



## Strategies for Improving Food Security in Remote and Outermost Island Areas

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### Abstract

Food security in remote and outermost islands is an increasingly urgent strategic issue in the context of sustainable development in Indonesia. This study aims to analyze the challenges, strategies, and policy implications of food security in these regions using a literature review method. A total of 21 scholarly articles and policy documents (2021–2025) were critically reviewed based on the FAO's five-pillar framework: availability, access, utilization, stability, and sustainability/agency. Findings reveal that limited local production, high food distribution costs, dietary shifts from traditional foods to low-nutrition imports, climate vulnerability, and low community participation are the main drivers of food insecurity. The latest FSVA 2025 data indicates national improvement, with food-vulnerable areas reduced from 92 districts (2024) to 81 (2025). The Food Security Index (IKP 2024) also highlights persistent vulnerability pockets, particularly in small and outermost islands. In response, the National Food Agency (NFA) has strengthened the Diverse, Nutritious, Balanced, and Safe Food Program (B2SA) in 809 locations and accelerated the implementation of the Free Nutritious Meal (MBG) program in 3T areas such as Morotai and Nias Selatan. These initiatives prioritize the use of local food resources (fish, maize, horticultural products) and the establishment of MBG kitchens that comply with nutrition and food safety standards. The most relevant strategies for the Indonesian context include local food diversification (sago, maize, cassava, fish, moringa), agroforestry, blue food governance, strengthening local institutions, and integrating national programs such as the sea toll and MBG

## Introduction

Food security is a strategic global issue as well as a fundamental human right recognized in various national and international regulations. At the global level, the Food and Agriculture Organization (FAO) identifies four pillars of food security: availability, access, utilization, and stability. These pillars have been further enriched with the dimensions of sustainability and agency (FAO 2023, 2023) This framework underscores that food security is not solely related to food production, but also encompasses affordability, nutritional utilization, the capacity of systems to withstand shocks, and socio-ecological sustainability.

As an archipelagic nation, Indonesia faces unique challenges in ensuring food security. Remote areas and outermost islands such as Natuna in the Riau Islands, Morotai in North Maluku, Sebatik in North Kalimantan, as well as clusters of small islands in Maluku and Papua, are particularly vulnerable. This vulnerability stems from limited infrastructure, logistical distribution constraints, geographical isolation, dependence on imported food, climate change, and structural poverty (Juliannisa et al., 2025; Guasch, 2022; Rouhana et al., 2025; Amato-Ali et al., 2025; Afif et al., 2025)

The literature indicates that the availability of local food in small islands tends to decline due to a shift in consumption patterns from traditional staples (such as sago, maize, and cassava) to rice, the distribution of which remains unstable (Nurhasan et al., 2024; Nurhasan et al., 2022). At the same time, marine products continue to serve as the backbone of protein sources; however, their utilization is challenged by resource degradation and spatial conflicts (Soselisa et al., 2021). Access to food is also constrained by inconsistent logistical distribution. Research by Sofiyandi et al. (2023) demonstrates that the “sea toll” subsidy only reduces food prices in the short term, while persistent poverty and limited nutrition services in Eastern Indonesia further exacerbate vulnerabilities (Juliannisa et al., 2025).

From the perspective of utilization, local food-based innovations have proven effective in improving nutritional status, such as the development of corn-, moringa-, and anchovy-based biscuits in East Nusa Tenggara (Picauly et al., 2023). However, the dietary shift in Papua from local food to rice illustrates a decline in diet quality that potentially undermines food utilization (Nurhasan et al., 2022). The stability of food security in outermost islands also faces challenges from climate anomalies, such as the 2023 El Niño, which reduced cereal production (Food and Agriculture Organization of the United Nations, 2025), as well as empirical evidence linking such events to child nutrition outcomes (Colozza et al., 2025; Rogna, 2024; Demurtas & Occansey Agbeko, 2025).

Global studies reveal that Small Island Developing States (SIDS) face similar challenges: limited land availability, dependence on imports, and climate vulnerability (Atzori et al., 2024). A study in Kiribati emphasizes the critical role of access to marine resources as a primary pathway to food security (Seto et al., 2024), while research (Teneva et al., 2023) highlights the importance of adaptive governance of blue foods in response to climate change. Such comparisons reinforce the argument that Indonesia’s context as an archipelagic nation shares structural similarities with SIDS.

