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THE IMPACT OF FOOD CONSUMPTION, AGRICULTURAL PRODUCTION, AND FOOD IMPORTS ON FOOD SECURITY IN ASEAN-6

El impacto del consumo de alimentos, la producción agrícola y las importaciones de alimentos en la seguridad alimentaria en la ASEAN-6

O impacto do consumo alimentar, da produção agrícola e das importações alimentares na segurança alimentar na ASEAN-6

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ABSTRACT
Food security is a complex issue influenced by the availability, access, and utilization of food. This study examines the impact of food consumption, agricultural production, and food imports on food security in ASEAN-6 countries from 2000 to 2021. The results show that food consumption negatively impacts food security due to unbalanced consumption patterns and pressure on natural resources. On the other hand, agricultural production positively impacts food security by improving supply stability. Technological advancements such as precision farming and drought-resistant crops have enhanced productivity and reduced environmental pressure. Food imports also play a significant role in ensuring food availability, particularly for countries with production deficits. However, over-reliance on imports poses risks due to external market volatility. The findings highlight the need for policies that promote balanced food consumption, innovation in agricultural practices, and diversified food sources to achieve long-term food security in the ASEAN region.

KEYWORDS
Food consumption, agricultural production, food imports, food security.

RESUMEN
La seguridad alimentaria es un tema complejo influenciado por la disponibilidad, el acceso y la utilización de los alimentos. Este estudio examina el impacto del consumo de alimentos, la producción agrícola y las importaciones de alimentos en la seguridad alimentaria de los países ASEAN-6 desde 2000 hasta 2021. Los resultados muestran que el consumo de alimentos afecta negativamente a la seguridad alimentaria debido a los patrones de consumo desbalanceados y la presión sobre los recursos naturales. Por otro lado, la producción agrícola impacta positivamente en la seguridad alimentaria al mejorar la estabilidad del suministro. Avances tecnológicos como la agricultura de precisión y los cultivos resistentes a la sequía han mejorado la productividad y reducido la presión ambiental. Las importaciones de alimentos también juegan un papel importante en garantizar la disponibilidad de alimentos, especialmente para los países con déficits de producción. Sin embargo, la dependencia excesiva de las importaciones conlleva riesgos debido a la volatilidad del mercado externo. Los resultados resaltan la necesidad de políticas que promuevan un consumo equilibrado de alimentos, la innovación en las prácticas agrícolas y la diversificación de las fuentes de alimentos para lograr una seguridad alimentaria a largo plazo en la región ASEAN.

PALABRAS CLAVE
Consumo de alimentos, produção agrícola, importações de alimentos, segurança alimentária.

RESUMO
A segurança alimentar é uma questão complexa influenciada pela disponibilidade, pelo acesso e pela utilização de alimentos. Este estudo examina o impacto do consumo de alimentos, da produção agrícola e das importações de alimentos na segurança alimentar dos países do grupo ASEAN-6, no período de 2000 a 2021. Os resultados indicam que o consumo de alimentos afeta negativamente a segurança alimentar, devido a padrões de consumo desequilibrados e à pressão sobre os recursos naturais. Por outro lado, a produção agrícola impacta positivamente a segurança alimentar ao aumentar a estabilidade do abastecimento. Avanços tecnológicos, como a agricultura de precisão e o cultivo de variedades resistentes à seca, elevaram a produtividade e reduziram a pressão ambiental. As importações de alimentos também desempenham um papel relevante na garantia da disponibilidade de alimentos, especialmente para países com déficit de produção. No entanto, a dependência excessiva de importações acarreta riscos decorrentes da volatilidade dos mercados externos. As conclusões ressaltam a necessidade de políticas que promovam o consumo equilibrado de alimentos, a inovação nas práticas agrícolas e a diversificação das fontes de alimentos, visando alcançar a segurança alimentar a longo prazo na região da ASEAN.

PALAVRAS-CHAVE
Consumo de alimentos, produção agrícola, importações de alimentos, segurança alimentária.

Introduction

ASEAN-6 refers to six founding member countries of the Association of Southeast Asian Nations (ASEAN), namely Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Brunei. These nations have long been at the forefront of ASEAN's efforts to promote regional cooperation and development. Food security in the ASEAN-6 is a particularly pressing issue due to several factors, including population growth, the rising demand for food, and the vulnerability to climate change. With the problem of increasing population and the challenge of climate change, countries in ASEAN-6 face various pressures in maintaining food security for their populations (Zavaglia et al., 2020). Nonetheless, ASEAN countries have demonstrated commitment to addressing food security challenges through various efforts, such as increasing investment in agricultural infrastructure, promoting sustainable agricultural practices, strengthening early warning systems, and intensifying regional cooperation in agriculture.

Food consumption can affect a country's food security. Changes in consumption patterns will impact on the increase in agricultural production. High dependence on food imports can lead to greater fluctuations in food prices in the domestic market (Kimaro et al., 2024). These fluctuations in food prices can ultimately affect the purchasing power and access of people, especially low-income groups, to sufficient and nutritious food. This shift in consumption also contributes to the dual nutritional problem, namely undernutrition and overnutrition, in some ASEAN countries. In general, reducing food waste related to the circular economy can enhance the efficiency of the food system, reduce dependence on imports, and help create more sustainable food security (Morales-Pablo et al., 2024). Therefore, a deeper understanding of food consumption dynamics and the management of food waste is essential for strengthening food security in the ASEAN region.

Figure 1. ASEAN Food Security 2021
Figura 1. Seguridad alimentaria ASEAN, año 2021

Source: data processed from Faostat. Fuente: datos procesados desde Faostat.

The increasing demand for various types of food such as animals, fruits, and in Southeast Asia, is driven by increasing people's incomes, rural urbanization, and changes in the lifestyle of its population (Putra et al., 2020). The shift in consumption patterns began to shift to highly nutritious. However, there are problems faced by ASEAN countries. Domestic agricultural production capabilities in some ASEAN countries have not been able to meet the increased demand (Sundram, 2023). Limited production capacity and suboptimal agricultural technology hinder the increase in local food production, especially animal products, fruits, and vegetables (Michel et al., 2024). Efforts to increase domestic agricultural production, diversify commodities, and adopt innovative technologies are key to maintaining food security in ASEAN.

