Journal of the Community Development in Asia (JCDA) Vol. 8 No. 1, pp. 80-96, January, 2025
E-ISSN: 2654-7279 P-ISSN: 2685-8819
https://www.ejournal.aibpmjournals.com/index.php/JCDA

Supply and Demand of Rice in Indonesia: A Critical Review

Sri Herliana[1*], Sudrajati Ratnaningtyas[2], Qorri Aina[3], Umi Zuraida[4], Acip Sutardi[5], Syifaya Qorina[6]
Bandung Institute of Technology (ITB), Indonesia[1,2,3,4,5,6]
Jl. Ganesha No.10, Lebak Siliwangi, Coblong, Bandung, Jawa Barat 40132, Indonesia
Corresponding Author: sri.herliana@sbm-itb.ac.id[1]

ARTICLE INFORMATION

Publication information

Research article

HOW TO CITE
Herliana, S., Ratnaningtyas, S., Aina, Q., Zuraida, U., Sutardi, A., & Qorina, S. (2025). Supply and demand of rice in Indonesia: A critical review. *Journal of the Community Development in Asia, 8*(1), 80-96.

DOI:
https://doi.org/10.32535/jcda.v8i1.3665

Received: 16 November 2024
Accepted: 19 December 2024
Published: 20 January 2025

ABSTRACT

The demand and supply of rice as a staple food is a crucial factor in the food supply chain and food security in Indonesia. Indonesia still faces a deficit in domestic rice supply, which leads the government to adopt import policies to fill this shortage. Therefore, there is a need to understand the dynamics of rice supply and demand, as the interaction between the two is complex, to address food security concerns. This research aims to critically assess the dynamics of rice supply and demand in Indonesia, highlighting the key challenges and opportunities to improve food security. Using a critical review methodology, the study analyzes and critiques recent linear studies, literature, government policies, and statistical data to highlight their strengths, weaknesses, and challenges, providing a comprehensive understanding of the rice production supply and demand. The conclusion of this research is that a holistic approach is needed to achieve food security. The findings suggest that Indonesia must implement a comprehensive approach, incorporating environmental, political, and socioeconomic factors in food security. Future research should explore the role of climate resilience and global trade dynamics in shaping Indonesia's rice sector. This comprehensive perspective can help decision-makers create a more sustainable food system.

Keywords: Food Security; Food Sustainability; Rice Consumption; Rice Productivity; Supply and Demand

INTRODUCTION

Food is essential to human life and a fundamental need. Since everyone has the human right to access food, the government must guarantee that it is affordable, readily available, and sufficient to meet quality requirements consistently and fairly throughout the region. Indonesia, as an agrarian country with vast agricultural land and diverse natural resources, has most of its population working in the agricultural sector (Bondansari et al., 2023). In Indonesia, agriculture plays a crucial role in meeting basic needs and is a primary sector vital to the national economy (Zaeroni & Rustariyuni, 2016). One of the essential basic needs produced by agriculture is rice, as it is a staple food for more than 90% of Indonesia's population (Ministry of Agriculture Indonesia, 2019). Rice is a crucial food commodity for the national economy, significantly affecting the Indonesian population (Sari, 2014). As a food necessity for the Indonesian population, rice production and consumption continue to increase annually in line with population growth (Azzahra, 2021). Rice is a staple meal for the Indonesian people, and as the country's population grows, so does its production and consumption (Azzahra, 2021).

To address the population's needs for essential foods, especially rice, the Indonesian government has implemented several measures. These include planting diversification, expanding paddy fields, enhancing farming technology (intensification), and regulating the conversion of agricultural land through laws. However, because domestic output is insufficient to meet the country's rice demand (Bondansari et al., 2023), the Indonesian government continues to enforce import policies. Indonesia continues to struggle to balance the supply and demand of rice despite its substantial output. Some research oversimplifies the causes of this situation, attributing it to factors such as population growth, unmet rice production compared to rice consumption, urbanization, and a linear cause-and-effect relationship resulting in rice imports. Understanding the dynamics of rice supply and demand, which in reality consist of more complex situations, is essential for addressing food security concerns. According to Mankiw et al. (2014), demand refers to the quantity of goods and services that buyers desire and can afford at a specific price point and time frame. Meanwhile, supply is defined as the quantity offered in production or services to sell by the seller. This supply-and-demand approach can explain the dynamics of market shifts in rice. According to this theory, the demand side is influenced by consumer preferences, while the supply side is influenced by production costs or inputs that serve as the foundation for suppliers and the government to decide how much should be made available to consumers (Samuelson & Nordhaus, 2003). Therefore, a more focused and rigorous assessment of recent progress in rice supply and demand, along with the factors influencing rice production, consumption, and market dynamics in the country, should be conducted. The present review aims to fill these gaps.

In this review, a depth analysis of supply and demand is provided by focusing on more holistic and complex variables that influence the supply and demand of rice in Indonesia. Using the mechanism of critical review, this paper will examine existing literature and draw on recent data to gain insights into the underlying factors that affect the supply and demand of rice. The paper also highlights some adjustments that are sometimes ignored due to generalization, such as policy interventions, technological advancements, and market trends on the future of Indonesia's rice sector.

This review has been organized based on the following structure. First, the relationship between rice production, rice consumption, and imported rice. Then, the relationship between rice production, population, and Robert Malthus' theory will be criticized. Finally, the impact of urbanization on rice demand and imported rice will be discussed. After

these three main discussions, the main findings of the review are summarized, and an outlook for the future is provided.

LITERATURE REVIEW

Supply and Demand

Modern economics relies heavily on supply and demand. The famous graphic of market equilibrium was firmly established as the cornerstone of economic reasoning with the publication of Alfred Marshall's widely successful textbook “Principles of Economics” in 1890. However, these divine laws did not emerge spontaneously. More than fifty years of comparable work preceded the "Marshallian Cross" (Humphrey, 1996), and more than a century of economic theory contributed to the evolution of the ideas of supply and demand (Galbraith, 1987; Valentinov & Thompson, 2019). Moreover, in the agricultural sector, crop failure, climate change, natural disasters, pests, diseases in plants and animals, and other hazards make agriculture a high-risk industry. According to Wedowati et al. (2014), agricultural products differ from other manufactured goods due to their distinct features, which include (1) the product's continued metabolism after harvest, making it susceptible to damage; (2) its bulk; (3) its reliance on weather and climate; (4) its diverse qualities; and (5) its dispersed locations. Because of the primary crop, rice products can experience plentiful supplies in some months but shortages in others.

