

# THE ROLE OF FOOD MANUFACTURING INDUSTRIES IN SHAPING INDONESIA'S NATIONAL FOOD SECURITY POLICY FRAMEWORK

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## Abstract

This study aims to examine the strategic role of the food processing industry in forming a national food security policy framework in Indonesia. In the context of increasingly complex global dynamics and domestic challenges, the food processing sector is one of the key elements in supporting the availability, affordability, and sustainability of food. This study uses a literature review method by examining various scientific sources, government policies, and secondary data related to industry performance and national food policies. The results of the study show that the food processing industry not only plays a role in increasing the added value of agricultural products, but also in creating an efficient distribution system, expanding market access, and strengthening strategic food reserves. Furthermore, this industry has a significant contribution to the formation of policies that are responsive to the food crisis, increasing nutritional security, and achieving sustainable development goals. Thus, close integration between the industrial sector and public policy is an important prerequisite for strengthening national food security in the future.

**Keywords:** *food processing industry, food security policy, food sustainability, Indonesia*

## INTRODUCTION

Food security is a strategic issue that is always a major concern in national development planning in Indonesia. As a country with a population of more than 270 million people, Indonesia faces a major challenge in ensuring the availability of sufficient, safe, nutritious, and sustainable food for its entire population. The increasing need for food is not only caused by population growth, but also by changes in consumption patterns, increasing community income, urbanization, and increasing awareness of the importance of nutrition and food safety. In this context, the food processing industry plays an increasingly strategic role and cannot be separated from the framework for developing national food security. The food processing industry is the main link between the primary food production sector and end consumers. It plays a role in processing agricultural, livestock, and fishery products into food products that have added value, are more durable, and are easier to distribute. In the modern era, consumers not only demand the availability of food in sufficient quantities, but also expect the quality, safety, and diversity of food products consumed (Andrianti et al., 2024). Therefore, the food processing industry is an important driver in creating efficiency in the national food system and strengthening food security in economic, social, and environmental dimensions.

According to (An Analysis of the Food Security Policy Implementation Framework, 2024) national food security includes three main pillars: availability, accessibility, and utilization of food. The three are interrelated and require an active role from all actors in the food system, including the food processing industry. Food availability is not only determined by primary production results, but also by the ability to process, store, and distribute food effectively. Accessibility to food is influenced by price factors, geographic distance, and logistics infrastructure, which are largely influenced by the existing food industry structure. Meanwhile, food utilization is related to nutrition, food safety, and community consumption habits, where the processing industry is also responsible for providing healthy, nutritious food products that meet national and international food safety standards. In the context of Indonesia, the food processing industry sector has shown fairly stable growth in recent decades. Based on data from the Ministry of Industry, the food and beverage sub-sector is one of the largest contributors to the non-oil and

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gas processing industry structure, both in terms of contribution to national GDP, employment absorption, and exports. The food processing industry also plays a role in increasing the income of farmers, fishermen, and micro, small and medium enterprises (MSMEs) involved in the food supply chain. By processing crops into high-value products, this industry is able to provide positive economic incentives for upstream sector actors and encourage overall food sector productivity. However, the great potential of the food processing industry in strengthening food security has not been fully integrated into the national policy framework. National food policies tend to focus more on aspects of production and stabilization of staple commodity prices, while the development of the food processing industry is still often seen as a matter of the industrial sector alone. In fact, the relationship between food production, processing, distribution, and consumption is a chain that cannot be separated in building a resilient national food system. Therefore, there needs to be a review of the design of a more inclusive food security policy, which not only emphasizes production but also provides space for the development of the processing industry as a strategic actor in the national food system. Furthermore, the role of the food processing industry is also very relevant in facing global challenges that have an impact on Indonesia's food security. The climate crisis, pandemic, geopolitical conflict, and disruption of the global supply chain are real threats to food stability. In these conditions, the food processing industry has the ability to increase the resilience of the food system through product diversification, preservation technology, and the development of a wider and more adaptive distribution network. The industry can also help reduce dependence on imported food products by processing local products into competitive import substitute products. This certainly requires consistent, integrative, and data-based policy support so that this potential can be utilized optimally.

