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Comparing national food security policies in Indonesia and Thailand: a systematic meta-synthesis approach

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Using a systematic meta-synthesis approach, this study compares Indonesia and Thailand's national food security policies. The study focuses on three main aspects, namely food distribution networks, infrastructure development, policy resilience and sustainability. A thematic analysis was conducted on various official sources and the latest scientific literature, including FAO, World Bank, and Global Food Security Index reports. The study results show that Indonesia tends to apply a state-based protectionism model emphasizing irrigation and food self-sufficiency. At the same time, Thailand adopts an export-oriented strategy with the support of cooperatives and foreign investment. These findings indicate a paradigm shift between developmental statism and agrarian neoliberalism approaches. This study emphasizes integrating food security theories such as the entitlement approach (Sen) and institutional analysis (Ostrom) to understand policy divergence patterns in Southeast Asia. The significance of this research lies in its contribution to building a hybrid conceptual model of food security for Global South countries. However, this study has limitations, including a literature scope that remains focused on the ASEAN region and the absence of primary field data, leaving room for further research to expand the empirical database.

KEYWORDS

food security, agrarian policy, food distribution, agricultural infrastructure, resilience

1 Introduction

Food security is a strategic global issue that is crucial for economic development, social stability, and the well-being of societies. Indonesia and Thailand, as agrarian countries in the Southeast Asian region, face similar challenges in maintaining national food security, such as climate change, land-use conversion, commodity price fluctuations, and population growth. Although both countries share comparable geographic characteristics and agricultural cultures, they adopt different policy approaches and strategies in managing their food systems. According to the Global Food Security Index published by the Economist Intelligence Unit (EIU) (2020), Thailand ranked 51st with a score of 64.0, while Indonesia ranked 65th with a score of 59.5.

Food security remains a significant challenge for nations like Indonesia and Thailand, which struggle to ensure consistent access to nutritious and affordable food for their populations. Over the past decade, both countries have faced challenges in maintaining food safety due to weather fluctuations and changes in global food prices. To enhance food

security, it is essential to implement policies that address food security in each country (Rozaki, 2021).

Food security policies will significantly influence the government's ability to fulfil society's food consumption needs (Seligman and Berkowitz, 2019). The policy concerns the community's financial capacity and purchasing staple foods. High purchasing power enables people to buy food easily, but low purchasing power makes it difficult to obtain staple foods. The government can implement various policies and programs to ensure that everyone has access to more food and becomes more secure (Carlson et al., 2021).

Indonesia and Thailand differ in demographic and economic structures that shape their food security outlook. Indonesia, with a population of approximately 282 million, has a GDP of US$ 1.39 trillion and a lower GNI per capita (US$ 4,580) compared to Thailand's 72 million people, US$ 0.50 trillion GDP, and higher GNI per capita (US$ 7,230) (World Bank, 2024). These income disparities are reflected in affordability dimensions of the Global Food Security Index (GFSI), where Thailand ranks higher (52nd; score 65.1) than Indonesia (62nd; score 62.6) (Economist Impact, 2023). In terms of food supply, Thailand consistently produces surpluses, exporting about 9.2 million tons of rice in 2024, while Indonesia, despite producing 54 million tons of paddy in 2023, often resorts to imports to stabilize domestic supply [FAO GIEWS, 2024; USDA Foreign Agricultural Service (USDA/FAS), 2024]. Logistics further accentuate these differences: Thailand ranks significantly higher on the World Bank Logistics Performance Index (37th), whereas Indonesia (63rd) faces distribution inefficiencies due to archipelagic geography and infrastructure gaps (World Bank, 2023).

The divergence in food security policies reflects distinct institutional and theoretical orientations. Indonesia pursues a state-interventionist strategy, prioritizing domestic price stability and access through the Government Rice Reserve (CBP), managed by BULOG under Presidential Regulation No. 125/2022, and coordinated nationally by the National Food Agency (Ruspayandi et al., 2022). These mechanisms, including rice subsidies and food assistance, were intensified during recent El Niño shocks and India's rice export restrictions (FAO GIEWS, 2024). In contrast, Thailand adopts a market-oriented framework, with the government supporting farmers through the rice price guarantee program since 2019 while maintaining export competitiveness [Demont and Zilberman, 2016; USDA Foreign Agricultural Service (USDA/FAS), 2024]. Thailand's resilience strategies emphasize water resource management, irrigation, and climate-smart agricultural practices to mitigate drought risks, while Indonesia emphasizes buffer stocks and social protection programs to safeguard consumption in times of crisis (Suebpongsang et al., 2020a, 2020b; Yuan et al., 2022).

Agriculture is central to feeding the population and providing employment in Indonesia and Thailand. Differences in policy approaches for managing food distribution systems, food product diversification, and assisting governments in maintaining stable food prices and supplies demonstrate the need for various strategies to address food security issues (Leach et al., 2020; Seligman and Berkowitz, 2019). For example, initiatives such as the Government Rice Reserve (CBP) support farmers' empowerment as a crucial component of Indonesia's strategy to mitigate the impact of food security challenges (Laborde et al., 2024). Meanwhile, as one of the world's major rice exporters, Thailand developed a strategy to manage exports and increase agricultural productivity (Suebpongsang et al., 2020a, 2020b). Another example based on a comparative study of rice harvest outcomes highlights that Thailand has achieved a rice production surplus and has become a major exporter. In contrast, Indonesia tends to import rice due to high domestic demand, inefficient agricultural practices, and limited infrastructure (Herliana et al., 2025).

