International Conference on Sustainable Economics, Management, and Accounting (ICSEMA 2025)
Proceedings
Vol. 01 No.01 Year 2025, Page 3891-3903

ANALYSIS OF PRODUCTION FACTORS ON NATIONAL RICE AVAILABILITY: QUANTITATIVE AND SWOT APPROACH

Sri Herliana[1], Qisthyna Salimi[2], Fikriya Khoerani[3]

[1] Institut Teknologi Bandung, Indonesia, Indonesia
[2] Universitas Gajah Mada, Indonesia
[3] Politeknik Kesehatan Kemenkes Bandung, Indonesia
*Email corresponding author: sri.herliana@sbm-itb.ac.id

Abstract

Rice is a staple food in Indonesia that plays a crucial role in supporting national food security, maintaining social and economic stability, and ensuring household food security. However, its availability is often affected by production fluctuations that depend on cropping patterns and the impact of climate change. This study aims to analyze the impact of production factors, imports, and exports on rice availability in Indonesia during the period 2012-2022. In addition, this study also conducted a SWOT analysis to develop a strategy to increase the availability of rice in a sustainable manner. A quantitative approach was used with multiple linear regression method to identify the relationship between independent and dependent variables. Secondary data was obtained from various trusted institutions, including the Central Statistics Agency (BPS), the Logistics Agency (Bulog), the Ministry of Agriculture, Bank Indonesia, the World Bank, and the Food and Agriculture Organization (FAO). Data processing was conducted using Microsoft Excel and Python software. The regression results found that the size of the harvest area has a positive and significant influence on national rice production with a coefficient of 5.32. This means that an increase in harvest area is directly proportional to an increase in national rice production. However, other variables such as rainfall, irrigation area, and population did not show strong statistical significance on rice production, although theoretically these factors are expected to play a role in determining rice availability. SWOT analysis reveals the internal and external factors that influence rice availability in Indonesia. The analysis shows that Indonesia has strengths in the form of large harvest areas and government support for food production. However, there are weaknesses such as suboptimal irrigation infrastructure, crop shrinkage, labor, and land degradation. On the other hand, opportunities such as agricultural modernization and food diversification can support efforts to improve food security. However, climate change, population increase, and conversion of agricultural land pose significant threats to the sustainability of national rice availability. The results of this analysis are expected to serve as a basis for developing more effective strategies in dealing with the dynamics of the food sector in Indonesia.

Keywords: Production, Factors, National, Rice, Quatitative, SWOT

INTRODUCTION

The agricultural sector plays an important role in sustaining the economy and meeting the food needs of the Indonesian people. One of the most prominent commodities is rice, which is not only a staple food but also a symbol of national food security. Demand for rice continues to increase along with population growth, making it a strategic element in maintaining food security, economic stability, and national politics (Gunawan, 2017). However, a major challenge facing the world today is the significant increase in population from year to year, which has direct implications for global food demand. In his work An Essay on the Principles of Population (1798), Thomas Malthus argued

that population growth tends to increase geometrically (2, 4, 8, 16, ...) while food production only increases arithmetically (2, 4, 6, 8, ...). This imbalance, he argued, could trigger a food crisis or famine if there was no effective control mechanism.

Food security according to Food Law No. 18/2012 is a condition of food fulfillment for the state to individuals, which is reflected in the availability of sufficient food, both in quantity and quality, safe, diverse, nutritious, equitable, and affordable and not contrary to religion, beliefs, and culture of the community, to be able to live healthy, active, and productive lives in a sustainable manner. According to the Global Food Security Index (GFSI) published by The Economist Intelligence Unit (EIU), Indonesia's Food Security Index ranks 63rd out of 113 countries with a score of 60.2, and ranks 5th among ASEAN countries in 2022. However, this score has not reached the global food security average of 62.1, so Indonesia is still classified as a food insecure country.