Due to the numerous parties involved and the lack of coordination among them, the supply chain for agricultural commodities has become increasingly complex as a result of present global trade (Ekawati et al., 2021). Consequently, a system that integrates the entire supply chain is required. To create a reliable system, it is necessary to identify all supply chain participants and define their roles (Purwandoko et al., 2024).

Food Security

More than 45 years ago, during global food shortages, the term "food security" was introduced. It initially emphasized the availability of food and the stability of vital food item prices both domestically and internationally. This focus arose from a series of adverse circumstances, including the volatility of food commodity prices in the early 1970s, coupled with fluctuations in the energy and currency markets. The 1974 World Food Conference redefined food security as “the availability of an adequate global food supply of vital commodities at all times to ensure a constant increase in food consumption and to compensate for changes in production and price" (Bhat et al., 2021; Burchi & De Muro, 2016). Food availability depends on various factors, including local climate, environmental conditions, and the availability of natural resources. Long-term social and economic stability is essential to ensure food access for everyone. Furthermore, considerations related to social sustainability influence food consumption. For food systems to remain stable, consistency across all aspects of food security is essential, with social, economic, and environmental pillars of sustainability working in tandem (Wani et al., 2024).

Food security is based on four pillars, as identified by the United Nations System High-Level Task Force on Global Food Security, the Committee on World Food Security, and WFS. The first pillar, food availability, refers to the consistent presence of sufficient quantities of food. Food availability is shaped by factors such as gross trade, food production levels, and food stock. However, the mere presence of food does not guarantee that people will access and consume it. Humans must also have food access (Farrukh et al., 2020). The second pillar, food access, is defined as the ability to obtain sufficient food for a balanced diet. Accessibility is determined by three factors: distribution, cost, and preference. Economic access (the ability to purchase), physical availability (transportation and facilities), and social-cultural access are integral

components of accessibility. Food prices, incomes, consumption patterns, and market conditions require significant attention to address food access concerns.

The third pillar is food utilization, which focuses on acceptable food consumption, food safety, and nutritional and social value. Utilization encompasses feeding practices, food preparation, dietary diversity, and equitable intra-household food distribution. It also involves ensuring adequate energy and nutrient intake for individuals and households (Food and Agriculture Organization [FAO], 2011; Farrukh et al., 2020). The fourth pillar, stability, includes the availability, accessibility, and utilization of food. According to Farrukh et al. (2020), stability reflects a nation's, individual's, or household's ability to remain food secure over time. Factors such as political upheaval, adverse weather conditions, and economic disruptions can pose significant challenges to long-term food security (Wani et al., 2024).

Food security, and the supply and demand approach, can be implemented in both the economic and agricultural sectors. In analyzing the dynamics of food security, it is essential to understand the concept of supply and demand in economics. In the agricultural sector, a country's capacity to guarantee access to sufficient food is determined by the balance of production, availability, and consumption. Indeed, both ideas are interconnected. The agricultural sector, which is heavily influenced by social, economic, and environmental challenges, embodies the fragile equilibrium between supply and demand in ensuring food security for growing populations. Based on supply and demand, market equilibrium is reached when the amount of commodities supplied and the quantity demanded at a particular price are equal. This equilibrium reflects the availability and accessibility of rice, making it crucial to food security. Moreover, the relationship between food security and supply and demand is undeniable, as each is interconnected and mutually reinforcing. Therefore, the government and other involved actors should maintain this balance through effective supply chain management, reactive market regulations, and sustainable agricultural practices.

RESEARCH METHOD

The supply and demand of rice in Indonesia are holistically examined using a critical review methodology to identify potential, problems, patterns, and gaps within Indonesia's rice industry. A critical review involves the combination and assessment of multiple research studies, regulations, and statistical data related to the topic. The objective of this methodology is to provide a comprehensive analysis of how supply and demand dynamics are influenced by multifaceted factors that cannot be generalized or simplified.

Data Collection

This study gathers data from diverse sources, including academic research, government policies and regulations, and statistical reports and databases. First, academic research in this data collection consists of peer-reviewed journals, conference papers, and other scholarly articles focusing on agricultural economics, rice supply and demand, rice management, and food security. Second, government regulations referenced in this study include policies, acts, and guidelines established by Indonesian authorities to regulate the rice industry. Lastly, statistical data are sourced from national and international databases such as the Central Agency of Statistics Indonesia (BPS Indonesia), the Food and Agriculture Organization (FAO), and other relevant organizations. These materials were selected to align with the research topic and represent a variety of perspectives, ensuring a balanced and comprehensive dataset.

Journal of the Community Development in Asia (JCDA) Vol. 8 No. 1, pp. 80-96, January, 2025
E-ISSN: 2654-7279 P-ISSN: 2685-8819
https://www.ejournal.aibpmjournals.com/index.php/JCDA

Critical Review Analysis

This research employs a critical review approach to analyze the issue. A critical review goes beyond summarizing existing studies by evaluating their credibility and relevance to the issue at hand. This method helps identify trends and patterns within the data, such as fluctuations in rice production and consumption or shifts in trade policies. Additionally, it highlights potential opportunities, including innovations or transformations aimed at enhancing rice productivity and distribution. Furthermore, the critical review pinpoints existing problems and challenges while detecting gaps in the literature, data, and analysis.

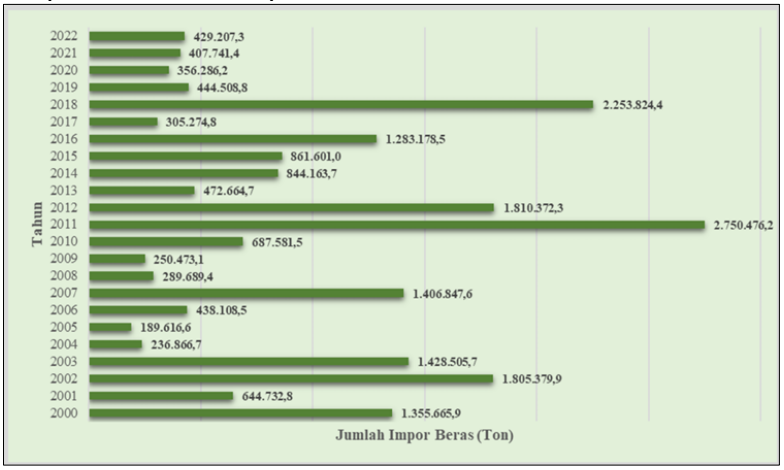
RESULTS

The concepts of supply and demand are indirectly connected with food security. These two concepts are also related to the dynamics of rice production and consumption in Indonesia, where supply and demand provide the foundation and explanation for analyzing the challenges of food security by illustrating how price fluctuations, production constraints, and consumer behavior influence the availability, accessibility, and stability of food. Hence, this research highlights how supply and demand imbalances are generated by several factors that are sometimes oversimplified and generalized, such as population growth, urbanization, uneven distribution of agricultural resources, stockpile policies, and other government interventions. These dynamics directly affect food availability and accessibility, which are critical pillars of food security. Additionally, the interconnectedness of supply chain stakeholders and external factors, such as global trade, complicates achieving equilibrium. Food security addresses this issue by emphasizing the need for sustainability and resilience in food systems. By integrating supply and demand principles into the broader context of food security, Indonesia can better ensure that its population has consistent access to adequate and nutritious food, aligning with the goals of sustainable development through a holistic perspective on the supply and demand of rice.

