupting the food system and indirectly through the impact of activity restrictions on physical access to food itself.

With the unexpected event, namely Covid-19, the country's resilience experienced a quite serious stability shock. COVID-19 and the response to this pandemic can weaken food production, processing and marketing, but the most worrying impact occurs on the demand side, namely economic and physical access to food(Devereux et al., 2020). Apart from this, Covid-19 creates disruption to the food system and its impact on livelihoods and eating patterns is the main focus due to the COVID-19 pandemic (Amare et al., 2021).This pandemic has had a major impact on tourism, remittances and international trade, as well as other aspects of the political economy in the region, thereby impacting food systems, food security and livelihoods. Of particular concern is the link between loss of income and availability. as well as the affordability of local and imported food(Farrell et al., 2020).

The widespread impact of Covid-19 has caused a crisis that has disrupted the food system on both a local and global scale. Apart from causing a public health crisis, the current global pandemic is also having a significant impact on the food system, both at the local and global levels(Savary et al., 2020). A crisis like this can have a negative impact on the stability of food production, with one of the main fears being its potential impact on primary food production, especially if the infrastructure that supports agriculture is damaged, weakened, or destroyed. Moreover, looking ahead, without underestimating the urgency of this crisis, the COVID-19 crisis could be a catalyst for fundamental transformations in agriculture and the global food system that have previously been overlooked.(Savary et al., 2020). This is due to the dysfunction of the current global food system, which is characterized by a significant increase in the number of people experiencing hunger worldwide, with the World Food Program (WFP) even warning of the potential for a "hunger pandemic".

Indonesia is experiencing a food resource crisis, causing Indonesia to have to import food from other countries. So it is necessary to carry out the Indonesian Agricultural Human Resources Development Movement towards the World Food Granary in 2045, an effort to increase the capacity and competency of agricultural human resources to support Indonesia to become the world food barn in 2045 and accelerate economic growth. With the condition of the agricultural sector which has enormous potential for the Indonesian economy, the reality is that it is not yet optimal.

Many sectors in Indonesia are experiencing serious impacts due to the Covid-19 pandemic, and agriculture is not immune from this negative impact. The food crisis is one of the serious implications caused by the disruption of the agricultural sector in this country during the pandemic.

Agriculture, as one of the main pillars in providing food needs for society, is experiencing major challenges in maintaining continuity of production and distribution. Movement restrictions, closure of traditional markets, and supply chain disruptions are some of the factors affecting agricultural productivity. Farmers also face difficulties in obtaining the necessary support and resources to carry out their agricultural activities. Nevertheless, this food crisis has encouraged Indonesia to increase food independence and security. Stability of food production is the main focus to ensure adequate food supply for the population. The government and stakeholders are engaged in joint efforts to support farmers, facilitate the distribution of agricultural products, and improve the efficiency of food supply chains.

Efforts to strengthen food security are also reflected in increasing food production in Indonesia. Innovation in agricultural methods, application of modern technology, and strengthening agricultural infrastructure are strategic steps taken to overcome the impact of the pandemic. With increasing awareness of the importance of food security, Indonesia continues to strive to build a solid foundation to face future challenges. The involvement of all parties, including the government, private sector and society, is key in ensuring the sustainability and independence of the agricultural sector in order to maintain national food security.

Food is a basic need that is vital for human life, and a nation's success in meeting its food needs can influence economic, social and political stability. The food crisis faced by Indonesia during the Covid-19 pandemic highlights the urgency of food security as a main focus. Availability of adequate food, both in terms of quantity and quality, is the key to successful food security. The implementation of Large-Scale Social Restrictions (PSBB) and fluctuations in basic food prices affect people's purchasing power. Therefore, strategic steps, such as anticipating and distributing food needs appropriately, need to be taken to overcome this impact.

COVID-19 has changed life globally, raising concerns about food shortages and causing disruption to food supplies. The UN has warned of job and income losses for 1.6 billion formal workers. The pandemic cannot be separated from other problems such as inequality and the climate crisis, which are making the situation even worse. The food and agricultural system that was already damaged before the pandemic forces us to renew the urgency of solving the root of the food problem. In the midst of global food policies that result in 30% of food being wasted globally and 300 kg of food every year in Indonesia being thrown away, while Indonesia ranks 3rd in the world in cases of malnutrition and 820 million people lack food, the question arises: why do millions of people have to choose between hunger or COVID-19.