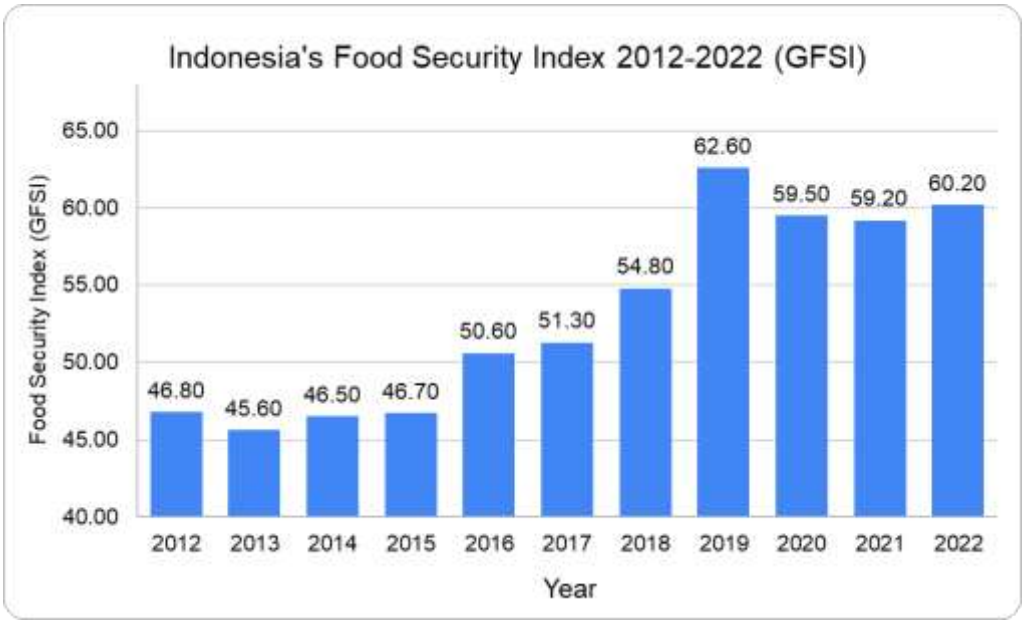

Figure 1. Indonesia's Food Security Index 2012-2022 (Source: GFSI)

In general, despite fluctuations, Indonesia's food security index shows an increasing trend from 2012 to 2022, especially during 2016 to 2019. During 2012-2015, Indonesia's food security index was relatively stable. However, in 2020, there was a decrease in the index from 62.60 in the previous year to 59.50. This decline was caused by the impact of the COVID-19 pandemic on the food supply chain and the economy as a whole (Vadilaksono, 2023). In 2021, the index decreased slightly again to 59.20, but in 2022 there was a small increase to 60.20, showing signs of recovery. In understanding national food security, it is important to see how rice availability in Indonesia is formed. The availability of rice is influenced by several factors, mainly domestic rice production, stocks, as well as adjusted import and export volumes as mentioned in a study by Lestari, Lubis, and Jufri (2013). The graph below presents data on production, stocks, imports, and exports in Indonesia from 2012 to 2022.

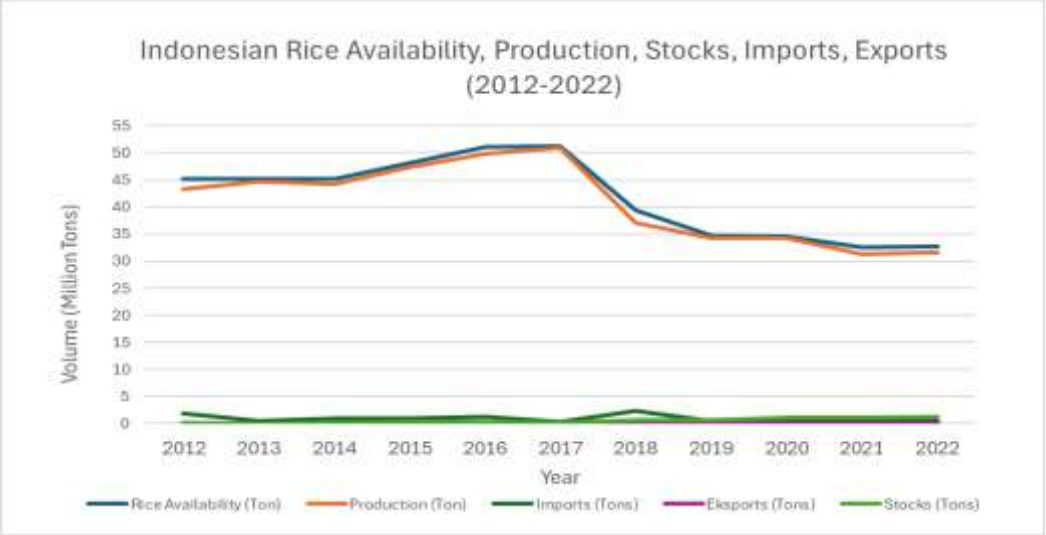

Figure 2. Indonesian Rice Availability, Production, Stock, Import, Export (2012-2022) (Source: Central Bureau of Statistics, processed 2024)

Through this graph, we can see the trends that illustrate the large role of rice production as the main support for food availability, as well as how these factors interact to maintain stable rice supply. Rice production plays a major role in supporting rice availability in Indonesia from 2012 to 2022. The trend of rice availability generally follows the pattern of rice production. This means that rice supply in Indonesia is highly dependent on domestic output, and changes in rice production directly affect the level of rice availability. A significant decline in rice production after 2018, for example, resulted in a decrease in rice availability, despite contributions from imports. This indicates that if rice production can be increased sustainably, food security will also be more secure without relying too much on imports. Therefore, to ensure the sustainability of production as the main support for food security, it is important for the author to analyze more deeply the factors that affect rice production. By understanding these factors, the authors can explore SWOT-based strategies to increase stable and sustainable rice production, thus supporting national food security.