The Relationship Between Rice Production, Rice Consumption, and Imported Rice

Kurniawan (2014) described rice production as the total amount of rice produced by Indonesian rice mills within a specific time period, which is utilized for both reselling and household consumption. Moreover, Sari (2014) emphasizes that there is a negative correlation between rice imports and production. Importing rice does not occur if domestic production can satisfy people's requirements. On the other hand, the government will import rice from overseas when local supply cannot meet community demands.

Figure 1. Development of Rice Imports in Indonesia 2000 – 2022



Source: Badi'ah et al. (2023), Central Agency of Statistics Indonesia (BPS Indonesia, 2024)

According to Figure 1, it is clear that from 2000 until 2022, even until now, Indonesia still imported rice, which means that domestic production could not fulfill the needs yet. The highest rice import was recorded in 2011 with almost 2,800,000 tons rooted from several economic factors. The past 4 years were considered as a low import period, which lay in approximately 400,000 tons. Although Indonesia has the potential to become an agricultural exporter, the country does not currently hold a significant position in the global agricultural product market. Indonesia has become highly reliant on imports, even for the commodity of rice. One of the government's initiatives in the area of international commerce is Indonesia's imports. The phrase "In the event that the sources of supply of food as referred to in paragraph (1) are not sufficient, Food can be fulfilled with Food Imports according to needs" appears in Article 14 Paragraph 2 Law no. 18 of 2012 concerning Food, which outlines Indonesia's policy for rice imports (FAO, 2012).

Government Policy

It seems clear that the relationship between rice production and imports has a legitimate connection. However, this statement oversimplifies the dynamics of rice production and imports by neglecting broader aspects such as economic, political, and social issues that directly or indirectly impact both imports and rice production. This simplistic causality does not account for the complexity of Indonesia's rice production, such as government policies, price controls, and market demand, which are not fully addressed in the statement. For example, importing rice cannot be avoided even if rice production is high when the policy aims to address price differences, meet quality preferences, or fulfill international trade agreements. This is because the price of rice is not solely determined by the quantity of supply but also by the quality of rice (Nurpalina et al., 2022).

Market Preferences

Market preferences play a crucial role in the supply and demand of rice. Consumer preferences are paramount to consider, particularly whether they favor imported rice or domestic rice production. In situations where consumers prefer imported rice due to quality, texture, and variety, the level of domestic production may become secondary, even if it meets consumption needs. Thus, this demand can drive imports regardless of the sufficiency of rice production in Indonesia.

Public Stockpiles

From a holistic point of view, imported rice can be considered a means of maintaining public stockpiles, a common policy implemented in many countries worldwide. During the World Wars, staple foods as public stockpiles were prioritized to avoid food insecurity. This policy did not end with the wars but continues to be seen as a viable option in national food policies to counteract international trade uncertainties and volatility (Santos, 2024). Stockpiles are defined as being directly owned, monitored, and administered by governments through state-owned enterprises such as the Food Corporation of India, Bulog in Indonesia, Bernas in Malaysia, the National Food Authority in the Philippines, and the Public Warehouse Organization in Thailand (Caballero-Anthony et al., 2016).

Imported rice for stockpiles addresses emergencies, including humanitarian stocks, food security reserves, safety net stocks, and trade stocks (Santos, 2024). Emergency stocks must always be readily available, as food shortages can occur unexpectedly. These stockpiles assist vulnerable groups affected by crises such as disasters or wars, obligating governments to release such stocks. Buffer stocks, another type of reserve, are held by governments to prevent price volatility and stabilize markets. For instance, the Indonesian government imports rice to maintain buffer stocks, ensuring that sharp fluctuations in rice prices or quantities are mitigated, even during peak harvest periods.

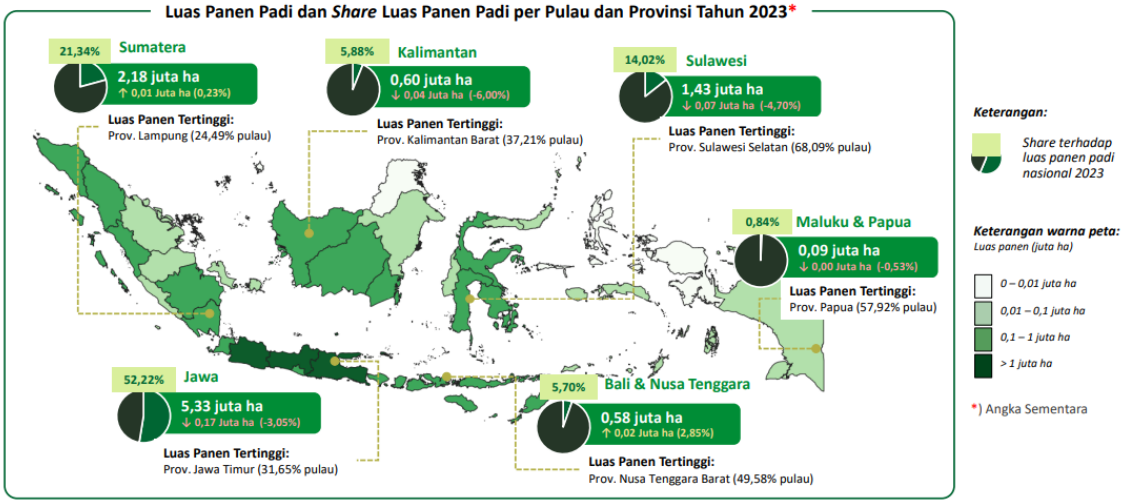
Safety net stocks are aimed at lower-income segments, with the government subsidizing these rice prices. Lastly, trade stocks are managed to secure a minimum profit margin from export activities.

Diverse Production Among Regions

Moreover, the singular causality between rice production, rice consumption, and imported rice oversimplifies Indonesia's geographic conditions. Rice production in Indonesia is not uniform across its islands. Some regions may experience shortages while others produce surpluses, necessitating regional transfers or localized imports. Thus, the imported rice policy is not solely a response to insufficient rice production but can also result from the uneven distribution of production or harvested land area.