Resilient food security also demands innovation and efficiency in food processing and distribution. Technology is an important key in the development of the future food processing industry, starting from digital-based processing technology, the use of artificial intelligence, the Internet of Things (IoT), to environmentally friendly packaging technology. The development of functional food products, organic food, and increasing nutritional value through fortification are also trends that encourage the industry to continue to innovate. This innovation is not only important to meet the increasingly complex needs of consumers, but also to address the challenges of malnutrition, stunting, and food insecurity that are still problems in various regions of Indonesia (Neilson & Wright, 2017). On the other hand, the food processing industry is also faced with internal challenges that need to be managed properly. Classic problems such as dependence on imported raw materials, fluctuations in commodity prices, limited access to financing, and low technological capacity for small business actors are obstacles to strengthening the role of industry in the food system. This challenge requires affirmative policies from the government to strengthen the domestic industrial base, encourage partnerships between large and small industries, and accelerate technology transfer and increase the human resource capacity of the food industry.

In the context of policy governance, coordination between government institutions is also an important issue that needs to be considered. There is often an overlap of authority between ministries and institutions related to food, industry, trade, and health. As a result, the resulting policies are not synchronized and do not support the strengthening of the industry as a whole. In this case, it is necessary to establish an integrative food security policy framework, which not only looks at production and distribution aspects, but also includes the role of the food processing industry as part of an interconnected and mutually supportive system. The formulation of a national food security policy involving the food processing industry as a key actor will have an impact on the creation of a more inclusive and efficient food ecosystem. With the support of the right policies, the industry can expand investment, strengthen upstream-downstream partnerships, expand access to domestic and export markets, and increase the competitiveness of national food products. In addition, the industry can also play a role in promoting healthy food consumption through product reformulation and consumer education (Arundhati et al., 2019).

This study departs from the need to more comprehensively examine the contribution and potential of the food processing industry in strengthening national food security (Dalimunthe et al., 2024). In this context, the study will identify the actual role of industry in the national food system, examine the obstacles faced, and develop policy recommendations that support industry integration within the framework of the national food security policy. This study will also examine how global dynamics, technological developments, and changes in consumer preferences influence the direction of food industry development in Indonesia. The urgency of this study is further strengthened by the fact that Indonesia is still facing various serious food security issues, ranging from inequality in food distribution between regions, vulnerability to food crises, to nutritional problems that have not been fully resolved. Amid these challenges, the role of the food processing industry as part of the solution is becoming increasingly important. By strategically positioning the industry in the national food policy, Indonesia is not only able to increase the efficiency of the food system, but also encourage economic transformation based on local resources and sustainability. Ultimately, the success of national food security development is largely determined by the extent

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to which all actors in the food system, including the processing industry, are actively involved and supported by a solid, adaptive, and future-oriented policy framework. Therefore, this study is expected to provide an important contribution in formulating a policy approach that is not only oriented towards short-term food security, but also sustainable and resilient in facing various challenges ahead.

## LITERATURE REVIEW

### National Food Security Concept

Food security is a strategic issue that is of global and national concern because it is directly related to the welfare of society, social stability, and security of a country. According to the Food and Agriculture Organization (FAO), food security is defined as a condition in which all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life. This definition emphasizes the importance of food availability, access to food, food utilization, and stability in these aspects over time (Спанкін et al., 2023). At the national level, Indonesia adopts a definition of food security that is in line with the FAO's view, as stated in Law Number 18 of 2012 concerning Food. Food security is defined as a condition in which food is fulfilled for households as reflected in the availability of sufficient food, both in quantity and quality, safe, evenly distributed, and affordable.