At the national level, the Food Security and Vulnerability Atlas (FSVA) 2025 (BAPANAS 3T 2025, n.d.) indicates progress, with the number of food-vulnerable districts decreasing from 92 in 2024 to 81 in 2025. The Food Security Index (IKP, 2024) also underscores the persistence of pockets of vulnerability in small island and border regions. In response, the National Food Agency (NFA), in collaboration with the National Nutrition Agency (BGN), has launched the accelerated *Makan Bergizi Gratis* (Free Nutritious Meals) program, particularly targeting disadvantaged, frontier, and outermost (3T) areas, with priority given to the utilization of local food and the strengthening of B2SA (Balanced, Diverse, Nutritious, and Safe Food) Villages/Households in 809 locations (Bapanas, 2025). This initiative aligns with Presidential Regulation No. 81/2024 (Pemerintah Pusat Indonesia, 2024) on the acceleration of local food-based diversification, which emphasizes the importance of integrating food and nutrition policies within regional contexts.

Although numerous studies have examined food security in Indonesia, research that specifically addresses strategies for enhancing food security in remote and outermost island regions remains limited. Most previous studies have been partial, focusing only on aspects of availability or nutrition, and have yet to provide a comprehensive synthesis across the FAO’s food security pillars (Food and Agriculture Organization of the United Nations, 2025) that is relevant to the current policy context of the *Makan Bergizi Gratis* (MBG) program. Therefore, this study seeks to fill that gap by presenting a synthesis of recent literature (2021–2025) on efforts to strengthen food security in Indonesia’s outermost islands.

This research is expected to provide an academic contribution in the form of a literature-based mapping of food security strategies, as well as a practical contribution in the form of policy

recommendations that can support development planning in remote regions, while simultaneously reinforcing national food security through the implementation of the MBG and B2SA programs.

## Literature Review

The literature review in this study is organized according to the five pillars of the FAO framework. Existing studies indicate that in remote and outermost island regions, food security challenges are multidimensional: limited local food production (availability), barriers to access due to distribution constraints and poverty (access), insufficient nutritional utilization (utilization), vulnerability to climate variability and supply volatility (stability), as well as the need for community-based sustainable strategies (sustainability/agency). The following synthesis discusses the main findings of relevant literature within each pillar.

### Availability (Food Availability)

Food availability in outermost islands is influenced by limited local production, dependence on imported food, and coastal and marine ecosystems. (Nurhasan et al., 2022) observed a dietary shift in West Papua from traditional staples (such as sago and tubers) to rice, despite low rice productivity and unstable distribution. (Kurniasih et al., 2023) highlighted the potential for diversifying local food sources (including sago, maize, hotong (*Setaria italica*), cassava, and bananas, although land fertility constraints remain a challenge (Rozi et al., 2023) demonstrated that agroforestry can strengthen food availability by integrating food crops with forest trees, thereby preserving ecosystems while simultaneously enhancing food production.

In the marine sector, (Soselisa et al., 2021) found that coastal communities in Maluku are highly dependent on fisheries as a source of protein and income, yet overexploitation threatens their sustainability. At the global level, (Atzori et al., 2024) emphasized that Small Island Developing States (SIDS) face similar challenges, making local food diversification and fisheries protection an urgent priority.

The FSVA 2025 (Badan Pangan Nasional, 2025) reported a decline in food-vulnerable districts from 92 in 2024 to 81 in 2025; however, most of these remain concentrated in small and outermost island regions. The MBG program in Morotai illustrates the potential of utilizing local fish as a primary protein source to strengthen local food availability.

### Access (Food Access)

Food access represents a critical dimension of food security, particularly in outermost islands that face barriers such as distribution constraints, high transportation costs, and limited household purchasing power. (Sofiyandi et al., 2023) demonstrated that the sea toll subsidy as a maritime transportation policy was able to reduce food prices by up to 3.2 percent. However, its impact proved temporary, as prices eventually rose again in the long term due to supply chain limitations and dependence on unstable distribution routes. This indicates that logistical subsidies must be complemented by more integrated and sustainable distribution strategies (Huang et al., 2024; Judijanto et al., 2024).

Household economic factors also serve as barriers to food access. (Juliannisa et al., 2025) found that 68 districts in Eastern Indonesia remain classified as food-vulnerable due to a combination of structural poverty, limited access to nutrition services, and disparities in food prices across regions. Thus, the challenge of food access in outermost islands is not solely related to distribution, but is also closely intertwined with the socio-economic conditions of local communities (Mendonça et al., 2023; Freiheit, 2022).

Community-based approaches offer promising solutions. Bakri et al. (2025) developed a community empowerment model in Sebatik that emphasizes the strengthening of human, social, and natural capital. Their findings indicate that when local communities are empowered to manage their own resources, household food security capacity increases significantly. In line with this, (Bakri et al., 2025) also highlighted the resolution of fisheries conflicts in Sebatik through participatory zoning and multi-stakeholder forums. These mechanisms not only reduced resource conflicts but also facilitated more equitable access to marine products as a food source.