Regional variability in rice production, where some areas produce surpluses while others face deficits, often leads to localized imports or inter-regional transfers. This complexity is not accounted for in statements that assume a uniform national production capability.

Figure 2. Rice Harvested Area Per Island

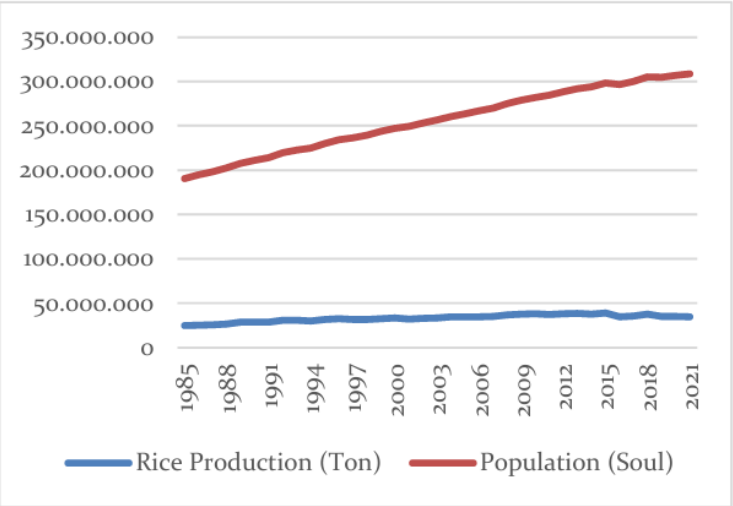


Source: BPS Indonesia (2023)

According to data from the BPS Indonesia (2023) in Figure 2, the harvested land area for rice in Indonesia is primarily concentrated in Jawa and Sumatra. Rice harvested area in Jawa spans 5.33 million hectares, while Sumatra accounts for 2.18 million hectares. Below these are Sulawesi with 1.43 million hectares, Bali and Nusa Tenggara with 0.58 million hectares, and finally Kalimantan with 0.6 million hectares. This data highlights the uneven distribution of rice harvesting and production across the country. Furthermore, the population varies significantly across these islands, leading to imbalances between supply and demand. To address this disparity, the government often resorts to importing rice.

The Relationship Between Rice Production, Population, and Robert Malthus Theory

Figure 3. Development of Rice Production and Population in Indonesia in 1985-2021



Source: Kusmiati & Bowo (2024)

A positive correlation exists between rice imports and production due to rising rice output and Indonesia's growing population. Figure 3 illustrates the evolution of Indonesia's population and rice output from 1985 to 2021. While rice output has generally increased, albeit at a relatively slow growth rate, Indonesia's population has grown linearly year over year, as shown in Figure 3. These findings align with Robert Malthus' theory, which posits that while the growth of food supply follows an arithmetic progression, population growth follows a geometric progression. In other words, population growth is outpacing the growth of food supply.

Land Availability, Land Efficiency, and Regional Disparities

The relationship between population and rice production is not as simple as it seems. Sometimes, the relationship is not always linear; an increase in population can directly impact the increase of rice production. Several important aspects, such as land availability, the efficiency of land usage, and regional disparities, should be included in the consideration. Land is a fundamental element of life. As the primary input for agricultural operations, land is vital to agricultural output (Sitko & Jayne, 2014). For farmers, agricultural land is a valuable resource that generates wealth and is essential to economic expansion (Prayitno et al., 2018; Prayitno et al., 2021). The growing population will undoubtedly raise the need for food and shelter, particularly for human existence. However, the land area will become increasingly limited. Accordingly, this is also the reason why land conversion occurs most frequently in metropolitan areas. Changes in the land's environmental conditions, including its climate and soil properties, also lead to changes in land usage. Land availability refers to population growth, where the increase in population puts additional pressure on land. The availability of land is decreasing due to industrialization, urbanization, and the expansion of residential areas, leading to the need to maximize land productivity (Handayani, 2022; Najim et al., 2007).

Apart from that, land efficiency involves maximizing land function through mechanization, technology, or improved irrigation, resulting in higher productivity even when the harvested area does not increase correspondingly. Lastly, regional disparities, as mentioned before, describe the uneven distribution of rice production across provinces or islands. Consequently, some areas may experience rapid population growth alongside stagnation in rice production, leading to localized shortages and potential imports.

As shown in Figure 2, the availability of land across islands or provinces is diverse. For instance, West Papua, Maluku, and South Maluku have the least land allocated for rice production. During the 2018–2023 period, North Maluku faced a rice deficit that showed

an increasing trend and has not been balanced by increasing public consumption (Baba, 2024). As a result, the rice deficit continues to grow, increasing dependence on supplies from other regions. The Food Security Index or Indeks Ketahanan Pangan (IKP) of North Maluku has experienced a downward trend over the past four years. When compared to other provinces, North Maluku is ranked 32 out of 34 provinces in the somewhat resilient category (*agak tahan*) with a score of 62.34. The low IKP was triggered by smaller food production compared to needs, higher stunting prevalence, and limited access to clean water in several areas. Maximizing the harvested area in Maluku could be one solution to achieving the target of Maluku Emas in 2045. If 31,113 hectares of potential rice fields are utilized, the rice shortage could be reduced to 17,832 tons per year, equivalent to IDR 267.48 billion (Azis, 2024).

Malthus Theory and Its Relevance Today

Economists and other social scientists have long been concerned about the issue of population and population growth. The question has always been how many people a nation will likely have in the future and what the social and economic effects of a population shift might be, whether upward or downward (Oladimeji, 2017). According to Malthus (1798), the world population is growing geometrically, while food production grows only arithmetically. If the population is not controlled, it may double every 25 years (Malthus, 1798; 1998). As a result of these two trends, the population will eventually increase beyond agriculture's ability to sustain it and will continue to rise until a growth limit is reached. Malthus (1998) categorized two forms of checks and claimed that the population could not grow unchecked: the preventative check, often referred to as the negative check, which includes elements that decrease fertility, such as moral restraint, contraception, and abortion; and those that increase mortality, such as war, starvation, and disease, which would raise the death rate.

The geometric progression means the population increases exponentially over time, leading Malthus to conclude that population growth is exponential. In contrast, arithmetic progression means it increases constantly or gradually, which led him to conclude that food production operates in this way. This argument provides some valid insights, but in some aspects, it is not linear. Malthus' theory was groundbreaking in its time, but it has been widely criticized and refined due to advancements in cutting-edge agricultural technology and practices, as well as the inaccuracy of some of his predictions about the future. Numerous studies on the diffusion of technology have verified that farmers who adopt new technologies have effectively increased farm output (Ali & Abdulai, 2010; Awotide et al., 2013). Modern farming techniques, improved skills, advanced irrigation systems, and genetically modified crops have significantly boosted rice production at a rate that defies the arithmetic correlation suggested by Malthus.