RESEARCH METHODS

This type of research is quantitative research. The population in this study is 34 provinces in Indonesia and the sample is in the form of secondary data of annual time series of independent variables and dependent variables from 2012 to 2022 sourced from the Central Statistics Agency (BPS), the Logistics Agency (Bulog), the Ministry of Agriculture, the World Bank, and FAO (Food Agricultural Organization) in the form of panel data. Data processing is done using Microsoft Excel and Python software.

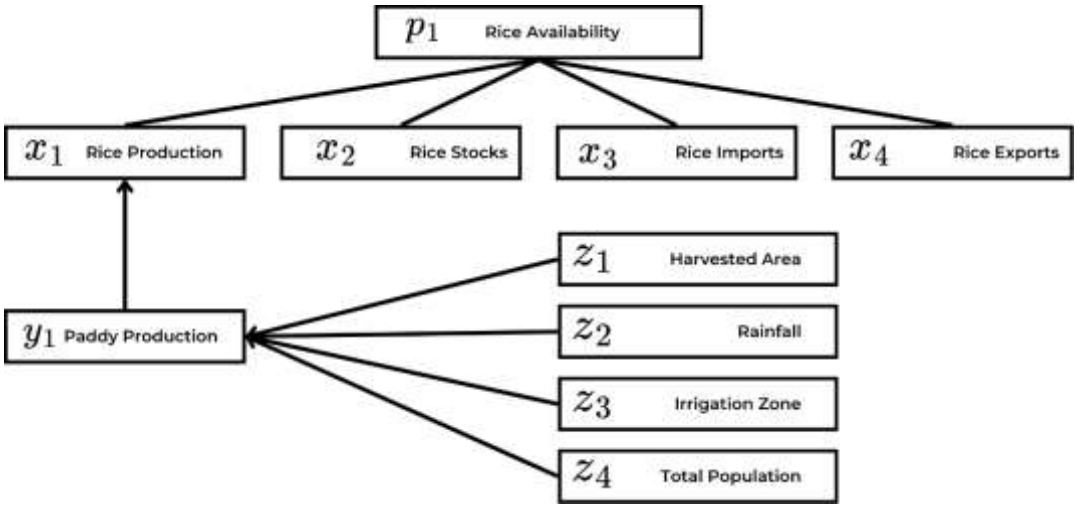

Figure 3. Diagram of Rice Availability and its Influencing Factors

This study uses a multilevel analysis with the equations below. The variables used, including dependent and independent variables, are estimated to have an influence on rice availability in Indonesia.

Model 1: Rice Availability Regression

$$p1 = \alpha 0 + \alpha 1x1 + \alpha 2x2 + \alpha 3\ x3 + \alpha 4x4 + \varepsilon 1$$

$p_1 = Rice\ Availability\ (Tons)$
$x_1 = Rice\ Production\ (Tons)$
$x_2 = Rice\ Imports\ (Tons)$
$x_3 = Rice\ Stocks\ (Tons)$
$x_4 = Rice\ Exports\ (Tons)$

Model 2: Rice Production Regression

$$x1 = \beta 0 + \beta 1y1 + \varepsilon 2$$

$x_1 = Rice\ Production\ (Tons)$
$y_1 = Paddy\ Production\ (Tons)$

Model 3: Paddy Production Regression

$$y1 = \gamma 0 + \gamma 1z1 + \gamma 2z2 + \gamma 3\ z3 + \gamma 4z4 + \varepsilon 3$$

$y_1 = Paddy\ Production\ (Ton)$
$z_1 = Harvested\ Area\ (Ha)$
$z_2 = Rainfall\ (mm)$
$z_3 = Irrigation\ Area\ (Ha)$
$z4 = Total\ Population\ (Thousands\ of\ People)$

