

Analysing Food Estate Development's Impact on Indonesia's Food Sovereignty and Security Challenges

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ABSTRACT

Indonesia's large-scale Food Estate programs aim to strengthen national food security but generate complex socio-economic and environmental consequences. While some projects increase agricultural output, their top-down, production-oriented approach often neglects community participation, land rights, and ecological sustainability. This has resulted in land conflicts, indigenous displacement, livelihood erosion, and weakened local food sovereignty. The expansion into fragile ecosystems, particularly peatlands, has triggered deforestation, biodiversity loss, and rising carbon emissions. Power imbalances and limited Free, Prior, and Informed Consent (FPIC) further intensify social tensions. This study argues that the current model creates structural tensions between food security and food sovereignty. It recommends reorienting foodland governance toward participatory, community-based, and environmentally sustainable approaches to ensure equitable, resilient, and long-term national food security.

INTRODUCTION

Over the years, global discourse surrounding food systems has increasingly emphasised the importance of food security and sovereignty as key components of sustainable development and public well-being. While often used interchangeably, these terms represent distinct paradigms. The U.S. Department of Agriculture defines food security as “access by all people at all times to enough food for an active, healthy life” (Maudrie et al., 2023). This concept emphasises economic access and caloric sufficiency, often framed within market-driven, individualistic frameworks.

In contrast, food sovereignty encompasses a broader, rights-based approach, asserting the right of communities to culturally appropriate and ecologically sustainable food and to define their food systems (Maudrie et al., 2023). For many Indigenous and marginalised communities, including in Indonesia, this distinction is critical: while food security may ensure survival, food sovereignty is essential for cultural continuity, environmental stewardship, and long-term well-being (Maudrie et al., 2023).

In Indonesia, the distinction between food security and food sovereignty becomes increasingly relevant in light of growing national efforts to strengthen agricultural capacity. As the fourth most populous country in the world (World Bank, 2023), Indonesia faces significant pressure to secure adequate food supplies for its population. A food estate, or national food barn, is a government program designed to create large-scale food production areas to reduce reliance on imports and enhance national food security (Qodriyatun & Sawalman, 2024). This strategic push reflects Indonesia’s broader commitment to achieving national food resilience in response to global uncertainties such as climate change, pandemics, and geopolitical instability.

These programs also reflect how Indonesia employs a production-focused approach that aligns with global definitions of food security, emphasising availability and access. However, food sovereignty highlights additional dimensions such as local agency, ecological sustainability, and cultural appropriateness, which are increasingly acknowledged in global and regional discussions on food systems. Understanding how these two frameworks interact is essential for evaluating the broader implications of agricultural development in Indonesia.

Despite their aim to strengthen national food security, Indonesia’s food estate projects face significant challenges that undermine their effectiveness and equitable impact. A primary concern is their top-down implementation, which often disregards local contexts and community needs (Surbakti et al., 2023). This approach has led to widespread criticism regarding potential land dispossession, displacing smallholder farmers and indigenous communities who depend on these lands for their livelihoods and cultural heritage. Furthermore, the large-scale nature of these projects raises serious questions about their negative ecological impacts, including deforestation, biodiversity loss, and unsustainable water usage, threatening the long-term environmental health of the affected regions.

Beyond environmental and social justice issues, food estate projects' economic sustainability and contribution to equitable food access remain highly debatable. Critics argue that these initiatives often favour large-scale agribusiness over the empowerment of local farmers, potentially exacerbating existing inequalities within the agricultural sector (Surbakti et al., 2023). The lack of meaningful participation from and benefits for smallholder farmers and indigenous communities, the very groups often most vulnerable to food insecurity, calls into question whether these projects genuinely enhance national food security or merely concentrate agricultural control and benefits among a select few.

Having established the significant socio-economic and environmental criticisms surrounding Indonesia's food estate projects, it becomes imperative to delve deeper into the specific dynamics. Accordingly, this research seeks to critically examine the question: "What are the socio-economic and environmental challenges arising from Indonesia's food estate development, and how do these challenges reflect a tension between the goals of national food security and the principles of local food sovereignty?" This inquiry thoroughly examines the tangible impacts on communities and ecosystems while uncovering the underlying conceptual conflict between large-scale national agricultural objectives and the foundational importance of localised, community-driven food systems.

The primary aim of this study is to analyse the impacts of Indonesia's food estate development program. This analysis focuses on understanding how the program contributes to or hinders the achievement of national food security. In doing so, the study seeks to uncover whether large-scale agricultural initiatives align with long-term national food goals. At the same time, the research critically assesses the implications of these developments for local food sovereignty, particularly regarding the rights and livelihoods of indigenous and rural communities. By exploring these dimensions, the study aims to provide a balanced perspective on the trade-offs between centralised food production strategies and localised, community-based food systems.