Data states that around five percent of food consumption in ASEAN is in shortage. This shows that ASEAN countries have a deficit in domestic food production, so they depend on food imports. High dependence on imports can cause fluctuations in food prices in the domestic market, who will affect the purchasing power and access of people, especially low-income groups, to adequate and nutritious food. The limitations of domestic agricultural production, and its implications for equitable access and availability of food, are important for efforts to improve sustainable food security in the Southeast Asian region.

Although many studies have discussed the factors affecting food security in ASEAN, most of them still focus on specific aspects, such as the impact of agricultural production or the role of food imports on market prices, without considering the direct linkage between food consumption, agricultural production, and food imports in the analysis of food security. Additionally, no study has yet chosen ASEAN-6 as a sample. Previous studies have generally focused on one aspect of food security, such as food availability or access, without integrating all the dimensions defined by FAO. This study offers a more comprehensive approach by analyzing the simultaneous relationship between food consumption, agricultural production, and food imports in ASEAN-6 food security. The primary objective of this study is to explore the interactions between these three variables in the context of long-term food security and analyze their impact on achieving sustainable food security in the ASEAN region. This research also aims to support the achievement of SDG 2 (Zero Hunger) by providing deeper insights into how effective policies can improve food security through more efficient food consumption management and agricultural production. Using panel data from 2000 to 2021, this study enables a more in-depth analysis of long-term trends compared to previous studies. The findings will be useful in guiding policymakers to formulate more effective and sustainable food security policies in ASEAN countries, while also supporting SDG 12 (Responsible Consumption and Production) through food waste reduction and the improvement of food system efficiency.

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Literature review

The consumption theory according to Keynes states that the marginal consumption tendency (MPC) or the amount that people consume in each additional income they earn is in the range between zero and one. In addition, Keynes also stated that the ratio of consumption to income, referred to as the average consumption tendency (APC), would tend to decline as the income earned by society increased. On the other hand, Keynes argued that income is a very important determinant of consumption, while interest rates are considered to have no significant role in influencing people's overall consumption patterns (Srivani and Faisal, 2024).

From the legal side of demand in economics, the number of goods or services required by consumers will increase when the price of the goods or services decreases, assuming that other factors are considered constant (Morley, 2021). In food demand, demand is inelastic, meaning that even though food prices are increasing, people's demand for food will not decrease significantly considering that food is a basic need for society. However, a surge in food prices that exceeds people's purchasing power, especially for low-income groups, can significantly suppress food demand. This condition not only risks reducing the consumption of proper nutrition, but also can trigger social instability and increase food insecurity at the national level.

Meanwhile, the law of bidding stating that the number of goods or services offered by the manufacturer will increase when the price of the goods or services rises, assuming other factors are considered constant. When food prices increase, producers will tend to be more motivated to increase the amount of food production they produce. However, there are several factors such as weather, harvest season, and domestic production capacity that can limit the response of producers' supply to price changes that occur in the market (Wheeler, 2015).

Research by Farooq et al. (2022) suggests that uncontrolled food consumption can lead to an imbalance in food supply and demand, which ultimately negatively impacts national food security. In addition, they found that excessive food consumption in one type of commodity can increase import dependence, which in turn can trigger price fluctuations and decrease food accessibility for low-income communities. Meanwhile, a study by Tessalonica et al. (2023) highlighted that diversification of food consumption, especially increased consumption of animal and vegetable proteins, contributes to increasing food security through improving the nutritional status of the community.

Based on previous theories and research, it can be hypothesized that there is a positive and significant influence of food consumption, agricultural production, and food imports on food security. Meanwhile, the alternative hypothesis is that there is no significant influence of food consumption, agricultural production, and food imports on food security.

Data and methods

This study examines the influence of Food Consumption, Agricultural Production, and Food Imports on Food Security in ASEAN-6, namely Cambodia, Indonesia, the Philippines, Thailand, Vietnam, and Malaysia, with the period 2000 to 2021. These countries were chosen for their role as major agribusiness countries in the ASEAN region, with the agricultural sector contributing significantly to the regional economy and food security. This study uses secondary data obtained from Faostat,

$$LnKT_{it} + \beta_0 + \beta_1 LnKP_{it} + \beta_2 LnRP_{it} + \beta_3 IP_{it} + \varepsilon_{it} \quad (1)$$

Description: KT is food security, KP is food consumption, RP is agricultural production, IP is food import; β_0 constant; β_{1-3} is - parameter, Ɛ is a error term.

World Bank, and World in Data. The analysis technique in this study uses panel data regression. The function of this research is formed as follows:

Table 1. Variable operational definition
Table 1. Definición de variable operacional

Variable	Definition	Unit	Source
Food consumption	The amount and composition of food consumed by individuals or communities in each period of time.	Per capita calorie per day	Faostat
Agricultural production	The amount and type of production from plant cultivation, livestock, fisheries, and other agricultural activities in a period.	Agricultural Production (USD)	World In Data
Food Imports	The amount and value of food that is imported into a country from abroad to meet the consumption needs and domestic food reserves.	Food Imports (%)	World Bank
Food security	The ability of a country or society to ensure that all its population gets sufficient, safe, and nutritious food at all times to live a healthy and productive life.	SDGS Nutrition Prevalence Indicator (USD)	Faostat

Source: own elaboration. Fuente: elaboración propia.