The main difference between the FAO and Indonesian definitions lies in the emphasis on affordability and equity, which reflect the socio-geographic and demographic context of Indonesia as an archipelagic country with a fairly high level of distribution inequality. Food security consists of four main dimensions known as the pillars of food security. The first pillar is food availability, which includes domestic production, imports, and national food reserves (Clapp et al., 2022). Food availability is influenced by the productivity of the agricultural sector, climate, access to agricultural inputs, and supporting infrastructure such as irrigation and logistics. The second pillar is food access, namely the ability of individuals and households to obtain the food they need, both physically and economically. This access is highly dependent on income, food prices, market distribution, and food subsidy policies. The third pillar is food utilization, which refers to how people consume food to achieve optimal nutritional status. This aspect relates to food security, consumption behavior, and health and sanitation services that affect nutrient absorption. The fourth pillar is stability, which reflects the sustainability of access to food in the long term, including in the face of disruptions such as natural disasters, price fluctuations, conflicts, or economic crises. Food security cannot be said to be realized if one of the four pillars is not running optimally.

In the national context, policy plays a central role in ensuring that the four pillars of food security can be maintained and strengthened. The government has the responsibility to formulate and implement regulations that support the fulfillment of the right to food, as well as develop a sustainable and resilient food system against various pressures. Agricultural, food, trade, and social welfare policies must be integrated with each other in order to create an inclusive and adaptive food ecosystem. For example, fertilizer and seed subsidy policies aim to increase national food production, while social food assistance programs such as Non-Cash Food Assistance aim to expand poor people's access to nutritious food. On the other hand, strengthening government food reserves and diversifying local food sources are part of the strategy to ensure long-term supply stability. National food security policies are also required to be responsive to climate change, population growth, urbanization, and global trends such as digitalization and changes in consumption patterns (Котикова & Kotykova, 2022). Therefore, the food security strategy does not only focus on food quantity, but also on nutritional quality, food safety, and environmental sustainability. A multi-sectoral approach, involving synergy between central and regional governments, business actors, research institutions, and civil society, is essential in realizing inclusive and equitable food security. Through transparent and participatory food governance, national policies can be an important instrument in building a food system that is able to answer current and future challenges, and ensure that every citizen has the same right to adequate food.

### Food Processing Industry in Indonesia: Conditions and Developments

The food processing industry in Indonesia is one of the strategic sectors in national economic development because of its major role in creating added value from agricultural products, opening up employment opportunities, increasing farmers' incomes, and strengthening community food and nutritional security. Structurally, this industry consists of various business scales, ranging from household industries and micro, small and medium enterprises (MSMEs), to large-scale and multinational companies. Each segment of this industry plays an important role in forming a comprehensive production chain, although with different contributions to gross domestic product. Large companies usually contribute the largest portion to the GDP value of the food processing industry due to their large production capacity and more advanced technology. Meanwhile, MSMEs contribute to economic equality and the

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provision of employment in rural and semi-urban areas (Wattie et al., 2024). The contribution of the food processing industry to Indonesia's GDP has continued to show a positive trend in the last two decades. According to data from the Central Statistics Agency (BPS), the non-oil and gas processing industry sector contributes more than 19% to national GDP, and within it, the food and beverage industry is the main contributor. This shows that food processing is not only a mainstay of the manufacturing sector as a whole, but is also a sector that is resilient to economic shocks, including during the COVID-19 pandemic. During that period, demand for food products was relatively stable and even increased, in line with people's basic needs for food consumption. This shows that the processed food sector has inelastic demand characteristics, making it a relatively safe sector for long-term investment (Arwanto et al., 2022).

The trend in processed food production also shows a significant increase, both in terms of volume and product diversification. This growth is driven by the development of processing technology, increasing domestic and export demand, and increasing public awareness of healthy food and value-added products. Food companies have begun to innovate by presenting various product variants such as nutritious instant foods, functional foods, and local food-based products. Investment in this sector continues to grow, both from domestic and foreign investors. Ease of business licensing, fiscal incentives, and development of food industrial areas are attractive factors for investors. In addition, exports of Indonesian processed food products have experienced stable growth, with main destination countries such as ASEAN, the Middle East, Japan, and the European Union. The commodities that are widely exported include processed palm oil, snacks, processed coffee, and spice-based products (Irianto et al., 2021). Behind the increasing performance of the food processing sector, there is a network of actors involved in the value chain of this industry. The value chain of the food processing industry involves farmers or raw material producers as upstream, then collectors or cooperatives as intermediaries, the processing industry as a production center, distributors and retailers as marketing intermediaries, to end consumers as beneficiaries. The government and supporting institutions also play an important role as regulators, infrastructure providers and facilitators of access to financing and technology. Large companies tend to have more integrated and efficient supply chains, while MSMEs still face challenges such as access to quality raw materials, limited technology, and difficulties in penetrating export markets. Therefore, strengthening the relationship between actors in this value chain is key to increasing the efficiency, competitiveness, and sustainability of the national food processing sector (Fahmid et al., 2022).