Regional food security in Southeast Asia is strongly influenced by both international trade dynamics and climate change. For example, rice export restrictions, such as those recently imposed by India, have demonstrated significant spillover effects on global and regional food prices, disproportionately affecting rice-importing countries while altering the competitive advantage of major exporters like Thailand (Valera et al., 2024). Beyond trade, long-term food security in the region also depends on narrowing the rice yield gap, as evidence shows that without substantial improvements in productivity, Southeast Asia will face difficulties sustaining its position as a major rice supplier by 2040 (Yuan et al., 2022). Compounding these challenges, climate change poses a critical threat to rice production, as meta-analyses of crop model simulations consistently project substantial yield reductions under future climate scenarios, underscoring the urgency for adaptive agricultural and policy responses (Li et al., 2024).

Indonesia and Thailand adopt distinct policy approaches in managing food distribution systems, infrastructure, and resilience strategies, which shape their long-term food security outcomes. In Indonesia, food distribution networks are heavily centralized through Logistics Affairs Agency (BULOG), which manages procurement, storage, and distribution to stabilize staple food prices and ensure accessibility, particularly for vulnerable populations (Ruspayandi et al., 2022). However, this centralized system often faces logistical bottlenecks due to archipelagic geography and limited infrastructure investments. In contrast, Thailand's distribution relies more on market-driven mechanisms and extensive rural infrastructure, enabling efficient linkages between farmers, markets, and export channels (Demont and Zilberman, 2016). Thailand's resilience strategy is closely tied to maintaining export competitiveness while diversifying agricultural products to mitigate risks, whereas Indonesia emphasizes social protection measures such as rice subsidies and public stockpiling to safeguard domestic food access (Yuan et al., 2022). Sustainability efforts also differ: Indonesia prioritizes smallholder empowerment and land-use regulation to maintain domestic self-sufficiency, while Thailand advances sustainability by promoting technological innovation and climate-smart practices to sustain its role as a global rice exporter (Suebpongsang et al., 2020a, 2020b). These contrasting approaches highlight how differences in distribution networks, infrastructure development, and policy orientation shape the resilience and sustainability of food systems in both countries.

The divergence between Indonesia and Thailand in managing food distribution networks, infrastructure, resilience, and sustainability can be explained by distinct theoretical underpinnings in food policy. Drawing on the Foreign Agricultural Organization's (FAO) four pillars of food security—availability, access, utilization, and stability—Indonesia emphasizes access and stability through state-led interventions such as Logistics Affairs Agency (BULOG), food subsidies, and public stockpiling, aligning with the food sovereignty perspective. In contrast, Thailand prioritizes availability and sustainability, adopting a market-oriented approach that leverages comparative advantage in rice exports, supported by

efficient infrastructure and private sector participation. From a resilience perspective, Indonesia relies on social protection and buffer mechanisms to withstand shocks, while Thailand builds adaptive capacity through diversification and investment in climate-smart agriculture. These differences also reflect broader sustainability transition pathways, with Indonesia focusing on inclusive smallholder empowerment and land-use regulation, whereas Thailand advances technological innovation and market-driven sustainability (FAO, 2008; Folke, 2006; Geels, 2002; Tendall et al., 2015).

Despite both nations implementing extensive food security measures, key challenges persist. Indonesia struggles with import dependence, price dispersion across islands, and vulnerability to climate variability, while Thailand faces exposure to global price volatility and recurring droughts (Valera et al., 2024; Li et al., 2024). These contrasting contexts raise scientific questions on the effectiveness of public stockholding versus price insurance schemes in stabilizing retail food prices, the role of logistics frictions in spatial food access, and the long-term trade-offs between import-reliant buffer stocks and sustainability-driven productivity investments. Understanding these dynamics is significant not only for national food security but also for regional stability in Southeast Asia, a critical rice-producing and -consuming hub. By systematically comparing Indonesia's state-led approach and Thailand's market-oriented model, this study addresses the scientific problem of identifying which policy instruments most effectively enhance resilience, affordability, and sustainability under compound shocks such as climate change and global trade disruptions (Folke, 2006; Tendall et al., 2015).

Despite both countries implementing various policies and mitigation programs to address food security issues, a comprehensive review of the effectiveness of these strategies has not been conducted. It is crucial to assess how effectively these plans are implemented for emergencies and long-term food safety in countries facing similar food security challenges. By examining the approaches of two nations for food security, we can anticipate necessary adjustments in response to food shortages resulting from natural disasters or climate shifts (Tchonkouang et al., 2024).

Therefore, the purpose of this study is to examine the food security mitigation policies implemented by Indonesia and Thailand and evaluate the effectiveness in maintaining long-term food security. By understanding the different approaches and results of the two countries, this research provides more effective and adaptive policy recommendations for addressing future food security challenges, while strengthening cooperation between countries to create a more stable food security situation in the Southeast Asian region.

2 Materials and methods

These two countries were selected because both Indonesia and Thailand are agrarian nations in Southeast Asia that share similarities in tropical climate, biodiversity, and significant agricultural potential. Comparison enables a more relevant evaluation due to their comparable geographical and socio-economic backgrounds. Thailand's success as a leading rice exporter is attributed to its advanced agricultural infrastructure, strict quality control, government support, and competitive pricing, enabling consistent surpluses and a strong international reputation, while Indonesia relies heavily on rice imports to meet demand which has implications for its food security strategy (Herliana et al., 2025).

The research method used is a Meta-Synthesis Systematic Literature Review. A meta-synthesis combines emerging narrative themes to inform the research field on a topic of importance. It helps produce an explanatory framework for understanding why the intervention works (Vlachopoulos et al., 2024). In this study, the meta-synthesis approach was specifically applied to literature that discusses food security policies in Indonesia and Thailand, with a focus on comparing national strategies. The synthesis process drew inspiration from the seminal work of Noblit and Hare (1988), which emphasizes the importance of translating concepts across studies to generate higher-order interpretations. This orientation allowed the present review to move beyond individual findings and identify overarching patterns that explain similarities and differences in food security policies between the two countries.

