

Integrated Management of Food Security and National Defense Systems to Face Global Challenges

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Abstract: The integration of food security with the national defense system faces significant challenges in the ever-changing global dynamics. Food crises triggered by climate change, geopolitical conflicts, and dependence on food imports pose serious threats to national sovereignty. From a management perspective, this integration requires a comprehensive and sustainable management strategy. One of the main challenges is the high dependence on food imports, which creates vulnerability to global supply disruptions. Therefore, integrated management is needed that emphasizes efficiency, cross-sector coordination, and strengthening local capacity in food provision. The purpose of this study is to analyze the relationship between food security and the national defense system within the framework of strategic management in facing global challenges, such as climate change, dependence on food imports, and potential threats of economic and geopolitical crises. The theory used is Food System Theory, which views food as an interconnected system ranging from production, distribution, to consumption. The research method used is a literature study with a managerial approach, namely reviewing, analyzing, and synthesizing various relevant literature sources. The results of the study indicate several important indicators in the management of the integration of food security and national defense, including: Local Food Availability Management, strengthening domestic production. Defense and Food Security Policy, integration of cross-sector policies. Import Dependency Risk Management, reducing vulnerability to global supply. Utilization of Technology and Innovation, increasing production and distribution efficiency. Inter-Agency Collaborative Management, strengthening synergy between government, communities, and the private sector.

Keywords: Food Security, Global Challenges, National Defense

A. Introduction

Food security has become one of the most critical global strategic issues due to the increasing impacts of climate change, geopolitical conflicts, economic instability, and disruptions in global supply chains (Mihrete & Mihretu, 2025). According to the Food

and Agriculture Organization (FAO), hundreds of millions of people continue to experience food insecurity, while global food production and distribution systems face growing pressure from extreme weather events, trade restrictions, and international conflicts (Anis & Norfarizan-Hanoon, 2022). These conditions have shifted food security from being solely an agricultural concern to becoming an essential component of national security and resilience. Consequently, many countries have begun incorporating food resilience into their national security strategies as a means of safeguarding economic stability, social cohesion, and national defense.

Indonesia faces similar challenges. Although endowed with abundant agricultural resources, the country remains dependent on imported strategic food commodities, exposing it to fluctuations in international markets, geopolitical tensions, and disruptions in global supply chains (Sundram, 2023). Climate change has also intensified the frequency of floods, droughts, and other extreme weather events that reduce agricultural productivity and threaten domestic food availability (Saccone & Vallino, 2025). At the same time, advances in precision agriculture, biotechnology, digital farming, and smart irrigation systems offer significant opportunities to strengthen domestic food production and improve national food resilience (García-Díez et al., 2021). However, these technological opportunities require integrated governance involving government institutions, research organizations, the private sector, and local communities to ensure effective implementation.

Food System Theory provides an appropriate theoretical perspective for understanding the interconnections among food production, distribution, consumption, governance, and resilience (Daniel et al., 2022). The theory emphasizes that food security is influenced not only by agricultural production but also by institutional coordination, infrastructure, technological innovation, policy integration, and risk management (Molotoks et al., 2021). Within this perspective, food systems should be managed as interconnected strategic systems capable of supporting national resilience, particularly during crises arising from climate change, global economic shocks, or geopolitical conflict.

Despite increasing recognition of food security as a strategic national issue, existing studies have primarily examined food security from agricultural, economic, or environmental perspectives, while relatively limited attention has been given to its formal integration within national defense management systems (Ben Hassen & El Bilali, 2022). Moreover, studies addressing institutional coordination between defense agencies and agricultural authorities remain scarce, particularly in Southeast Asia. Previous research has also rarely examined how import dependency, fragmented governance, and technological readiness collectively influence national defense resilience through food security mechanisms (Sarangi et al., 2024). This represents an important research gap because effective national defense increasingly depends on resilient food systems capable of sustaining national stability during multidimensional crises.

Based on these gaps, this study aims to develop an integrated management framework linking food security and national defense in Indonesia by identifying the key management indicators connecting both sectors, analyzing the implications of food import dependency for national defense vulnerability, and formulating strategies to strengthen policy integration between agricultural and defense institutions. Accordingly, this study addresses the following research questions:

RQ1: What management indicators effectively link food security and national defense?

RQ2: How does food import dependency affect Indonesia's national defense vulnerability?

RQ3: What strategies can reduce policy fragmentation between the agricultural and defense sectors to strengthen national resilience?