In the context of policy, support for strengthening the food processing industry value chain is very important to encourage added value and its contribution to economic growth. The government needs to strengthen the national logistics system, ensure the availability of sustainable raw materials, and encourage collaboration between large business actors and MSMEs through partnership schemes. In addition, strengthening product quality standardization, developing export markets, and empowering farmers and fishermen as raw material providers will strengthen Indonesia's position in the global value chain of the processed food sector. With these strategic steps, the food processing industry is expected to continue to grow and become the main driving force in building national food security and inclusive economic growth in the future.

## METHOD

This study uses a literature review method as the main approach to analyze the role of the food processing industry in shaping the framework of Indonesia's national food security policy. Literature review was chosen because it is able to provide a comprehensive and in-depth understanding of various concepts, theories, historical data, and relevant empirical findings. Through a review of scientific sources such as academic journals, books, policy reports, and government documents, this study attempts to trace the relationship between the development of the food processing industry and its implications for food security in the national context. Data collection was carried out by selecting relevant literature from various scientific databases and policy archives, both national and international. The selection criteria included publications discussing food industry issues, agribusiness sector transformation, food development strategies, and national food policy frameworks. These literatures were then systematically analyzed to identify patterns, research gaps, and dynamics of the relationship between industry actors and the formation of food security regulations and strategies. The analysis was carried out descriptively-critically to evaluate the contribution of the food processing sector to the dimensions of national food availability, affordability, access, and stability. With this literature review method, the study aims to build a conceptual synthesis that explains the strategic role of the food processing industry as the main driver in the national food security ecosystem. This approach also allows researchers to identify policy recommendations based on previous empirical findings, as well as linking the role of industry to global dynamics such as climate change, international trade, and technological innovation. The results of the study are expected to be a strong academic foundation in

formulating a more inclusive, sustainable, and synergy-based food security policy direction between the industrial sector and the government.

## RESULTS AND DISCUSSION

### The Strategic Role of Industry in Formulating Food Security Policies

Industry participation in the formulation of food regulations is a crucial aspect in forming policies that are responsive, realistic, and in line with market dynamics. Amid the complexity of the national food system and global challenges such as the climate crisis, price fluctuations, and geopolitical tensions, food regulations cannot be formulated unilaterally by the government alone. The active participation of industry players, including large and medium-scale food processing companies, provides practical input on field constraints, production capabilities, technology, and distribution chains that have not been fully understood by the bureaucracy. This helps produce regulations that not only prioritize safety and quality standards, but also ensure business continuity and supply chain efficiency (Munaweera et al., 2022). The process of formulating food regulations involving industry has undergone a transformation along with the implementation of the principle of collaborative governance (Yang & Zhang, 2021). Through consultative forums, public dialogues, and focus group discussions, the government openly hears input from industry players regarding draft new regulations, such as setting raw material quality standards, nutritional labeling, chemical residue limits, and export-import provisions for processed foods. One real example is the involvement of the Indonesian Food and Beverage Entrepreneurs Association in the formulation of processed food policies issued by the Food and Drug Supervisory Agency. In such a forum, companies can also voice the impact of certain policies on production costs or operational obstacles, so that a balanced regulatory compromise is created between the interests of consumer protection and industry sustainability.