Thematic synthesis proceeded through several stages. First, the selected articles were carefully read, and relevant passages related to food security policies in Indonesia and Thailand were extracted. Second, initial coding was performed to identify recurring patterns and concepts, such as agricultural strategies, trade dynamics, and institutional governance. Third, these codes were grouped into categories representing broader dimensions of national food security. Finally, categories were synthesized into overarching themes, which served as the analytical framework for comparing Indonesia and Thailand. This systematic process ensured that themes were generated transparently from disparate studies while maintaining the contextual integrity of each article.

This study employed a Systematic Literature Review (SLR) based on the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to synthesize recent scientific knowledge related to comparing national food security policies in Indonesia and Thailand. The review process was designed to ensure transparency, reproducibility, and scientific rigor. The methodology followed three key stages: (1) defining inclusion and exclusion criteria; (2) selecting information sources and search strategy, using relevant policy-related keywords such as *food security, Indonesia, Thailand,* and *meta-analysis*; and (3) applying the PRISMA flow for article screening and eligibility.

2.1 Inclusion and exclusion criteria

The review included only peer-reviewed scientific and review articles, written in English, and published between 2014 and 2024. The 10-year time frame was purposefully selected to ensure that the literature reflects contemporary developments in technology, policy frameworks, and global challenges related to food security. This period encompasses major global shifts, including the rise of digital transformation in agriculture, growing emphasis on climate resilience, and particularly the impact of the COVID-19 pandemic on food systems, agricultural productivity, and technology adoption. By focusing on the 2014–2024 period, the review captures both the pre-pandemic baseline trends and the post-pandemic responses, which are crucial for understanding the evolving dynamics of food security policy. In the pre-2020 phase, Indonesia and Thailand continued strengthening their agricultural and food security frameworks under relatively stable conditions—for instance,

Indonesia enacted Government Regulation 17/2015, which formalized food and nutrition security strategies, and in 2021 established the National Food Agency (Badan Pangan Nasional) to streamline food policy coordination. Meanwhile, the post-2020 period reflects significant adaptation to the COVID-19 shock and growing vulnerabilities: Indonesia launched in 2025 a free-meal program targeting 83 million people, aiming to combat child malnutrition and strengthen food access amid ongoing socio-economic pressures.

This decade-long window (2014–2024) also aligns with broader, region-wide shifts such as accelerated digitization in agriculture, rising trade interconnectivity through ASEAN frameworks, and heightened climate resilience policymaking. Consequently, selecting this time span offers a balanced, policy-relevant view that integrates both structural continuity and crisis-induced innovation in national food security trajectories.

Eligible studies were identified based on their relevance to the selected keywords, including "food security" in the context of national strategies, "Indonesia" and "Thailand" as the geographical scope of analysis, "policy" as the institutional and regulatory dimension, and "meta-analysis" as the methodological approach. Studies were included if they explicitly addressed food security policies, national strategies, or comparative perspectives between Indonesia and Thailand. Studies were excluded if they were duplicate entries, inaccessible, not published in English, or did not directly relate to the research objectives. Conference proceedings, editorials, book chapters, and gray literature were also excluded to maintain academic quality and focus.

2.2 Systematic review process

The systematic selection process is illustrated in the PRISMA 2020 flow diagram (Figure 1). A total of 154 records were identified, 136 from databases and 18 from registers. Prior to screening, 110 records were removed due to duplication ($n = 29$), automation-filtered ineligibility ($n = 51$), and other reasons ($n = 3$). Consequently, 44