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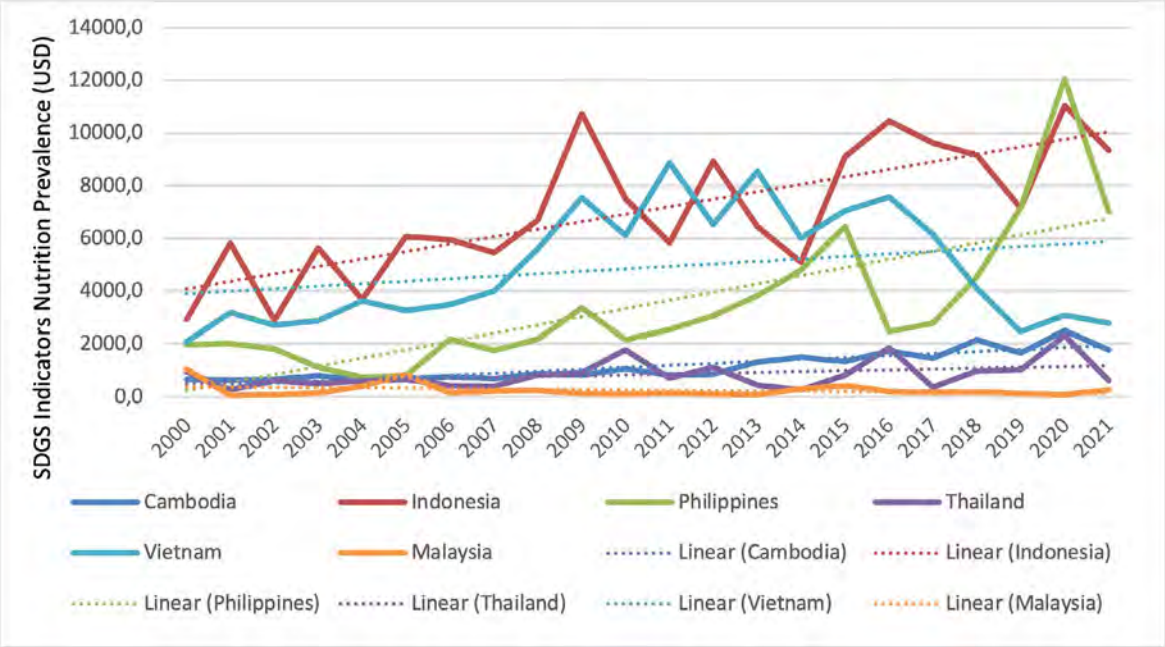
Results and discussion

Movement of Food Security Variables

Food security is a multidimensional concept, defined by FAO as a condition when all people have sufficient physical, social, and economic access to safe and nutritious food to meet the needs of a better life (Batt, 2024). Based on Figure 2, it shows that ASEAN-6 countries show an increase in food security, except for Malaysia. The highest upward trend occurred in Indonesia, the Philippines, and followed by Vietnam. Meanwhile, Cambodia, Malaysia, and Thailand showed only a slight upward trend. In 2008 and 2020, there was a fairly high increase in food security in ASEAN-6. The financial crisis that occurred in 2008 caused fluctuations in global food prices, which had an impact on people's purchasing power for nutritious food. The Covid-19 pandemic has also caused food supply chain disruptions, food price inflation, and limited access to nutrition.

Figure 2. Food security
Figura 2. Seguridad alimentaria



Source: Faostat, year 2025. Fuente: Faostat, año 2025.

Indonesia has experienced food security growth since the beginning of 2000. This increase was driven by food self-sufficiency policies, diversification of strategic commodities (such as rice, corn, soybeans, and palm oil), and the adoption of agricultural technologies based on irrigation and fertilizers. Rice, palm oil and cocoa are the main commodities that contribute to the stability of the national food supply (Otsuka, 2021). Vietnam in the long-term trend shows an increase, but since 2016

food security in Vietnam has shown a decline. Vietnam is particularly vulnerable to climate change, especially natural disasters such as floods, droughts, and tropical storms. The Mekong Delta, which is Vietnam's main food barn, is experiencing seawater inflows damaging farmland. However, since 2017, the Rodrigo Duterte administration has launched various policies such as the Rice Competitiveness Enhancement Fund (RCEF), the agricultural credit program, and the Rice Tariffication Law (RTL) which removes restrictions on rice import quotas and replaces them with a tariff system.

Thailand and Cambodia have relatively flat trends. Thailand, as the world's largest rice exporter, maintains food security through investment in efficient irrigation systems and the development of commodities such as sugar and rubber. Meanwhile, Cambodia has recorded gradual growth since 2000 through investment in the rice, maize, and cassava agricultural sectors, as well as simple technology-based farmer training programs. Malaysia showed the lowest food security and was fairly stable, with a slight decline. Malaysia still imports 60 percent of its food needs. Malaysia's rice self-sufficiency is only about 70 percent, while the rest depends on imports from Thailand, Vietnam, and Pakistan. However, the Government has implemented policies such as the State Agrofood Policy (DAN) 2021-2030 to increase food security.

Food consumption movement in ASEAN

Food consumption in ASEAN-6 countries continues to increase in line with economic and population growth. Based on Figure 3, food consumption that occurs in most ASEAN-6 countries, shows an increasing trend. Thailand has the highest food consumption, showing a trend of flat or stable food consumption measured using daily per capita calories. The level of welfare and consumption patterns are well established, where the Thai people have achieved a fairly high and stable level of food consumption. Based on research (Wongmonta, 2022), the elasticity of quarrying for rice and other grains in Thailand is relatively low, meaning that consumption of staple foods tends to be stable despite price changes. In contrast, meat, fish, eggs, and dairy products are considered luxury items.

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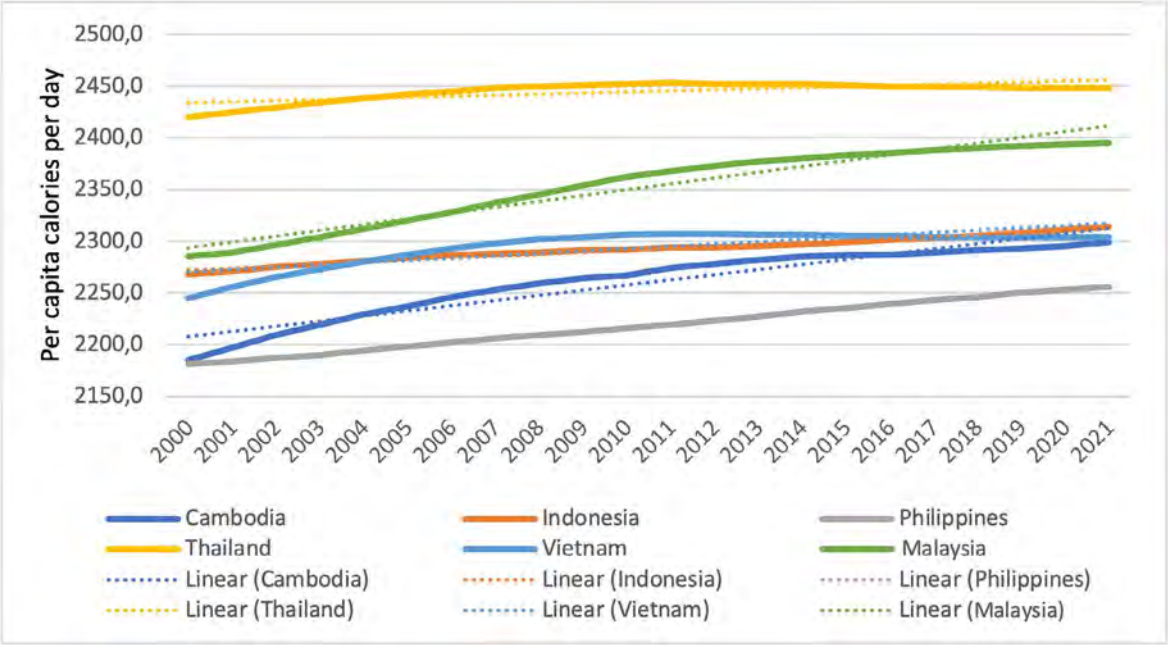
Figure 3. Per capita food consumption
Figure 3. Consumo de alimentos per cápita