This study is significant as it offers a critical evaluation of the effectiveness of Indonesia's food estate program in meeting its national food security objectives. The research addresses key dimensions often overlooked in policy implementation by focusing on aspects such as equitable access to food and the sustainability of agricultural production. It highlights the importance of balancing large-scale agrarian development with the needs of local communities and environmental considerations. The findings aim to contribute to the ongoing policy discourse by identifying strengths and weaknesses in the current approach. Ultimately, this study provides valuable insights for policymakers, scholars, and stakeholders interested in shaping Indonesia's more inclusive and sustainable food security strategies.

THEORETICAL REVIEW

The Concept of Food Security and Food Sovereignty

Food security and food sovereignty are essential to understanding sustainable food systems, as they aim to ensure access to adequate and nutritious food, but differ in their focus on control, production practices, and environmental sustainability (Cadavid et al., 2024). Food security refers to the overall condition in which food is consistently available, accessible, properly utilised, and stable over time, all while supporting nutritional well-being (Herlina et al., 2024). Recognised as a fundamental human right, it plays a critical role in national development and is featured prominently in the Sustainable Development Goals (SDGs), particularly in the agenda to eliminate hunger (Subekti et al., 2024). Several key indicators to assess food security are:

- a. Food Cost/Expenditure: Higher incomes correlate with better food access, and food basket pricing simplifies assessment.
- b. Adequacy of Food, Caloric Intake, and Nutrients: This reflects both quantity and quality of food, which are closely tied to health outcomes.
- c. Food Access: Assessed through hunger reports, skipped meals, or coping strategies.
- d. Policy: Government initiatives like food banks or community gardens signal a commitment to food security.
- e. Food-Related Health Conditions: Malnutrition, obesity, and related illnesses indicate dietary imbalances.
- f. Access to Fresh Food: Fresh produce availability is essential but often limited in urban or low-income areas.
- g. Water Access: Clean water, though indirect, is vital for food preparation and health (Cadavid et al., 2024).

In contrast, Food sovereignty refers to the authority of states, communities, and individuals to shape their food systems and policies based on their specific needs, capacities, and cultural values (Cadavid et al., 2024). This concept emphasises the importance of producing nutritious, culturally relevant food through environmentally friendly and sustainable methods, while affirming the right of people to define their own agricultural and food systems (Cadavid et al., 2024). Its key indicators include:

- a. Resources: Access to land, water, and infrastructure, enabling smallholder-based agriculture.
- b. Food Consumption and the Right to Food: Emphasises dietary diversity and nutrition.
- c. Production Models: Focuses on environmental impact and traditional, sustainable methods.
- d. Agrarian Policies and Civil Society Involvement: Community-based initiatives and government support.
- e. Trade: Evaluates food import-export ratios and domestic agricultural value-added.
- f. Gender: Measures gender equity in agriculture, including women's roles in farming, leadership, and decision-making as critical to food sovereignty (Cadavid et al., 2024).

While food security prioritises outcomes like food availability, food sovereignty adds dimensions of control, cultural relevance, and environmental sustainability. However, integrating environmental concerns into food security discourse remains limited, often reduced to general references without detailed ecological evaluation (Cadavid et al., 2024).

To bridge this gap, methods such as Life Cycle Assessment (LCA) provide a comprehensive tool to evaluate the environmental impacts of food systems. LCA enables analysis of factors like supply chain emissions or the sustainability of farming practices, helping guide environmentally responsible decisions (Cadavid et al., 2024). In this context, the idea of a “green constitution” emerges as a legal foundation for environmental sovereignty, promoting alignment between food strategies and ecological preservation. Ecuador’s constitution, for example, grants rights to nature, while Indonesia’s 1945 Constitution (Article 33 paragraphs 3 and 4) mandates state responsibility over natural resources. However, Indonesia’s human-centred focus may risk environmental degradation unless balanced with stronger ecological protections (Subekti et al., 2024).

Global Large-Scale Agricultural Projects

The increasing global demand for food, fibre, and bioenergy, driven by population growth and climate change, has accelerated the expansion of large-scale agricultural projects. While these projects are often framed as pathways to economic development and food security, they raise critical concerns about sustainability, equity, and environmental impact. Large-scale agriculture typically involves extensive landholdings, capital-intensive methods, and commercially oriented production, often supported by advanced technologies, modern irrigation infrastructure, and access to international markets (Su et al., 2025). In contrast, small-scale farms tend to be labour-intensive, subsistence-based, and more vulnerable to environmental and economic stresses.

Despite accounting for approximately 43% of the global harvested area, small-scale farms contribute a disproportionately lower share of nutrient production. This disparity is primarily due to limited soil fertility and water availability. Large-scale farms, benefiting from superior access to inputs and infrastructure, achieve higher productivity and water-use efficiency, supported by more advanced irrigation systems and crop management technologies (Su et al., 2025).

Agriculture is the largest global consumer of blue water (surface and groundwater) and green water (precipitation), with large-scale farms alone responsible for 62% of global blue water consumption (Su et al., 2025). Although they tend to use this water more efficiently, the scale of their operations still contributes significantly to environmental stress. In contrast, small-scale farms, particularly in arid and semi-arid regions, often operate under irrigation deficits, limiting yields and increasing their vulnerability to climate change.

