JURNAL ILMU MANAJEMEN
PROFITABILITY
ISSN 2714-6332(print) | 2614-3976 (online)
Member of Crossref 10.26618
Published by :
Program Studi Manajemen
Fakultas Ekonomi dan Bisnis
Universitas Muhammadiyah Makassar

Analysis of Rice Availability in Central Java Province 2018-2022

Bela Christiana Wati[1], Sitti Retno Faridatussalam[2]
Faculty of Economics and Business . Muhammadiyah University of Surakarta
b300200053@student.ums.ac.id

Keywords:
Central Java, Availability Rice, Production Paddy, Total Population, Panel Data

Abstract

Central Java Province, one of the regions with the largest population in Indonesia, has great potential in the food sector, particularly in rice cultivation. Food, as a fundamental human need, is key to ensuring food security in a region. This study uses a quantitative approach with secondary time series and cross-sectional data from January 2018 to December 2022, involving 29 districts and 6 cities in Central Java Province. The factors influencing rice availability were analyzed using the panel data method. The Fixed Effect Model (FEM) was chosen as the best model, indicating that rice production and population size have a positive and significant impact on rice availability in Central Java Province. On the other hand, rice harvested area and paddy productivity were not significantly influential. The results of this study show that rice production positively influences rice availability, but rice availability is also affected by the population size. The continuous population growth exerts pressure on rice availability, as a larger population increases the demand for rice consumption. These findings contribute to government efforts and the business strategies of farmers in maintaining food security in Central Java Province.

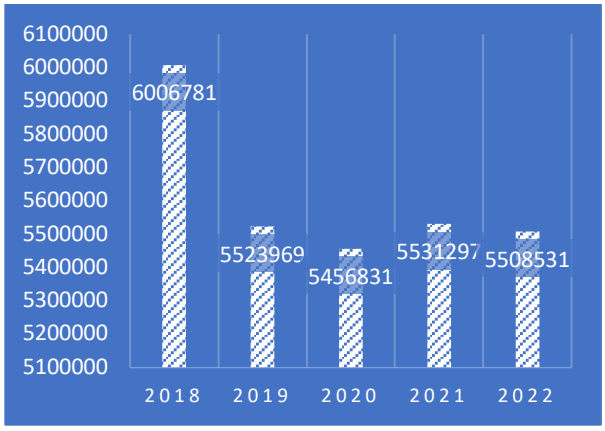
1. Introduction

Central Java Province ranks third as the most populous region in Indonesia, following West Java and East Java, with a population of 37.03 million people. In addition to its large population, Central Java is endowed with vast resource potential, supported by its highly favorable geographical conditions. One of the key regional resources is in the food sector, particularly rice cultivation, which thrives in most parts of Central Java. This is evidenced by the fact that in 2019, the area of land planted with rice in Central Java reached 1,049,661 hectares, making it the second-largest after East Java in the same year (Central Statistics Agency, 2022).

Food is the most essential need for every human being, consumed as a source of energy to carry out daily and sustainable activities, making the achievement of food security crucial. Law Number 18 of 2012 concerning Food defines food security as a condition where the country's and individuals' food needs are met, reflected in the availability of sufficient food, both in quantity and quality, that is safe, diverse, nutritious, balanced, equitable, and affordable, and does not conflict with religious beliefs and community culture (Saragih et al., 2021).

Rice, as a staple food, holds strategic value and significantly impacts the economic, environmental, and socio-political sectors. Therefore, the availability of safe rice is essential for achieving stable food security (Chaireni et al., 2020). In reality, rice remains the dominant staple food in Indonesian society. However, over time, rice production in Indonesia has experienced fluctuations in volume (Purnomo & Utami, 2019).

Graph 1. Development of Rice Demand in Central Java Province 2018-2022



Source: Central Statistics Agency

Graph 1 illustrates the fluctuation in rice supplies in Central Java Province from 2018 to 2022. The highest rice availability occurred in

2018, reaching 6,006,781 tons, while 2020 saw the lowest availability at 5,456,831 tons. The issue of rice availability remains a strategic concern. One contributing factor is the harvest area. According to Gayatri & Ashar (2017), the area of harvested land impacts rice production efficiency. A smaller land area can create an imbalance in rice production, potentially failing to meet consumer demand. Conversely, a larger harvest area generally leads to increased and more efficient rice production, which helps maintain adequate rice availability.