In addition to large industries, the involvement of the small to medium-scale private sector is also key. Many food regulations have a direct impact on the operations of food MSMEs, especially related to licensing, halal certification, and packaging. Therefore, the involvement of MSME associations and food cooperatives in policy formulation is very important so that regulations do not become bureaucratic obstacles. The government also encourages the formation of partnerships with business incubators and capacity building institutions so that MSMEs are better prepared to comply with regulations. By involving all levels of industry players, food policies will be more inclusive and reach the entire spectrum of food production and distribution. Collaboration between the government, private sector, and research institutions is also an important pillar in the formulation and evaluation of food regulations. Research institutions play a strategic role in presenting scientific data and study results that underlie the formulation of evidence-based regulations. The government can bridge research results with industry needs, while business actors provide feedback on the technical feasibility and implementation costs of the designed policies. This synergy is seen in various national programs such as the development of functional foods, food fortification, and control of microbiological contamination risks. Research produced by universities and institutions such as the National Research and Innovation Agency helps identify health risks and formulate food quality parameters, while industry provides access to field-scale trials and technology validation.

This partnership is not only consultative, but also implementative. Many food policies are implemented through pilot projects or pilot models in certain industries before being implemented nationally. In this context, cross-sector collaboration becomes a forum to evaluate the effectiveness of policies on a small scale, improve weaknesses, and identify implementation barriers. The role of research institutions is also important in conducting independent monitoring and evaluation of policies, supported by objective data. Thus, this collaboration encourages the sustainability of a national food system that is more adaptive to scientific developments and market dynamics (Yang & Zhang, 2021). In addition to involvement in regulation, the partnership model between the food industry and farmers and MSMEs is an important instrument in building a competitive and sustainable national food system. This partnership allows for technology transfer, market access, and increased production capacity upstream in the food system. Many food processing companies build long-term relationships with farmers through production contracts, provision of superior seeds, sustainable cultivation training, and price guarantees. With this kind of partnership pattern, farmers get market certainty and technical assistance, while the industry gets raw materials that meet standards and are guaranteed continuity of supply. A similar model is also applied to strengthen food MSMEs operating in the downstream sector. Large industries can establish partnerships in the form of providing semi-finished materials, processing and packaging training, and joint marketing. Some companies even develop food entrepreneurship ecosystems that include MSME incubation, product legality facilitation, and connections to digital markets. This is an important strategy in empowering the local economy and reducing inequality in the food value chain. These partnerships are often facilitated by non-governmental organizations or food cooperatives, which serve as liaisons between small business actors and large companies (Matthews et al., 2021). Regulatory support that

recognizes the partnership model as part of the national food system is also needed. The government can encourage fiscal incentives or tax breaks for companies that provide guidance to farmers and partner MSMEs. Regulations can also set fair, transparent, and mutually beneficial partnership standards to prevent exploitation. With this approach, industrial partnerships with farmers and MSMEs are not only business instruments, but also economic development strategies based on social justice and food independence. Industrial participation in partnerships like this shows that the business world can be a driving force for the transformation of the food system, not only as economic actors, but also as strategic partners for the state in building national food security.

## Policies and Regulations Affecting the Food Processing Industry

Regulatory barriers and the role of supervisory institutions and harmonization of food quality standards in Indonesia require a comprehensive approach because they involve synergy between state institutions, the business world, and public interests. Within the framework of national development, food policy has become a strategic priority, considering that food is not only a basic human right, but also a key factor in national resilience, social stability, and economic growth. The Indonesian government has issued various regulations and medium to long-term plans to ensure national food security and encourage the growth of the food processing industry as the backbone of the domestic resource-based economy (Phelan et al., 2022). Law Number 18 of 2012 concerning Food is a major milestone in regulating the national food system. This law regulates aspects of food availability, affordability, and security, and emphasizes the importance of food sovereignty and food independence. This law places the strategic role of the food processing industry as a government partner in realizing sustainable food security. However, the implementation of the Food Law still faces major challenges, especially in the synchronization of policies between the center and regions, minimal infrastructure support, and the less than optimal use of data and technology in managing the food supply chain. In the 2020–2024 National Medium-Term Development Plan, food security and strengthening the food processing industry are included in the national priority agenda. The RPJMN targets the development of competitive agro-industry by increasing the added value of local commodities and strengthening the food innovation ecosystem through incentives and research collaboration.