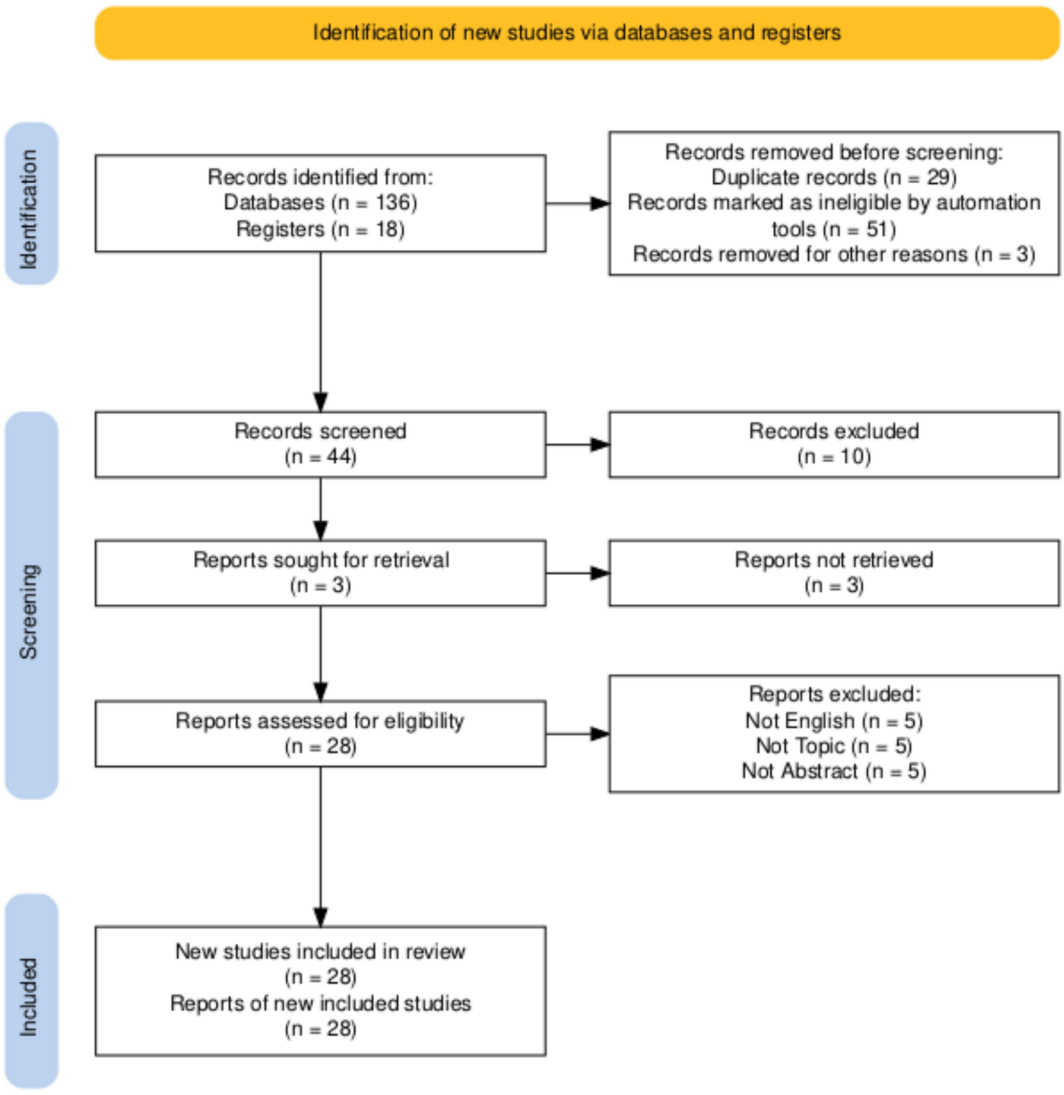

FIGURE 1
PRISMA 2020 flowchart for the SLR.

records were manually screened by reviewing titles and abstracts. Of these, 10 records were excluded for not meeting the inclusion criteria. Three reports were sought for full-text retrieval but not obtained. Ultimately, 28 full-text articles were assessed and all were deemed eligible, forming the basis of the final analysis. Articles were sourced from official organizational websites, including Food and Agriculture Organization (FAO), Global Food Safety Initiative (GFSI), United States Agency for International Development (USAID), and Association of Southeast Asian Nations (ASEAN), covering policy documents and institutional reports relevant to the research theme.

The final corpus of 28 studies underwent a thematic analysis to extract patterns, concepts, and research gaps. This synthesis provided the foundation for discussing strategies, challenges, and policy implications related to comparing national food security policies in Indonesia and Thailand using a systematic meta-synthesis approach. All stages adhered to the PRISMA framework to ensure clarity, validity, and scientific accountability in reporting.

3 Results

3.1 The role of food security policy strategies in Southeast Asia

The agricultural sector plays a strategic role in ensuring food security in Southeast Asia, particularly in Indonesia and Thailand. In line with the four pillars of the FAO (availability, access, utilization, and stability), the two countries have adopted policies targeting these four pillars in different ways. According to data from the Food and Agriculture Organization (FAO), Indonesia and Thailand have an average food insecurity rate of over 10% (Food and Agriculture Organization, 2024b). The 2023 Global Food Security Index (GFSI) data show Thailand ranked 52nd, higher than Indonesia at 64th (Economist Impact, 2023). World Bank data (World Bank, 2024) also confirms the difference in orientation: Thailand's agricultural sector contribution (around 11% of GDP) is dominated by exports, while Indonesia tends to be domestically oriented with high import dependency (Tansuchat et al., 2022).

These differences reflect different institutional capacities and policy priorities. This is due to the high growth rates in both countries, which impact the countries' production levels and trade in the global market. First, changes in food production in the medium term can arise due to many factors, such as labor, fertilizer, land, and producers' productivity. Secondly, changes in international market conditions for various products could impact profits and production decisions. In individual countries, production changes are more diverse. While the general increase structure persists, changes in production, land constraints, and profits often result from these activities (Food and Agriculture Organization, 2024b; Nguyen et al., 2023).

The importance of increasing productivity in agricultural production has significant implications for government policy. In addition to focusing on achieving food sufficiency, the national food security policy should also aim to achieve food independence and sovereignty, thereby enhancing the competitiveness of national food products. The availability and affordability of food are key indicators for national stability. Therefore, in addition to focusing on meeting food needs independently, the national food security strategy must also aim to enhance the quality and efficiency of domestic food products, enabling them to compete in the global market (Lencucha et al., 2020; Feng et al., 2023).

A supportive environment for new production techniques and more coordinated incentives for producers is necessary to support this policy and increase the efficiency of their agricultural productivity. We need this supportive environment to help Indonesia and Thailand adapt and mitigate food security risks (Food and Agriculture Organization, 2021a).

To create a supportive environment, Indonesia, Thailand, and other Association of Southeast Asian Nations (ASEAN) countries have collaborated to enhance the food control system and ensure the safe and quality movement of food. Given this, ASEAN food and agricultural products must meet international standards, focusing on improving the quality and standards of food safety assurance and standardizing the trade of food and agricultural products (World Health Organization, 2020). The existence of an ASEAN agreement on food security encompasses regulations outlined in the ASEAN Food Safety Regulatory Framework (AFSRF). This AFSRF is an agreement to create a comprehensive and integrated food safety approach in the ASEAN region. This aligns with the objectives of the ASEAN vision, which aims to ensure regional food security. The AFSRF agreement involves policymakers' active role in the health, economic, and agricultural sectors (World Health Organization, 2020). The ASEAN countries expect the AFSRF to facilitate the smooth flow of food in the region. Implementing food flow security facilities involves harmonizing standards and sanitation practices. Additionally, it minimizes technical barriers in intra-ASEAN trade and reduces differences in food management systems between ASEAN countries.

3.2 Comparison of food security policies in Indonesia and Thailand

Indonesia and Thailand implement food security strategies through three main aspects: distribution networks, infrastructure, and resilience and sustainability. These three aspects represent policy instruments for maintaining short-term food access and long-term adaptation (Folke, 2016; Purwanto, 2022). Thus, this analytical framework is consistent with the FAO's four pillars of food security (availability, access, utilization, stability).