RESULTS AND DISCUSSION

Rice Availabillity

	coef	std err	t	P>|t|	[0.025	0.975
const	2.128e+05	1.11e+06	0.192	0.854	-2.49e+06	2.92e+0
Rice Production	0.9964	0.022	45.831	0.000	0.943	1.05
Rice Stocks	0.4572	0.374	1.223	0.267	-0.457	1.37
Rice Imports	0.9238	0.110	8.384	0.000	0.654	1.19
Rice Exports	-8.6038	4.818	-1.786	0.124	-20.393	3.18

Picture 4. Regression Results of Rice Availability vs Production, Stock, Import, and Export of Indonesian Rice 2012-2022 using Python

The regression equation formed is:

$$Rice\ Availability = 212771.99 + (0.99 \times Rice\ Production) + (0.45 \times Rice\ Stocks) + (0.92 \times Rice\ Imports) + (-8.60 \times Rice\ Exports)$$

The estimation results show that of the four explanatory variables, only rice production and imports have a significant effect on rice availability. The estimated coefficient of 0.9964 on rice production indicates that every 1-ton increase in production increases the availability of rice by 0.9964 tons. This result is in line with the research conducted by Pratama (2018) where rice production positively affects rice availability. Similarly, rice imports increase availability by 0.9238 tons per additional ton of imports. Meanwhile, rice exports and consumption have no significant effect, with the export coefficient showing a statistically insignificant reduction in availability ($p > 0.05$). The strong coefficient of rice exports (-8.60) reflects that despite its small volume, changes in rice exports significantly affect availability. This is because Indonesia's rice exports are relatively small compared to total domestic production and demand, so even small changes in exports can have a measurable impact on the regression model. This condition may also be reinforced by the presence of outlier data or the low variability of exports from year to year, which makes the relationship between exports and availability appear stronger than it actually is. This is in line with the view of Adriansyah et al. (2024) who mentioned that the value of Indonesia's rice exports tends to be low and fluctuating.

Rice Production

```
Intercept: -2819687.4476685524
Koefisien: [0.66508023]
Mean Squared Error (MSE): 1377876815022.3748
R-squared (R²): 0.9787367837354466
Root Mean Squared Error (RMSE): 1173829.9770504988
                       coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------
const             -4.23e+06   2.01e+06     -2.106      0.065   -8.77e+06    3.14e+05
Paddy Production      0.6838      0.030     22.686      0.000       0.616       0.752
```

Picture 5. Regression Results of Indonesian Rice Production vs. Indonesian Paddy Production 2012-2022 using Python

The regression equation formed is:

$$Rice\ Production = -4229916.13 + (0.68 \times Paddy\ Production)$$

The R-squared (0.9787) indicates that 97.87% of the variation in rice production can be explained by paddy production, with an F-statistic of 17,860 and a very small p-value (1.35e- 17), indicating the overall significance of the model. Each increase of 1 ton of paddy production is estimated to increase rice production by 0.68 tons, reflecting the conversion of paddy into rice. The coefficient of Paddy Production also indicates that about 68.3% of paddy production becomes rice. This is in line with the fact that in the process of milling paddy into rice, there will be shrinkage (due to husks, broken rice, etc.), so not all paddy production will become rice (Sary, 2017).

Paddy Production

```
Intercept: -38758.82573433111
Koefisien: [ 5.81601619 -1.20850934 -0.29312096 13.7816987 ]
Mean Squared Error (MSE): 3085896.4991853
R-squared (R²): 0.9740285546797844
Root Mean Squared Error (RMSE): 1756.6719953324525

                       coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------------
const             -1.213e+04   2.32e+04     -0.522      0.602   -5.77e+04    3.34e+04
Harvested Area         5.3216      0.584      9.111      0.000       4.177       6.466
Rainfall              -1.4339      3.580     -0.400      0.689      -8.451       5.584
Irrigation Area       -0.2244      1.407     -0.159      0.873      -2.983       2.534
Total Population       6.0444      9.680      0.624      0.532     -12.929      25.017
```

Picture 6. Regression Results of Paddy Production vs. Harvested Area, Rainfall, and Irrigation Area of Indonesia 2012-2022 using Python

The R-squared of 0.974 indicates that the model explains 97.4% of the variability in rice paddy production, suggesting that the model is very good at explaining the data. Here is the regression equation obtained:

$$Paddy\ Production = -12130.97 + (5.32 \times Harvested\ Area) + (-1.43 \times Rainfall) + (-0.22 \times Irrigation\ Area) + (6.04 \times Total\ Population)$$

Based on the regression results, harvest area has a significant influence on rice paddy production, with a very small p-value (0.000), indicating a statistically strong relationship. The regression coefficient of 5.32 indicates that every 1 hectare increase in harvested area will increase rice production by 5.32 tons, assuming other factors remain constant. This indicates that harvested area is the most dominant variable in determining rice production, compared to other variables such as rainfall, irrigation area, and population which are not significant in this model. The significance of harvest area reflects that the availability and optimal utilization of land is a key factor in increasing production.