Source: Faostat, year 2025. Fuente: Faostat, año 2025.

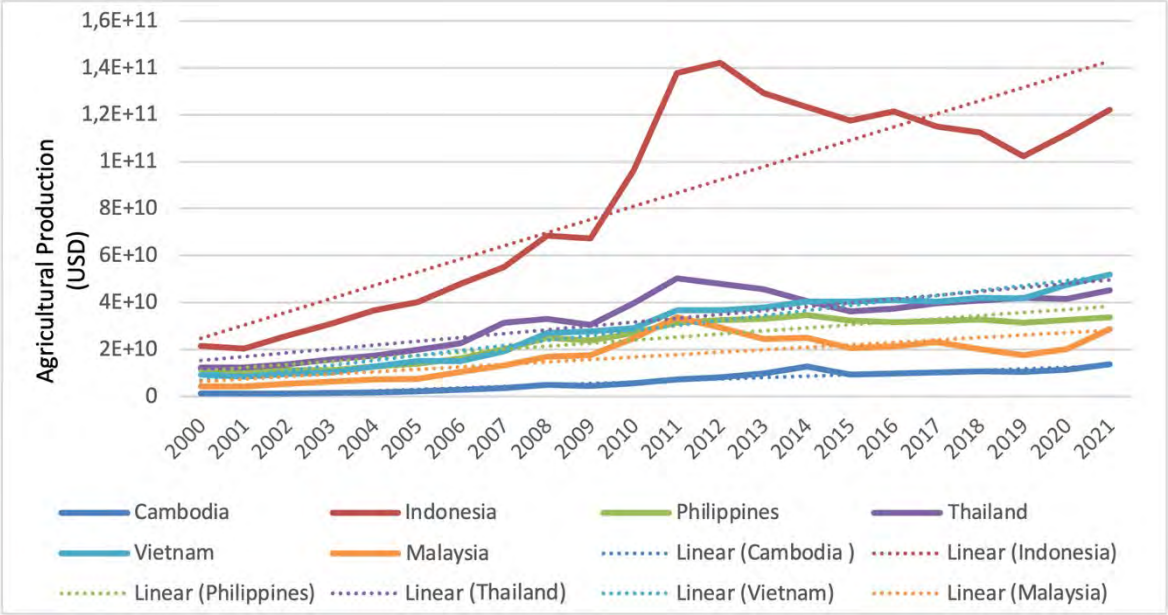
Malaysia shows a significant increase in food consumption. Steady economic growth has increased people's purchasing power, allowing them to access more food, including those that are higher in calories. The rapid urbanization has led to changes in diets, where people often consume processed and fast food that is higher in calories. According to Poulain et al. (2022), ethnic factors also play a role in diet, with each group having its own typical diet.

Vietnam, Indonesia, and Cambodia experienced a more moderate increase in food than Malaysia. Vietnam benefits from agrarian reforms, modernization of the agricultural sector, and increased food availability. In Indonesia, policies such as food subsidies, food security programs, and increased rice production have contributed to improving better access to food. The government implements a rice price subsidy policy through Perum Bulog and the Non-Cash Food Assistance (BPNT) program to maintain price stability and help poor households gain access to food. Cambodia recorded an increase in consumption thanks to stable economic growth, rural well-being, and investment in the agricultural sector. Meanwhile, the Philippines also showed an increase in food consumption due to food security policies and improved people's welfare, although it still faces challenges in the form of dependence on rice imports.

Agricultural production movement

Based on Figure 4, Indonesia shows the highest trend of increase in agricultural production. Indonesia has one of the largest agricultural land areas in ASEAN, allowing key commodities such as rice, palm oil, rubber, coffee and cocoa to continue to increase. The Indonesian government is also actively promoting food security through subsidies for fertilizers, superior seeds, and improving irrigation and road infrastructure. Programs such as the People's Oil Palm Replanting (PSR) also increase palm oil production. The government also runs programs such as the Farmer Card to provide subsidies and direct assistance to farmers, rice planting acceleration programs to increase productivity, and research and development of superior seeds that are more resistant to climate change and pests (Barbosa, 2024).

Figure 4. Agricultural production
Figura 4. Producción agrícola



Source: World In Data, year 2025. Fuente: World In Data, año 2025.

Thailand's agricultural production is experiencing an upward trend. This is due to the Thai government's various efforts in developing the agricultural sector, such as the implementation of smart farmer programs and land reform, infrastructure development, and investment in the modernization of cultivation technology and techniques. Meanwhile, relatively favorable climatic conditions and increased market access also contributed to the increase in Thailand's agricultural production (Chandio et al., 2022).