Table 1 illustrates that the food security policies of the two countries employ different approaches tailored to their respective needs. A resilient policy should incorporate the latest issues, considering the conditions of the people and the social and institutional systems that exist in each country (Folke, 2016; Rusmawati et al., 2023). Sensitivity to the latest issues is crucial in determining policies in each country, particularly in emergency conditions. This approach aims to enable countries experiencing shocks to model their food security policies after those countries that have successfully navigated similar crises (Folke, 2016). The policies listed in Table 1 will be discussed in detail in the following sections.

3.2.1 Distribution network

The food distribution network is critical to ensuring price stability, food availability, and the protection of vulnerable populations, especially during times of crisis like the COVID-19 epidemic. In Indonesia, the government developed several policies to keep food

TABLE 1 Comparison of food security policies between Indonesia and Thailand.

Aspect	Indonesia	Thailand
Food distribution network	1. Food price and distribution subsidies through market operations, especially during COVID-19 2. Acceleration of food aid distribution to affected communities 3. Monitoring supply chains for optimal distribution	1. Accelerated food distribution to affected communities. 2. Provision of loan assistance worth 150 billion Baht to support agricultural institutions and cooperatives
Infrastructure	Irrigation improvement programs to increase agricultural productivity and adapt to climate change	Development of agricultural infrastructure to support climate adaptation and enhance farmers' resilience
Resilience and sustainability	1. Agricultural diversification to strengthen national food security and reduce dependency on certain commodities 2. Import policies to support the domestic food and beverage sector	1. Support for rice exports to strengthen global market position 2. Diversification of export markets as a main strategy to increase domestic product value

prices stable and ensure that underprivileged populations have access. One of the key initiatives was the provision of food pricing and distribution subsidies via market operations, which proved effective in reducing price increases throughout the pandemic (Akbar et al., 2023). Additionally, efforts to hasten the distribution of food aid to affected populations were stepped up, building on pre-pandemic social safety net measures (Novita, 2016; Yeny et al., 2022; Purwanto, 2022). To promote equitable and effective distribution, the Indonesian government has prioritized supply chain monitoring, with the goal of optimizing the flow of commodities from producers to end consumers (Anggraeni et al., 2022; Darma and Darma, 2020). This is especially important considering Indonesia's archipelago nature, which creates logistical issues in rural and isolated places.

Thailand, on the other hand, made food distribution a priority in their crisis response framework. The government increased food distribution to affected communities, recognizing the urgent need to provide food security during emergencies (Tansuchat et al., 2022). Furthermore, Thailand took a proactive approach, giving credit assistance of 150 billion Baht to support agricultural institutions and cooperatives, which play critical roles in the country's food production and distribution systems (Hossen et al., 2020).

In short, both countries have shown a significant desire to strengthen their food distribution networks, albeit using techniques tailored to their respective institutional frameworks and national circumstances. Differences in distribution strategies are evident. Indonesia focuses on state intervention through market operations and supply chain monitoring, with the Logistics Agency (BULOG) as the main actor (Akbar et al., 2024). Thailand, on the other hand, prioritizes a local institutional approach with cooperative-based food distribution and credit support (Hossen et al., 2020). This comparison highlights the importance of comprehensive policies that include subsidies, logistics, social assistance, and institutional capacity building to enhance national food security, both in normal and crisis situations. This strategy reflects two governance logics, with Indonesia adopting a state-centric approach dominated by state intervention. In relation to Ostrom's theory (1990), this approach differs from Thailand's reliance on cooperatives as local institutions for distribution. Thus, Indonesia's distribution pattern emphasizes state control, while Thailand's is closer to the concept of collective action (Caraway and Ford, 2017).

3.2.2 Infrastructure

Infrastructure development is crucial to increasing agricultural output and building resilience in the face of climate change. Both Indonesia and Thailand understand the strategic importance of agricultural infrastructure, particularly water management, as a cornerstone for sustainable food systems and rural development. Climate change has a significant impact on food security around the world. One of the main impacts is a decline in food production due to unpredictable changes in temperature, rainfall patterns, and extreme weather (Myers S. et al., 2022; Myers S. S. et al., 2022). This can trigger food crises and increase food prices globally, especially in countries that depend on the agricultural sector. Additionally, climate change can affect the habitats of pests and plant diseases, resulting in crop losses and reduced production (Kumar et al., 2022). Climate change also affects water availability for agriculture through reduced rainfall or changes in water flow patterns. Every country must take a holistic approach to address these challenges, considering social, economic, and environmental aspects.

Indonesia and Thailand have implemented policies to deal with the challenges of climate change in the agricultural sector. The Indonesian government has taken three policy approaches to respond to the impacts of climate change, among others. Firstly, the irrigation improvement program focuses on improving irrigation infrastructure to ensure adequate water supply in agricultural areas, which is expected to reduce the risk of crop failure due to changes in weather patterns (Alaerts, 2020; Nugroho et al., 2022a, 2022b; Chaiyana et al., 2024). The Government of Indonesia, through the Ministry of Agriculture, targets the achievement of food security by developing irrigation rehabilitation programs. Implementing irrigation rehabilitation programs is considered one of the most successful ways to increase food crop production (Alaerts, 2020). However, there are challenges in terms of financing and management. The government strives to improve existing irrigation networks and build new, more efficient systems. Efforts in irrigation rehabilitation aim to ensure that farmers have adequate access to water for their farms, increasing crop yields (Nugroho et al., 2022a, 2022b; Purnamasari et al., 2023).

To ensure the successful implementation of the irrigation rehabilitation program, the government has issued regulations that utilize a participatory approach involving farmers in irrigation management. The regulations issued refer to Law No. 37/2014 on soil and water conservation (Nugroho et al., 2022a, 2022b; Limenta and Chandra, 2017). The regulation mandates that everyone who owns land rights in cultivated and protected areas must conserve soil and water for each type of use. Similarly, everyone who utilizes land and water is also obliged to conserve soil and water. By involving local communities, it is expected that a sense of ownership and

responsibility for the infrastructure will be created. This approach reduces investment costs and strengthens the social capital required to maintain irrigation systems. Farmer involvement in irrigation management is expected to increase the effectiveness and sustainability of irrigation systems, which is critical for long-term food security (Alaerts, 2020; Nugroho et al., 2022a, 2022b; Climate Investment Funds, 2022).