In the long run, his prediction of famine caused by overpopulation surpassing food production has not yet been proven. This is largely due to anticipatory measures in the short run, such as innovations in agriculture and global trade, which have positively impacted future conditions. For instance, global food networks and advancements in agricultural practices have helped mitigate the risks of food shortages, ensuring better food security in many regions.

Urbanization Impact on Rice Demand and Imported Rice

Urbanization on Rice Demand

Imports of rice are not significantly impacted in the short term by urban population increases. According to Dwipayana et al. (2014), population size has no effect on rice imports because Indonesians have shifted their consumption habits from eating rice to other foods like bread and wheat. Purwaningsih et al. (2010) state that urban families spend a lower percentage of their income on rice than rural households. According to

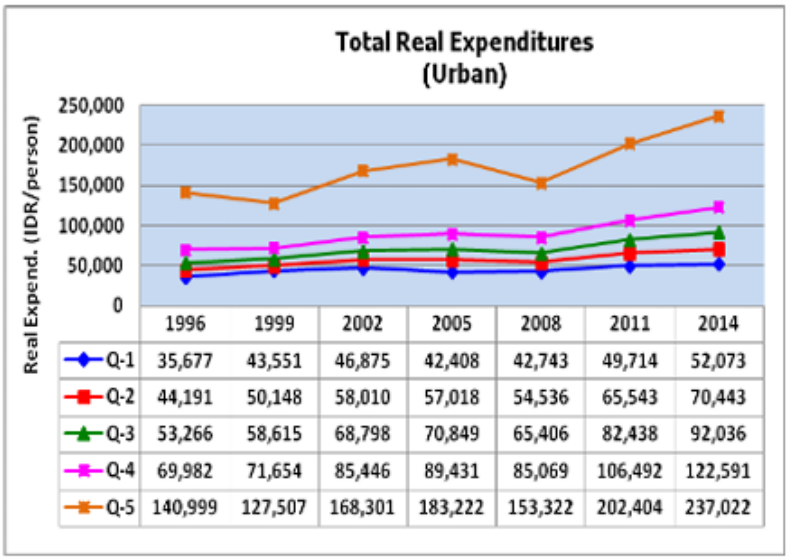
Miranti and Syaukat (2016), urban households are beginning to replace rice with tubers, fish, meat, eggs, milk, and fruits. Urban communities' consumption habits have shifted from rice to other foods due to rising income levels, which makes consumers choose more rice alternative products. Imports of rice are positively and significantly impacted over the long run by urban population expansion.

Rice Demand is Influenced by Income Level

This argument appears to attempt to generalize urban population behavior, but consumption patterns can vary greatly between regions and economic levels. Not all Indonesian cities may show the same patterns of consumption change. Research conducted by Saliem et al. (2019) has shown that rice demand or consumption depends on the level of income, rather than the location where individuals live. The higher the income level, the higher the expenditure or demand for rice.

All income levels showed a fluctuating tendency in the domestic rice consumption expenditures of urban households. Between 1996 and 1999, and between 2008 and 2011, the average real rice spending (which was deflated by the CPI) increased for all income levels. Meanwhile, during the periods of 1999–2002 and 2002–2008, actual domestic rice consumption fell.

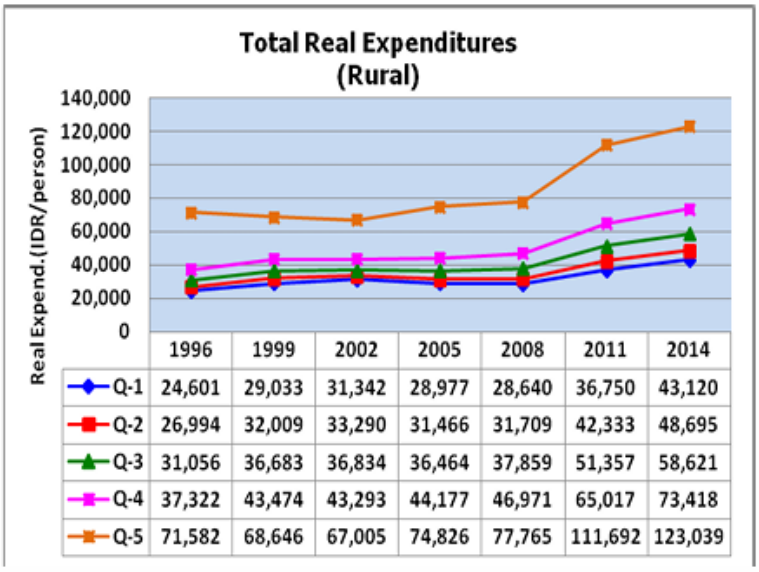
Figure 4. Total Real Expenditures in Urban Areas



	1996	1999	2002	2005	2008	2011	2014
Q-1	35,677	43,551	46,875	42,408	42,743	49,714	52,073
Q-2	44,191	50,148	58,010	57,018	54,536	65,543	70,443
Q-3	53,266	58,615	68,798	70,849	65,406	82,438	92,036
Q-4	69,982	71,654	85,446	89,431	85,069	106,492	122,591
Q-5	140,999	127,507	168,301	183,222	153,322	202,404	237,022

Source: Saliem et al. (2019)

Figure 5. Total Real Expenditures in Rural Areas



	1996	1999	2002	2005	2008	2011	2014
Q-1	24,601	29,033	31,342	28,977	28,640	36,750	43,120
Q-2	26,994	32,009	33,290	31,466	31,709	42,333	48,695
Q-3	31,056	36,683	36,834	36,464	37,859	51,357	58,621
Q-4	37,322	43,474	43,293	44,177	46,971	65,017	73,418
Q-5	71,582	68,646	67,005	74,826	77,765	111,692	123,039

Source: Saliem et al. (2019)

Q1 and Q2 represent groups from lower income, Q2 and Q3 represent a group from middle income, while Q5 is people from high income. The average growth rate of rice expenditures increases with household income levels. This phenomenon occurred in both rural and urban settings. In metropolitan regions, the lowest income groups' yearly growth in rice expenditure was 0.16%, while the highest income groups' annual growth rate was 2.4%. Figures 4 and 5 demonstrated that, across all income groups, the average rice spending growth rate for rural households was larger than that of urban households. Consequently, the location in which people live does not systematically impact rice production. Instead, it should be based on their income, regardless of whether they live in rural or urban areas. Customers with middle-class to upper-class incomes typically purchase rice from establishments that specialize in marketing rice with particular qualities, such as color, flavor, fluff, and others. People with lower-middle incomes, on the other hand, typically visit traditional markets that sell rice of lower-middle quality (Noer & Unteawati, 2022).