The environmental consequences of expanding large-scale agricultural systems are substantial. The conversion of forests, wetlands, and other natural landscapes to farmland accelerates biodiversity loss, land degradation, and greenhouse gas emissions. Due to land availability and favourable climates,

many of these projects are concentrated in ecologically sensitive areas, intensifying their environmental footprint (Su et al., 2025).

Large-scale agricultural expansion is also closely linked to major infrastructure projects, particularly dam construction. In Africa, irrigation dams have been promoted to address seasonal water scarcity and boost agricultural productivity. However, a study using remote sensing and machine learning found that after the construction of 18 major dams between 2000 and 2015, large-scale farms received the majority of the irrigated land, often more than 90% in certain command areas, underscoring how such infrastructure disproportionately benefits commercial agriculture (Baumgartner et al., 2022). This myriad of benefits has raised concerns about “water grabbing,” where infrastructure initially intended to serve broader development goals is instead captured by agribusiness interests. Smallholder farmers, often lacking capital and political influence, are marginalised and struggle to secure equitable access to water resources (Baumgartner et al., 2022).

Large-scale land acquisitions (LSLAs) have also proliferated since the 2007-2008 food and energy crises. These deals, often involving transfers of over 200 hectares of arable land to foreign or domestic investors, are typically aimed at commercial agricultural production and are commonly referred to as “land grabbing” (Yang & He, 2021). Such transactions frequently lack transparency and adequate community consultation, leading to displacement, loss of livelihoods, and heightened social conflict. A review of 128 case studies by Yang & He (2021) Shows that land grabbing is not uniform. While some communities benefit from infrastructure development or employment opportunities, many experience reduced land access, environmental degradation, and cultural disintegration. The review also highlights the growing role of domestic elites in land deals, challenging the common assumption that these processes are driven solely by foreign actors (Yang & He, 2021).

Global systems like the Global Agriculture Monitoring (GLAM) Project have become essential for monitoring these wide-ranging transformations. Developed through collaboration between NASA, USDA, and academic institutions, GLAM uses satellite imagery, meteorological data, field surveys, and crop models to monitor land-use change and agricultural productivity in real time. (Becker-Reshef et al., 2010). These technologies are particularly valuable in detecting the expansion of large-scale agribusiness operations and assessing their implications for food security, trade, and climate adaptation.

Simply put, large-scale agricultural projects present opportunities to boost productivity and address global food demands. However, they also pose serious risks related to water governance, land rights, and environmental sustainability. The literature highlights the urgent need for governance frameworks that promote equitable resource distribution, protect local communities, and ensure sustainable practices. Despite an expanding body of research, important gaps remain. Many studies fail to integrate biophysical models with socio-political analysis, and research often remains fragmented across sectors and regions. Future work should adopt interdisciplinary approaches, conduct long-term

impact assessments, and employ participatory methods that amplify the perspectives of affected communities (Yang & He, 2021).

History of Food Estate Programs in Indonesia

As an agrarian country, Indonesia has a long history of implementing large-scale agricultural programs, often referred to as “food estates,” to increase food production and ensure national food security. These programs have evolved across different governmental eras, each with its approach and outcomes. Food estate refers to the integrated development of food production, encompassing agriculture, plantations, and livestock over vast tracts of land (Rasji & Tobing, 2024).

The initiation of large-scale food estate programs in Indonesia can be traced back to the 1950s (Rasman et al., 2023). During this period, the Indonesian government began to promote an agricultural program known as the “*Pengembangan Lahan Gambut*” (PLG) or Mega Rice Project in Peat Land (MRP2L) in Central Kalimantan. This project, formalised through Presidential Decree No. 82/1995, aimed to convert one million hectares of peat and swamp areas into new agricultural land for food crops, primarily rice. However, due to numerous implementation problems, including a lack of mature planning that disregarded the actual conditions of the peatland, which was unsuitable for rice cultivation, and conflicts arising from the disregard of local community land rights, the project was deemed a failure and was terminated in 1999 by Presidential Decree No. 80/1999 (Rasman et al., 2023).

Following this, the concept resurfaced in the era of President Susilo Bambang Yudhoyono. In 2010, the government launched the Merauke Integrated Food and Energy Estate (MIFEE) project in Papua Province, covering approximately 1.28 million hectares in Merauke Regency (Trisista et al., 2025). This mega-project, intended to accelerate development in Papua and contribute to the vision of “feed Indonesia, feed the World,” faced significant controversies. Similar to its predecessor, MIFEE was criticised for not involving local communities, leading to conflicts over land rights and the impoverishment and displacement of indigenous peoples (Trisista et al., 2025). The project also suffered from the unsuitability of much of the land, peatland, for the intended crops like rice and vegetables (Rasman et al., 2023).