The condition of food security in Indonesia after the COVID-19 pandemic is still fragile and requires serious attention. The disruption caused by the pandemic to the

agricultural sector increases the risk of food shortages. Several urgent problems that need immediate solutions include the increasing average age of farmers, production deficits in several regions, and limited distribution. The imbalance in the number of older farmers compared to the small number of millennial farmers can have a negative impact on food productivity. Efforts to increase post-pandemic food security need to involve various parties, including reforming food and trade policies, diversifying food supplies, and collaborating with other countries to ensure regional food security. Integrated food regulations are crucial to ensure food availability, affordability, diversity and safety. Food system transformation is also an important step to overcome vulnerabilities in the system and improve overall food security. Therefore, the formulation of integrated food regulations is an urgent need in realizing food system governance after the COVID-19 pandemic.

In encouraging the acceleration of food security stability in Indonesia, there are 10 recommendations that need to be implemented as stated by(Savary et al., 2020)that is:

a. Encouraging sustainable global production of staple foods is a top priority to ensure the stability of the food basket. Policies must be designed to support sustainable and environmentally friendly agricultural practices.
b. Policies must be created to ensure a sustainable flow of staple foods between regions with food surpluses and food shortages. This could involve international cooperation and policy incentives to address regional imbalances.
c. Food system infrastructure, both material and non-material, must receive sustainable support from public policy. This includes investments in physical infrastructure and improvements in human resources, such as training and extension services.
d. Non-material infrastructure, such as professional training, consultancy, and extension services, needs to be strengthened through public policies to support agricultural sustainability. This could include training programs and consultancy support for farmers.
e. Policies to protect and preserve genetic diversity and genetic resources are key in adapting agrosystems to crises and climate change. This policy should include the development and implementation of regulations that ensure sustainability in genetic use and conservation.
f. Reevaluation of long-term agricultural research strategies must be guided by public policy. This includes appropriate allocation of research funds and strategies that promote innovation in agriculture.
g. Public policies need to strengthen national and international agricultural research systems to deal with climate change, conserve natural capital, and improve agricultural performance. This can include adequate budget allocation and cooperation between countries.
h. Network development for advice and information on research results must be supported by public policy. Public services in agricultural extension must also be strengthened and maintained.
i. Agricultural diversification, particularly through household gardens, must be supported by public policy. This includes policy incentives to encourage diverse farming practices and provide support to farming households.

j. Home garden production systems need to receive support from specific research, education and training policies. This can include budget allocations and the development of programs that support agricultural sustainability at national and international level

5. Conclusions

The global food system is a complex structure that has undergone evolution through social, cultural, economic and technological dimensions. This complexity includes diet, lifestyle of actors in the system, and impact on the environment. Although the process of globalization continues, this structure still reflects the diversity that arises from its local history. The food system shows strength and resilience, but can also be shaken in several aspects, especially when faced with crises such as conflict, environmental disasters, global food price crises, economic downturns, and pandemics. Approaches to understanding food systems involve analyzing components such as production, storage, transportation, economic access, and consumption. In another perspective, there is an identification of three main components, namely the food supply chain, food environment, and consumer behavior. These components are influenced by various driving factors, including biophysical and environmental, innovation and technology, policy and economic, sociocultural, and demographic.

In the realm of food production, there is a diversity of production units ranging from large-scale commercial farms in Northern countries to small-scale farms in Southern countries. On the consumption side, the comparison between "staple" food and "nutritious" food is a key point for understanding the dynamics of this system. The COVID-19 pandemic has demonstrated a significant impact on food systems, particularly through the closure of food processing facilities and disruption of supply chains, increasing the risk of hunger, and highlighting imbalances in food security. The crisis also provides insight into diverse adaptations to system stress, which are strongly influenced by geographic and economic context. In the Indonesian context, the COVID-19 pandemic has had a serious impact on the agricultural sector, which is the backbone of people's lives. Challenges such as decreasing productivity, distribution limitations, drought crises, and climate change demand fundamental changes in food and agricultural management.

Overcoming these challenges requires collaboration between government, the private sector and society. Reforming food and trade policies, diversifying food supplies, and investing in agricultural infrastructure are key to strengthening food security. Public awareness of their important role in maintaining access to food is also a crucial factor. Sustained food security is not only relevant in the context of a pandemic, but also as a main element in the stability of the country as a whole. The future outlook emphasizes the need for transformation in the global food system, taking into account aspects of sustainability, production efficiency, natural resource management and responses to global change. Facing future challenges, including the food crisis, requires a holistic understanding of the direct impacts on human needs, agriculture and the environment. Synergy between various stakeholders, integrated regulations,

and adaptation to changing global contexts are the keys to achieving effective and sustainable solutions

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