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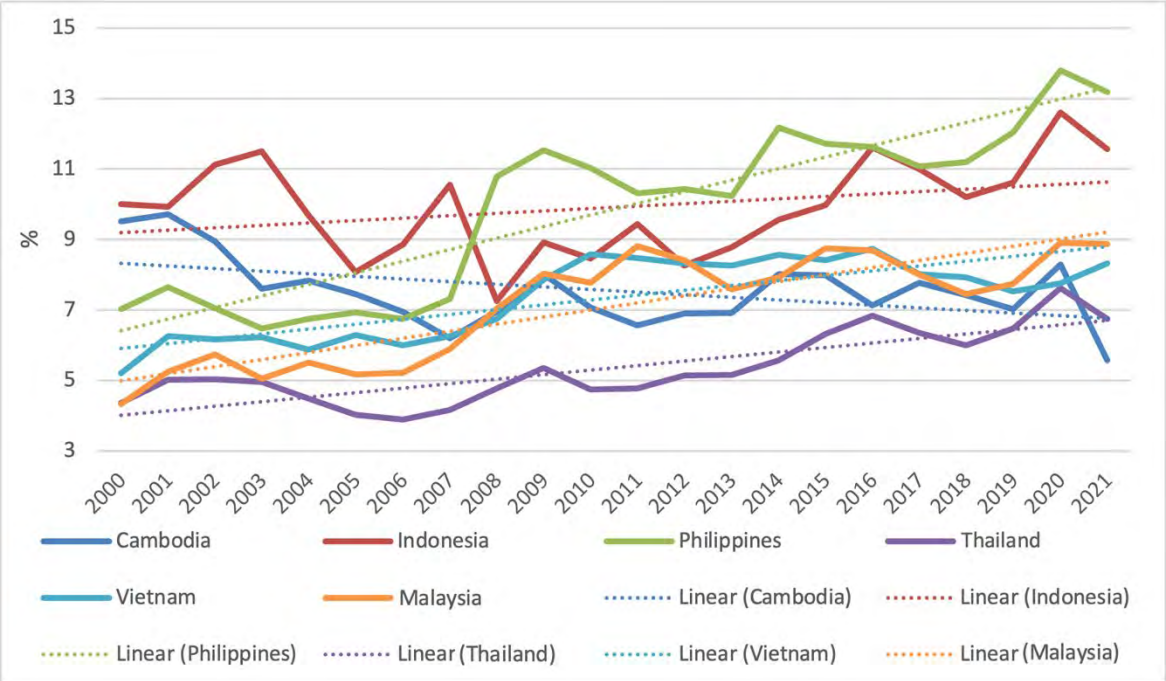
Vietnamese and Malaysian agricultural production also show a positive trend. This was driven by the success of agricultural reform in the Doi Moi policy, which introduced a market economy to the agribusiness sector. Vietnam is one of the world's leading exporters of rice and coffee. However, along with industrialization and urbanization, the contribution of the agricultural sector to the total economy tends to decrease, although production continues to increase. Meanwhile, Malaysia has almost the same commodities as Indonesia, which focuses on foods such as palm oil, rubber, and cocoa. Cambodia's agricultural sector still faces major challenges, such as a lack of irrigation infrastructure, limited technology, and the impact of climate change.

The Philippines faces various challenges in this sector, such as frequent natural disasters of typhoons and floods, limited agricultural land, and low productivity. Despite this, the Philippine government continues to strive to increase food production, especially rice, through the modernization of agricultural equipment.

Food import movements in ASEAN-6

Based on Figure 5, only Cambodia shows a downward trend in food imports. Cambodia, a country that is one of the main rice exporters in ASEAN, with increasing local food production, is less dependent on imports. Since 2017, Cambodia and China have signed several memorandums of understanding (MoU) that increased Cambodia's rice export quota to China (Ministry of Agriculture Cambodia, 2023). The Cambodian government has focused on agricultural land expansion, rehabilitation, and the construction of new irrigation systems.

Figure 5. Food imports in ASEAN-6
Figura 5. Importación de alimentos en ASEAN-6



Source: World Bank, year 2025. Fuente: Bando Mundial, año 2025.

The increase in food imports in Indonesia is caused by several factors, including rapid population growth, the accelerating urbanization process, and the increasing consumption of food commodities that are increasingly diverse among the public. Although Indonesia has enormous potential in the agricultural sector, the production of some strategic commodities such as wheat, soybeans, and sugar is still highly dependent on imports from other countries. Indonesia's rice imports reached 3.85 million tons, with Thailand being the largest supplier (Muhammad, 2024).

The Philippines also shows an increasing trend of food imports with greater fluctuations compared to other countries in the Southeast Asian region. The Philippines is heavily dependent on imports of staple foods, especially rice, due to limited agricultural land and the adverse impact of natural disasters such as typhoons that have caused crop failures in the country. In addition, the increase in food imports in the Philippines is also triggered by increasing population growth and changes in people's consumption patterns that prefer processed food products.

Malaysia continues to experience a steady increase in food imports. As one of the more developed countries in the Southeast Asian region, Malaysia has an increasingly diverse demand for food, including imported products such as beef, milk, and wheat. Thailand, despite being one of the world's largest food exporters, still shows a relatively stable trend of food imports with slight increases over time. Food imports by Thailand generally include special products that cannot be produced domestically, such as wheat and certain types of processed products. The stability of food imports in Thailand reflects the country's capacity to meet most of its food needs through domestic production, although Thailand also continues to import certain food ingredients to support the diversification of public consumption. Vietnam continues to increase food imports slowly but steadily over time.

Descriptive statistical analysis

Descriptive statistics is a statistical approach that aims to provide an overview of a set of data in research. The results of this analysis are described in Table 2.

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Table 2. Descriptive statistics
Tabla 2. Estadísticas descriptivas

Factor	LNKT	LNKP	LNRP	IP
Mean	6.826475	2.999279	10.32200	7.852296
Median	7.497955	2.046403	10.39646	7.752595
Maximum	9.397445	7.781139	11.15305	13.79436
Minimum	2.264.607	2.039601	9.082.024	3.893217
Std. Dev.	2.217647	2.138598	0.441091	2.16.660
Skewness	-1.168285	1.788876	-0.601665	0.427408
Kurtosis	3.122.584	4.200168	3.579363	2.653807
Jarque-Bera	30.11023	78.32395	9.810158	4.678077
Probability	0.000000	0.000000	0.007409	0.096420
Sum	901.0946	395.9048	1362.504	1036.503
Sum Sq. Dev.	644.2526	599.1415	25.48758	613.2667
Observations	132	132	132	132
Multicollinearity test				
lnKP		1	0.158207	0.156880
lnRP		0.158207	1	0.349340
IP		0.156880	0.349340	1

Source: own elaboration. Fuente: elaboración propia.