Other food estate initiatives during this period included the Delta Kayan Food Estate (DeKaFe) in Bulungan, North Kalimantan, launched in 2011 with a planned area of 50,000 hectares. DeKaFe aimed to integrate agricultural development with food processing industries. However, by its sixth year, it had not met its targets due to fragmented institutional management, land overlap issues, and the unsuitability of the flood-prone land for agriculture (Trisista et al., 2025). In 2013, the Ketapang Food Estate (KFE) in West Kalimantan was initiated. Despite Ketapang being a central food-producing area, this project also encountered conflicts related to land, labour, and production, with crop failures occurring due to the stripping of fertile topsoil during land clearing (Rasman et al., 2023).

The most recent iteration of the food estate program began in 2020 under President Joko Widodo's administration. This program was designated a National Strategic Program (PSN) for 2020-2024, aiming to strengthen national food reserves, especially in response to global crises and the COVID-19 pandemic (Rasji & Tobing, 2024). The Ministry of Environment and Forestry issued regulations (Permen LHK No. 24/2020, later replaced by No. 7/2021) to allocate forest areas for food estate development. Priority locations included Central Kalimantan, North Sumatra, South Sumatra, and Papua (Rasji & Tobing, 2024).

Central Kalimantan's current food estate involves reactivating 30,000 hectares of former peatlands from the failed 1995 project (Rasman et al., 2023). Another significant project was the 31,000-hectare cassava plantation in Gunung Mas, Central Kalimantan, initiated in 2021. This project led to environmental disruption, including the conversion of natural forest and increased flood risk, yielding negligible results (Siborutorop, 2023). In North Sumatra, particularly in Humbang Hasundutan Regency, a 30,000-hectare food estate was launched in 2021, focusing on commodities like shallots, garlic, and potatoes. This program faced issues such as crop failures due to unsuitable soil conditions, lack of farmer involvement, and concerns over corporate participation dictating farming practices and crop types, often leading to monocultural farming that threatened native crops and traditional practices (Siborutorop, 2023).

Across these eras, a recurring theme in implementing food estate programs in Indonesia has been the criticism regarding their planning, environmental impact, and socio-economic consequences for local and indigenous communities. Many projects have been criticised for failing to adequately consider local conditions, involving communities in decision-making, and often prioritising corporate interests over the rights and traditional practices of local farmers (Rasji & Tobing, 2024).

Critiques and Debates on Food Estates in Indonesia

The implementation of food estate programs in Indonesia, while enhancing national food security, has provoked substantial critique, particularly regarding environmental sustainability, agrarian conflict, and socio-economic repercussions (Rasda & Muhammad, 2025). Large-scale agricultural initiatives, such as MIFEE under President Susilo Bambang Yudhoyono and the subsequent food estate projects under President Joko Widodo, have faced recurring challenges that question their long-term viability and societal benefits (Fahira et al., 2022).

A central and persistent issue is the environmental degradation associated with these projects. Numerous studies emphasise that deforestation, peatland conversion, soil erosion, and biodiversity loss have been significant consequences of food estate expansion (Rasda & Muhammad, 2025). The targeting of ecologically sensitive areas, such as peatlands and forested zones, has raised alarms about irreversible ecological damage and unsustainable land use practices. Evidence shows that the MIFEE project, for example, involved the clearing of peatlands that failed to meet technical standards, reducing natural water storage capacity and undermining local ecological systems (Fahira et al., 2022). Similar environmental concerns have been identified in Central

Kalimantan, where large-scale land conversion has resulted in severe ecological degradation (Mahardhika et al., 2023).

Media coverage has also highlighted the social and ecological disruption caused by these programs, with headlines such as “When MIFEE Destroys the Forests of Merauke and Dislocates the Malind Tribe” illustrating the scale of the impact (Wahyudin & Harjanto, 2023). Furthermore, regulations that permit land acquisition for food estates in protected or productive forest areas are widely perceived as mechanisms that legitimise deforestation in the name of food security.

Beyond these environmental concerns, questions also persist regarding the long-term sustainability of food estate programs. Without the integration of sustainable agricultural practices, critics argue that the environmental costs may outweigh the intended benefits (Rasda & Muhammad, 2025). Intensive farming methods have been linked to declining soil fertility and land degradation, potentially undermining future productivity. Addressing these challenges requires a comprehensive strategy incorporating conservation, reforestation, and environmentally sound agricultural techniques.

In addition to environmental issues, food estate programs have been at the centre of agrarian conflicts and social injustice. The expansion of these projects has often resulted in land disputes, especially involving indigenous populations and smallholder farmers (Rasda & Muhammad, 2025). Land acquisition processes have been criticised for insufficient consultation and a lack of meaningful community engagement (Mahardhika et al., 2023). Corporate actors, typically awarded large land concessions, have been seen to marginalise traditional landholders, leading to the displacement of local farmers and the erosion of customary land management practices (Fahira et al., 2022). These dynamics have contributed to rising land tenure inequality and declining small-scale farming households.

In extreme cases, allegations of human rights violations have emerged. Civil society organisations have brought such cases before international forums, accusing the MIFEE program of facilitating the annexation of indigenous land under the guise of economic development (Wahyudin & Harjanto, 2023). These patterns indicate a pressing need for more inclusive governance mechanisms that ensure fair land distribution, uphold community land rights, and prioritise local participation in planning and implementation processes (Rasda & Muhammad, 2025).