Rice is the staple food for most people in Central Java Province, making it crucial for the provincial government to ensure a sufficient supply to meet regional consumption needs and ensure food security. However, the growing population in Central Java poses a challenge. Thomas Malthus's theory suggests that while human population grows exponentially, food supply increases arithmetically, leading to potential food shortages if food availability does not keep pace with population growth (Silalahi et al., 2014).

Rice production is another key factor influencing rice availability. In 2022, Central Java's rice production reached 9.36 million tons, which, when converted to rice, amounts to 5.38 million tons (Central Statistics Agency, 2022). Abdullah et al. (2022) define production as the process of transforming goods with no prior use value into those with use value by utilizing production factors. Higher rice production typically enhances rice availability, thus contributing to food security (Novalia & Ogari, 2022).

Productivity measures farming performance and is regularly assessed by the government as an indicator of farming success (Prihtanti & Pangestika, 2020). To enhance food security and address declining rice productivity, the government, along with relevant institutions, has implemented various measures. These include developing better rice varieties, initiating one data one map, improving food data collection methods through the Area Sampling Framework (KSA), promoting technological innovations in agriculture, and encouraging the use of local functional food substitutes to increase rice availability (Maizunati, 2018).

Research by Purnomo & Sartikasari (2023) analyzed factors affecting rice food security in Bojonegoro Regency, revealing that rice stock, production, and population size all significantly impact rice food security. Meanwhile, Nurul & Purnomo (2022) found that, for the period 2019-2021, population size did not affect rice availability in Central Java Province. Kristopo & Purnomo (2023) used the Cobb-Douglas production function to study East Java from 2001-2021 and found that harvest area positively affects rice production, whereas rainfall does not. Rini et al. (2023) identified factors beyond land area, production, and total household income that have a greater influence on rice availability for Lebak rice farmers during the Covid-19 pandemic.

Afrina & Wilis (2023) studied Padang Pariaman Regency, noting a decrease in rice availability from 179,766.56 tons in 2018 to 145,913.12 tons in 2022. Despite the decline, the region still had a surplus of rice, indicating that availability exceeded consumption needs. Research on rice availability is vital as it reflects regional food security and informs government policy to prevent national food crises. Therefore, examining the factors influencing rice availability in Central Java's regencies and cities during 2018-2022 is essential.

2. Literatur Review

2.1 Food Security and Rice Availability

Food security is a condition in which the food needs of both the country and individuals can be met properly, which is reflected in the availability of sufficient food in terms of quantity and quality (Saragih et al., 2021). The availability of rice as a staple food has a strategic role in achieving stable food security. Chaireni et al. (2020) emphasized the importance of the availability of safe rice as a foundation for food security, because rice is the dominant staple food in Indonesia.

2.2 Factors Affecting Rice Availability

The main factors affecting rice availability include rice production, harvested area, and population size. Gayatri & Ashar (2017) stated that the area of harvested land affects the efficiency of rice production. Limited land area can result in an imbalance in production, which has the potential to disrupt the fulfillment of consumer demand. Conversely, a larger harvested land area is generally associated with an increase in more efficient rice production, thus supporting adequate rice availability.

Rice production is another important factor affecting rice availability. Abdullah et al. (2022) explained that production is the process of converting goods that have no utility value into goods that have utility value by utilizing production factors. Higher rice production usually contributes to increased rice availability and food security (Novalia & Ogari, 2022). In this case, research by Purnomo & Sartikasari (2023) shows that rice stock, rice production, and population size significantly affect rice food security in Bojonegoro Regency.

2.3. Effect of Population Growth

Population growth is a significant challenge in maintaining rice availability. Malthus' theory states that exponential human population growth can lead to food shortages if food supply growth only occurs arithmetically (Silalahi et al., 2014). This emphasizes the need to pay attention to the relationship between population growth and food availability.

2.3 Rice Productivity and Government Efforts

Rice productivity, as a measure of agricultural performance, is often assessed to evaluate agricultural success (Prihtanti & Pangestika, 2020). The government and related institutions have made various efforts to increase rice productivity and food security. These include the development of better rice varieties, improving food data collection methods, and promoting technological innovation in agricultural management (Maizunati, 2018). Research by Kristopo & Purnomo (2023) in East Java revealed that the area of rice harvest positively affects rice production, while rainfall has no significant effect.