From a global perspective, (Georgeou et al., 2022) through a study in the Pacific, emphasized that food access in small island nations is highly dependent on the role of smallholder farmers and local distribution systems. When import channels are disrupted, communities that rely on local food sources are comparatively more resilient. This provides an important lesson that strengthening community-based food systems in Indonesia is a key strategy for addressing access limitations in outermost island.

Thus, the literature demonstrates that improving food access in Indonesia's outermost islands requires a dual approach: macro-level policies such as logistical subsidies and price controls, alongside micro-level strategies involving community empowerment and participatory management of local resources. The MBG program in South Nias (2025) highlights this duality by prioritizing the purchase of local agricultural products (such as maize and horticultural crops) through village cooperatives, thereby providing stable market access for farmers and fishers while ensuring nutritious food access for schoolchildren.

### **Utilization (Food Utilization)**

Food utilization encompasses the ways in which communities process, consume, and derive nutritional benefits from available food. In remote and outermost island regions, the main challenges include limited dietary diversity, shifts in consumption patterns, and low levels of nutritional awareness among the population.

(Picauly et al., 2023) demonstrated that local food-based innovations can significantly improve nutritional status. Their study in East Nusa Tenggara (NTT) showed that biscuits made from corn, moringa, and anchovies increased the body weight of toddlers within just 12 days. These findings underscore that the utilization of local foods, when combined with simple innovations, can serve as an effective nutritional intervention strategy in remote areas.

However, there are serious challenges related to shifting consumption patterns. (Nurhasan et al., 2022) revealed that in Papua, diets have shifted from traditional foods based on sago, tubers, and local vegetables to imported foods, particularly rice and processed products. This transition has had a negative impact on diet quality by reducing food diversity and nutritional content. Such a phenomenon highlights the urgent need to educate communities about the nutritional value of local foods (Nurhasan et al., 2024; Muonde et al., 2024; Silva et al., 2023; Carvalho et al., 2024).

Traditional food diversification is also crucial to sustaining nutrition. Research Synergy Press (2023) emphasized that sago, maize, hotong (*Setaria italica*), cassava, and bananas are staple foods with the potential to support food security in Maluku and surrounding islands. In addition to being nutrient-rich, these foods possess strong ecological adaptability, making them more resilient to the marginal land conditions commonly found in small islands.

From a global perspective, (Chin et al., 2024) noted that Small Island Developing States (SIDS) face similar challenges. Dependence on imported, low-nutrient processed foods has led to a rising prevalence of the double burden of malnutrition namely, the coexistence of

undernutrition and obesity. This lesson is highly relevant to Indonesia, as consumption patterns in outermost island communities are likewise beginning to show increasing reliance on less nutritious imported food products.

Thus, food utilization in Indonesia's outermost islands must be directed toward strategies of traditional food diversification, the development of local food-based innovations, and sustainable nutrition education programs. This approach not only improves community health but also strengthens local food identity as the foundation of food security. The B2SA program (2025) has been developed in 809 locations to promote nutrition education based on local foods. Its integration with the MBG program ensures the inclusion of high-nutrient local foods (such as fish, moringa, and local vegetables) in school meal menus (Badan Pangan Nasional, 2024).

### **Stability (Food Stability)**

Food stability refers to the capacity of food systems to withstand shocks, whether seasonal, economic, or ecological. In outermost islands, the stability of food security is highly vulnerable due to geographic isolation, the absence of adequate food reserves, and strong dependence on weather and climate conditions.

The FAO report (FAO 2023) highlighted that the 2023 El Niño phenomenon reduced cereal production in Eastern Indonesia while simultaneously increasing the risk of food supply instability. These impacts were felt more acutely in small and outermost islands due to limited storage and distribution infrastructure. (Colozza et al., 2025) In a systematic review also demonstrated that extreme climate events are directly associated with higher prevalence of child malnutrition and with declines in local food production. These findings reinforce the argument that food stability cannot be separated from the issue of climate change.

An addition to climate factors, post-harvest losses and food loss within supply chains also pose significant challenges to food stability. (Georgeou et al., 2022) in a study on Pacific nations, found that food losses caused by long-distance transportation, limited cold storage facilities, and weak distribution management contribute to price instability and reduced food availability. This condition is highly relevant to Indonesia, particularly in outermost islands that face similar supply chain challenges.