Debates have also emerged regarding the effectiveness of food estate policy implementation. While successive administrations, Soeharto’s Mega Rice Project, SBY’s MIFEE, and Jokowi’s Food Estate shared similar goals of boosting food security, many of these initiatives have fallen short in execution (Lasminingrat & Efriza, 2020). The Mega Rice Project, for example, failed due to environmental degradation and ineffective project continuity. MIFEE reportedly utilised only 0.03% of its planned land area and failed to meet its rice surplus targets (Fahira et al., 2022).

Recent iterations of the food estate program under Jokowi have also faced criticism, particularly regarding projects in Papua, which have been described as

infringing upon indigenous land rights due to extensive forest conversion and land allocation (Fahira et al., 2022). The Ministry of Defence's involvement in overseeing some aspects of the food estate program has raised concerns about the militarisation of agricultural policy and favouritism toward investors, with limited results regarding actual food production.

Moreover, critics argue that the current policy approach overemphasises land expansion and food availability while neglecting equally critical pillars of food security, such as accessibility, distribution, utilisation, and stability (Fahira et al., 2022). Media commentary has questioned the government's apparent failure to learn from past setbacks, suggesting that political and corporate interests continue to dominate at the expense of inclusive and sustainable development (Wahyudin & Harjanto, 2023).

To put it briefly, while Indonesia's food estate programs are designed to address national food security challenges, they remain subject to intense scrutiny due to their environmental, social, and implementation shortcomings. The critiques emphasise the importance of adopting a more integrative and inclusive policy framework, one that balances agricultural productivity with ecological preservation, equitable land governance, and meaningful stakeholder participation to ensure the long-term success and sustainability of these initiatives (Rasda & Muhammad, 2025).

METHODOLOGY

This study employs a qualitative descriptive approach through a comprehensive literature review to analyse the complex impacts of food estate development in Indonesia on national food security and local food sovereignty. Qualitative descriptive research aims to comprehensively summarize events in everyday terms (Sandelowski, 2000). This approach allows for a detailed, yet minimally interpretive, account of existing literature, enabling the identification of recurring themes and patterns without applying a pre-existing theoretical framework or abstracting the data excessively. This ensures both descriptive validity and an accurate account of events that most would agree upon, as well as interpretive validity, an accurate account of the meanings attributed to those events by the participants themselves (Sandelowski, 2000).

Data were collected through a systematic literature review, drawing from academic sources, policy documents, and media reports. In qualitative descriptive studies, data collection typically seeks to discover the who, what, and where of events or experiences and their fundamental nature and context. It may include document analysis (Vaismoradi et al., 2013). The method of analysis applied is qualitative content analysis, which is a dynamic process of analysing verbal and visual data to summarize informational content (Vaismoradi et al., 2013). While content analysis can include quantifying the frequency of categories and themes, this study emphasizes the qualitative dimension to understand the socio-economic and environmental challenges associated with Indonesia's food estate development, and how these challenges reflect tensions between national food security goals and local food sovereignty principles.

RESULTS AND DISCUSSION

The Effectiveness of Food Estates as a Strategy for National Food Security

The Indonesian government has implemented the Food Estate program as a National Strategic Program (NSP) to enhance national food security, particularly in the aftermath of the COVID-19 pandemic (Risdianto et al., 2024). This initiative aligns with the second Sustainable Development Goal (SDG) to end hunger and achieve food security (Ananta, 2023). The program is designed to increase food production on a large scale, integrating agriculture, plantations, and livestock within specific areas (Yusup & Sonia, 2024).

In some instances, the Food Estate program has demonstrated positive outcomes in increasing regional production and improving certain aspects of the agricultural sector. For example, in Kapuas, Central Kalimantan, a Food Estate project reportedly achieved a rice production of 4.58 tons per hectare (Risdianto et al., 2024). Similarly, in Temanggung, Central Java, the program led to a significant increase in shallot production, yielding 15.7 tons per hectare, an increase of approximately 3.2 tons per hectare (Ananta, 2023). These reported successes highlight the potential of Food Estates to boost agricultural output when certain conditions are met.

A study conducted in Riaria Village, Humbang Hasundutan Regency, North Sumatra, evaluated the performance achievements of a Food Estate program based on ten success indicators. The research indicated that five of these indicators were successfully achieved: the availability of area infrastructure, the application of specific location technology, the improvement of farmer knowledge and skills, the increase in production and productivity, and the increase in income for all participating farmer implementers (Sihombing et al., 2023). This suggests that with adequate support and strategic implementation, Food Estates can contribute to tangible improvements in farming practices and farmer welfare.

The program in Riaria Village has absorbed significant government funding from central and regional budgets to provide physical and non-physical infrastructure and other necessary activities. This includes the provision of production facilities, farming equipment, technical guidance, and physical infrastructure (Sihombing et al., 2023). The conceptual framework for the SNP Food Estate in this region emphasises a closed-loop agribusiness system with sufficient facilities and infrastructure, managed professionally with independent farmer institutions, adaptive technology, adequate funding, and collaboration with the business world to achieve high productivity and optimal income sustainably (Sihombing et al., 2023).