B. Methods

The method used is a literature study, which is used to collect, analyze, and synthesize information from various written sources relevant to the research topic (Prosekov & Ivanova, 2018). This approach aims to understand theoretical frameworks, concepts, or previous findings that can support the development of arguments or hypotheses in the research. Through a literature study, researchers can identify knowledge gaps, examine diverse perspectives, and evaluate the reliability and relevance of previous studies. Furthermore, this method helps researchers avoid research duplication and build a strong foundation for designing appropriate research methods (Saleem et al., 2025). By integrating information from various sources, a literature study enables researchers to gain a comprehensive understanding of the context and issues being studied.

C. Results and Discussion

Results

A systematic review of previous studies identified five major themes that explain the relationship between food security and national defense, namely: (1) local food availability, (2) defense policy and food security, (3) dependence on food imports, (4) the role of technology in food security, and (5) inter-institutional collaboration. These themes represent the principal dimensions required to establish an integrated food security management framework capable of supporting national defense resilience.

Theme 1. Local Food Availability

Previous studies consistently identify local food availability as the foundation of national food security. Studies conducted demonstrate that sustainable food availability depends on effective distribution systems, government policy support, agricultural innovation, and coordination among relevant stakeholders (Prayitno et

al., 2025). However, local food production remains constrained by seasonal dependence, agricultural land conversion, climate change, and limited adoption of modern agricultural technology. These constraints reduce production stability and increase vulnerability to domestic food shortages. Although previous studies comprehensively explain factors affecting local food production, they primarily evaluate food availability from agricultural and socio-economic perspectives (Reed et al., 2022). Limited attention has been given to how disruptions in local food availability influence national defense readiness, military logistics, and strategic food reserves. Therefore, local food availability should be recognized not only as an agricultural objective but also as a strategic component of national defense resilience.

Theme 2. Defense Policy and Food Security

The reviewed literature consistently emphasizes that food security policies significantly influence national stability and strategic resilience, that is conclude that adaptive and integrated food policies strengthen national preparedness against external threats, economic crises, and supply chain disruptions (Abbas et al., 2025). These studies also underline the importance of incorporating food security considerations into long-term national development planning. Nevertheless, existing studies generally discuss defense policy and food security as separate policy domains. Only limited research explicitly investigates how defense institutions should be integrated into national food security governance (Akpabio et al., 2025). Consequently, there remains an important policy gap regarding institutional mechanisms capable of synchronizing agricultural policy, food reserve management, and defense planning into a unified national resilience framework.

Theme 3. Dependence on Food Imports

Dependence on imported food commodities emerges as one of the most significant sources of vulnerability within Indonesia's food system. Previous studies indicate that reliance on imported rice, wheat, soybeans, and other strategic commodities exposes the country to international price volatility, geopolitical tensions, trade restrictions, and global supply chain disruptions (Rusmawati et al., 2023). These conditions increase national vulnerability during periods of international conflict or global food crises. Although previous literature acknowledges the economic consequences of import dependency, very few studies evaluate its implications for national defense (Pozza & Field, 2020). Existing research rarely examines how external supply disruptions may affect military logistics, emergency preparedness, or strategic food reserves. This indicates that food import dependency should be considered not only as an economic issue but also as a strategic security concern requiring integrated management.

Theme 4. The Role of Technology in Food Security

The literature consistently demonstrates that agricultural technology plays a critical role in improving food production, productivity, and resilience (Garcia et al., 2020). Modern technologies such as precision agriculture, biotechnology, smart irrigation systems, remote sensing, drones, and digital agricultural management significantly increase production efficiency while improving adaptation to climate change. Previous studies also highlight that technological innovation contributes to sustainable agricultural development and strengthens long-term food security. However, widespread implementation remains constrained by limited technological adoption among farmers, inadequate research investment, weak innovation ecosystems, and insufficient rural infrastructure (Hussain et al., 2025). Existing studies predominantly focus on technological benefits for agricultural productivity but rarely discuss how technological innovation contributes to strengthening national resilience, strategic food reserves, or defense logistics. Consequently, integrating technological innovation into food-defense management remains an important research gap.

Theme 5. Inter-Institutional Collaboration

The literature consistently recognizes inter-institutional collaboration as a prerequisite for sustainable food security governance. Previous studies indicate that collaboration among government agencies, research institutions, universities, private enterprises, and local communities improves policy coordination, emergency response capacity, technology dissemination, and food distribution systems (Nor & Yusof, 2025). Effective collaboration also enables more adaptive responses to climate change, natural disasters, and global market instability.