On the other hand, locally based adaptation strategies can enhance the stability of food systems. A study by (Bakri et al., 2025) in Sebatik showed that fisheries conflict resolution mechanisms through participatory zoning not only reduced social tensions but also strengthened the sustainability of marine food production. This participatory approach provides evidence that food stability is determined not only by environmental factors but also by inclusive social governance.

Global experiences in Small Island Developing States (SIDS) also underscore the importance of adaptive governance. (Teneva et al., 2023) emphasized that "blue foods," or marine-based food resources, have the potential to serve as a long-term foundation for food stability if managed under climate-adaptive principles. This insight resonates with the Indonesian context, where abundant marine resources remain underutilized in a sustainable manner.

Thus, the stability of food security in Indonesia's outermost islands is strongly influenced by a combination of ecological factors (climate change and weather vulnerability), technical factors (storage and distribution), and social factors (resource governance). Strategies to strengthen stability must therefore encompass climate adaptation, supply chain innovation, and the reinforcement of participatory governance mechanisms. The MBG program functions as a

demand stabilizer, whereby routine demand from schools contributes to more stable local food supplies and prevents sharp price fluctuations.

### **Sustainability / Agency**

The dimensions of sustainability and agency in food security highlight the importance of managing food systems not only to meet current needs but also to ensure the availability, access, and utilization of food for future generations, with the active involvement of local communities. In outermost islands, sustainability is particularly crucial due to fragile ecosystems, limited resources, and geographic isolation.

Pratama et al. (2025) demonstrated that agroforestry in Pahawang Island has strengthened food security while preserving ecological functions. The integration of food crops with forest trees enhances long-term food availability, improves soil fertility, and maintains biodiversity. This strategy is highly relevant for replication in Indonesia's outermost islands.

Beyond land-based foods, marine-based foods (blue foods) hold significant potential for sustaining food systems. (Teneva et al. (2023) emphasized that climate-adaptive governance of blue foods could become a cornerstone of food security for small island nations by 2050. Its relevance to Indonesia lies in optimizing the potential of fisheries and seaweed resources in outermost islands, which remain underutilized.

The aspect of agency, or the active role of communities, also emerges as a critical factor. (Levianto et al. (2023) demonstrated that community empowerment in Sebatik through the strengthening of human, social, and natural capital significantly improved household capacity to achieve self-sufficiency in food. This indicates that sustainability cannot be separated from the active involvement of local communities in planning and managing food resources.

From a global perspective, (Guell et al. (2024) noted that Small Island Developing States (SIDS) face the double burden of malnutrition, resulting from reliance on low-nutrient imported diets. Addressing these challenges requires an integrated sustainability strategy that strengthens local food production, reduces dependence on imports, and builds community capacity.

Thus, the literature underscores that the sustainability of food security in Indonesia's outermost islands can only be achieved through synergy among ecological strategies (agroforestry, blue food governance), social strategies (community empowerment, local participation), and policy strategies (integration of national and local food policies). The agency dimension demonstrates that the success of food security strategies is determined not only by macro-level policies but also by the initiatives and capacities of local communities as key actors. Presidential Regulation No. 81/2024 also emphasizes local potential-based food diversification as a sustainability strategy. Furthermore, an analysis by WRI Indonesia (2025) recommends implementing MBG through local food and MSMEs as an agency instrument, while CIPS (2025) warns of the risks of ultra-processed foods within MBG if menu quality is not properly safeguarded.

### **Methods**

This study employs a literature review approach using a qualitative descriptive method. This method was chosen because the topic of food security in remote and outermost island regions has been relatively underexplored empirically. Therefore, the collection of secondary data from various academic and policy sources represents a strategic step toward achieving a comprehensive and contextual understanding.

### **Data Sources**

The data for this study were drawn from the following sources:

International journal articles (2021–2025) obtained from reputable databases such as Scopus, Web of Science, SpringerLink, Frontiers, MDPI, ScienceDirect, and PLOS. A total of 21 journal articles were used as the academic foundation.

Reports from international organizations, such as the FAO (2021, 2023), which provide the five-pillar framework of food security as well as global data on climate anomalies and their impacts on food security.

National policy documents, including the Food Security Index (IKP, 2024), the Food Security and Vulnerability Atlas (FSVA, 2025), and Presidential Regulation No. 81/2024 on local food diversification.

Relevant national programs, namely the *Makan Bergizi Gratis* (MBG/Free Nutritious Meals) program in 3T regions (e.g., Morotai and South Nias), as well as the B2SA program 2025 implemented in 809 locations.

Supporting literature, including proceedings, conference publications, and local-level policy reports (e.g., from Natuna, Morotai, Sebatik, Maluku, and Papua).