Furthermore, analysis of paddy farming in the Belanti Siam Village food estate in Central Kalimantan revealed that certain production factors significantly impact rice yield. Land area, seed quantity, lime application, and fertiliser use were found to have a significant and positive influence on rice production (Yusup & Sonia, 2024). Specifically, a 1% increase in land area could result in a 0.118% increase in production output, and a 1% increase in seed use could lead to a 0.206% increase in production (Yusup & Sonia, 2024). The application of lime was also crucial, particularly in areas with acidic soil, as it can raise the soil's pH and enhance crop growth and yield. Farmers in Belanti Siam Village were also deemed

technically efficient, with an average technical efficiency of 96.5%, indicating that they are optimising their production factors (Yusup & Sonia, 2024). This suggests that Food Estates can lead to efficient and productive agricultural operations in locations where these factors are well-managed. The high level of technical efficiency among farmers in Belanti Siam indicates strong managerial skills and a reduced chance of increasing productivity through further input optimisation, as they already operate close to the maximum potential.

The program is also envisioned to expand employment opportunities and reduce reliance on food imports, contributing to national self-sufficiency (Risdianto et al., 2024). As seen in some European contexts, the involvement of farmer cooperatives could potentially lead to greater benefits for local communities and increased farmer welfare by providing direct involvement in asset management. For instance, farmer cooperatives in France have been shown to improve the agricultural ecosystem and access to advanced farming tools. In contrast, good collaboration between agricultural cooperatives and stakeholders in Sweden can enhance the sustainability of the cooperative and its business (Ananta, 2023). Based on those examples, it could be said that, if implemented correctly, Indonesia's food estate program can potentially empower local farmers, increase their welfare, and boost labour-intensive agricultural programs, consequently reducing unemployment in the area (Ananta, 2023).

Despite these positive indications, it is important to acknowledge that the overall effectiveness of the Food Estate program is a complex issue with varying results across different regions and commodities. While some areas show increased production and efficiency, other studies highlight significant challenges that impede the program's success.

The Challenges to Local Food Sovereignty: Socio-Economic Impacts of Food Estates

While often framed as solutions for national food security and economic recovery, food estate projects in Indonesia have introduced significant socio-economic challenges, particularly impacting local food sovereignty. These large-scale agricultural initiatives, frequently developed on peatlands, have negatively affected the communities and their traditional ways of life (Yeny et al., 2022). One of the primary challenges identified is the moderate to high risk associated with operating food estates on degraded peatlands. Community activities and changes in farming methods, primarily through the increased use of inputs and mechanical equipment, are particularly susceptible to negative impacts. The low substitutability of peatlands further necessitates careful mitigation efforts as part of risk management strategies (Yeny et al., 2022).

A significant concern revolves around land rights and the traditional livelihoods of indigenous communities. For instance, the MIFEE project has faced extensive criticism for conflicts with local indigenous populations, notably the Malind Anim tribe, the South Papua ethnic group (Sefriani et al., 2023). Concession permits were issued without obtaining prior consent from the Malind Anim, leading to the improper expropriation of their customary land and a lack of awareness or approval from the people regarding government policies (Sefriani et

al., 2023). This practice contravenes international recognition of indigenous land rights.

The conversion of natural forests for food estate development, as seen in the MIFEE project, directly impacts the Malind Anim tribe's ability to hunt, fish, and gather essential resources like sago, firewood, and clean water (Sefriani et al., 2023). This extensive deforestation results in the loss of traditional livelihoods, making it difficult for communities to meet their basic food needs. Consequently, individuals often cannot work for the developing businesses due to skill requirements, leaving only rough labour opportunities. This directly violates the right to work as guaranteed by international covenants (Sefriani et al., 2023).

The economic well-being of local communities is further threatened. In Central Kalimantan, most residents in surveyed villages had an average monthly income lower than the regional minimum wage, indicating a strong dependence on forest products and peatlands for their daily needs (Yeny et al., 2022). The conversion of these lands and shifting away from traditional practices can exacerbate poverty and malnutrition. The Malind Anim community experienced increased poverty and a significant rise in maternal and child fatalities, alongside increased malnutrition rates among the younger generation, due to decreased sago and livestock supplies caused by MIFEE-related deforestation (Sefriani et al., 2023).

Furthermore, introducing modern agricultural systems and emphasising monoculture farming within food estate projects disrupt traditional farming practices and ecological balance. Farmers are often encouraged to adopt hybrid seeds, fertilisers, and pesticides, shifting their roles from traditional farmers to "peasant workers" (Chelsy et al., 2023). This transformation can lead to a loss of ancestral knowledge and a decline in the diversity of working patterns and plant species (Chelsy et al., 2023). The monoculture pattern of food estates, requiring extensive farmlands, can have detrimental effects on heterogeneous natural ecosystems and lead to changes in the consumption behaviour of local wildlife due to the loss of food sources.