Regulatory barriers remain a significant challenge to the development of the food processing industry in Indonesia. One of the main obstacles is the complexity and overlapping of permits, both from the central government and local governments. Many business actors, especially MSMEs and food cooperatives, face difficulties in obtaining distribution permits, halal certification, and other food safety standards. On the other hand, rapid regulatory changes without adequate socialization and technical assistance often disrupt the stability of industry operations. The absence of an integrated digitalization system between agencies also causes inefficiency in the licensing and reporting process. In addition, fiscal and non-fiscal incentives that should encourage investment in the food processing sector are still unevenly distributed and are enjoyed more by large industries, while small and medium actors have not received adequate affirmative treatment (Popkin et al., 2021).

Amid these challenges, the government has actually developed a number of incentive schemes, such as tax reductions, ease of importing certain raw materials, and access to financing through state financial institutions such as the Indonesian Export Financing Agency and People's Business Credit. However, the effectiveness of these incentive policies still depends on the clarity of technical regulations, transparency of implementation, and the capacity of the institutions involved. For example, regulations regarding local ingredient content often become obstacles to product innovation if they are not accompanied by adaptive flexibility to market dynamics and the availability of raw materials in the regions. Therefore, policy reforms are needed that are oriented towards simplifying procedures, harmonization between agencies, and partnership-based approaches in supporting the growth of an inclusive food processing industry. The role of supervisory institutions such as the Food and Drug Supervisory Agency and the Ministry of Agriculture, as well as standardization institutions such as the National Standardization Agency is very crucial in ensuring the safety and quality of processed food in Indonesia. The Food and Drug Supervisory Agency has the main mandate to carry out pre-market and post-market supervision of processed food products through registration, certification, and direct supervision in the field. Meanwhile, BSN plays a role in determining the Indonesian National Standard for various food products, including laboratory testing and accreditation of certification institutions. Harmonization of food quality standards is important to ensure the consistency of domestic product quality and to increase the competitiveness of Indonesian products in the global market. In practice, the challenges faced are the low literacy of standards among small industry players, the lack of certified testing laboratories in the regions, and weak cross-sector coordination in enforcing standards (Wood et al., 2021).

Harmonization of Indonesian food quality standards with international standards, such as the FAO-WHO Codex Alimentarius, is an urgent need in facing free trade and export demands. The government has made efforts

to encourage the adoption of international standards into national regulations, but there are still gaps in implementation, especially in aspects of documentation, human resource training, and ownership of production facilities according to standards. Cooperation between countries and integration within the framework of the ASEAN Economic Community also requires Indonesia to continue to update the standardization system and increase the capacity of supervisory institutions in anticipating cross-border food safety issues. On the other hand, strengthening the internal supervision system in the industry is also an urgent need, considering that cases of misuse of food additives and misleading labeling are still often found (Sampaio et al., 2021). In the overall context, the success of the food processing industry in contributing to national food security is highly dependent on policy consistency, bias towards local actors, and the reliability of the supervision system. Regulatory reform must be directed at creating an innovative but accountable industrial ecosystem, with transparent food governance that is responsive to global challenges. Active involvement of regulatory bodies, academics, industry players, and civil society is needed to build public trust and ensure sustainable food quality for all levels of society. This is where the role of public policy becomes very important, not only as a legal instrument, but also as a tool for social and economic transformation in realizing sustainable food sovereignty in Indonesia.

### Challenges and Obstacles of the Processing Industry in Supporting Food Security

Access to local raw materials is the main foundation in building a resilient and sustainable food processing industry. In Indonesia, the wealth of natural resources should be a comparative advantage in providing local food raw materials (Barrett, 2021). However, in reality, many processing industries still face significant challenges in obtaining raw materials that are consistent in quality and quantity. Seasonal variations, price fluctuations, and limited distribution infrastructure cause uncertainty in supply for the industry. As a result, many industry players turn to imported raw materials which are considered more stable and easily accessible, although in the long term they create structural dependence on the global market. This dependence is a serious dilemma, especially in the context of global price volatility, disruptions in international logistics, and trade policies of partner countries that can change at any time and threaten the stability of the domestic industry. This condition is further exacerbated by the suboptimal use of technology and limited supporting infrastructure in various regions of Indonesia. Post-harvest technology, cold logistics systems, and modern storage facilities are not evenly distributed throughout the food supply chain. In fact, the adoption of this technology is very important to maintain the quality of local raw materials to meet industry standards. In addition, basic infrastructure such as roads, ports, and digital connectivity are still major obstacles in accelerating the movement of raw materials from production centers to processing locations. Infrastructure disparities between regions also create significant disparities in raw material prices, increasing production costs and reducing the competitiveness of Indonesian food products in the international market. In a situation of tight global competition, industrial competitiveness is greatly influenced by logistics efficiency and mastery of cutting-edge technology, including automation of production processes, the use of artificial intelligence for supply management, and digitalization of quality control systems (Jakhar et al., 2022).