2.4 Related Research in Certain Locations and Periods

Research by Nurul & Purnomo (2022) shows that population size does not affect rice availability in Central Java Province during the 2019-2021 period. Meanwhile, Rini et al. (2023) highlighted that other factors besides land area, production, and total household income of farmers have a greater influence on rice availability during the Covid-19 pandemic. Research by Afrina & Wilis (2023) in Padang Pariaman Regency showed a decrease in rice availability from 179,766.56 tons in 2018 to 145,913.12 tons in 2022. Despite the decrease, the area still experienced a rice surplus, indicating that rice availability exceeded consumption needs.

3. Research Methods

This study uses a quantitative approach with secondary data covering annual data from January 2018 to December 2022 as well as cross-sectional data involving 29 districts and 6 cities in Central Java Province. Data sources were obtained from the Central Statistics Agency (BPS) and various units in the Ministry of Agriculture, including the Secretariat General of the Ministry of Agriculture, the Directorate of Food Crops, the Directorate of Agricultural Facilities and Infrastructure, the Food Security Agency, and the Data and Information Center of the Ministry of Agriculture. To analyze the factors affecting rice availability, the panel data method was used and the data was processed using the E-views version 13 program.

The research variables consist of dependent and independent variables. The dependent variable is the amount of rice availability, while the independent variables include the area of rice harvest, rice production, rice productivity, and population. The panel data regression models used include the Common Effects Model (CEM), Fixed Effects

Model (FEM), and Random Effects Model (REM). To determine the best estimation model, the Chow test and the Hausman test were carried out. The panel data regression equation formed through logarithmic transformation is as follows:

JKB_it = β_0 + β_1 LP_it + β_2 PD_it + β_3 PDS_it + β_4 JP_it + ε_it

In this equation, JKB refers to the amount of rice availability in tons, LP is the area of rice harvest in hectares, PD is rice production in tons, PDS is rice productivity in tons, and JP is the population in million people. The regression coefficients of the independent variables are indicated by β_1 to β_4, while β_0 is a constant and ε_it is the error term or error factor. This methodology is designed to provide an in-depth analysis of the factors that influence rice availability in Central Java Province, with the aim of clarifying the existing dynamics.

4. Results and Discussion

The results of Panel Data Regression estimation using the *Pooled Ordinary Least Squares* (*PLS)* , *Fixed Effect Model* (*FEM*) and *Random Effect Model* (*REM*) approaches can be seen in Table 1.

Table 1
Cross section Panel Data Regression Results

Variable	Regression Coefficients		
	PLS	**FEM**	**BRAKE**
C	72 , 69440	-7256 , 590	72.69440
L.P	-0 , 000911	0 , 001573	-0.000911
PD	0 , 573788	0 , 569483	0.573788
PDS	-3 , 505681	0 , 413846	-3.505681
JP	0 , 000176	0 , 008162	0.000176
R ²	0 , 999984	0 , 999994	0 , 999984
Adjusted. R ²	0 , 999983	0 , 999992	0 , 999983
***F* statistics**	2604459	565456 , 5	2604459
Prob. *F* statistics	0 , 000000	0 , 000000	0 , 000000

Source : Appendix

In this study, the Chow test and the Hausman test will be used to select the best estimation model, namely Pooled Least Squares (PLS), Fixed Effects Model (FEM), or Random Effects Model (REM). If the Chow test results indicate that FEM is selected and the Hausman test results also indicate that FEM is selected, then the best estimation model is FEM. The Chow test is used to determine whether the most appropriate estimation model is PLS or FEM. The null hypothesis (H0) of the Chow test states that the estimation model is Pooled Least Squares (PLS), while the alternative hypothesis (HA) states that the estimation model is Fixed Effects Model (FEM). H0 is accepted if the p-value (p-value) or empirical statistical significance F is greater than α (p> α), and H0 is rejected if the p-value (p-value) or empirical statistical significance F is less than α (p < α). The results of the Chow test can be seen in Table 2.

Table 2
Chow Test Results

Statistics	Mark	df	Prob.
Cross-section *F*	6 , 312665	(34,136)	0 , 0000

Source : Appendix.