Despite these findings, previous studies generally concentrate on agricultural governance without adequately considering collaboration between food institutions and defense organizations (Zulkifli et al., 2025). Institutional fragmentation remains one of the major obstacles preventing comprehensive national food security management. Consequently, stronger governance mechanisms are required to integrate ministries responsible for agriculture, defense, national development planning, food reserves, and disaster management into a coordinated national food security framework.

Overall, the synthesis of previous studies demonstrates that food security is influenced by multiple interconnected dimensions rather than by agricultural production alone. Local food availability, policy integration, import dependency, technological innovation, and institutional collaboration collectively determine national resilience (Tyczevska et al., 2023). Nevertheless, existing studies rarely integrate these dimensions within a comprehensive national defense management framework. This finding confirms the existence of a significant research gap and

provides the rationale for developing an integrated food security and national defense management model.

Table 1. Synthesis of Previous Studies

Theme	Key Findings	Research Gap	Relevance to National Defense
Local Food Availability	Local production depends on effective distribution, innovation, and government support.	Previous studies rarely connect local food supply with defense logistics and strategic reserves.	Stable domestic food production strengthens national resilience and military logistics.
Defense Policy and Food Security	Integrated food policies improve national resilience and crisis preparedness.	Limited studies integrate defense institutions into food security governance.	Food security should become a component of national defense planning.
Dependence on Food Imports	Import dependency increases vulnerability to global market disruptions and geopolitical instability.	Defense implications of import dependency remain largely unexplored.	Reducing import dependency enhances strategic autonomy and national security.
Role of Technology	Precision agriculture and digital technologies improve productivity and sustainability.	Existing studies rarely examine technology from a defense resilience perspective.	Agricultural technology strengthens strategic food resilience and emergency preparedness.
Inter-Institutional Collaboration	Collaboration improves governance, policy implementation, and emergency response.	Coordination between food institutions and defense agencies remains weak.	Integrated governance enhances national preparedness against multidimensional threats.

Discussion

The findings demonstrate that food security and national defense are interconnected strategic systems that cannot be managed independently. The synthesis of previous studies shows that local food availability, defense policy, import dependency, technological innovation, and inter-institutional collaboration collectively determine the resilience of a nation's food system (Tyczevska et al., 2023). Rather than functioning as separate policy domains, these components form an integrated system in which weaknesses in one dimension directly influence the performance of the others. Consequently, strengthening national food security requires a governance framework that simultaneously addresses agricultural productivity, institutional coordination, strategic logistics, and national defense preparedness.

These findings strongly support the principles of Food System Theory, which argues that food security is determined through the interaction of production, distribution, consumption, governance, and resilience rather than agricultural production alone (Wudil et al., 2022). Within this theoretical framework, food systems operate as interconnected networks where disturbances in one subsystem inevitably affect the overall performance of the system. In Indonesia, limited domestic production

increases dependence on imported food commodities, while inefficient distribution systems reduce accessibility and weaken national food reserves (Clapp et al., 2022). At the same time, fragmented governance among ministries limits policy effectiveness, thereby reducing the country's ability to respond to food crises. This demonstrates that food security should be understood as a systemic issue requiring integrated management across multiple sectors.

From a national defense perspective, Food System Theory provides a broader understanding that food security is not merely a social welfare objective but also a strategic national asset (Islam, 2025). Stable food production supports military logistics, strategic food reserves, disaster response capacity, and civilian resilience during emergencies. Conversely, disruptions in domestic food production or international food supply chains may reduce the government's ability to maintain social stability, support military operations, and sustain critical public services during crises. Therefore, integrating food security into national defense planning contributes directly to strengthening comprehensive national resilience.

One of the most significant findings concerns Indonesia's dependence on imported food commodities. Although imports remain necessary to stabilize domestic supply in the short term, excessive dependence creates strategic vulnerabilities during geopolitical conflicts, global pandemics, international trade restrictions, or supply chain disruptions (Christiansen, 2019). Under these circumstances, food insecurity extends beyond economic concerns and becomes a national security issue because shortages of strategic commodities may undermine political stability, increase social unrest, and reduce defense readiness. Consequently, reducing import dependency through increased domestic production should be considered a strategic defense priority rather than solely an agricultural policy objective.