Urbanization Impact on Imported Rice

Moreover, Kusmiati and Bowo (2024) state that the urban population has a positive and significant effect on rice imports in the long term. The urban population is a large consumer of rice and also demands the quality of the rice consumed. The growth of urbanization will increase the demand for imported rice, which is considered to be of better quality than domestic rice.

Imported Rice is Influenced by Quality Preferences

Despite this plausible argument, it may not be fully accurate across urban areas in Indonesia. This is because it oversimplifies the demand for rice if it only relies on urbanization. As mentioned earlier, consumption patterns vary in each region and can be influenced by income, culture, and preferences. Not all urban consumers have the purchasing power to buy imported rice, which is sometimes cheaper than domestic production. Income should be considered in comparison to location. Meanwhile, culture and preferences are indirectly related to the quality of rice, which impacts the demand for imported rice.

Genotype has a significant impact on the physicochemical characteristics that determine the quality of rice grains (Kishine et al., 2008). Consumers place a high value on milled rice's physical appearance, which benefits millers and marketers alike. When creating

new rice varieties for commercial production and release, breeders prioritize grain size and shape as key quality factors. Different consumer groups have different preferences for grain size and shape (Rani et al., 2006).

DISCUSSION

Analyzing the demand side of rice, it can be seen from the number of its rice consumption. The higher rice intake in a country, the higher rice production should be done. This rice production has a negative correlation with rice imports, meaning that if imported rice still dominates over several years, the production is considered low because it could not meet the demand yet (Sari, 2014). The fact that Indonesia has imported rice for more than 24 years (Badi'ah et al., 2023) shows that rice production is not sufficient enough to cover all the demand despite its high production. However, production is not the only factor contributing to imported rice, because in reality, factors such as government policy, which considers the quality aspect (Nurpalina et al., 2022), market preferences, public stockpiles to ensure emergency stocks (Santos, 2024), and geographic factors like diverse production among regions should be analyzed more deeply.

Most research also highlights that there is a positive correlation between population and rice production (Kusmiati & Bowo, 2024), which is strengthened by Robert Malthus' theory. In that theory, he explained that the growth of food supply follows an arithmetic formula, while population follows a geometric formula. This means that if a country has a large population, the rice supply will not cover the demand, because population growth is outpacing the growth of food supply. Moreover, this population growth will put additional pressure on land availability (Handayani, 2022; Najim et al., 2007), which, in the end, will compete with agricultural land existence (Prayitno et al., 2018; Prayitno et al., 2021; Sitko & Jayne, 2014). Hence, in today's era, decision-makers should implement land maximization through mechanization, technology, and improved irrigation to achieve higher production despite the decreasing land. This solution has been proven by the research of Azis (2024), which explains that land area maximization can tackle rice shortages in Maluku. The Malthusian theory is considered not relevant nowadays because his prediction neglected the possibility of cutting-edge technology in the agricultural sector, which can address the issues caused by higher population and production.

Furthermore, researchers argue that the demand side of rice is affected by the urbanization effect. Urbanization leads to a lower demand for rice due to the shifting eating habits of urban people, from rice to bread and wheat (Dwipayana et al., 2014). They believed that rural households consume more rice than urban families (Purwaningsih et al., 2010). However, this assumption is rejected by the research of Noer and Unteawati (2022), which explains that the location where people live does not determine the rice production. In reality, the income effect is the significant factor that determines rice production. The higher the income of people, the higher the quality and production they demand. Hence, urbanization, in the end, impacts the higher preference of customers toward rice quality, which can be fulfilled by rice imports (Kishine et al., 2008; Rani et al., 2006).

CONCLUSION

Rice is a fundamental commodity in Indonesia, both as a primary food source and as an important agricultural product. Despite being one of the world's largest rice producers, Indonesia faces challenges in balancing rice supply and demand. The first argument for this condition is the negative correlation between rice imports and production, which is

not fully proven, as the increase in rice imports is not solely caused by insufficient rice production. Rice imports to fulfill the rice demand can be caused by government policies designed to fill the price gap between imported and local prices or international trade agreements. Moreover, market preferences also play an important role in supply and demand forces. Another reason for the imported rice policy is to ensure public stockpiles, such as humanitarian stock, buffer stocks, safety net stock, and stock for trade. Lastly, diverse production across regions is also a crucial factor influencing rice production, consumption, and even imported rice.

The second argument is the linear assumption between population and rice production, which is reinforced by Malthus' theory, yet it seems to oversimplify the situation. In reality, land availability, efficiency of land usage, and regional disparities have a more significant impact on rice production from the supply side. Furthermore, Malthus' theory is considered outdated, as it projected that population increases would lead to famine and crisis. Due to improvements in agricultural technologies, irrigation systems, and genetic approaches, production has successfully been enhanced. Hence, in the long run, these advancements will prevent the situation from worsening.

The final argument critiqued in this paper is the phenomenon of urbanization, which positively impacts rice demand and imported rice as a supply. In reality, the factor that should be considered is not urbanization, but the level of income. The higher the income level of individuals, the higher the demand for rice, regardless of location, whether rural or urban. Furthermore, urbanization is not the sole factor influencing rice imports, as not all urban populations have the purchasing power to buy imported rice. Therefore, quality preferences are a more appropriate reason for consumers to demand more imported rice.

Considering all these factors, the supply and demand of rice in Indonesia should be analyzed from a holistic point of view, as it is influenced by a complex interplay of environmental, economic, social, and political factors. Therefore, future research should adopt a more comprehensive approach to addressing the challenges facing Indonesia's rice market, incorporating environmental, political, and socioeconomic factors in a thorough analysis.