JURNAL ILMU MANAJEMEN
PROFITABILITY
ISSN 2714-6332(print) | 2614-3976 (online)
Member of Crossref 10.26618
Published by :
Program Studi Manajemen
Fakultas Ekonomi dan Bisnis
Universitas Muhammadiyah Makassar

Based on Table 2, it can be seen that the p-value, probability, or empirical significance of the F statistic is 0.000 (<0.01), so H0 is rejected. Thus, the selected estimation model is the Fixed Effects Model (FEM). Furthermore, the Hausman test is used to choose between the Fixed Effects (FEM) or Random Effects Model (REM) models. The null hypothesis (H0) of the Hausman test states that the estimation model is the Random Effects Model (REM), while the alternative hypothesis (HA) states that the estimation model is the Fixed Effects Model (FEM). H0 is accepted if the p-value, probability, or statistical significance of χ^2 is greater than α (χ^2 > α), and H0 is rejected if the p-value, probability, or statistical significance of χ^2 is less than α (χ^2 < α). The results of the Hausman test can be seen in Table 3.

Table 3
Hausman Test Results

Statistics	Mark	df	Prob.
Random cross section χ^2	214.417587	4	0.0000

Source : Appendix.

Based on Table 3, it can be seen that the p-value, probability, or statistical significance of the χ^2 statistic for the random cross-section is 0.0000 (<0.05), so H0 is rejected. Thus, the selected estimation model is the Fixed Effects Model (FEM). With the results of the Chow test and the Hausman test, the Fixed Effects (FEM) model was selected as the best estimation model. The complete estimation results of the FEM model are presented in Table 4.

Table 4
***Fixed Effect* Model Estimation Model**

Variable	Coefficient	Standard Error
Constant	-7256.590	(0.9231)
LP_it	0.001573	(0.0000)
PD_it	0.569483	(0.9547)
PDS_it	0.413846	(0.0000)
JP_it	0.008162	

Model Statistics:
R^2 = 0.999994 DW = 1.326815 F = 56,456.5 Prob. F = 0.000000
Source: Appendix

From Table 4, it can be seen that the p value , *probability* , or empirical significance of the *F statistic* is 0.00000 (< 0.01); so H_0 is rejected. In conclusion, the *FEM estimated model* exists. The coefficient of determination (*R2*) shows the predictive power of the estimated model. From Table 4, it can be seen that the R2 value *in the* Fixed *Effect Model* (FEM) is 0.999994, meaning that 99.9% of the variation in the variable Amount of Rice Availability can be explained by variations in the variables Harvested Area, Rice Production, Rice Productivity and Population. The remaining 0.1% is influenced by variations in variables or other factors not included in the model.

Table 5
Effect Validity Test Results

Variable	Sig.t	Criteria	Conclusion
L.P	0 .9231	> 0.10	Not significant
PD	0 , 0000	< 0.01	Significant at α = 0.01
PDS	0 .9547	> 0.10	Not significant
JP	0 , 0000	< 0.01	Significant at α = 0.01

Source: Attachment, processed.

Based on the validity test results in Table 5, it can be seen that Rice Production (PD) and Population Number (JP) significantly influence the Total Availability of Rice (JKB). In contrast, Harvested Area (LP) and Rice Productivity (PDS) do not significantly affect the Total Rice Availability in the districts and cities of Central Java Province for the period 2018-2022. The Rice Production variable has a regression coefficient of 0.569483, indicating a linear relationship. This means that an increase in rice production by 1 ton leads to an increase in the amount of available rice by 0.569483 tons. The Population variable has a regression coefficient of 0.008162, also indicating a linear relationship. This means that an increase in population by 1 person results in an increase in the amount of available rice by 0.008162 tons.

4.1 The Effect of Rice Production on the Amount of Rice Availability

The research findings indicate that rice production positively impacts rice availability in Central Java Province. Increased rice production will enhance rice availability, provided that production factors remain stable and are maintained until the harvest season. However, this is contingent on avoiding issues such as crop failure due to pest infestations or natural disasters like flash floods and typhoons, which can damage rice fields and lead to a decrease in rice quantity, consequently reducing rice availability in Central Java Province.

To sustain high rice production, the Central Java government, in collaboration with agricultural business stakeholders, can focus on intensifying rice production practices. This includes adopting high-yielding seed varieties, implementing effective pest control measures, utilizing advanced agricultural machinery to replace conventional labor, and other intensification strategies (Jatengprov.go.id, 2021).