Table 4 shows that the Jarque Bera test of all variables is normally distributed. The Food Security variable showed an average of 6,827 and a median of 7,497. This illustrates that the data is symmetrically distributed. The minimum value for food security is 2,264, while the maximum value is 9,397, this shows that this variable is quite large and varied. Meanwhile, the average food consumption of 2,999 and the median of 2,046 describe symmetrical distributed data, with a minimum of 2,039 and a maximum of 7,781. The minimum value for the Agricultural Production (RP) variable is 9,082 to a maximum of 11,153, illustrating significant data variations. The Food Import (IP) variable also has an average of 7,852 and a median of 7,752, which means that the IP variable data has a symmetrical distribution.

Regression results

The results of regression analysis were used to test the relationship between variables in the study. Based on the results of the Chow Test and the Hausman Test, the best model used in this study is the Fixed Effect Model (FEM). This model was chosen because it is more suitable in describing the characteristics of the data used.

Table 3. Regression estimation results
Tabla 3. Resultados de la estimación de regresión

Variable	Coefficient	t-Statistics	Prob.
C	66.56866	3.869940	0.0002***
LNKP	-23.59628	-3.969513	0.0001***
LNRP	0.972843	6.855195	0.0000***
IP	0.125819	5.045394	0.0000***
Chow Test	0.0000		
Hausman Test	0.0012		
Cross Section Effect			
CAMBODIA--C	-21.75508	F Statistics	598.799
INDONESIA--C	-21.29372	Prob F statistics	0.0000
MALAYSIA--C	108.1493	R-Square	0.9749
PHILIPPINES--C	-21.77962	Adj. R-Square	0.9733
THAILAND—C	-22.39193	Normality Test	0.5703
VIETNAM--C	-20.92899	-	-

Source: own elaboration. Fuente: elaboración propia.

The constant value of 66.568 indicates that if food consumption (KP), agricultural production (RP), and food imports (IP) have a value of zero, then food security (KT) will be worth 66.568. The coefficient for the KP variable is -23.596, which indicates that if the value of the KP variable increases by one unit, with the constant of the other variable, the KT will decrease by 23.60 percent. The KP variable also had a probability value of less than 0.01, indicating its significant effect on KT. The coefficient for the RP variable is 0.973, which indicates that an increase of one unit in RP, with the other variables fixed, will lead to an increase in food security by 0.973 percent. A probability value of RP of less than 0.01 indicates a significant effect on KT. The coefficient for the IP variable is 0.126, which means that an increase of one unit in IP, with the other variable fixed, will result in an increase in KT of 0.126 percent. The IP variable also showed a significant effect on KT with a probability value of less than 0.01. In the determination coefficient test, the R-Square value was obtained at 0.9749.

The effect of food consumption on food security in ASEAN-6

Food consumption has a negative effect on food security in ASEAN-6. This is in line with the trend of increasing global food consumption, as seen in Figure 2, which shows the growth of food demand exceeding production and distribution capacity in many countries. According to Le et al. (2024), while in line with the concept of food availability which is a key pillar of food policy, the excessive focus on availability and access often ignores the importance of optimal food utilization. If food consumption increases faster than domestic production, ASEAN-6 countries will

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become more dependent on food imports.

Diverse and quality food consumption should be supported by policies that ensure optimal use of resources. However, an imbalance between food availability and utilization can trigger nutritional problems as well as import dependence, as happened in Thailand and Malaysia. High food demand in both countries has increased vulnerability to global price fluctuations and supply chain disruptions, while food access inequality exacerbates food insecurity among low-income communities. In addition, overconsumption has the potential to lead to the degradation of natural resources, such as land and water exploitation, which reduces long-term production capacity. In Vietnam, for example, the intensification of agriculture to meet domestic demand has led to land degradation and a decline in biodiversity.

Malaysia and Thailand, strengthening local food security through commodity diversification and empowering smallholder farmers have reduced dependence on imports while maintaining supply stability. This step needs to be strengthened with technological innovations, such as precision irrigation systems and climate-resistant crop varieties, to increase productivity without harming the environment. In addition, the management of national food reserves can be a buffer when a crisis occurs. By prioritizing equitable distribution, this policy not only ensures access to food for all levels of society, but also prevents overexploitation of natural resources (Naresh et al., 2024).

Impact of agricultural production on food security in ASEAN-6

Agricultural production has a positive and significant influence on food security. The results of this study are in accordance with the theory of food availability that adequate agricultural production, as seen in the countries of Indonesia, Thailand, and Vietnam, will directly contribute to stable food availability, which is one of the main factors in achieving food security. When agricultural production is high, as achieved by Indonesia through efficient management of the agribusiness sector, food supply in the market will be more secure, so that food prices tend to be stable and people's access to food becomes easier.

The Philippines faces challenges related to dependence on food imports, which lead to food scarcity, increase prices, and reduce food accessibility. In addition, the sustainability of agricultural production also affects food security in the long term. If production methods are not environmentally friendly or inefficient, as Vietnam has experienced due to agricultural land degradation, then there can be a decline in agricultural yields in the future, which will affect food supply (Chandio et al., 2024).

The implementation of precision farming in Thailand increases the efficiency of fertilizer and water use by up to 30 percent, reducing the risk of crop failure due to climate change. In Indonesia, the use of drought-tolerant rice varieties has helped

farmers in arid areas such as East Nusa Tenggara maintain productivity even in extreme weather conditions. This technology not only supports production stability, but also reduces pressure on natural resources, thus strengthening the sustainability aspect. Technological developments and innovations play an important role in strengthening food security through improving production and distribution efficiency (Hidayat et al., 2020). In this context, the industrial revolution 4.0 has had a positive impact on the development of the business world, including the agricultural sector and the food industry. The use of appropriate cutting-edge technology, supported by an established entrepreneurial spirit, can optimize the process as well as the results of the business unit developed.