SWOT ANALISYS

In facing the challenges of food security in Indonesia, particularly related to rice availability, it is important to thoroughly understand the internal and external conditions and factors affecting the sector. To this end, SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis provides a comprehensive approach to identify strengths and opportunities that can be maximized, as well as weaknesses and threats that need to be anticipated.

Strengths

Quoted from Elpawati et al. (2017), FAO estimates that food crop production in developing countries in 2030 will increase by 67 percent compared to the production level in the 1997/99 reference year. Indonesia itself has a major strength in the rice production sector thanks to significant harvest areas, especially in production center provinces such as West Java, East Java, and Central Java. Research results by Pratama (2018) show that the geographical conditions in Indonesia, which are suitable as paddy fields, cause the availability of rice in Indonesia to be quite large. In addition, BPS data in 2023 showed that the harvest area in Indonesia reached more than 10 million hectares, providing a large production capacity to meet national rice needs. The diversity of local rice varieties is also an advantage, such as the Anak Daro variety that is able to adapt to areas up to an altitude of 600 meters above sea level or varieties such as Inpari that are drought and disease resistant are additional advantages that support adaptation to various climatic and geographical conditions.

Government support is also an important force. According to Ilyas (2020), rice availability has increased thanks to various policies implemented by the government, such as input subsidies in the production sector (seeds and fertilizers), provision of facilities and infrastructure, output subsidies, determination of the Government Purchase Price, and regulation in the import sector through regulations and tariffs. All these factors provide a strong foundation for Indonesia to achieve more stable food security.

Weaknesses

Despite having a large harvest area, the availability of rice in Indonesia is still hampered by several structural weaknesses. One of them is the sub-optimal condition of irrigation.

According to the Ministry of PUPR in March 2023, there were around 35% of irrigation networks in Indonesia experiencing damage that required repair. However, Moeno (2020) stated that 52% of irrigation networks out of a total of 7.2 million hectares in Indonesia were damaged, while in West Java the damage reached 40%. Irrigation management institutions have a very significant influence on the damage to irrigation buildings, as well as the volume of waste that also significantly affects the damage.

Limited labor, the use of overly manual equipment, and inappropriate planting times are also major weaknesses in the agricultural sector that can negatively impact crop yields. Kobarsih and Siswanto (2015) note that limitations in the number or quality of labor lead to delays in harvesting, which increases the risk of damage to produce that should have been harvested on time, as was the case in Gunungkidul. In addition, the use of less efficient farm equipment slows down the harvesting process, increasing potential losses and lowering productivity. According to Karim and Aliyah (2018), inappropriate planting timing can cause crops to face a lack of water when they need it or excess water at a stage when they no longer need it. All of these point to weaknesses in the planning and management of agricultural production, which can hinder the achievement of maximum yields and reduce the efficiency of resource use, as well as exacerbate losses due to crop losses.

In addition, excessive agricultural intensification practices without land restoration have led to soil degradation, especially in Java, as per the Ministry of Environment and Forestry (MoEF) 2022 report. Intensification often involves changes in the way farmers manage water resources, such as the use of irrigation. If irrigation is not managed properly or if there is a mismatch between irrigation systems and rainfall patterns, crops can experience water shortages or excesses at critical times. High fragmentation of farmland also hampers production efficiency, as small and fragmented landholdings are difficult to manage optimally, resulting in reduced farmer productivity and competitiveness.

Opportunities

Indonesia has a number of opportunities that can be utilized to strengthen rice availability. One of the big opportunities is the utilization of new water sources through the construction of dams and reservoirs, where until 2023, as many as 60 new dams have been completed by the Ministry of PUPR to increase access to water for agricultural land. In addition to the utilization of water sources, Indrayanti et al. (2024) explained that the application of modern agriculture with agricultural tools and machinery (alsintan) is a great opportunity to increase productivity and efficiency. The use of agricultural tools and machinery can reduce operational costs compared to conventional methods, as shown in the financial analysis which reveals that modern farming costs are relatively lower. In addition, agricultural tools and machinery is also effective in minimizing the risk of crop loss in the field, resulting in higher and more consistent production yields.

The food diversification campaign since 2022 is also an opportunity to reduce dependence on rice and encourage consumption of local alternatives such as sago, corn and tubers. International research and development (R&D) cooperation with institutions such as IRRI also paves the way for the development of rice varieties that are more resilient to climate change, thereby increasing the resilience of the agricultural sector amidst unpredictable weather conditions.