The findings further indicate that technological innovation plays an essential role in strengthening food security. Precision agriculture, digital farming, biotechnology, artificial intelligence, remote sensing, and smart irrigation systems improve production efficiency while increasing resilience against climate change and natural disasters (Bullock & Chêne, 2019). However, technology alone cannot solve food security challenges without supportive governance, sufficient investment, research capacity, and institutional commitment. The limited adoption of agricultural technology among Indonesian farmers reflects structural challenges related to financing, education, infrastructure, and innovation management. Therefore, technological transformation should be accompanied by comprehensive institutional reforms that facilitate knowledge transfer, research collaboration, and farmer capacity development.

Institutional collaboration also emerges as a critical determinant of successful food security management. The literature consistently demonstrates that effective cooperation among ministries, research institutions, universities, local governments,

and private organizations enhances policy implementation, emergency response, technological diffusion, and food distribution efficiency (Malakootian & Nozari, 2019). Nevertheless, the Indonesian governance system continues to experience fragmentation between agricultural institutions and defense organizations. This fragmentation reduces policy coherence and delays coordinated responses during food emergencies. Strengthening cross-sectoral governance is therefore essential to establish an integrated national food security management system capable of responding to multidimensional threats.

The present findings are also consistent with international experiences. China has incorporated food security into its broader national security strategy by investing heavily in agricultural modernization, strategic grain reserves, and technological innovation to reduce external dependence. Israel, despite limited natural resources, has successfully strengthened national food resilience through advanced irrigation technology, agricultural research, and continuous innovation (Boenke, 2019). Similarly, Singapore maintains state-managed strategic food stockpiles integrated with civil defense planning while simultaneously diversifying international food supply chains to minimize disruption risks. Compared with these countries, Indonesia still relies primarily on sectoral coordination among ministries rather than an integrated food-defense governance framework. This comparison suggests that Indonesia requires stronger institutional integration supported by long-term strategic planning and modern food system management.

Despite supporting greater integration between food security and national defense, alternative perspectives should also be considered. Some scholars argue that food security should remain predominantly under civilian governance because excessive involvement of defense institutions may create the perception of agricultural militarization and reduce institutional flexibility (Buckley, 2019). This perspective emphasizes that agricultural development should continue to prioritize farmers' welfare, market efficiency, and community participation rather than military objectives. Nevertheless, the present study does not propose military control over agricultural production. Instead, it advocates collaborative governance in which civilian institutions remain responsible for food production and agricultural development, while defense institutions contribute to strategic planning, emergency logistics, infrastructure protection, and national preparedness during crises.

The findings also contribute to the theoretical development of Food System Theory by extending its application beyond conventional agricultural and food policy studies. Previous studies generally explain food systems from production, consumption, environmental sustainability, or economic perspectives (Baqi, 2019). This study expands the theoretical framework by demonstrating that national defense represents an additional strategic dimension influencing food system resilience. Accordingly, food security should be viewed as a multidimensional governance system integrating

agricultural management, technological innovation, institutional collaboration, strategic logistics, and national defense planning within a single policy framework.

From a policy perspective, several strategic implications emerge from this study. First, the Ministry of Agriculture should accelerate the implementation of precision agriculture, climate-smart farming, and farmer capacity-building programs to improve domestic production. Second, the Ministry of Defense should formally integrate food security considerations into national defense planning, including strategic food reserves and military logistics (Soto Monroy, 2019). Third, the National Food Agency should strengthen national food reserve management and improve emergency food distribution mechanisms. Fourth, the National Development Planning Agency (Bappenas) should formulate an integrated national roadmap connecting agricultural development with national resilience objectives. Finally, provincial and local governments should establish regional food resilience clusters that promote collaboration among farmers, research institutions, local industries, and community organizations. These coordinated policy actions will reduce food import dependency, improve domestic production capacity, strengthen strategic preparedness, and enhance Indonesia's overall national resilience against future multidimensional threats.

Table 2. Thematic Synthesis of Previous Studies on Food Security and National Defense

Theme	Key Findings	Research Gap	Relevance to National Defense
Local Food Availability	Local food availability is influenced by agricultural productivity, distribution efficiency, climate resilience, and government support. Sustainable domestic production reduces food insecurity and improves supply stability.	Previous studies mainly discuss local food availability from agricultural and economic perspectives without examining its contribution to defense logistics and national resilience.	Stable local food production ensures strategic food reserves, strengthens military logistics, and improves national resilience during emergencies.
Defense Policy and Food Security	Integrated food policies improve national preparedness, strengthen food sovereignty, and enhance resilience against economic and geopolitical shocks.	Existing studies rarely integrate food security into national defense planning or explain institutional coordination between agricultural and defense sectors.	Food security should become a strategic component of national defense policy to support long-term national stability.
Dependence on Food Imports	Heavy reliance on imported food commodities increases vulnerability to international price fluctuations, trade restrictions, and geopolitical conflicts.	Limited research investigates how import dependency affects military readiness, strategic food reserves, and national defense capability.	Reducing food import dependency enhances national strategic autonomy and decreases external security risks.