### **Inclusion and Exclusion Criteria**

**Inclusion:** Publications from 2021–2025 that are relevant to food security in small/remote islands, focused on the FAO pillars or food security enhancement strategies, and available with a DOI or open access.

**Exclusion:** Publications outside the specified time frame, those not relevant to the context of small/remote islands, or popular opinion pieces lacking empirical or policy foundations.

### **Data Analysis Procedure**

**Data Reduction:** Selecting articles in accordance with the inclusion criteria.

**Classification:** Grouping the literature based on the five FAO pillars (availability, access, utilization, stability, sustainability/agency).

**Thematic Synthesis:** Organizing the main findings from each pillar, identifying barriers, strategies, and comparisons with international studies (e.g., SIDS and the Pacific).

**Interpretation:** Drawing theoretical and practical implications for the Indonesian context, with particular emphasis on policy relevance such as the MBG and B2SA programs.

### **Data Validation**

Validation was carried out through source triangulation by:

Comparing academic literature with official policy reports (e.g., FAO, FSVA, IKP, Presidential Regulation No. 81/2024, and reports from the National Food Agency).

Linking findings from international studies (SIDS, Kiribati, Pacific) with those from Indonesia.

Ensuring consistency with national quantitative indicators (FSVA 2025, IKP 2024, indicators of Food Consumption Patterns/PPH, and stunting prevalence).

Table 1. Summary of Reviewed Literature

<b>FAO Pillar</b>	<b>Key Findings Focus</b>	<b>Example of Main Sources</b>
Availability	Low local production; traditional food diversification (sago, maize, cassava); agroforestry; small-scale fisheries	Nurhasan et al. (2021); Research Synergy Press (2023); Pratama et al.

		(2025) (Nurhasan et al., 2024)
Availability	Decline in cereal production due to El Niño; land degradation	(Food and Agriculture Organization of the United Nations, 2025) (Colozza et al., 2025)
Access	Sea toll subsidies reduce food prices only temporarily; distribution disparities between Eastern and Western Indonesia	(Sofiyandi et al., 2023)
Access	Structural poverty exacerbates food access vulnerability in Eastern regions	(Juliannisa et al., 2025)
Access	Conflict resolution and community empowerment to improve local food distribution	(Bakri et al., 2025)
Access	The MBG program emphasizes the involvement of local cooperatives/MSMEs in the supply chain	( <i>BAPANAS FSVA DAN IKP 2025</i> , n.d.) (Badan Pangan Nasional, 2024) Bapanas (2025a, Morotai); Bapanas (2025b, Nias Selatan)
Utilization	Utilization of local foods (maize, moringa, anchovies) improves toddlers' nutritional status	(Picauly et al., 2023)
Utilization	The dietary shift from local foods to rice has reduced diet quality in Papua	(Nurhasan et al., 2024)
Utilization	B2SA as a nutrition-oriented food consumption education strategy in 809 locations	( <i>BAPANAS FSVA DAN IKP 2025</i> , n.d.)
Stability	The impact of the 2023 El Niño reduced global cereal production, affecting Eastern Indonesia	FAO (2023)
Stability	High food loss in the supply chains of small island nations	Amato-Ali et al. (2025) (Atzori et al., 2024)
Stability	Climate variability increases the risk of child malnutrition	(Colozza et al., 2025)
Sustainability/Agency	Climate-adaptive blue food governance is crucial for the food security of small islands	(Teneva et al., 2023)
Sustainability/Agency	The nutrition transition in SIDS resembles that of Eastern Indonesia (double burden)	(Chin et al., 2024)
Sustainability/Agency	Agroforestry enhances food availability while preserving small island ecosystems	(Georgeou et al., 2022)
Sustainability/Agency	Integrative cross-sectoral policy governance as a prerequisite for sustainability	(Atzori et al., 2024)

Sustainability/Agency	Presidential Regulation No. 81/2024: the legal foundation for local food diversification	(Pemerintah Pusat Indonesia, 2024)
Sustainability/Agency	Local food and MSME-based MBG strategy (WRI Indonesia)	(Sidiq et al., 2022)
Sustainability/Agency	The risk of ultra-processed foods in the MBG program (CIPS)	CIPS (2025)
Cross-cutting	FSVA 2025: wilayah rentan rawan pangan turun dari 92 → 81 kabupaten/kota	Bapanas (2025d) (Badan Pangan Nasional, 2024)
Cross-cutting	IKP 2025: peta kerentanan pangan nasional per provinsi/kabupaten	Bapanas (2025e) (DATASET IKP 2025, n.d.)