Threats

In their journal, Sumastuti et al. (2016) explained that climate change poses a significant threat to food availability, especially rice, in Indonesia. The three main impacts of climate change- floods, droughts, and attacks by plant-disrupting organisms (pests)-directly affect the agricultural sector. Floods can damage rice fields, cause crops to die before harvest, and reduce the quality of production. Droughts, which are becoming more frequent due to erratic rainfall patterns, reduce the availability of water for irrigation, so rice plants do not grow optimally. In addition, climate change also triggers an increase in pest attacks that threaten crop yields in terms of both quantity and quality. These three impacts not only reduce production, but also have the potential to cause total crop failure, which in turn can threaten national rice availability and overall food security stability.

Land conversion also poses a serious threat to the availability of rice in Indonesia, especially as population growth increasingly drives land use change. Data from BPS (2021) shows that the conversion of paddy fields nationally reaches 60,000-80,000 hectares per year, with the main factors including poor irrigation systems (73%) and ease of substitute cultivation techniques (27%) (Pramono et al., 2015). In addition, Kamilah (2013) highlighted that the value of land for industry and housing is much higher than agricultural land, especially paddy fields. The low direct economic benefits of agricultural land make land conversion easier to occur. If this trend continues, land conversion will further reduce productive land, threaten rice production, and undermine national food security.

Table 1. SWOT Matrix of Increasing Rice Availability in Indonesia

	S	W
	● Significant Harvest Area ● Geographical Conditions ● Adaptive Local Rice Varieties ● Government Program Support	● Irrigation Damage ● Labor Limitations ● Land Degradation due to Intensification ● Farmland Fragmentation ● Planting Time Management
O ● Utilization of New Water Sources ● Modernization of Agriculture ● Food Diversification Support ● International Collaboration	SO ● Optimizing Harvest Area with Technology ● Utilization of New Dams and Reservoirs for Agricultural Irrigation ● Strengthening Food Diversification Program	WO ● Irrigation Infrastructure Revitalization ● Utilization of Agricultural Tools and Machinery for Harvesting Efficiency and Reducing Dependence on Manual Labor

		• Soil Restoration for Sustainable Agriculture
T • Climate change • Population Increase • Agricultural Land Conversion • Water Availability • Infrastructure Damage	ST • Climate Change Adaptation with Climate-Resilient Varieties • Land Efficiency through Technology to Overcome Land Conversion • Enforcement of Productive Agricultural Land Zoning	WT • Strict Control of Agricultural Land Conversion • Improving Rice Distribution to Reduce Dependence on Imports • Socialization of the Importance of Sustainable Agriculture

SWOT Strategy

SWOT Strategy As a strategic measure to optimize rice availability in Indonesia, SWOT analysis provides a comprehensive overview of the internal and external factors affecting the sector. From this analysis, we see that there are a number of strengths that can be maximized, weaknesses that need to be addressed, opportunities that can be exploited, and threats that need to be anticipated. Based on this mapping, it is important to design appropriate strategies to capitalize on the synergies between strengths and opportunities, mitigate the impact of weaknesses, and anticipate threats.

SO (Strengths-Opportunities Strategy)

To take advantage of existing strengths and opportunities, Indonesia can optimize harvest areas by implementing modern agricultural technology, such as precision irrigation systems supported by new dams. This program can be integrated with agricultural machinery assistance (agricultural tools and machinery) from the government to increase efficiency in rice production centers. In addition, with 60 new dams to be built by 2023, the government can utilize these water sources to increase irrigation in water-scarce lands, especially outside Java. A more vigorous food diversification program can also support the reduction of dependence on rice, by encouraging the consumption of local food alternatives in food security-prone areas.

ST (Strengths-Threats Strategy)

To deal with the threat of climate change, adaptation through the use of climate-resistant rice varieties is an effective solution, especially drought-resistant varieties. In addition, increasing agricultural land efficiency through precision technology can reduce the negative impact of land conversion. The government can also strengthen regulations on zoning for productive agriculture in areas prone to land conversion, such as Jabodetabek. Support for infrastructure development such as new dams also needs to be directed at repairing damaged irrigation to maintain water supply. Stricter rice import policies are also needed to protect local farmers from international market pressure when production threats occur.