The broader socio-cultural fabric of indigenous communities is also at risk. For the Malind Anim community, forests are not merely a source of sustenance but are deeply intertwined with their family worship, social interaction, and overall identity (Sefriani et al., 2023). The "Mother Earth" concept is central to many indigenous beliefs, emphasising the importance of nature's sustainability and its sacredness. The loss of forests due to food estate projects can destroy cultural values and identity, effectively transforming the socio-cultural sacredness of these communities (Chelsy et al., 2023). This can be seen as an "ecologically induced genocide," where the environment's capacity to sustain life is lost, impacting a community's physical, cultural, and ecological ties to its surroundings (Sefriani et al., 2023).

Finally, the top-down approach in the planning and implementation of food estate projects often disregards local wisdom and adequate public participation from affected communities and stakeholders (Chelsy et al., 2023). This lack of involvement in decision-making processes can lead to social conflicts and an unequal distribution of benefits, further challenging local food sovereignty.

The dominance of external cultures supported by commercial interests can marginalise indigenous communities in their territories (Sefriani et al., 2023).

Environmental Challenges and Political Ecological Dimensions of Food Estate Development

Implementing food estate programs in Indonesia, particularly in Central Kalimantan and Merauke, has met with significant environmental challenges and raised critical political and ecological dimensions. While aiming to enhance national food security, these large-scale agricultural developments often neglect sustainable development principles and result in severe ecological degradation (Yuwono, 2024).

A primary concern is the environmental degradation associated with the location of these food estate projects on fragile ecosystems, such as peatlands in Central Kalimantan (Hendra & Ismunarta, 2024). Past projects, like the One Million Hectare Peatland Project, have already led to extensive environmental damage, including severe peatland fires, biodiversity loss, and significant carbon emissions (Hendra & Ismunarta, 2024). The current food estate initiatives risk repeating these mistakes, with land conversion often involving the clearing of forests and peatlands, leading to deforestation, loss of biodiversity, and increased greenhouse gas emissions (Hendra & Ismunarta, 2024).

In Merauke, the project is criticized for massive deforestation, especially in carbon-rich peatlands, exacerbating the ecological crisis (Yuwono, 2024). Other ecological impacts include land degradation, erosion, and water quality degradation, directly affecting local communities (Tulis et al., 2024). The utilization of protected forest areas for food estate development, as seen in South Papua, where nearly 2.7 million hectares of forest area are planned for use, directly conflicts with the primary function of protected forests to safeguard life support systems (Yuwono, 2024).

Beyond environmental concerns, the long-term sustainability of food estate programs is also questioned from a political perspective. The political ecology framework is beneficial for analyzing how underlying socio-political dynamics within food estate initiatives shape environmental outcomes (Hendra & Ismunarta, 2024). This interdisciplinary approach highlights how environmental issues are deeply embedded within social and political contexts, influenced by power relations and economic. The implementation of food estates often demonstrates a disregard for the Free, Prior, and Informed Consent (FPIC) principle, leading to violations of the rights of Indigenous Peoples and social conflicts (Yuwono, 2024). In Merauke, the program has faced significant criticism for not adhering to FPIC, as directly affected communities and environmental organizations were excluded from discussions regarding environmental documents (Yuwono, 2024). This lack of consultation and transparency exacerbates conflicts, as Indigenous communities (MHA) feel systematically excluded from decisions that directly impact their land and livelihoods.

The involvement of military personnel in facilitating the program further complicates the situation, drawing international scrutiny and raising concerns about the safety of MHA. This reflects a power imbalance where state and investor interests override indigenous rights, leading to social unrest and undermining the

law's intent to protect customary rights (Yuwono, 2024). The "Profit Taking" theory explains how third parties exploit existing difficulties by engaging parties with conflicting interests to gain benefits, which is evident in the conflicts arising from the food estate program, where government and investor interests prioritize profitability over the rights of MHA (Yuwono, 2024).

The lack of tangible results in line with the original goal of food self-sufficiency, massive deforestation, and ecological damage further highlight the flawed planning and execution of these programs (Tulis et al., 2024). This situation further underscores the need for genuine dialogue and respect for FPIC to mitigate conflicts and ensure equitable and sustainable development.

Bridging Food Security and Sovereignty in the Indonesian Context.

Indonesia stands at a critical juncture in shaping its food future. The government's pursuit of national food security through large-scale Food Estate programs has demonstrably increased production in certain areas, as evidenced by positive yields and improved agricultural efficiency in specific projects. However, a deeper examination reveals that this top-down, production-centric approach often creates profound challenges, undermining the very essence of local food sovereignty. This chapter argues that a truly sustainable and equitable food system for Indonesia demands a synergistic integration of these two concepts, moving beyond a singular focus on output to embrace holistic, community-centric, and ecologically sound practices.