Role of Technology in Food Security	Precision agriculture, biotechnology, digital farming, and smart irrigation improve agricultural productivity, efficiency, and climate resilience.	Previous studies focus primarily on agricultural productivity while overlooking technology's contribution to defense logistics and national preparedness.	Agricultural technology strengthens domestic production capacity, strategic food reserves, and defense resilience during crises.
Inter-Institutional Collaboration	Effective collaboration among government agencies, research institutions, private organizations, and local communities improves policy implementation and emergency response capacity.	Institutional coordination between food authorities and defense organizations remains fragmented and insufficiently explored.	Cross-sector collaboration supports integrated food governance, emergency logistics, and comprehensive national defense preparedness.

The synthesis presented in Table 2 demonstrates that previous studies have predominantly examined food security from agricultural, economic, environmental, or governance perspectives. Although these studies provide valuable insights into domestic food production, technological innovation, and institutional collaboration, they rarely integrate these dimensions into a comprehensive national defense management framework. This study addresses this research gap by proposing an integrated governance model that positions food security as a strategic pillar of national defense and resilience.

Policy Implications and Theoretical Contribution

The findings of this study generate important theoretical and practical implications for strengthening the integration of food security and national defense in Indonesia. From a theoretical perspective, this study extends the application of Food System Theory by incorporating national defense as an essential component of food system resilience (WHO, 2019). Previous studies have predominantly conceptualized food systems through the dimensions of production, distribution, consumption, governance, and sustainability. While these dimensions remain fundamental, the present study demonstrates that they are also closely associated with national defense capacity, particularly through strategic food reserves, defense logistics, institutional preparedness, and crisis management.

This study proposes that food security should no longer be viewed solely as an agricultural or socio-economic issue but as a strategic national asset that contributes directly to comprehensive national resilience (Committee, 1998). The integration of local food availability, defense policy, technological innovation, institutional collaboration, and reduced dependence on imported food commodities forms a comprehensive governance framework capable of enhancing both food sovereignty

and national security. Accordingly, this study expands Food System Theory by introducing a defense management perspective that has received limited attention in previous research, particularly in developing countries.

Furthermore, this study contributes to the literature by demonstrating that the effectiveness of national food security depends not only on increasing agricultural productivity but also on strengthening institutional coordination across multiple sectors (Inas Adil, 2019). The findings indicate that fragmented governance among agricultural institutions, defense organizations, research institutions, and regional governments reduces policy effectiveness and weakens national preparedness in responding to multidimensional threats. Therefore, an integrated governance approach is required to ensure that food security policies support long-term national resilience.

From a policy perspective, the findings suggest that food security should be formally incorporated into Indonesia's national defense strategy. The Ministry of Agriculture should prioritize climate-smart agriculture, precision farming, and digital agricultural transformation to improve domestic food production and reduce vulnerability to climate change (Hessien et al., 2019). Simultaneously, the Ministry of Defense should integrate strategic food security considerations into national defense planning, including military logistics, emergency food reserves, and contingency planning for food-related crises. Such integration will strengthen Indonesia's preparedness against geopolitical instability, supply chain disruptions, and natural disasters.

The National Food Agency should strengthen the management of strategic food reserves through improved storage systems, early warning mechanisms, and integrated emergency food distribution networks capable of responding rapidly during national emergencies (Yolanda Natasha Basson, 2019). In addition, the National Development Planning Agency (Bappenas) should formulate a long-term national roadmap that integrates agricultural development, food security, disaster risk reduction, and national defense into a unified policy framework. This integrated planning approach will reduce institutional fragmentation while improving coordination among relevant ministries and agencies.

At the regional level, provincial and local governments should establish food resilience clusters by strengthening collaboration among farmers, universities, research institutions, private enterprises, and community organizations. Such collaborative governance will accelerate technological adoption, improve local food production capacity, and increase regional self-sufficiency (Kolzow et al., 2021). Moreover, investment in agricultural research, digital innovation, climate adaptation technologies, and human resource development should become a national priority to reduce dependence on imported food commodities and strengthen Indonesia's strategic autonomy.