## Results and Discussion

The literature review reveals that food security in Indonesia's outermost islands is a complex phenomenon influenced by geographic constraints, ecological conditions, socio-economic factors, and public policies. The main findings can be summarized within the FAO's five pillars:

### Availability (Food Availability)

The literature underscores the limited local food production in small and outermost islands. Nurhasan et al. (2021; 2024) demonstrated a dietary shift from traditional staples (such as sago, tubers, and maize) to imported rice, making communities increasingly dependent on external supplies that are vulnerable to disruption. Soselisa et al. (2021) further noted that marine ecosystem degradation threatens the availability of animal protein for coastal communities. Diversification of local food sources such as sago, maize, cassava, and bananas emerges as a strategic solution (Research Synergy Press, 2023). Globally, similar challenges are faced by Small Island Developing States (SIDS), which struggle with land scarcity and import dependency (Atzori et al., 2024).

### Access (Food Access)

The primary barriers to food access in outermost islands are high distribution costs, dependence on maritime transport, and low household purchasing power. Sofiyandi et al. (2023) observed that the *sea toll* subsidy reduced food prices by up to 3.2%, though its impact proved unsustainable. Juliannisa et al. (2025) added that structural poverty exacerbates food vulnerability in Eastern Indonesia, where 68 districts remain categorized as food-insecure. A community-based study in Sebatik (Levianto et al., 2023) showed that strengthening the socio-economic capacity of local communities can sustainably improve food access.

### Utilization (Food Utilization).

The utilization of local food resources remains limited, even though innovations based on traditional foods have been proven effective. Picauly et al. (2023) found that biscuits made from maize, moringa, and anchovies significantly improved toddlers' nutritional status in East Nusa Tenggara within a short period. However, Nurhasan et al. (2024) reported that the dietary shift from local foods to low-nutrient imported products has reduced dietary diversity and increased the risk of malnutrition. The B2SA (*Beragam, Bergizi, Seimbang, Aman* / Diverse, Nutritious, Balanced, Safe) program, developed in 809 locations in 2025, plays a critical role in nutrition education, aimed at optimizing the utilization of local foods.

## Stability (Food Stability)

Food security in small islands is highly vulnerable to external shocks. The FAO (2023) highlighted the impact of the 2023 El Niño, which reduced cereal production in Eastern Indonesia. Colozza et al. (2025) confirmed the direct link between extreme weather events and the prevalence of child malnutrition, while Amato-Ali et al. (2025) emphasized the high levels of food loss in island nations due to long distribution chains and limited cold-chain facilities. A study in Sebatik (Ajfar Journal, 2025) showed that participatory governance in resolving fisheries conflicts can strengthen local food stability.

## Sustainability / Agency

The sustainability of food systems in outermost islands can only be achieved through the active involvement of local communities. Pratama et al. (2025) demonstrated that agroforestry in small islands can enhance food security while simultaneously maintaining ecological functions. Teneva et al. (2023) highlighted the importance of climate-adaptive governance of blue foods. Levianto et al. (2023) showed that strengthening social and human capital in Sebatik can improve household capacity to cope with food vulnerabilities. From a policy perspective, Presidential Regulation No. 81/2024 on the acceleration of local food diversification and the MBG (*Makan Bergizi Gratis / Free Nutritious Meals*) program in disadvantaged, frontier, and outermost (3T) areas underline the importance of integrating local foods, MSMEs, and educational institutions as instruments of sustainability.

Table 2. Synthesis of Barriers and Strategies for Food Security Based on the Literature (2021–2025)

FAO Pillar	Barrier	Identified Strategies	Key Literatur
Availability	Low production, high imports, marine ecosystem degradation	Local food diversification, agroforestry, marine resource protection	Nurhasan et al. (2021, 2024); Soselisa et al. (2021)
Access	Unstable distribution, high prices, poverty	Maritime logistics subsidies, cold chain development, community empowerment, resource conflict resolution	Sofiyandi et al. (2023); Juliannisa et al. (2025); Bakrie et al. (2023)
Utilization	Shift in consumption, low utilization of local foods	Local food innovations (maize, moringa, anchovy biscuits), nutrition education, local consumption campaigns	Picauly et al. (2023); Nurhasan et al. (2024); Guell et al. (2024)
Stability	Climate vulnerability, food loss	Climate adaptation, sustainable supply chain management, participatory governance	FAO (2023); Colozza et al. (2025); Amato-Ali et al. (2025)
Sustainability/Agency	Fragile ecosystems, high imports, low community participation	Agroforestry, blue food governance, community empowerment, policy integration	Pratama et al. (2025); Teneva et al. (2023); Levianto et al. (2023); Guell et al. (2024)