In Indonesia, the government has identified irrigation enhancement schemes as a critical tool for increasing agricultural productivity and supporting climate change adaptation. Given the country's vulnerability to changing rainfall patterns and catastrophic weather events, updating irrigation systems has become critical for ensuring water supply and efficiency. These programs seek to improve not just crop yields but also the sustainability of agricultural operations by incorporating climate-resilient infrastructure designs (Alaerts, 2020; Nugroho et al., 2022a, 2022b; Irham et al., 2022). Infrastructure investments are frequently geared at repairing existing irrigation networks, building new canals, and promoting water-saving technologies to help smallholder farmers throughout the archipelago.

Thailand, on the other hand, has prioritized the creation of larger agricultural infrastructure to improve farmers' adaptive capacity and resistance to climate unpredictability. The Thai government has launched projects to create and improve rural infrastructure, such as irrigation facilities, water reservoirs, and farm access roads, with the specific purpose of promoting climate adaptation and boosting the long-term viability of rural livelihoods (Witsanu, 2018; Sarom et al., 2015; Sheikh et al., 2024). These activities relate to national strategies to manage the consequences of drought, floods, and other climate-related risks that affect the agricultural economy.

Although both countries are committed to developing infrastructure to support agricultural sustainability, their approaches are shaped by different national objectives and geographical challenges. Indonesia places irrigation rehabilitation as a key instrument of food security, while integrating a participatory model based on law no. 37/2014 (Nugroho et al., 2022a, 2022b). This strategy is consistent with Ostrom's institutional theory on the shared management of water resources, where farmer involvement strengthens sustainability (Nigussie et al., 2018). In contrast, Thailand implements a comprehensive infrastructure strategy: in addition to irrigation, it also builds village roads, storage warehouses, and dams to strengthen farmer integration into national and global supply chains (Sheikh et al., 2024). When compared, Indonesia resembles Africa's experience in strengthening community irrigation, while Thailand aligns with agro-export infrastructure expansion in Latin America (Food and Agriculture Organization, 2024b). This comparative study emphasizes the importance of agricultural infrastructure as a key component of adaptive capacity and productivity growth. Strategic investment in such infrastructure is essential not only to meet current food demand but also to enhance resilience in the face of climate change.

3.2.3 Resilience and sustainability

In seeking resilience and sustainability, both Indonesia and Thailand have adopted food security policy approaches that reflect the structural characteristics and institutional capacity of each country. However, the strategic approaches taken show significant differences, especially in the aspect of market and product diversification as part of efforts to build a resilient and sustainable food system.

In Indonesia, diversification of agricultural production is the focus in strengthening domestic food security. This approach is realized through programs such as UPSUS Pajale and Siwab (Special Efforts to Increase Rice, Corn, and Soybean Production, as well as Mandatory Pregnant Breeding Cows), which target the increase of strategic commodities, including rice, corn, soybeans, and livestock. Despite its good intentions, however, this policy remains biased towards low-value commodities and has not fully encouraged the transition to a high-value-added, global market-based food system (Muhafidin, 2022; Herlina et al., 2024). Dependence on commodities such as rice also remains high, with rice imports reaching 6.2% in 2018 (Central Bureau of Statistics, 2020), indicating weaknesses in diversifying food consumption and production.

In contrast, Thailand has consistently developed an export market diversification strategy as the main axis of its food security policy. Exports of processed food products, such as fish, meat, and cereal-based products, to high-income countries demonstrate Thailand's ability to leverage global trade networks to enhance its domestic economic resilience (Nidhiprabha, 2017). Thailand also actively responds to market dynamics through export policy reforms and adaptation to international standards, such as the SPS, reflecting its institutional readiness to face non-tariff challenges (Nidhiprabha, 2017; Sheikh et al., 2024).

Indonesia faces different challenges in its logistics and import licensing system for food raw materials. Indonesia's import policy is still dominated by protectionist instruments, such as licensing systems and import quotas, which hinder the flexibility of the food industry and drive-up production costs (Amanta and Gupta, 2022). An ARDL study found that a 1% increase in raw material imports can lead to a 0.96% increase in processed product exports (Amanta and Gupta, 2022), confirming the importance of controlled liberalization in the food supply chain.

In contrast to Indonesia, Thailand encourages the involvement of FDI (Foreign Direct Investment) as the main driver of growth in the processed food sector. FDI plays an important role in bringing in technology, expanding market networks, and accelerating the value-added transformation of the food sector (Nidhiprabha, 2017). This makes Thailand's food security policy not only a domestic endeavour but also part of the regional and global food security architecture, particularly through its role as a major exporter of rice and other food products (Chen and Zhao, 2023).

From the perspective of dependency theory, Indonesia tends to be protectionist to avoid external dependency, while Thailand is more open to neoliberal market integration (Gellert, 2019). However, both approaches pose risks: Indonesia's protectionism increases food costs for poor consumers, while Thailand's FDI strategy has the potential to marginalize small farmers (Warr, 2014; Nugroho et al., 2021). These findings are consistent with the literature on Africa and Latin America, where the tension between food sovereignty and market openness is also a major dilemma (Merino, 2020; Charoenratana et al., 2021).

4 Discussion

An efficient and resilient food distribution network is essential for ensuring food price stability, equitable access, and the protection

of vulnerable groups, especially during national or global crises. The COVID-19 pandemic illustrated the vulnerability of food systems and underscored the need for adaptive policies that strengthen supply chain logistics and food access. Indonesia responded to COVID-19 with a combination of food pricing and distribution subsidies through market operations, which were aimed at stabilizing food prices and minimizing market volatility (Akbar et al., 2024). The government, in cooperation with state logistics agency *BULOG*, executed market interventions to ensure affordability and availability of staple commodities such as rice, sugar, and cooking oil.

