

A model analysis of rice production and consumption trends in South Sumatra Province

Fitri Wardani ¹, Maryadi ^{2,*} and Agustina Bidarti ²

¹ *Agribusiness Master Study Program, Faculty of Agriculture, Sriwijaya University, Palembang Indonesia.*

² *Department of Social Economics, Faculty of Agriculture, University of Sriwijaya, Palembang, Indonesia.*

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Abstract

Food is a basic human need to sustain life. Rice production and rice consumption in Indonesia continue to increase and fluctuate from year to year. On the other hand, Indonesia also has the potential and opportunities to meet its food needs independently and sovereignly and can even contribute to world food security. However, several regions in one of Indonesia's provinces, namely South Sumatra Province, are still unable to meet the demand for rice in their own regions, so rice from rice production centers in South Sumatra Province is still needed. This study aims to analyze the condition of the development of rice production and consumption in 2003–2023 in South Sumatra Province, analyze trends in rice production and consumption in the last 10 years, and analyze estimates of rice production and consumption in the next 10 years in South Sumatra Province. This study used secondary data originating from data from the South Sumatra Province and processed it using Microsoft Excel and IBM SPSS Statistics 21 software. The results show that the development of rice production and consumption in South Sumatra Province has tended to increase from year to year for a period of 20 years. The trend of rice production and rice consumption in South Sumatra Province in 2003–2022 increased with an average growth in rice production of 5.96 percent and rice consumption of 0.82 percent per year. Based on the estimated rice production and rice consumption in South Sumatra Province for 2023–2032, it is known that in the next ten years they will continue to increase. so that until 2032.

Keywords: Rice; Trend; Production; Consumption

1. Introduction

Food is a basic human need to sustain life. One of the most cultivated crops by farmers in Indonesia is rice, which is the staple food for the majority of Indonesians. The increase in population each year makes the role of agriculture very important in the national economy. [1].

Rice production and rice consumption in Indonesia continue to increase and fluctuate from year to year. The government still imports rice because Indonesia has not been able to cover all of its rice consumption for 37 years. The factors that affect rice production (expressed in terms of harvested area and productivity) are the ratio of real grain prices at the farm level to the real wages of farm laborers, the amount of urea fertilizer used, and the area intensified and trends over time. The factors that affect rice consumption are the price of rice and the population, but the price of rice is only influenced by the real price of rice in the previous year [2].

Indonesia still faces various problems and challenges in providing food for all its people. On the other hand, in the era of economic and trade globalization and in the ongoing process of economic decentralization, Indonesia is facing problems and challenges both from abroad and within the country. On the other hand, Indonesia also has the potential

* Corresponding author: Maryadi

and opportunities to meet its food needs independently and sovereignly and can even contribute to world food security [3]. The most important rice-producing countries in the world are China, India, Bangladesh, Vietnam, Thailand, Myanmar, the Philippines, China, and India. At the same time, Indonesia is the largest rice-importing country in the world, with a share of 14 percent of the world rice trade. Indonesia is the third-largest rice producer in the world [4].

The paddy and rice commodity is also a source of food crops whose growth is highly sought after in South Sumatra Province. Because rice is the staple food of the population in South Sumatra, The need for food, especially rice, in South Sumatra Province is likely to continue to increase as the population increases every year because food is one of the most basic human needs. Therefore, the production of rice and rice commodities is still being pursued.

However, several areas in South Sumatra Province are still unable to meet the demand for rice in their own regions, so rice from rice production centers in South Sumatra Province is still needed. This can be seen when a calculation is made between the rice produced and the rice consumed by residents of each region in South Sumatra to determine whether there is a surplus or deficit of rice in that area. From these figures, it can be seen whether the area is able to meet the need for rice or not. This is what prompted this research: to see how far paddy and rice production in general in South Sumatra Province is from trends and estimates, both for rice production and rice consumption in South Sumatra Province.