ACKNOWLEDGMENT
N/A

DECLARATION OF CONFLICTING INTERESTS
The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

Ali, A., & Abdulai, A. (2010). The adoption of genetically modified cotton and poverty reduction in Pakistan. *Journal of Agricultural Economics, 61*(1), 175-192. https://doi.org/10.1111/j.1477-9552.2009.00227.x

Awotide, B. A., Karimov, A., Diagne, A., & Nakelse, T. (2013). The impact of seed vouchers on poverty reduction among smallholder rice farmers in Nigeria. *Agricultural Economics, 44*(6), 647-658. https://doi.org/10.1111/agec.12079

Azis, O. D. L. A. (2024, May 23). *Akademisi: Optimalisasi Lahan Tekan Risiko Kekurangan Beras di Maluku [Academics: Land Optimization Reduces Risk of Rice Shortage in Maluku]*. Antara Maluku. https://ambon.antaranews.com/berita/214218/akademisi-optimalisasi-lahan-tekan-risiko-kekurangan-beras-di-maluku

Azzahra, D. M. (2021). Faktor-faktor yang mempengaruhi impor beras di Indonesia tahun 2001-2019 [Factors affecting rice imports in Indonesia 2001-2019]. *E-Journal Perdagangan Industri & Moneter, 9*(3), 181–192. https://doi.org/10.22437/pim.v9i3.14642

Baba, D. (2024, November 26). *Perwakilan Kemenkeu Paparkan Penyebab Defisit Beras di Maluku Utara [Ministry of Finance Representative Explains Causes of Rice Deficit in North Maluku]*. RRI. https://www.rri.co.id/daerah/1148014/perwakilan-kemenkeu-paparkan-penyebab-defisit-beras-di-maluku-utara

Badi'ah, R., Wiratama, D., Yusuf, M. F., Sari, D. A., & Ulya, D. (2023). Dynamics of rice imports in Indonesia: Analysis of development, causative factors, impacts and solutions. *Journal of Economics, Finance and Management Studies, 06*(11), 5745-5752. https://doi.org/10.47191/jefms/v6-i11-57

Bhat, R. A., Bhat, Z. A., Rafiq, S., Nazki, I. T., Khan, F. U., Neelofar, R. Z., ... & Rather, R. A. (2021). Influence of growing media on vegetative, floral and bulb parameters of crown lily (Fritillaria Imperialis L.). *Acta Scientific Agriculture, 5*(4), 56-60.

Bondansari, W., Munibah, K., & Ambarwulan, W. (2023, December). The alternative policies to sustain the level of sufficient domestic rice staple food supply for the population (A case study in Banyumas Regency, Central Java, Indonesia). In *IOP Conference Series: Earth and Environmental Science* (Vol. 1266, No. 1, p. 012032). IOP Publishing. https://doi.org/10.1088/1755-1315/1266/1/012032

Burchi, F., & De Muro, P. (2016). From food availability to nutritional capabilities: Advancing food security analysis. *Food Policy, 60*, 10-19. https://doi.org/10.1016/j.foodpol.2015.03.008

Caballero-Anthony, M., Teng, P., Lassa, J., Nair, T., & Shrestha, M. (2016). Public stockpiling of rice in Asia Pacific. In *NTS Report No. 3*.

Central Agency of Statistics Indonesia (BPS Indonesia). (2023, October 16). *Paddy Harvested Area and Production in Indonesia 2023 (Preliminary Figures)*. BPS-Statistics Indonesia. https://www.bps.go.id/en/pressrelease/2023/10/16/2037/paddy-harvested-area-and-production-in-indonesia-2023--preliminary-figures-.html

Central Agency of Statistics Indonesia (BPS Indonesia). (2024, March 20). *Imports of Rice by Major Countries of Origin, 2000-2022*. BPS-Statistics Indonesia. https://www.bps.go.id/en/statistics-table/1/MTA0MyMx/imports-of-rice-by-major-countries-of-origin--2000-2022.html

Dwipayana, I., Agus, K., & Kesumajaya, W. W. (2014). Pengaruh harga, cadangan devisa, dan jumlah penduduk terhadap impor beras Indonesia [The influence of prices, foreign exchange reserves, and population on Indonesia's rice imports]. *E-Jurnal Ekonomi Pembangunan Universitas Udayana, 3*(4), 164-172.

Ekawati, R., Arkeman, Y., Suprihatin, S., & Sunarti, T. C. (2021). Business analysis based on traceability framework on sugar supply chain. *Jurnal Teknologi Industri Pertanian, 31*(2), 242-248.

Farrukh, M. U., Bashir, M. K., Hassan, S., Adil, S. A., & Kragt, M. E. (2020). Mapping the food security studies in India, Pakistan and Bangladesh: Review of research priorities and gaps. *Global Food Security, 26*, 100370. https://doi.org/10.1016/j.gfs.2020.100370

Food and Agriculture Organization (FAO). (2011). *Global Food Losses and Food Waste–Extent, Causes and Prevention*. FAO.

Food and Agriculture Organization (FAO). (2012). *Law of the Republic of Indonesia Number 18 of 2012 on Food*. FAO. https://www.fao.org/faolex/results/details/en/c/LEX-FAOC139381/

Galbraith, J. K. (1987). *A History of Economics: The Past as the Present*. Penguin Books.

Handayani, S. (2022). Optimization of organic rice production using linear programming analysis in lampung province. *Asia Pacific Journal of Management and Education, 5*(3), 37-47. https://doi.org/10.32535/apjme.v5i3.1643

Humphrey, T. M. (1996). Marshallian cross diagrams and their uses before Alfred Marshall: the origins of supply and demand geometry. *Alfred Marshall: Critical Assessments. Second Series*, 224-255.

Kishine, M., Suzuki, K., Nakamura, S., & Ohtsubo, K. I. (2008). Grain qualities and their genetic derivation of 7 new rice for Africa (NERICA) varieties. *Journal of Agricultural and Food Chemistry, 56*(12), 4605-4610. https://doi.org/10.1021/jf800141y

Kurniawan, H. (2014). Faktor – faktor yang mempengaruhi impor beras di Indonesia tahun 1980-2009 [Factors influencing rice imports in Indonesia 1980-2009]. *Economics Development Analysis Journal*, 3(3). https://doi.org/10.15294/edaj.v3i3.1036

Kusmiati, K., & Bowo, P. A. (2024). Analysis of factors influencing rice imports in Indonesia. *Efficient: Indonesian Journal of Development Economics, 7*(1), 44-54.https://doi.org/10.15294/6mr20w80

Malthus, T. R. (1798). *An Essay on the Principle of Population, as it Affects the Future Improvement of Society, with Remarks on the Speculations of Mr. Godwin, M. Condorcet, and other Writers* (1st ed.). Johnson.

Malthus, T. R. (1998). An Essay on the Principles of Population (2nd ed.). Electronic Scholarly Publishing Project.

Mankiw, N., Quah, E., & Wilson, P. (2014). *Pengantar Ekonomi Mikro [Introduction to Microeconomics]*. Salemba Empat.