Furthermore, the issue of sustainability is a dimension that cannot be ignored in managing the supply chain of the food processing industry. The industry is faced with consumer demands and international regulations that increasingly emphasize the importance of the principle of environmental sustainability. Intensive agricultural practices that produce raw materials with a high carbon footprint or have a negative impact on biodiversity are now questionable in their legitimacy and feasibility (Li et al., 2022). Likewise, the use of fossil fuels in the production process and industrial waste that is not managed responsibly can be obstacles to market expansion, especially to countries that implement strict environmental standards. In this context, the industry must be able to integrate circular economy approaches, such as reusing organic waste, optimizing renewable energy, and resource efficiency throughout its production process. These efforts not only add value to the sustainability of the product but also improve the industry's reputation in the eyes of global investors and consumers. In addition to environmental aspects, supply chain security is also a major concern, especially after the world experienced global logistics disruptions due to the pandemic, geopolitical conflicts, and extreme climate change. Supply chain resilience must be built on the principle of diversifying raw material sources, creating a strong network of local partners, and using a digital tracking system to anticipate potential disruptions (Xu et al., 2022). The government, industry players, and the research sector need to build a collaborative ecosystem that is able to detect supply chain vulnerabilities and respond adaptively. On the other hand, empowering local farmers and strengthening cooperatives as the main suppliers of the industry are long-term strategies to reduce dependence on imports. By improving the quality of local production through training, access to financing, and integration with precision agriculture technology, the national food industry can maximize domestic potential and lead to sustainable supply independence. Overall, efforts to strengthen access to local raw materials and reduce dependence on imports cannot be separated from

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holistic improvements in technology, infrastructure, and national competitiveness. This must also be accompanied by full awareness of the importance of the principles of sustainability and supply chain security amidst evolving global challenges. The food processing industry in Indonesia has a great opportunity to transform into a strategic sector that not only supports national food security but also becomes a major player in the global food trade map, as long as it is able to overcome structural obstacles and strengthen its local foundations systematically and sustainably.

### Policy Recommendations for Optimizing the Role of Industry

Policy recommendations for optimizing the role of the food processing industry within the framework of national food security development need to be based on a comprehensive understanding of the dynamics of this sector, both from upstream to downstream. The government as the holder of regulatory authority and development facilitator needs to take an integrative and long-term oriented approach in formulating policies. One crucial initial step is the preparation of a national food industrialization roadmap based on local potential and national strategic needs (Zhang et al., 2022). This roadmap must be able to identify superior food production clusters, availability of raw materials, supporting infrastructure, and domestic and export market targets in a measurable manner. The preparation of this kind of strategic document will help formulate a more structured policy direction, avoid overlapping between agencies, and create a framework that can be used by industry players, farmers, academics, and financial institutions as a common reference. In addition, fiscal and non-fiscal policy support is needed to encourage the growth of the national food processing industry. Tax incentive policies, investment credit interest subsidies, and ease of licensing for food industry players who use local raw materials sustainably are forms of strategic intervention that can increase investor interest in building processing facilities domestically.