Based on this description, the aims of this research are: (1) to analyze the condition of the development of rice production and consumption in 2003–2023 in South Sumatra Province; (2) to analyze the trend of rice production and rice consumption in the last 10 years; and (3) to analyze the estimated production estimates of paddy and rice consumption in the next 10 years in the province of South Sumatra.

2. Material and methods

This study uses secondary data derived from South Sumatera Province. The selection of the research location was done deliberately (purposefully) with the consideration that South Sumatra is one of the largest rice-producing provinces in Indonesia after Java. South Sumatera Province is also one of the provinces that has the potential to achieve self-sufficiency in rice in an effort to achieve national food security.

Data collection techniques were carried out by tracing data and official documents that already existed and were stored in agencies including the Central Bureau of Statistics, the Service for Food Security and Animal Husbandry, and the Hortikutura Food Crops Agriculture Service in South Sumatra Province, as well as literature and sites related to this research that provide the necessary data needed in research. The type of data collected is in the form of quantitative data, including (a) Harvested area, (b) productivity, (c) Lowland rice and dryland rice production, (d) Rice production, (e) Average per capita rice consumption, and (f) Total population, Province of South Sumatra, 2003–2022.

Paddy production and rice consumption data from 2003–2022 were processed manually into simple tables (tabulations) and used simple linear regression analysis. Quantitative data processing is carried out with the help of calculators or computers (the MS Excel program and IBM SPSS Statistics 21 software). Qualitative data are described descriptively. Data on the average per capita consumption of rice in the province of South Sumatra 2003–2022 is multiplied by the total population of the province of South Sumatra 2003–2022 to find the amount of rice consumption in tons in the province of South Sumatra 2003–2022, while looking for rice production in the province of South Sumatra. In 2003–2022, conversions were carried out using rice production data in Province South Sumatra with a determination of the yield of rice of 64.02% and reduced by the use of rice and non-consumption rice.

Data analysis to achieve the first objective uses a descriptive analysis method with tabulation, namely by analyzing the development of rice production and consumption in South Sumatra using a computer program, namely Microsoft Office Excel. In this paper, descriptive analysis is used to provide explanations and interpretations of information and research data. The rate values used in analyzing rice production and consumption data in South Sumatra used in this study are [5]:

$$\text{Production or Consumption Rate} = \frac{\text{The difference value between P and K}}{\text{P or K lag values}} \times 100$$

Information:

The rate of production or consumption: Percent (%)

The value of the difference in production or consumption= $(Pt - Pt-1)$ or $(Kt - Kt-1)$

Lag value of production or consumption= $(Pt-1)$ or $(Kt-1)$

P and K = Production and Consumption

t= Production or consumption in year t

t-1=Lag (Production or consumption in one year previously)

Data analysis to achieve the second research objective is the trend analysis of rice production and rice consumption in South Sumatra, namely the Least Squares Method. Trend analysis is an analytical method that is intended to make an estimate or forecast for the future. This method was chosen because, in carrying out good forecasting, a number that is able to estimate data as precisely as possible or an estimate that has the smallest possible error. This minimal error can be anticipated by using the Least squares method, which is an attempt to minimize the squared result between the original data and the predicted data in order to obtain a more accurate forecast. The linear line equation from time series analysis is [6]:

$$Y = a + b X$$

Information :

Y : variable sought (trend)

X : time variable (year).

a : constant value ($a = \Sigma Y/N$)

b : coefficient value ($b = \Sigma XY/\Sigma X^2$)

n : number of samples

3. Results and discussion

3.1. Development of Rice Production and Consumption in South Sumatra

The development of rice production and consumption in South Sumatra shows fluctuating conditions every year. During a period of 20 years, production and consumption grew in 2003–2022, respectively, by an average of 3.05 percent and 0.82 percent, with an average production of 2,081,495.57 tons per year and an average consumption of 757,559.94 tons per year.

The increase in rice production in South Sumatra was due to increased productivity and the area of rice harvested, which continued to increase every year. However, rice consumption is affected by fluctuations in the population, which increase every year. Rice is a strategic food commodity and plays an important role in the Indonesian economy, including in South Sumatra. A shortage of rice supplies can threaten economic and political stability.