In addition to market operations, Indonesia intensified food aid distribution, particularly to low-income and food-insecure populations (Novita, 2016; Yeny et al., 2022). These measures built upon pre-existing social safety net programs, such as *Bantuan Pangan Non-Tunai (BPNT)* and *Program Keluarga Harapan (PKH)*. The increased scale and speed of food assistance during the pandemic highlights how integrated policy instruments can mitigate food insecurity during emergencies. Crucially, Indonesia placed emphasis on supply chain monitoring to improve the flow of agricultural commodities from farmers to consumers (Anggraeni et al., 2022). This was especially important given the archipelagic geography, where logistical constraints often hinder timely and equitable distribution. Studies such as Indrawati et al. (2024) and Keefe et al. (2024) emphasize the need for data-driven logistics planning and real-time monitoring systems to ensure resilience in food supply chains.

Thailand also prioritized food security during COVID-19 by accelerating food distribution to at-risk communities, supported by a robust decentralized delivery model (Tansuchat et al., 2022). What set Thailand apart, however, was its emphasis on institutional financial support. The government provided loan assistance of 150 billion Baht to agricultural cooperatives and institutions to sustain local production and ensure the continuity of distribution (Hossen et al., 2020). Cooperatives played a vital role in linking smallholder producers with consumers through local markets and distribution networks. According to Béné (2020), such institutional support not only stabilized food supply during crises but also strengthened the long-term capacity of rural communities to absorb shocks. Indonesia's approach focused more on market intervention and logistical oversight, while Thailand emphasized institutional resilience and financing. Both strategies reflect broader policy frameworks and governance models. A cross-national study by Fanzo et al. (2020) supports this comparative finding, arguing that resilient food systems require a multi-dimensional policy mix, comprising subsidies, real-time logistics, institutional credit, and participatory governance to address both acute and structural food security challenges.

Infrastructure development, particularly in water management, is central to addressing the effects of climate change on agriculture. Global studies show that unpredictable rainfall patterns, temperature extremes, and climate-induced disasters are undermining food production and threatening rural livelihoods (Myers S. et al., 2022; Myers S. S. et al., 2022; Kumar et al., 2020; Charoenratana et al., 2021). Indonesia has adopted a targeted approach focused on irrigation enhancement as a critical adaptation strategy. As rainfall variability increases, reliable irrigation systems become indispensable for protecting crop yields. The government has implemented large-scale irrigation rehabilitation programs, particularly for rice-growing regions (Alaerts, 2020; Nugroho et al., 2022a, 2022b; Purwanti et al., 2023). These programs aim to modernize existing irrigation networks, construct new water channels, and promote efficient water use technologies such as drip irrigation and groundwater recharge systems.

One distinctive feature of Indonesia's strategy is the participatory governance model in irrigation management. Through Law No. 37/2014 on Soil and Water Conservation, the government mandates that land and water users actively participate in conservation practices (Nugroho et al., 2022a, 2022b; Limenta and Chandra, 2017). This community-based approach strengthens ownership and sustainability, reducing maintenance costs and promoting long-term functionality of irrigation systems. Research by Ma'Mun et al. (2021) supports this model, showing that community involvement significantly enhances the efficiency and durability of rural infrastructure projects. Thailand, by contrast, employs a more comprehensive infrastructure development model. While irrigation remains a core component, the government also invests in rural roads, water reservoirs, on-farm storage, and drainage systems (Witsanu, 2018). These integrated infrastructure efforts aim to enhance not only water availability but also market access and supply chain connectivity, which are crucial for remote farming communities. The Office of the National Water Resources in Thailand has taken steps to align infrastructure development with national climate adaptation strategies. For example, initiatives like the *Royal Rainmaking Program* and *community water banks* represent innovative localized responses to climate stress (Vongsamut et al., 2022).

While both countries acknowledge the role of infrastructure in building agricultural resilience, their approaches are shaped by geography, institutional capacity, and policy orientation. Indonesia's strategy is irrigation-centric and farmer-led, focusing on maximizing water use efficiency in food production. Thailand, on the other hand, implements a multisectoral infrastructure strategy, addressing not just water but also transport and logistics as part of climate adaptation. A synthesis study by Aggarwal et al. (2018) emphasizes that contextualized infrastructure strategies, tailored to specific agroecological and institutional conditions, are key to achieving climate-resilient agriculture in Southeast Asia.

A comparison between Indonesia and Thailand's food security policies also reveals two contrasting yet complementary approaches to addressing global food system challenges. This discussion aims not only to analyze the effectiveness of each strategy but also to provide critical reflections for policy designers and researchers concerned with the issue of resilience and sustainability in national and regional food systems.

On the one hand, Indonesia's approach, which focuses on diversifying domestic agricultural production, emphasizes the importance of self-reliance and utilizing local potential as the foundation of food security. This approach has strategic value in the context of food sovereignty (Law No. 18/2012), but is vulnerable to classic problems such as land limitation, productivity stagnation, and dependence on input subsidies. For example, the Upsus Pajale and Upsus Siwab programs have indeed succeeded in increasing the production of strategic commodities; however, they have not systematically transformed the agricultural structure into one with high added value and responsiveness to market dynamics (Muhafidin, 2022). In other words, food security in the Indonesian framework

tends to be production-based and has not fully integrated the market, distribution and consumption dimensions holistically.