Table 3. Synthesis of FAO Pillars and MBG & B2SA Strategies in Indonesia’s Outermost Islands

FAO Pillar	MBG & B2SA Strategies
Availability	Local food diversification (sago, maize, cassava, fish, moringa); utilization of marine resources; agroforestry.
Access	Logistics subsidies & sea toll; integration of local MSMEs/cooperatives into the MBG supply chain.
Utilization	Nutrition education based on B2SA; MBG kitchens using local foods; healthy product innovations (moringa/fish biscuits).
Stability	Climate adaptation; resilient supply chains; food loss reduction; regular MBG distribution mechanisms.
Sustainability/Agency	Agroforestry; blue foods; community empowerment (Sebatik, Morotai); policy foundation of Presidential Regulation No. 81/2024.

### Cross-Pillar Discussion

Food security in the outermost islands must be understood as an interconnected system across the FAO pillars. High availability does not automatically guarantee access if distribution is costly or purchasing power is low. A concrete example can be seen in Maluku, where local food is relatively abundant, yet inter-island transportation costs create price disparities in markets (Research Synergy Press, 2023). This condition is consistent with FSVA 2025, which identified that most food-vulnerable districts are located in archipelagic regions, despite their potential local food resources.

Similarly, food utilization is highly dependent on the previous two dimensions. Nutritious foods such as moringa and local fish will not have an optimal impact if household economic access remains limited or if cultural preferences lean more heavily toward imported foods. This cultural dietary shift weakens the utilization of local foods (Nurhasan et al., 2024). The B2SA program (2025) attempts to bridge this gap through local food-based nutrition education implemented in 809 locations, including 3T areas.

Stability serves as the “guardian” of the three preceding pillars. Climate change and extreme weather events can undermine the entire food security chain, even when availability, access, and utilization are relatively strong. For instance, the 2023 El Niño reduced agricultural and fisheries yields in Eastern Indonesia, which in turn contributed to increased child malnutrition (FAO, 2023; Colozza et al., 2025). This illustrates the importance of climate adaptation and the strengthening of food distribution systems to ensure supply stability in small island regions.

Finally, Sustainability/Agency serves as the foundation that ensures all pillars function not only in the short term but also in a sustainable manner. Without the participation of local communities, government strategies risk failure. Levianto et al. (2023) demonstrated that when communities in Sebatik were empowered through the strengthening of social and human capital, household capacity improved significantly, which in turn reinforced the other four pillars. Its relevance to national policy is evident in the *Makan Bergizi Gratis* (MBG) program: when schools collaborate with cooperatives and local farmers, not only does students’ nutrition improve, but community economic sustainability is also strengthened.

Thus, cross-pillar integration underscores that food security in outermost islands cannot be addressed through partial, sectoral approaches. An integrative strategy involving local food diversification, affordable distribution access, nutrition education, climate adaptation, and community participation must be prioritized. This aligns with the direction of national policy

as articulated in Presidential Regulation No. 81/2024, which emphasizes the importance of local potential-based food diversification to strengthen sustainable food security.

### **National and Global Policy Context**

Indonesia has established the Food Security Index (IKP) and the Food Security and Vulnerability Atlas (FSVA) as instruments for mapping vulnerabilities. FSVA 2025 data show improvements, with the number of food-insecure districts/cities decreasing from 92 in 2024 to 81 in 2025. However, vulnerability pockets remain concentrated in small and outermost island regions, particularly in Maluku, East Nusa Tenggara (NTT), and Papua. The IKP 2024 also highlights that interregional disparities remain significant, primarily due to geographic isolation, limited logistics infrastructure, and structural poverty.

Food development policies in the National Medium-Term Development Plan (RPJMN) 2020–2024 target transformation through food diversification, agricultural modernization, and strengthened distribution. However, these policies remain macro in nature and tend to emphasize national price stability. For example, the *sea toll* program has temporarily reduced food prices, but it has not succeeded in establishing a sustainable supply chain (Sofiyandi et al., 2023).

As a policy update, the government issued Presidential Regulation No. 81/2024 on accelerating local food diversification. This policy aligns with the expansion of the *Makan Bergizi Gratis* (MBG/Free Nutritious Meals) program in disadvantaged, frontier, and outermost (3T) regions, such as Morotai and South Nias, which utilize local food sources (fish, maize, horticultural crops) for school meals. The integration of MBG with the B2SA program (2025), implemented in 809 locations, represents a concrete step in linking national policies with local practices.