The government can also provide special incentives to industries that implement environmentally friendly practices, energy efficiency, and social sustainability such as fair partnerships with local farmers and food MSMEs. This policy will encourage the growth of industries that not only pursue economic benefits, but also address increasingly complex social and ecological challenges in the future. In this context, the implementation of national sustainable certification integrated with global standards is an important step to increase the competitiveness of Indonesian food products in the international market. In addition to incentives, the government also needs to strengthen institutional policies and governance of the national food sector. One of the main challenges in optimizing the food processing industry is the lack of coordination between the agricultural sector as a provider of raw materials and the industrial sector as a processing actor. A cross-sectoral coordinating body is needed that is able to effectively synchronize upstream and downstream programs, ensuring that the industry's raw material needs can be met by domestic production with consistent quality and volume.

This agency also needs to have the authority to set priorities for supporting infrastructure investment such as production roads, food logistics centers, and post-harvest processing facilities. Focused and targeted infrastructure development policies will accelerate connectivity between regions, reduce logistics costs, and strengthen domestic market integration. In this case, collaboration between the central government, regional governments, state-owned enterprises, and the private sector must be positioned as the main pillar in strengthening the decentralized but systemically connected national food system. Another important aspect in the policy recommendations is increasing the capacity of human resources in the food industry sector. The government needs to encourage the integration of vocational and polytechnic education curricula with the needs of the ever-growing food processing industry. Technical training programs, innovation incubation, and technology transfer must be expanded not only for industrial workers, but also for farmers and food MSMEs so that they are able to meet the quality standards required by the modern market. In this context, research and higher education institutions need to be more empowered in producing appropriate technology that is applicable and supports locally-based food industrialization. The government can facilitate the establishment of regional food innovation centers that connect industry with researchers, academics, and local producer communities. This synergy will create an innovation ecosystem that is responsive to industry needs while increasing the added value of national food products in a sustainable manner. In facing global challenges such as climate change, food crises, and geopolitical uncertainty, an equally important policy recommendation is to strengthen the food intelligence system and supply chain risk mitigation mechanisms. The government needs to build a national food information system that can monitor in real time the conditions of food production, prices, distribution, and stocks from all over Indonesia. This system will be an important tool in formulating rapid interventions against potential supply disruptions, whether due to natural disasters, international trade conflicts, or logistics disruptions. In addition, strategic policies such as building industrial raw material reserves, diversifying supply sources, and protecting strategic commodities need to be continuously developed in the context of strengthening industrial food security. The government must also improve

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food diplomacy through bilateral and multilateral cooperation to ensure open access to export markets and protection of domestic industries from detrimental trade practices. Finally, the implementation of all these policies must be based on the principles of transparent, participatory, and data-based governance. The active involvement of the private sector, farmer organizations, civil society institutions, and the academic community in the process of formulating and evaluating policies will increase the legitimacy and effectiveness of their implementation. The government must become a director and facilitator in the development of an inclusive food industry, not just a regulator or sole implementer. With an adaptive, evidence-based policy approach that addresses structural challenges comprehensively, the role of the food processing industry in Indonesia can be optimized not only as a driver of economic growth, but also as a foundation for sovereign, resilient, and sustainable national food security.

## CONCLUSION

The conclusion of the study on the role of the food processing industry in shaping Indonesia's national food security policy framework confirms that this sector has a strategic contribution in strengthening the national food system. The food processing industry not only plays a role in adding value to agricultural products, but also ensures the continuity of quality and safe food supplies, and is able to expand public access to various types of nutritious and affordable processed foods. By utilizing technology and innovation, this industry is able to extend the shelf life of products, minimize post-harvest losses, and increase the efficiency of the national food distribution chain. On the other hand, synergy between the food processing industry and the government is the main key in formulating an inclusive and adaptive food security policy to global dynamics. Regulatory support in the form of fiscal incentives, investment facilities, and protection of local industries will strengthen the industry's capacity to absorb farmers' production, maintain price stability, and increase the competitiveness of Indonesian food in domestic and global markets. A policy approach that favors the development of the food processing industry also has implications for job creation and reducing inequality in food distribution between regions. Thus, the food processing industry cannot be separated from the national food security policy framework. Its role covers economic, social, and environmental dimensions, which are interrelated in maintaining the availability, affordability, security, and sustainability of food. To strengthen long-term food security, a holistic and sustainable policy is needed that makes the food processing industry a strategic partner in national food development.

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