In contrast, Thailand stands out as a case study of how food security can be built through active integration with global markets. Export diversification strategies not only expand market access and add value to products but also create a system that is more resilient to domestic fluctuations. An example is the export of processed products, such as meat, fish, and cereal-based beverages, which have successfully penetrated the markets of high-income countries (Nidhiprabha, 2017). This approach offers valuable lessons on the importance of trade connectivity, logistical sophistication, and the willingness to open to foreign direct investment (FDI) as key instruments for enhancing competitiveness and promoting technology transfer (Nidhiprabha, 2017).

However, Thailand's approach is not without risks. Dependence on export markets and foreign investment presents vulnerabilities when global disruptions, such as pandemics or geopolitical conflicts, occur. Thailand's experience with implementing a rice pledging scheme policy that was counterproductive to global competitiveness demonstrates that policy interventions not aligned with market logic can undermine long-established export structures (Chen and Zhao, 2023). Therefore, striking a balance between export orientation and domestic sustainability is crucial, especially in the face of systemic crises that have cross-country implications.

The discussion also highlighted the role of import policies as a crucial point in ensuring food security. In the Indonesian context, overly protectionist import policies, through complex quota and licensing systems, have weakened the capacity of downstream industries and increased logistics costs (Amanta and Gupta, 2022). Empirical studies show that openness to imports of strategic raw materials is positively correlated with increased exports of final products (Amanta and Gupta, 2022). Unlike Thailand, which is more flexible in absorbing FDI and responding to changes in the global market, Indonesia is still trapped in a self-sufficiency logic that tends to be normative and administrative.

The comparison shows that Indonesia and Thailand represent two different paradigms in food security governance. Indonesia's state-based developmentalist model emphasizes self-sufficiency, participatory irrigation, and protectionist import policies. Thailand displays a market liberalization model, with export diversification, cooperative support, and openness to foreign investment.

From a political economy perspective, Indonesia approaches the tradition of developmental statism, while Thailand is closer to agrarian neoliberalism (Gellert, 2019; Hirsch, 2019). However, both models have limitations. Indonesia's protectionism can reduce consumer food rights (Thow et al., 2019), while Thailand's export orientation risks increasing inequality due to corporate dominance (Nidhiprabha, 2017).

Institutionally, Indonesia's participatory irrigation aligns with Ostrom's (1990) framework on collective management, while Thailand demonstrates cooperatives' capacity as food distribution agents (Ma'mun et al., 2021; Ahado et al., 2022). However, power dynamics show that both protectionism and liberalization are equally vulnerable to distortions by elites and global market actors (Stephen and Parízek, 2018).

When viewed from a Global South perspective, the differences between Indonesia and Thailand's food security policies are not unique. Agrarian reforms in Latin America emphasize state-based land distribution, while the food sovereignty movement in Africa criticizes dependence on global markets (Merino, 2020). Comparing these contexts broadens the generalization of findings while reducing ASEAN-centric bias.

Therefore, a hybrid conceptual model is needed: combining domestic self-sufficiency strategies (Indonesia) with adaptive global integration (Thailand). This model aligns with the resilience thinking framework (Folke, 2016) and recent literature on evolutionary governance (Aggarwal et al., 2018), emphasizing flexibility, cross-sector collaboration, and distributive justice.

Furthermore, the discourse on food security in the future needs to expand beyond production or trade to include narratives on the right to food, distributional justice and adaptability to the climate crisis. In this regard, Indonesia can learn from Thailand's strategy in strengthening institutional capacity, building an efficient market information system, and encouraging partnerships with global businesses and consumers. Meanwhile, Thailand can learn from Indonesia's approach to strengthening its local base and production sovereignty, particularly in reducing its dependence on increasingly volatile global markets.

For researchers and policymakers, it is important to recognize that there is no single, universally applicable food security policy model. The complexity of the food system demands a hybrid approach that combines domestic production orientation with export strategies, opening to trade and investment while still ensuring equitable access to food for all levels of society. The policy implications of this discussion emphasize the importance of building adaptive governance, strengthening food data transparency, and establishing an evidence-based policy evaluation system that can address both short-term challenges and long-term transformations.

5 Conclusion

Based on the findings and discussion, this study shows that Indonesia and Thailand have taken different paths in terms of food security policy, despite having relatively similar geographical backgrounds and agrarian challenges. Indonesia tends to emphasize food self-sufficiency through protectionism, diversification of domestic production, and strengthening of state institutional capacity, particularly in the irrigation and logistics sectors. In contrast, Thailand is more oriented toward the global market with export strategies, cooperative support, and openness to foreign investment. This paradigm shift reflects two contrasting logics: developmental statism in Indonesia versus agrarian neoliberalism in Thailand.

The policy implications of this difference are important for formulating food security strategies in the Global South. Indonesia must balance protectionism with more consumer-friendly pricing policies, not burdening vulnerable groups. Thailand, on the other hand, needs to ensure that its export orientation and involvement of large corporations do not sacrifice the sustainability of small farmers. Both are required to develop evidence-based adaptive governance that not only maintains supply and price stability but also ensures distributional justice and long-term resilience to climate crises and global disruptions.

However, this study has limitations. First, the data coverage is mainly sourced from official documents and secondary literature, without the support of primary field data that can capture the perspectives of local actors. Second, the review is still predominantly focused on the ASEAN context, so generalizations to other Global South regions must be made

cautiously. Therefore, further research should expand the empirical database and include more diverse cross-regional comparative studies. Thus, this study enriches the discourse on food security governance while offering the idea that a combination of domestic sovereignty-based strategies and adaptive openness to global markets can be a middle ground for developing countries.

Author contributions

AP: Formal analysis, Resources, Writing – review & editing, Writing – original draft, Data curation, Visualization, Investigation, Methodology, Conceptualization. KD: Supervision, Conceptualization, Writing – review & editing, Methodology, Resources, Validation, Project administration. KW: Validation, Resources, Writing – review & editing. AF: Resources, Writing – review & editing, Validation.

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The author(s) declare that Gen AI was used in the creation of this manuscript. The author(s) uses Grammarly to check the grammar.

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