The paradox of the Food Estate program lies in its trade-offs. While some regions report increased yields and technical efficiency, these gains frequently come at significant human and environmental costs. As previously explored, the implementation often bypasses the FPIC of indigenous communities, leading to unjust land expropriation and the erosion of customary rights, exemplified by conflicts with groups like the Malind Anim tribe. This displacement not only severs cultural ties to ancestral lands but also destroys traditional livelihoods derived from natural forests, pushing communities into poverty and jeopardizing their nutritional well-being. The shift towards monoculture and modern agricultural inputs further disrupts diverse traditional farming practices, transforming self-sufficient farmers into "peasant workers" and eroding invaluable ancestral knowledge.

Environmentally, the program's reliance on vulnerable ecosystems, particularly peatlands, carries immense risks. The documented deforestation, biodiversity loss, and increased carbon emissions from past and current Food Estate sites in regions like Central Kalimantan and Merauke highlight a critical misalignment with the Sustainable Development Goals. From a political ecology perspective, these outcomes are not merely unfortunate side effects but are deeply embedded in power imbalances, where state and investor interests frequently override indigenous rights and environmental safeguards. The lack of genuine consultation and the involvement of external actors, sometimes with military backing, further underscores a system prioritizing profitability over ecological integrity and social justice.

Moving forward, a truly robust food system for Indonesia must reconcile the imperative of national food security with the foundational principles of food sovereignty. This requires a fundamental paradigm shift:

- a. Food Security with a Sovereignty Lens: Future food security initiatives should be designed to empower, not displace. This means prioritizing revitalizing and supporting diverse, local food systems and smallholder farmers. Policies must ensure secure land tenure, adhere to FPIC, and integrate agroecological principles that enhance biodiversity and soil health.
- b. Food Sovereignty for National Resilience: Conversely, strong local food sovereignty inherently contributes to national resilience. By fostering community-led food production, diverse crop varieties, and robust local markets, Indonesia can build a more adaptable and stable food supply that is less vulnerable to global market fluctuations and external shocks.

Achieving a sustainable and equitable food future for Indonesia necessitates a holistic approach. It demands a recalibration of priorities, where large-scale production is tempered by respect for indigenous rights, environmental stewardship, and genuine community participation. By bridging food security and food sovereignty, Indonesia can cultivate a productive but also just, resilient, and harmonious food system with its people and planet.

CONCLUSIONS AND RECOMMENDATIONS

Indonesia's pursuit of food security through Food Estate programs reflects a deep tension between increasing agricultural output and preserving food sovereignty. While these initiatives have improved production in some areas, their top-down execution often neglects local participation, land rights, and ecological resilience. The result has been widespread socio-environmental costs, ranging from deforestation and biodiversity loss to the displacement of Indigenous communities and erosion of traditional livelihoods. The dominance of state and investor interests and inadequate adherence to FPIC underscores the need for a paradigm shift. Achieving food sovereignty alongside food security requires community-based, ecologically sustainable, and socially approaches.

Based on the critical analysis of Indonesia's food estate development and the identified challenges, the following recommendations are proposed to foster a more sustainable, equitable, and effective food system:

- a. Strengthen Land Tenure Security and Protect Customary Rights: Implement robust legal frameworks and enforcement mechanisms to secure the land tenure of smallholder farmers and indigenous communities. This includes recognizing customary land rights, preventing land dispossession for large-scale projects, and safeguarding livelihoods and cultural heritage.
- b. Adopt Sustainable and Environmentally Sound Agricultural Practices: Avoid intensive, monocultural farming in ecologically sensitive areas. Promote and invest in sustainable agricultural techniques, such as agroforestry, organic farming, and diversified cropping, that minimize

environmental degradation, conserve natural resources, and enhance ecosystem resilience.

- c. Foster Community-Led Development and Empowerment: Empower local communities and farmer cooperatives through capacity building, resource access, and direct involvement in decision-making processes. This can lead to more equitable distribution of benefits, increased farmer welfare, and the development of agricultural programs tailored to local needs and conditions.

However, this study, while comprehensive in its review of existing literature, is subject to several limitations:

- a. Reliance on Secondary Data: The analysis is primarily based on a review of existing academic literature, policy documents, and media reports. This means the findings depend on the availability and quality of these secondary sources, and direct empirical data collection was not undertaken.
- b. Generalizability: While the study focuses on Indonesia, the specific impacts and challenges of food estate programs can vary significantly across different regions, ecosystems, and socio-cultural contexts. The generalizations made are based on recurring themes identified in the literature.
- c. Potential for Bias in Sources: As with any literature review, inherent biases may exist in the selected sources, particularly in media reports or advocacy-driven publications. Efforts were made to synthesize information from various perspectives, but complete neutrality is challenging.

In conclusion, Indonesia's sustainable and sovereign food future depends not only on the amount of food produced but also on who controls the land, how it is cultivated, and whose voices are heard. Without systemic reforms, the food estate strategy risks undermining the security it seeks to ensure.

FURTHER STUDY

Future research should employ longitudinal and comparative regional analyses to examine the long-term socio-economic, ecological, and governance impacts of Food Estate development, particularly its implications for community resilience, indigenous rights, and sustainable food sovereignty in Indonesia.

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