Overall, the theoretical and policy contributions of this study provide a foundation for developing an integrated food security governance model that supports both sustainable agricultural development and national defense resilience (Mihrete & Mihretu, 2025). By positioning food security as a strategic pillar of comprehensive national security, this study offers a new perspective for policymakers and scholars seeking to strengthen Indonesia's capacity to address increasingly complex global food and security challenges.

D. Conclusions

This study demonstrates that integrating food security into the national defense system is essential for strengthening Indonesia's resilience in responding to increasingly complex global challenges, including climate change, geopolitical instability, supply chain disruptions, and global food crises. Through a systematic review, five strategic management indicators were identified as the key dimensions for developing an integrated food security and national defense framework: local food availability, policy integration, food import risk reduction, technological innovation, and inter-institutional collaboration. These dimensions are interdependent and collectively determine the effectiveness of national food security management in supporting long-term national resilience. The findings indicate that Indonesia's continued dependence on imported food commodities and fragmented coordination among government institutions create strategic vulnerabilities that may weaken both food sovereignty and national defense preparedness. Therefore, food security should no longer be viewed solely as an agricultural issue but as a strategic component of comprehensive national security. Integrating food governance with defense planning enables the development of more resilient food systems capable of sustaining military logistics, strategic food reserves, emergency preparedness, and civilian resilience during periods of crisis. From a practical perspective, this study provides several policy implications for Indonesian policymakers. The Ministry of Agriculture should accelerate climate-smart agriculture, precision farming, and technology adoption programs to increase domestic food production while reducing vulnerability to climate change. The Ministry of Defense should formally integrate food security into national defense planning by strengthening strategic food reserves and emergency logistics. Furthermore, the National Food Agency, the National Development Planning Agency (Bappenas), and regional governments should establish an integrated governance mechanism to improve cross-sector coordination, strengthen strategic food reserve management, and promote sustainable food resilience. The establishment of a National Food Defense Council, involving relevant ministries, research institutions, and the private sector, is recommended to coordinate national food security and defense policies more effectively. In addition, technology transfer programs should be expanded to enable smallholder farmers to adopt modern agricultural technologies and improve domestic production capacity. Despite these contributions, this study has several limitations. First, the research is based exclusively on a systematic literature review and does not include primary empirical data

collected from policymakers or other stakeholders. Second, the analysis focuses primarily on the Indonesian context; therefore, the findings may not be directly generalizable to countries with different political, institutional, or agricultural systems. Third, the proposed governance framework has not yet been empirically validated through quantitative or qualitative field studies. Future research should focus on empirically testing the proposed framework using case studies, surveys, or interviews involving policymakers, defense institutions, agricultural agencies, and other relevant stakeholders. Comparative studies involving countries with different food security strategies, particularly those in Southeast Asia, Africa, and South Asia, would also provide valuable insights into the effectiveness of integrated food security and defense governance models. Furthermore, future studies may examine the role of emerging technologies, including artificial intelligence, digital agriculture, and predictive food security analytics, in strengthening national resilience against multidimensional threats. Overall, this study contributes to the growing body of knowledge on food security governance by demonstrating that sustainable food systems and national defense are mutually reinforcing components of comprehensive national resilience. The proposed integrated management framework provides both a theoretical foundation and practical guidance for policymakers seeking to strengthen Indonesia's food sovereignty while enhancing national preparedness against future global challenges.

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References

- Abbas, S., Haider, A., Kousar, S., Lu, H., Lu, S., Liu, F., Li, H., Miao, C., Feng, W., Ahamad, M. I., Mehmood, M. S., & Zulqarnain, R. M. (2025). Climate variability, population growth, and globalization impacting food security in Pakistan. *Scientific Reports*, 15(1). <https://doi.org/10.1038/s41598-025-88916-2>
- Akpabio, E. S., Akeju, K. F., & Omotoso, K. O. (2025). E-agriculture and food security in developing countries: beaming the searchlight on Nigeria. *Smart Agricultural Technology*, 10. <https://doi.org/10.1016/j.atech.2024.100689>
- Anis, M. M. S., & Norfarizan-Hanoon, N. A. (2022). Interrelated of food safety, food security and sustainable food production. In *Food Research* (Vol. 6, Number 1). [https://doi.org/10.26656/fr.2017.6\(1\).696](https://doi.org/10.26656/fr.2017.6(1).696)
- Baqi, F. A. (2019). Implementing Question-Answer Relationships (Qar) Strategy To Improve Students' Reading Comprehension Skill. *English Journal*, 13(2).