Vietnam has reduced production fluctuations in the past five years, proving that the integration of modern technology can be a long-term solution to food security. In addition to technology, a holistic approach in food policy is needed to ensure that agricultural production is directly correlated with increasing people's access to food. For example, the seed and fertilizer subsidy program in Malaysia not only increases productivity, but is also followed by the development of food storage infrastructure to reduce post-harvest losses. In the Philippines, food diversification policies by strengthening local commodities such as sweet potatoes and sorghum have reduced dependence on rice imports. Synergy between the government, the private sector, and the community in designing inclusive policies will accelerate the achievement of equitable food security, especially in crisis-prone areas (Rosales et al., 2023).

The influence of food imports on food security in ASEAN-6

The results show that food imports show a positive influence on food security in ASEAN-6. In a broader context, food security is also influenced by the adaptability of business actors in facing various challenges. As seen during the Covid-19 pandemic, the MSME sector has shown significant resilience in adapting and surviving, even becoming a solution for improving the national economy. The use of financial technology (fintech) through collaboration with e-commerce partners has helped MSMEs in the food sector to develop their businesses in the midst of limitations. This shows that increasing the digital capacity of food business actors, including in terms of financing through peer to peer lending and crowdfunding, as well as the use of digital payments through digital wallets and marketplaces, can strengthen the food supply chain and increase distribution efficiency.

If a country is hampered by various factors such as natural factors, disasters, or technological limitations, food imports are a strategic solution to ensure the availability of basic commodities. The Philippines and Cambodia with high levels of dependence on food imports rely on international trade to mitigate the vulnerability of their food supplies (Nunes et al., 2022). On the other hand, Indonesia and Vietnam have shown commitment to reduce import dependence through intensification of domestic production, such as rice self-sufficiency programs and agricultural tech-

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nology development.

A hybrid policy has been implemented by Malaysia by maintaining imports of certain commodities while investing in agricultural research and irrigation infrastructure to increase domestic food productivity. This strategy not only reduces vulnerability to global market turmoil, but also builds long-term resilience through diversification of food sources. Thus, while food imports are a vital tool in filling the domestic production gap, the sustainability of food security depends on the country's ability to optimize local resources, strengthen regional cooperation, and build responsive food reserve systems. Policies that combine global trade efficiency with domestic agricultural innovation will be key in facing food challenges in an era of uncertainty.

The findings of this study make a significant contribution to the achievement of several SDGs, particularly SDG 2 (Zero Hunger) and SDG 12 (Responsible Consumption and Production). The results show that high dependence on food imports increases vulnerability to global market fluctuations, which, in turn, poses a long-term risk to food security. Countries with high import dependence, such as the Philippines and Cambodia, exhibit their vulnerability to disruptions in global food supply chains, which can lead to price instability and difficulties in food access, particularly for low-income groups (Shobur et al., 2025). Therefore, one of the main findings of this study is the importance of enhancing domestic food security through policies that support the intensification of agricultural production and reduce dependence on imports. This aligns with SDG 2 (Zero Hunger), which emphasizes ensuring adequate, nutritious, and sustainable food availability for all.

Furthermore, this study supports SDG 12 by highlighting the importance of more efficient food consumption management and reducing food waste within domestic production systems. The findings advocate for policies promoting sustainability in the agricultural sector, such as diversifying domestic food sources and applying environmentally friendly agricultural technologies. For instance, the use of precision farming technologies and climate-resilient crop varieties can reduce waste of natural resources and enhance productivity without harming the environment. Thus, this research demonstrates that policies optimizing domestic food production, reducing import dependence, and integrating circular economy principles in the food sector can contribute to more sustainable food security, ultimately supporting the achievement of SDG 12, which aims to promote responsible production and consumption.

Conclusions

Food security in ASEAN-6 has been proven to be significantly influenced by food consumption, agricultural production, and food imports. Uncontrolled food consumption can have a negative impact on food security, for example pressure on natural resources, double nutrition problems, and import dependence. Countries

in ASEAN, such as Thailand and Malaysia show high dependence on food imports, while Vietnam still faces problems in land degradation due to agricultural intensification. Agricultural production shows a significant positive influence on food security in ASEAN-6. Indonesia, Thailand, and Vietnam have succeeded in increasing food security by modernizing agricultural technology, precision farming, and diversifying commodities. However, the country still faces the challenges of climate change, land degradation, and fluctuations in agricultural prices. This all has an impact on the decline in food security. Meanwhile, food imports have a strategic role in maintaining food security, especially for countries whose domestic production has not been met. Countries like Malaysia are implementing a hybrid strategy of maintaining imports of certain commodities while investing in agricultural research.

This research resulted in several recommendations. The government needs to encourage local food consumption to reduce pressure on one particular commodity. Indonesia is able to promote sago and sorghum as an alternative to rice in increasing food security. The use of technology such as precision farming, climate-resistant varieties, and modern irrigation systems can increase production efficiency without damaging natural resources. The country of Thailand has succeeded in improving the efficiency of fertilizer and water use through precision farming. Subsidy programs for healthy and quality food should be expanded to low-income communities to increase access to high-nutrition food. ASEAN governments also need to collaborate with the private sector in building food storage infrastructure to reduce post-harvest losses. Increasing access to capital for farmers is also needed through fintech, so as to encourage investment in food production and reduce their financial risks.

Contributor Role Taxonomy (CRediT)

Mohd Annasrul Karim: Conceptualization, data curation, formal analysis, investigation, methodology, validation, visualization, writing — original draft, and writing — review and editing.

Ariodillah Hidayat: Conceptualization, formal analysis, investigation, methodology, supervision, validation, and writing — review and editing.

Imam Asngari: Data curation, methodology, software, validation, visualization, and writing — review and editing.

Muhammad Subardin: Formal analysis, investigation, validation, , and writing — review and editing.