WO (Weaknesses-Opportunities Strategy)

Revitalizing irrigation infrastructure using water sources from new dams and reservoirs can improve suboptimal water distribution, especially in paddy fields that often experience water

shortages. Modernization of irrigation infrastructure can be done by utilizing the construction of new dams to repair damaged networks, improve water supply efficiency, and ensure timely harvests. The use of agricultural tools and machinery needs to be expanded to reduce dependence on limited manual labor and improve harvesting efficiency. In addition, food diversification can be used as an alternative to support farmers on small and fragmented land. Training on cropping pattern management and technology use also needs to be conducted to overcome resource limitations that affect productivity. To address soil degradation, the government can support sustainable practices, such as crop rotation and soil conservation, to maintain long-term soil productivity.

WT (Weaknesses-Threats Strategy)

In the face of both weaknesses and threats, the government needs to implement strict controls on agricultural land conversion to maintain the existing productive land area. Policies such as tax incentives for farmers who keep their land as agricultural land, as well as penalties for zoning violations, can help reduce productive land loss. To deal with the threat of climate change and infrastructure weaknesses, agricultural insurance programs should be implemented to protect farmers from losses due to floods, droughts, or pest attacks. Irrigation management systems need to be improved by involving local managers and utilizing new reservoirs to address water shortages. In addition, socializing the importance of sustainable agricultural practices and incentivizing farmers to implement environmentally friendly methods can help sustain rice production in Indonesia.

CONCLUSIONS

Based on the research results regarding the analysis of factors affecting rice food availability in Indonesia, it can be concluded that several main factors contribute to this condition. Harvest area has a positive and significant effect on national rice production with a coefficient of 5.32, which means that an increase in harvest area is in line with an increase in rice production. Despite having a large harvest area, the availability of rice in Indonesia is still hampered by several structural weaknesses. One of them is the less than optimal irrigation conditions. According to the SWOT analysis, Indonesia's strengths lie in its large harvest areas and government support, while its weaknesses include suboptimal irrigation infrastructure. Opportunities such as the use of modern technology and food diversification can improve food security, but challenges from climate change, population growth and land conversion pose a threat to the sustainability of rice availability

BILLIOGRAPHY

Adriansyah Prasetyo et al. (2023). *Analisis Perbandingan Nilai Ekspor Beras Indonesia & Thailand*.

Andaresta, D. P., & others. (2024). *Analisis Faktor yang Mempengaruhi Ketahanan Pangan di Indonesia*.

Badan Pusat Statistik. (2018). *Jumlah Penduduk Menurut Provinsi di Indonesia (ribu) 2014-2018*. Retrieved from https://jatim.bps.go.id/id/statistics-table/1/MTcxNSMx/jumlah-penduduk-menurut-provinsi-di-indonesia--ribu---2014-2018.html

Badan Pusat Statistik. (2023). *Impor Beras Menurut Negara Asal Utama (2017-2023)*. Retrieved from https://www.bps.go.id/id/statistics-table/1/MTA0MyMx/impor-beras-menurut-negara-asal-utama-2017-2023.html

Badan Pusat Statistik. (2023). *Volume Impor Menurut Negara Asal Utama (berat bersih, ribu ton) (2017-2023)*. Retrieved from https://www.bps.go.id/id/statistics-table/1/MTAzNSMx/volume-impor-menurut-negara-asal-utama--berat-bersih-ribu-ton---2017-2023.html

Badan Urusan Logistik. (2013). *Annual report BULOG 2013*. Retrieved from https://www.bulog.co.id/wp-content/uploads/2021/03/ANNUAL_REPORT_BULOG_2013.pdf

Beritagar. (2018). *Luas Panen Padi 1998-2017*. Retrieved from https://lokadata.beritagar.id/chart/preview/luas-panen-padi-1998-2017-1516875120

Beritagar. (n.d.). *Volume dan Nilai Impor Beras Nasional (2010 - November 2017)*. Retrieved from https://lokadata.beritagar.id/chart/preview/volume-dan-nilai-impor-beras-nasional-2010---november-2017-1516074002#

Elpawati, E., Purnomowati, R., & Nugraha, A. (2017). *Analisis Faktor Ketersediaan Beras di Kabupaten Cianjur Tahun 2002-2013. Jurnal Agribisnis Terpadu*, 10(1), 52. https://doi.org/10.33512/jat.v10i1.5055

Gunawan, C. I. (2017). *Pengaruh Luas Panen, Produktivitas, Konsumsi Beras, dan Nilai Tukar Petani Terhadap Ketahanan Pangan di Kabupaten Brebes*. Universitas Negeri Semarang, 1–97. http://lib.unnes.ac.id/29767/

Ilyas A, Noer M, & Wahyuni I. 2020. Analisis Faktor-Faktor yang Memengaruhi Ketersediaan Beras di Indonesia. *Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*. 6 (2):740-753. DOI: http://dx.doi.org/10.25157/ma.v6i2.3456