Supporting these findings, research by Ramadhan et al. (2023) shows that increased rice production contributes to greater rice availability in Indonesia in 2021. Similarly, Sartikasari & Purnomo (2023) found that in Bojonegoro Regency from 2017 to 2021, rice production positively influenced rice availability. Furthermore, Asnuri & Yuliana (2023) confirmed that effective utilization of substantial rice production can lead to increased rice availability in Indonesia in 2021.

4.2 The Influence of Population on the Availability of Rice

The research findings reveal that population size positively affects rice availability. This relationship is rooted in the fact that a growing population increases the demand for food and, consequently, the need for higher rice production. For example, the population of Central Java was recorded at 36.52 million people in September 2020 according to SP2020. This marks a continuous increase compared to previous census results, with an average annual growth of approximately 400,000 people over the past decade (Central Statistics Agency, 2020).

As reported by Jatengprov.go.id (2020), rice consumption among the people of Central Java was 91 percent of their food intake in 2019, significantly higher compared to other food sources like tubers, corn, and breadfruit. Despite this high consumption rate, rice

availability in Central Java remains adequate, with 6.2 million tonnes available to meet a projected need of 3.9 million tonnes in 2023. This suggests that the growing population in Central Java is matched by a proportional increase in rice availability, supported by the staple consumption patterns in the region.

Supporting these findings, Yulianti & Sarifah (2021) demonstrated that population size contributes to increased rice availability in Bali Province. Hamdani et al. (2023) found similar results in Malang City, where population growth positively influenced rice availability. Additionally, research by Donoriyanto et al. (2023) suggests that proper management of a large population can further enhance rice availability in Surabaya.

5. Conclusion

Based on the research results, the analysis using the panel data method identified the Fixed Effect Model (FEM) as the most suitable model. In this model, two independent variables—rice production and population—demonstrate a positive and significant influence on rice availability. Conversely, the harvested area and rice productivity do not significantly affect rice availability in Central Java Province from 2018 to 2022. To ensure that rice production meets the availability requirements in Central Java, several measures should be taken. These include enhancing agricultural technology, utilizing superior seed varieties, and improving farmers' skills to increase production efficiency. Such measures will help ensure that rice availability in Central Java Province is sufficiently met by domestic production.

For future research, it is advisable to consider additional independent variables such as market rice stocks and rice stocks held by farmers. Including these factors could provide a more comprehensive understanding of the elements influencing rice availability in Central Java Province.

Bibliography

Abdullah, F., Imran, S., & Rauf, A. (2022). Analysis of Rice Availability in Selang Regency, Gorontalo. *Agrenesia: Agribusiness Scientific Journal* , *6* (3), 1–11.

Afrina, L., & Wilis, R. (2023). Availability of Rice Food in Padang Pariaman Regency. *Journal of Education and Socio-Culture* , *3* , 1464–1477. https://doi.org/10.58578/yasin.v3i6.1914

Asnuri, S., & Yuliana, R. (2023). Preparation of a Sustainability Index for the Rice Availability System in Indonesia in 2021. *In National Seminar on Official Statistics* , *1* , 675–686.

Central Bureau of Statistics. (2022a). *Harvest Area and Rice Production in Central Java Province 2022* . https://jateng.bps.go.id/publication/2023/09/01/2c72d94e4ca041ab97443c7d/lebar-panen-dan-produk-padi-di-provinsi-jawa-tengah-2022.html

Central Statistics Agency, B. (2020). *Results of the 2020 Population Census for Central Java Province Official News 2020 Population Census Statistics* . https://sensus.bps.go.id/berita_resmi/detail/sp2020/13/hasil-sensus-penbesar-2020-provinsi-jawa-tengah#:~:text=Compared with the previous census results, the population of Java is %2C, million people or an average of 400 thousand every year.

Central Statistics Agency, B. (2022b). *Harvest Area and Rice Production in Central Java 2022 Fixed Figures* . https://jateng.bps.go.id/pressrelease/2023/03/01/1460/lebar-panen-dan-produk-padi-di-jawa-tengah-2022--angka-tetap-.html

Chaireni, R., Agustanto, D., Wahyu, RA, & Nainggolan, P. (2020). Sustainable Food Security. *Journal of Population and Environmental Development* , *1* (2), 70–79. jkpl.ppj.unp.ac.id/index.php/JKPL/article/view/13

Donoriyanto, DS, Nugraha, I., & Ardlianti, RA (2023). Analysis of Rice Availability in Surabaya Using a Dynamic Systems

Approach. *Tekmapro* , *1* (2), 11–15.