The development of rice production and consumption in South Sumatra from 2003 to 2022 can be seen in Table 1.

Based on Table 1. the condition of rice production in South Sumatra Province in the past 20 years has increased every year, although there have been several years where production has decreased due to several factors, namely the influence of the dry season, floods due to El Nino, and the COVID-19 pandemic, which caused The country's economic crisis has caused many residents to lose their jobs, and their incomes have decreased, so that the poverty rate has increased sharply and has had an impact on the price of nine basic commodities (Sembako), one of which is rice.

It is different from the condition of rice consumption in South Sumatra; along with population growth, which continues to increase every year, the need for rice also increases for food consumption. Overall, over the past 20 years, the average annual rice consumption has been lower than the average annual rice production. Therefore, domestic rice production covers domestic rice consumption, which means rice self-sufficiency has been achieved. This is due to the success of food diversification; people have turned to other alternatives by consuming diverse, nutritious, balanced, and safe local non-rice food (B2SA) in order to create healthy, intelligent, and productive families. Local food is a food product that has been produced by the community for a long time and is called traditional food [7].

Diversification of food consumption requires socialization. On the other hand, the type of food consumed is not only determined by nutrition and public awareness of nutrition but also by nutritional factors such as eating habits, socio-cultural values of the community, etc. Economic situation. People are reducing their food portions as they shift to a healthier lifestyle. Consuming adequate and balanced food is one of the most important factors that determine a

person's state of health and intelligence. This is reflected in the increasing prevalence of diseases caused by food or nutrition problems that cannot be cured. One of the causes is unbalanced consumption habits, which cause more and more heart disease, high cholesterol, diabetes, obesity, and other diseases.

Table 1 Development of Rice Production and Consumption in South Sumatra

Year	Rice Production (Tons)	Growth (%)	Rice Consumption (Tons)	Growth (%)	Difference between Production and Consumption (Tons)
2003	1,265,896.27	-	706,636.94	-	559,259
2004	1,447,359.68	14.33%	709174.22	0.36%	738,185
2005	1,485,334.42	2.62%	711,193.59	0.28%	774,141
2006	1,572,491.89	5.87%	717,519.76	0.89%	854,972
2007	1,762,498.77	12.08%	723,407.29	0.82%	1,039,091
2008	1,902,217.30	7.93%	732,760.97	1.29%	1,169,456
2009	2,000,776.09	5.18%	738,225.52	0.75%	1,262,551
2010	2,095,023.13	4.71%	750,552.69	1.67%	1,344,470
2011	2,166,865.73	3.43%	765,872.84	2.04%	1,400,993
2012	2,112,050.13	-2.53%	753,226.79	-1.65%	1,358,823
2003-2012	1,781,051.34	5.96%	730,857.06	0.72%	1,050,194
2013	2,263,579.25	7.17%	762,519.27	1.23%	1,501,060
2014	2,349,812.05	3.81%	771,913.31	1.23%	1,577,899
2015	2,719,519.66	15.73%	773,424.85	0.20%	1,946,095
2016	3,248,767.88	19.46%	778,713.17	0.68%	2,470,055
2017	3,164,554.05	-2.59%	774,616.30	-0.53%	2,389,938
2018	3,249,738.81	2.69%	782,539.78	1.02%	2,467,199
2019	1,666,694.27	-48.71%	788,539.78	0.77%	878,154
2020	1,756,106.81	5.36%	779,003.74	-1.21%	977.103
2021	1,634,074.08	-6.95%	806345.06	3.51%	827,729
2022	1,766,531.13	8.11%	825,012.86	2.32%	941518
2013-2022	2,381,937.80	0.41%	784,262.81	0.92%	1,597,675
Average	2,081,494.57	3.05%	757,559.94	0.82%	1,323,935