Indrayanti, T., Prayoga, A., & Zakky, M. (2024). Penggunaan Agricultural tools and machinery pada Pertanian Modern dalam Usahatani Padi Sawah Untuk Mendukung Ketahanan Pangan di Kabupaten Tangerang. *Jurnal Ketahanan Nasional, 30*(2), 258–274. https://doi.org/10.22146/jkn.97632

Katadata. (2023). *Produksi Padi Indonesia Cenderung Menurun dalam 10 Tahun Terakhir*. Retrieved from https://databoks.katadata.co.id/datapublish/2023/04/20/produksi-padi-indonesia-cenderung-menurun-dalam-10-tahun-terakhir

Karim, H. A., & Aliyah, M. (2018). *Evaluasi Penentuan Waktu Tanam Padi (Oryza Sativa L.) Berdasarkan Analisa Curah Hujan dan Ketersediaan Air Pada Wilayah Bedungan Sekka-Sekka, Kabupaten Polewali Mandar*. *Jurnal Ilmu Pertanian Universitas Al Asyariah Mandar*, 3(2), 45– 52.

Kementerian Pekerjaan Umum dan Perumahan Rakyat. (n.d.). *Dokumen IIP*. Retrieved from https://sda.pu.go.id/assets/uploads/files/00788-l3529-8327-ino-iip.pdf

Kementerian Pertanian Republik Indonesia. (2019). *Statistik lahan pertanian tahun 2015-2019*. Retrieved from https://satudata.pertanian.go.id/assets/docs/publikasi/Statistik_Lahan_Pertanian_Tahun_2015-2019.pdf

Khasanah, N. N., & Gunanto, E. Y. A. (2024). *Pengaruh Luas Panen Padi, Produktivitas Lahan, Pertumbuhan Harga Beras dan Jumlah Penduduk terhadap Ketersediaan Beras di Indonesia tahun 1990-2022*. Diponegoro Journal of Economics, 13(2), 67-79. https://doi.org/10.14710/djoe.44900

Kurniasih, T., Taryono, & Toekidjo. (2008). *Keragaan Beberapa Varietas Padi (Oryza spp) Pada Kondisi Cekaman Kekeringan dan Salinitas. Iptek Tanaman Pangan*, 3(1), 1–10. https://doi.org/10.22146/ipas.1547

Kusumastuti, A. C., Kolopaking, L. M., & Barus, B. (2018). *Faktor yang Mempengaruhi Alih Fungsi Lahan Pertanian Pangan di Kabupaten Pandeglang.*

Lestari, L., Lubis, S.N., dan Jufri, M. 2013. *Faktor-Faktor yang Mempengaruhi Ketersediaan dan Konsumsi Pangan Strategis di Sumatera Utara.* Jurnal Vol. 2, No. 6. Universitas Sumatera Utara.

Moeno, H. U. (2020). *Sistem Evaluasi Pengaruh Daya Rusak Air, Kinerja Lembaga Pengelola Irigasi, Tumbuhan Liar, Sampah, dan Prilaku Masyarakat Terhadap Kerusakan Bangunan Irigasi*. *Jurnal Teknik Sipil*, 27(2), 123–132. https://doi.org/10.5614/jts.2020.27.2.10

Pramono, M. S., Supriana, T., & Kesuma, S. I. (2015). *Analisis Alih Fungsi Lahan Sawah dan Prediksi Produksi dan Konsumsi Beras di Kabupaten Deli Serdang*.

Pratama AR, Sudrajat, & Harini R. 2018. *Analisis Ketersediaan dan Kebutuhan Beras di Indonesia Tahun 2018*. *Media Komunikas Geografi*. 20(2) 101-114. DOI: 10.23887/mkg.v20i2.19256.

Pusvita, E., & others. (2019). *Analisis Strategi Penguatan Ketahanan Pangan Beras di Kabupaten Ogan Komering Ulu*.

Sary, S. F. (2017). *Analisis Biaya Penyusutan pada Proses Pengeringan Pascapanen Padi di Kecamatan Trimurjo Kabupaten Lampung Tengah*. Retrieved from http://digilib.unila.ac.id/29781/3/SKRIPSI%20TANPA%20BAB%20PEMBAHASAN.pdf.

Statista. (2020). *Indonesia annual precipitation*. Retrieved from https://www.statista.com/statistics/1314394/indonesia-annual precipitation/#:~:text=In%202020%2C%20the%20annual%20precipitation,Indonesia%20exp erience%20the%20most%20precipitation