Gayatri, N.F., & Ashar, K. (2017). Analysis of Factors that Influence the Availability of Rice in Malang City. *Student Scientific Journal of the Faculty of Economics and Business, Brawijaya University* , *5* (2), 1–12.

Hamdani, AW, Budijanto, B., & Deffinika, I. (2023). Projections of population growth and rice food security in Malang City for 2020–2045. *Journal of Innovative Integration and Harmony in the Social Sciences* , *3* (7), 760-772.

Jatengprov.go.id, A. (2020a). *Raise the Prestige of Uwi and Gembili, Central Java, Drive Local Food Diversification* . https://jatengprov.go.id/beritaopd/angkat-pamor-uwi-dan-gembili-jateng-mobilkan-diversifikasi-pangan-lokal/#:~:text=In addition %2C based on Expected Food Pattern score %28PPH%29, is expected to reduce dependence on rice and wheat.

Jatengprov.go.id, A. (2020b). *Rice production in Central Java is the highest in Indonesia* . https://jatengprov.go.id/publik/produk-padi-di-jateng-tertinggi-se-indonesia/

Jatengprov.go.id, A. (2021). *Environmentally Friendly, District Government Uses Biological Agents to Control Planthopper Pests - Central Java Provincial Government*.

Kristopo, MB, & Purnomo, D. (2023). Cobb Douglas Production Function Analysis with Multiple Linear Regression Method on Rice Farming Business. *Balance Economic Journal* , *19* (01).

Maizunati, N.A. (2018). The Role of Productivity in Improving the Welfare of Rice Farmers in Indonesia. *Journal of Agribusiness & Livestock RESEARCH* , *3* (2), 11–21.

Novalia, F., & Ogari, P. (2022). The Influence of Harvest Area and Rice Production on Rice Availability in Muara Enim Regency. *Jasep* , *8* (2), 61–66.

Nurul, A., & Purnomo, D. (2022). Analysis of Rice Production in Central Java Province for the 2019-2021 Period. *SEIKO : Journal of Management & Business* , *4* (3), 454–461. https://doi.org/10.37531/sejaman.vxix.547

Prihtanti, T., & Pangestika, M. (2020). Rice Productivity Dynamics, Retail Price of Rice (HEB), Government Purchase Price (HPP), and the Correlation between HPP and HEB. *Indonesian Journal of Agricultural Sciences* , *25* (1), 1–9. https://doi.org/10.18343/jipi.25.1.1

Purnomo, D., & Sartikasari, D. (2023). Analysis of factors influencing rice food security in Bojonegoro Regency. *Economics and Digital Business Review* , *4* (1), 649–654.

Purnomo, D., & Utami, PN (2019). Analysis of Rice Production in Indonesia. *Proceedings of The URECOL* , 224–230.

Ramadhan, NS, Himalaya, K., Wardani, AP, Maheswara, ABE, Khairunnisa, E., & Budiasih, B. (2023). Application of Simultaneous Equations in the Analysis of the Relationship between Availability and Consumption of Rice to View Food Security Conditions. *In National Seminar on Official Statistics* , *1* , 449–458.

Rini, AM, Yunita, Y., Bidarti, A., & Riswani, R. (2023). Factors that Influence the Availability of Rice for Rawa Lebak Farmers' Households in Muara Belida District During the Covid-19 Pandemic. *National Seminar on Suboptimal Land* , *10* (1), 458–468.

Saragih, JR, Sahara, R., & Harmain, U. (2021). Food Security in Simalungun Regency: Rice Availability Ratio Approach. *Agroland: Journal of Agricultural Sciences* , *28* (3), 257–267. https://doi.org/10.22487/agrolandnasional.v28i3.1027

Sartikasari, D., & Purnomo, D. (2023). Analysis of factors influencing rice food security in Bojonegoro Regency 2017-2021. *Economics and Digital Business Review* , *4* (1), 649-654.

Silalahi, D., Sitepu, R., & Tarigan, G. (2014). Analysis of Food Security in North

Sumatra Province. *Mathematics Science* , *02* (03), 237–251.

Yulianti, R., & Sarifah, SN (2021). The Influence of Economic Growth, Population, and Rice Production on Total Rice Consumption in Bali. *Regional Innovation Window Journal* , *6* (1), 11–22.