In the global context, SDG 2 (*Zero Hunger*) calls for the transformation of food systems through an integrative approach that combines ecological, social, and economic dimensions. The FAO (2023) also emphasizes the need for food governance that is adaptive to climate change, while literature on Small Island Developing States (SIDS) highlights challenges similar to those in Indonesia, including land scarcity, import dependency, and climate vulnerability (Atzori et al., 2024; Teneva et al., 2023).

Thus, a gap remains between national policies and local realities. The central government tends to focus on national price and supply stability, while outermost islands face geographic isolation, limited infrastructure, and weak local institutions. An integrative approach that combines local food diversification, community participation, and regionally adapted policies is therefore essential to bridging this gap.

### **Relevance of the Free Nutritious Meals (MBG) Program**

The government's *Makan Bergizi Gratis* (MBG/Free Nutritious Meals) program holds strong practical relevance within the framework of the FAO's five pillars:

**Utilization (Nutritional Utilization).** MBG can directly improve the nutritional intake of schoolchildren. When food ingredients are sourced from local staples (such as sago, tubers, moringa, and fish), nutritional benefits are complemented by the reinforcement of local food identity and community self-reliance.

**Availability & Access.** Schools function as a stable market for local farmers and fishers. Through routine procurement mechanisms, local food production is encouraged and the economic access of poor households is improved. This aligns with the findings of IKP 2024, which highlighted the importance of local markets as drivers of food security in vulnerable regions.

Stability (Supply Stability). Through contracts and routine procurement, MBG creates stable demand. This functions as a demand stabilizer, ensuring that local food prices and supplies remain steady, even in the face of climate shocks or distribution disruptions.

Sustainability/Agency. MBG has the potential to empower cooperatives, MSMEs, and local communities as service delivery partners. When managed on the basis of participation, the program can serve as a strategic instrument to strengthen the role of communities in the food system.

However, if MBG implementation relies heavily on imported foods or large external contractors, the goal of food self-sufficiency may be undermined. CIPS (2025) has warned of the risk of increased dependency on ultra-processed foods if the quality standards of MBG menus are not properly safeguarded. Therefore, the program must be locally based to ensure alignment with food security strategies in Indonesia's outermost islands.

## Conclusion

This study confirms that food security in Indonesia's outermost islands is a multidimensional phenomenon, interlinked within the FAO's five-pillar framework. Limited local production, dependence on imported foods, and dietary shifts from traditional staples toward low-nutrient imported foods remain key challenges in the dimensions of availability and utilization. Distribution barriers, high food prices, and structural poverty further exacerbate access. Meanwhile, stability is increasingly threatened by climate change, El Niño events, and high levels of food loss within supply chains. Sustainability and agency can only be achieved when local communities actively participate in managing food resources and institutional governance.

These findings align with the most recent FSVA 2025 data, which show a reduction in the number of food-vulnerable districts from 92 in 2024 to 81 in 2025, though vulnerabilities remain concentrated in Maluku, East Nusa Tenggara (NTT), and Papua. The IKP 2024 also highlights persistent gaps in food access and nutrition in island regions. From a policy perspective, Presidential Regulation No. 81/2024 on local food diversification and the *Makan Bergizi Gratis* (MBG/Free Nutritious Meals) program in 3T regions serve as strategic instruments to strengthen food availability, access, utilization, stability, and sustainability in outermost islands.

In conclusion, this study emphasizes the need for an integrative approach across the FAO pillars, combining ecological strategies (agroforestry, blue foods), socio-economic strategies (community empowerment, cooperatives/MSMEs), and national policy frameworks (MBG, B2SA, Presidential Regulation No. 81/2024) to achieve sustainable food security in Indonesia's outermost islands.

## Policy Recommendations

Based on the literature findings and policy context, this study proposes the following recommendations:

Integration of national policies with the specific needs of outermost islands. The government should formulate more contextualized food policies that take into account local geographic, socio-economic, and institutional conditions. Programs such as MBG and B2SA must be adapted to align with local logistical challenges and community capacities.

Strengthening sustainable supply chains. There is a need to develop cold storage infrastructure, implement more efficient distribution management, and adopt strategies to mitigate food loss.

The routine procurement model of the MBG program can serve as an instrument to stabilize local food supply.

Synergy between MBG and local food diversification. MBG menus should be based on local foods (such as sago, maize, cassava, fish, moringa, and seaweed), not only to improve the nutrition of schoolchildren but also to strengthen local production and food identity.

Empowerment of local institutions. Cooperatives, MSMEs, and local communities should be given a central role as MBG service providers. This approach ensures sustainability while simultaneously strengthening community agency.

Climate adaptation and resource governance. Agriculture and fisheries in outermost islands must be prioritized within climate adaptation programs. Agroforestry and climate-adaptive blue food governance should be developed to maintain long-term stability.

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