- Ben Hassen, T., & El Bilali, H. (2022). Impacts of the Russia-Ukraine War on Global Food Security: Towards More Sustainable and Resilient Food Systems? *Foods*, 11(15). <https://doi.org/10.3390/foods11152301>
- Boenke, L. (2019). Misinformation about Travel Vaccines and the Perceived Credibility Assessment by University Students. *Molecules*, 9(1).
- Buckley, C. J. (2019). Factors that influence *Neisseria gonorrhoeae* antimicrobial resistance and transmission in Australia. *Journal of Infectious Diseases*, 9(1).
- Bullock, J., & Chêne, M. (2019). Corruption and unsolicited proposals: Risks, accountability and best practices. *Government Information Quarterly*, 9(1).
- Christiansen, P. E. (2019). Diplomacy Becomes Them: Mediating Knowledge In Spaces Of Conflict Resolution. *Molecules*, 9(1).
- Clapp, J., Moseley, W. G., Burlingame, B., & Termine, P. (2022). Viewpoint: The case for a six-dimensional food security framework. In *Food Policy* (Vol. 106). <https://doi.org/10.1016/j.foodpol.2021.102164>
- Committee, S. (1998). IEEE Standard for Software Verification and Validation IEEE Standard for Software Verification and Validation. In *IEEE Institute of Electrical and Electronics Engineers* (Vol. 1998, Number July).
- Daniel, A. I., Fadaka, A. O., Gokul, A., Bakare, O. O., Aina, O., Fisher, S., Burt, A. F., Mavumengwana, V., Keyster, M., & Klein, A. (2022). Biofertilizer: The Future of Food Security and Food Safety. In *Microorganisms* (Vol. 10, Number 6). <https://doi.org/10.3390/microorganisms10061220>
- Garcia, S. N., Osburn, B. I., & Jay-Russell, M. T. (2020). One Health for Food Safety, Food Security, and Sustainable Food Production. In *Frontiers in Sustainable Food Systems* (Vol. 4). <https://doi.org/10.3389/fsufs.2020.00001>
- García-Díez, J., Gonçalves, C., Grispoli, L., Cenci-Goga, B., & Saraiva, C. (2021). Determining food stability to achieve food security. In *Sustainability (Switzerland)* (Vol. 13, Number 13). <https://doi.org/10.3390/su13137222>
- Hessien, S., Tokgöz, S. C., Anous, N., Boyacı, A., Abdallah, M., Qaraqe, K. A., Talaei, F., Zhan, J., Dong, X., Pan, X., Yan, C., Zhang, J., Ge, L., Dong, P., Zhang, H. Y., Wang, J.-B. J.-Y., You, X., Yao, W., Yahya, A., ... Mestre, X. (2019). Secrecy Analysis of Generalized Space-Shift Keying Aided Visible Light Communication. *IEEE Access*, 7(2).
- Hussain, M. A., Li, L., Kalu, A., Wu, X., & Naumovski, N. (2025). Sustainable Food Security and Nutritional Challenges. *Sustainability (Switzerland)*, 17(3). <https://doi.org/10.3390/su17030874>
- Inas Adil, A. A. (2019). Antimicrobial Activity of *Nigella sativa* Seed Extracts Against *Staphylococcus aureus* Nasal Isolates among Sudan University of Science and Technology Students. *Molecules*, 9(1).
- Islam, S. (2025). Agriculture, food security, and sustainability: a review. In *Exploration of Foods and Foodomics* (Vol. 3, Number 1). <https://doi.org/10.37349/eff.2025.101082>
- Kolzow, D. R., Smith, C. C. C., Serrat, O., Dilie, H. M., Zeeshan, S., Ng, S. I., Ho, J. A., Jantan, A. H., Massey, J., Sulak, T., Sriram, R., Dennis, R. S., Bocarnea, M., Hai, T. N., Van, Q. N., Herbert, S. L., So-Jung Kim, Kyoung-Seok Kim, Y.-G. C.,