Ministry of Agriculture Indonesia. (2019). *Buletin Konsumsi Pangan* (Vol. 10 No. 1). Scribd. https://www.scribd.com/document/455530205/Buletin-Konsumsi-Vol-10-No-1-2019-pdf

Miranti, A., & Syaukat, Y. (2016). Pola konsumsi pangan rumah tangga di Provinsi Jawa Barat [Household food consumption patterns in West Java Province]. *Jurnal Agro Ekonomi, 34*(1), 67-80. https://doi.org/10.21082/jae.v34n1.2016.67-80

Najim, M. M. M., Lee, T. S., Haque, M. A., & Esham, M. (2007). Sustainability of rice production: A Malaysian perspective. *Journal of Agricultural Sciences, 3*(1). http://dx.doi.org/10.4038/jas.v3i1.8138

Noer, I., & Unteawati, B. (2022). Rice marketing systems model to strengthen institutional of rice marketing in Lampung Province Indonesia. *Asia Pacific Journal of Management and Education, 5*(2), 100-110.https://doi.org/10.32535/apjme.v5i2.1636

Nurpalina, N., Noer, I., & Kurniawan, H. (2022). Marketing system of grain from farmers to rice mill producers in Pringsewu District. *Journal of The Community Development in Asia, 5*(2), 102-109. https://doi.org/10.32535/jcda.v5i2.1501

Oladimeji, Y. U. (2017). Food production trend in Nigeria and Malthus theory of population: empirical evidence from rice production. *Nigerian Journal of Agriculture, Food and Environment, 13*(1), 126-132.

Prayitno, G., Ahari, M. I., & Rukmi, W. I. (2021). Structural equation model with partial least square (SEM-PLS) of place dependence with land used change. *Journal of International Studies (2071-8330), 14*(1). https://doi.org/10.14254/2071-8330.2021/14-1/11

Prayitno, G., Hidayat, A. R. T., Subagiyo, A., & Paramasasi, N. K. (2018, November). Factors that effect to land use change in Pandaan District. In *IOP Conference Series: Earth and Environmental Science* (Vol. 202, No. 1, p. 012006). IOP Publishing. https://doi.org/10.1088/1755- 1315/202/1/012006

Purwaningsih, Y., Hartono, S., Masyhuri, M., & Mulyo, J. H. (2010). Pola pengeluaran pangan rumah tangga menurut tingkat ketahanan pangan di Provinsi Jawa Tengah. *Jurnal Ekonomi Pembangunan, 11*(2), 236-253. https://doi.org/10.23917/jep.v11i2.327

Purwandoko, P. B., Solahudin, M., Novianti, F., Mayasti, N. K. I., Rahman, N., Susanti, N. D., ... & Andriansyah, R. C. E. (2024, May). Proposed design of blockchain technology for rice supply chain system in Indonesia. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1338, No. 1, p. 012053). IOP Publishing. https://doi.org/10.1088/1755-1315/1338/1/012053

Rani, N. S., Pandey, M. K., Prasad, G. S. V., & Sudharshan, I. (2006). Historical significance, grain quality features and precision breeding for improvement of export quality basmati varieties in India. *Indian Journal of Crop Science, 1*(1and2), 29-41.

Saliem, H. P., Suryani, E., Suhaeti, R. N., & Ariani, M. (2019). The dynamics of Indonesian consumption patterns of rice and rice -based food eaten away from home. *Analisis Kebijakan Pertanian, 17*(2), 95-110. http://dx.doi.org/10.21082/akp.v17n2.2019.95-110

Samuelson, P. A., & Nordhaus, W. D. (2003). *Ilmu Mikroekonomi [Microeconomics]*. PT Media Global Edukasi.

Santos, S. (2024). Rice buffer stock maintenance post-rice tariffication law (RA11203): An application of a partial equilibrium model for buffer stock level optimization. *DLSU Business & Economics Review*, 33(2),163-188.

Sari, K. R. (2014). Analisis impor beras di Indonesia [Analysis of rice imports in Indonesia]. *Economics Development Analysis Journal,* 3(2), 320-326. https://doi.org/10.15294/edaj.v3i2.3838

Sitko, N. J., & Jayne, T. S. (2014). Structural transformation or elite land capture? The growth of "emergent" farmers in Zambia. *Food Policy, 48*, 194-202. https://doi.org/10.1016/j.foodpol.2014.05.006

Valentinov, V., & Thompson, S. (2019). The supply and demand of social systems: towards a systems theory of the firm. *Kybernetes, 48*(3), 570-585. https://doi.org/10.1108/K-04-2018-0178

Wani, N. R., Rather, R. A., Farooq, A., Padder, S. A., Baba, T. R., Sharma, S., ... & Ara, S. (2024). New insights in food security and environmental sustainability through waste food management. *Environmental Science and Pollution Research, 31*(12), 17835-17857. https://doi.org/10.1007/s11356-023-26462-y

Wedowati, E. R., Singgih, M. L., & Gunarta, I. K. (2014). Production system in food industry: a literature study. In *6th International Conference on Operations and Supply Chain Management, Bali*.

Zaeroni, R., & Rustariyuni, S. D. (2016). Pengaruh produksi beras, konsumsi beras dan cadangan devisa terhadap impor beras di Indonesia. *E-Jurnal Ekonomi Pembangunan Universitas Udayana, 5*(9), 993-1010.

ABOUT THE AUTHOR(S)

1st Author
Dr. Sri Herliana, S.P., M.Si., serves as an assistant professor in the Entrepreneurship and Technology Management Interest Group at SBM ITB. She holds a Ph.D. in Agricultural Economy from Institut Pertanian Bogor, Indonesia. For correspondence, she can be reached via email at sri.herliana@sbm-itb.ac.id.

2nd Author
Prof. Dr. Sudrajati Ratnaningtyas, M.P., is a professor in the Entrepreneurship and Technology Management Interest Group at SBM ITB. She obtained her Ph.D. in

Management from Universitas Padjadjaran, Indonesia. She can be contacted via email at sudrajati@sbm-itb.ac.id.

3rd Author
Qorri Aina, S.E., M.Si., is an assistant professor in the Entrepreneurship and Technology Management Interest Group at SBM ITB. She earned her Master in Management from Universitas Padjadjaran, Indonesia. She can be contacted via email at qorri.aina@sbm-itb.ac.id.

4th Author
Dra. Umi Zuraida, M.Sc., is an Associate Professor in the People and Knowledge Management Interest Group at SBM ITB. She earned her Master in Industrial Engineering from Institut Teknologi Bandung, Indonesia. She can be contacted via email at umi.zuraida@sbm-itb.ac.id.

5th Author
Acip Sutardi, S.E., M.Si., is an Assistant Professor in the Business Risk and Finance Interest Group. He earned his Master's in Accounting from Universitas Padjadjaran, Indonesia. He can be contacted via email at acip.sutardi@sbm-itb.ac.id.

6th Author
Syifaya Qorina, S.H.Int., is a Master's student in Science Management at Institut Teknologi Bandung. She earned her Bachelor's degree in International Relations from Universitas Padjadjaran, Indonesia. She can be contacted via email at syifayaq@gmail.com.