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References

Barbosa, M.W. (2024). Government support mechanisms for sustainable agriculture: A systematic literature review and future research agenda. *Sustainability, 16*(5), 2185. DOI 10.3390/su16052185

Batt, P.J. (2024). Food security: Planning for our collective future. *BIO Web of Conferences, 98*, 05002. DOI 10.1051/bioconf/20249805002

Chandio, A.A., Shah, M.I., Sethi, N., and Mushtaq, Z. (2022). Assessing the effect of climate change and financial development on agricultural production in ASEAN-4: The role of renewable energy, institutional quality, and human capital as moderators. *Environmental Science and Pollution Research, 29*(9), 13211-13225. DOI 10.1007/s11356-021-16670-9

Chandio, A.A., Zhang, H., Akram, W., Sethi, N., and Ahmad, F. (2024). Climate change and crop production nexus: Assessing the role of technological development for sustainable agriculture in Vietnam. *International Journal of Climate Change Strategies and Management, 16*(2), 177-200. DOI 10.1108/IJCCSM-11-2022-0138

Farooq, M.S., Uzair, M., Raza, A., Habib, M., Xu, Y., Yousuf, M., Yang, S.H., and Ramzan Khan, M. (2022). Uncovering the research gaps to alleviate the negative impacts of climate change on food security: A review. *Frontiers in Plant Science, 13*, 1-39. DOI 10.3389/fpls.2022.927535

Hidayat, A., Robiani, B., and Marwa, T. (2020). Simultaneous equation of concentration, efficiency, and competitiveness of Indonesia's CPO industry: Impacts and policies. *Economia Agro-Alimentare, 27*(1), 1-42. DOI 10.3280/ecag2025oa18605

Kimaro, B. J., Kilonzo, R. G., & Matunga, B. N. (2024). Analysis of co-operative irrigation farming and household food security in Africa: A PRISMA model approach. *Heliyon, 10*(20), e39581. DOI 10.1016/j.heliyon.2024.e39581

Le, H.N., Sofija, E., Harris, N., Nguyen, T., and Phung, H. (2024). Food security in slow-onset disasters: A policy review in Southeast Asian regions. *World Medical and Health Policy, 16*(3), 353-375. DOI 10.1002/wmh3.604

Michel, M., Eldridge, A.L., Hartmann, C., Klassen, P., Ingram, J., and Meijer, G.W. (2024). Benefits and challenges of food processing in the context of food systems, value chains and sustainable development goals. *Trends in Food Science and Technology, 153*, 104703. DOI 10.1016/j.tifs.2024.104703

Ministry of Agriculture Cambodia (2023). *Cambodia's Agriculture Investment Framework*. Ministry of Agriculture Cambodia.

Morales-Pablo, R., Aguilar-Gutiérrez, G., Galaviz-Villa, I., García-Pérez, E., Soto-Estrada, A., Fonseca, J.M., and Ramírez-Martínez, A. (2024). Analysis of the regulations concerning circular economy and its relationship to the reduction of food loss and waste on an international level: A review. Waste Management & Research: The *Journal for a Sustainable Circular Economy, 43*(6). DOI 10.1177/0734242X241279942

Morley, T. (2021). A meta-analysis of projected global food demand and population at risk of hunger for the period 2010-2050. *Nature Food, 2*(7), 494-501. DOI 10.1038/s43016-021-00322-9

Muhammad, H. (2024, December 24). *Impor Beras Indonesia Tembus 3,85 Juta Ton pada 2024, Thailand Jadi Pemasok Terbesar*. Good Stat. https://goodstats.id/article/impor-beras-indonesia-tembus-3-85-juta-ton-di-2024-thailand-jadi-pemasok-terbesar-FCM6e

Naresh, R., Singh, N.K., Sachan, P., Mohanty, L.K., Sahoo, S., Pandey, S.K., and Singh, B. (2024). Enhancing Sustainable Crop Production through Innovations in Precision Agriculture Technologies. *Journal of Scientific Research and Reports, 30*(3), 89-113. DOI 10.9734/jsrr/2024/v30i31861

Nunes, L.M., Li, G., Chen, W.Q., Meharg, A.A., O'Connor, P., and Zhu, Y.G. (2022). Embedded health risk from arsenic in globally traded rice. *Environmental Science and Technology, 56*(10), 6415-6425. DOI 10.1021/acs.est.1c08238

Otsuka, K. (2021). *Strategy for Transforming Indonesian Agriculture*. Bulletin of Indonesian Economic Studies.

Poulain, J., Tibère, L., Mognard, E., and Laporte, C. (2022). The Malaysian Food Barometer Open Database : An invitation to study the modernization of Malaysian food patterns and its economic and health consequences. *Databases and Nutrition, 8*, 1-7. DOI 10.3389/fnut.2021.800317

Putra, A.S., Tong, G., and Pribadi, D.O. (2020). Food security challenges in rapidly urbanizing developing countries: Insight from Indonesia. *Sustainability, 12*(22), 9550. DOI 10.3390/su12229550

Rosales, A., Young, S., Mendez, T., Shelden, K., and Holdaway, M. (2023). Collaborative strategies to improve nutrition security and education: Lessons learned during a pandemic. *Journal of School Health, 93*(2), 148-152. DOI 10.1111/josh.13247

Shobur, M., Marayasa, I.N., Bastuti, S., Chaerul, A., Ardi, G., and Alfatiyah, R. (2025). Enhancing food security through import volume optimization and supply chain communication models: A case study of East Java' s rice sector. *Journal of Open Innovation: Technology, Market, and Complexity, 11*(1), 100462. DOI 10.1016/j.joitmc.2024.100462

Srivani, M. and Faisal, R.F. (2024). The dynamics of consumer spending in the Covid-19 pandemic. *Qubahan Academic Journal, 4*(2), 582-589. DOI 10.48161/qaj.v4n2a276

Sundram, P. (2023). Food security in ASEAN: Progress, challenges and future. *Frontiers in Sustainable Food Systems, 7*, 1-14. DOI 10.3389/fsufs.2023.1260619

Tessalonica, V., Fitriyani, A.E., Febrianti, M., Lesmana, M.E., Lukman, R.M., and Budiasih, B. (2023). The influence of Indonesian people's consumption on National Food Security. *Seminar Nasional Official Statistics, 2023*(1), 525-536. DOI 10.34123/semnasoffstat.v2023i1.1711

Wheeler, D.S. (2015). Do you know how much it costs? *Intensive Care Medicine, 41*(8), 1454-1456. DOI 10.1007/s00134-015-3911-1

Wongmonta, S. (2022). An assessment of household food consumption patterns in Thailand. *Journal of the Asia Pacific Economy, 27*(2), 289-309. DOI 10.1080/13547860.2020.1811191

Zavaglia, A., Mejuto, J.C., and Simal-Gandara, J. (2020). Mitigation of emerging implications of climate change on food production systems. *Food Research International, 134*, 109256. DOI 10.1016/j.foodres.2020.109256