- Guillaume, Dr. O., Honeycutt, Dr. A., ... Ingram, O. C. Jr. (2021). Unit 5 Theories of Leadership. *International Journal of Organizational Leadership*, 1(1).
- Malakootian, M., & Nozari, M. (2019). Contribution of the Sensitivity Analysis in Groundwater Vulnerability Assessing Using the DRASTIC and Composite DRASTIC Indexes. *Molecules*, 9(1).
- Mihrete, T. B., & Mihretu, F. B. (2025). Crop Diversification for Ensuring Sustainable Agriculture, Risk Management and Food Security. In *Global Challenges* (Vol. 9, Number 2). <https://doi.org/10.1002/gch2.202400267>
- Molotoks, A., Smith, P., & Dawson, T. P. (2021). Impacts of land use, population, and climate change on global food security. *Food and Energy Security*, 10(1). <https://doi.org/10.1002/fes3.261>
- Nor, B. A., & Yusof, Y. (2025). Environmental degradation and food security in Somalia. *Discover Sustainability*, 6(1). <https://doi.org/10.1007/s43621-024-00771-9>
- Pozza, L. E., & Field, D. J. (2020). The science of Soil Security and Food Security. In *Soil Security* (Vol. 1). <https://doi.org/10.1016/j.soisec.2020.100002>
- Prayitno, G., Auliah, A., Zuhriyah, L., Efendi, A., Arifin, S., Rahmawati, R., Nugraha, A. T., & Siankwilimba, E. (2025). Exploring the Role of Food Security in Stunting Prevention Efforts in the Bondowoso Community, Indonesia. *Societies*, 15(5). <https://doi.org/10.3390/soc15050135>
- Prosekov, A. Y., & Ivanova, S. A. (2018). Food security: The challenge of the present. In *Geoforum* (Vol. 91). <https://doi.org/10.1016/j.geoforum.2018.02.030>
- Reed, C., Anderson, W., Kruczkiewicz, A., Nakamura, J., Gallo, D., Seager, R., & McDermid, S. S. (2022). The impact of flooding on food security across Africa. *Proceedings of the National Academy of Sciences of the United States of America*, 119(43). <https://doi.org/10.1073/pnas.2119399119>
- Rusmawati, E., Hartono, D., & Aritenang, A. F. (2023). Food security in Indonesia: the role of social capital. *Development Studies Research*, 10(1). <https://doi.org/10.1080/21665095.2023.2169732>
- Saccone, D., & Vallino, E. (2025). Global food security in a turbulent world: reviewing the impacts of the pandemic, the war and climate change. In *Agricultural and Food Economics* (Vol. 13, Number 1). <https://doi.org/10.1186/s40100-025-00388-0>
- Saleem, A., Anwar, S., Nawaz, T., Fahad, S., Saud, S., Ur Rahman, T., Khan, M. N. R., & Nawaz, T. (2025). Securing a sustainable future: the climate change threat to agriculture, food security, and sustainable development goals. In *Journal of Umm Al-Qura University for Applied Sciences* (Vol. 11, Number 3). <https://doi.org/10.1007/s43994-024-00177-3>
- Sarangi, P. K., Pal, P., Singh, A. K., Sahoo, U. K., & Prus, P. (2024). Food Waste to Food Security: Transition from Bioresources to Sustainability. In *Resources* (Vol. 13, Number 12). <https://doi.org/10.3390/resources13120164>
- Soto Monroy, W. Y. (2019). Implementación de un sistema de Fitorremediación de Cd y Pb en Aguas de Minería con Azolla Caroliniana. *Molecules*, 9(1).

- Sundram, P. (2023). Food security in ASEAN: progress, challenges and future. *Frontiers in Sustainable Food Systems*, 7. <https://doi.org/10.3389/fsufs.2023.1260619>
- Tyczewska, A., Twardowski, T., & Woźniak-Gientka, E. (2023). Agricultural biotechnology for sustainable food security. In *Trends in Biotechnology* (Vol. 41, Number 3). <https://doi.org/10.1016/j.tibtech.2022.12.013>
- WHO. (2019). Framework for the implementation of the global vector control response in the WHO African Region. *Molecules*, 9(1).
- Wudil, A. H., Usman, M., Rosak-Szyrocka, J., Pilař, L., & Boye, M. (2022). Reversing Years for Global Food Security: A Review of the Food Security Situation in Sub-Saharan Africa (SSA). In *International Journal of Environmental Research and Public Health* (Vol. 19, Number 22). <https://doi.org/10.3390/ijerph192214836>
- Yolanda Natasha Basson. (2019). Towards a unified curriculum for English language learners in South Africa: Possibilities for academic language development at school level. *Molecules*, 9(1).
- Zulkifli, M. F. Bin, Rahman, A. A. A., Zulkifli, N., Yasid, A. F. M., Mat, B., & Alias, M. S. Bin. (2025). Implications Due to Challenges to Food Security in Malaysia. *Journal of Ecohumanism*, 4(1). <https://doi.org/10.62754/joe.v4i1.6005>