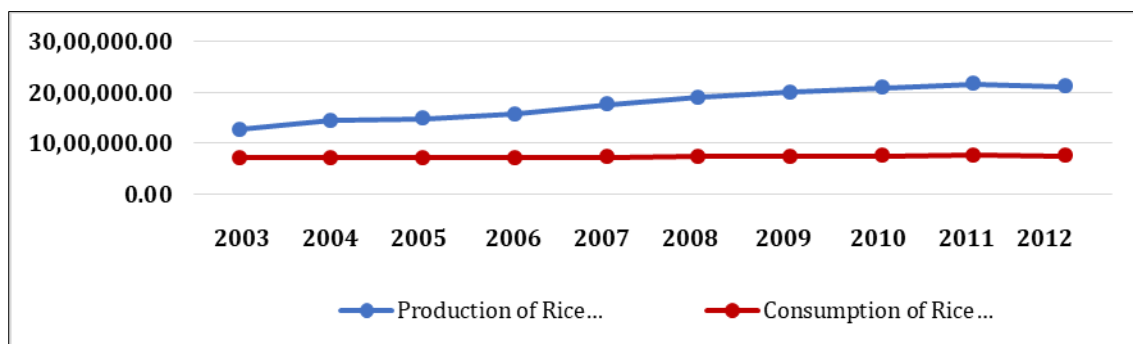
Source: [8]

Table 1. shows that rice production exceeds total rice consumption, which means that there is a rice surplus in South Sumatra Province, so rice self-sufficiency can be achieved. Efforts to increase rice production to achieve self-sufficiency in rice have been carried out so far. In addition to developing Mutual Assistance Guidance with five farming businesses, the government has also built a large-capacity fertilizer industry, set a Highest Retail Price (HET), and distributed subsidized fertilizers. Irrigation facilities are built and repaired on a large, medium, and small scale. The policy of stabilizing grain and rice prices was made by setting a base price and stabilizing domestic prices. Price stabilization is carried out by Bulog, which has monopoly rights for domestic procurement, import, storage, and distribution of rice. Complete, large, and centralized program support has enabled Indonesia's rice production, including in South Sumatra, to increase. This increase reached its peak in 1984, when Indonesia was self-sufficient in rice, but after 1984, support for national rice development diminished. National development is directed at accelerating economic growth through industrial development, but less attention is paid to agricultural development. So that the government of South Sumatra Province implemented Community Food Granary Development (PLPM) to maintain rice self-sufficiency in South Sumatra Province. This increase reached its peak in 1984, when Indonesia was self-sufficient in rice, but after 1984,

support for national rice development diminished. National development is directed at accelerating economic growth through industrial development, but less attention is paid to agricultural development. So that the government of South Sumatra Province implemented Community Food Granary Development (PLPM) to maintain rice self-sufficiency in South Sumatra Province. This increase reached its peak in 1984, when Indonesia was self-sufficient in rice, but after 1984, support for national rice development diminished. National development is directed at accelerating economic growth through industrial development, but less attention is paid to agricultural development. So that the government of South Sumatra Province implemented Community Food Granary Development (PLPM) to maintain rice self-sufficiency in South Sumatra Province.

3.1.1. Development of Rice Production and Consumption in South Sumatra, 2003-2012 Period

The development of rice production and consumption in South Sumatra Province in the period 2003–2012 showed fluctuating conditions. The average rice production is 2,263,579.25 tons per year, and the average growth is 7.17 percent per year. Due to the relatively rapid rate of population growth, rice consumption during this period averaged 762,519.27 tons per year, with an average growth rate of 1.23 percent per year. The graph of rice production and consumption growth in South Sumatra can be seen in Figure 1.



Source: [8]

Figure 1 Production and Consumption of Rice in South Sumatra 2003-2012 Period

Table 2 Harvest Area, Productivity and Rice Production in South Sumatra Province, 2003-2012 Period

Year	Harvest Area (Ha)	Growth (%)	Rice Production (Tons)	Growth (%)	Productivity (Tons/Ha)	Growth (%)
2003	570,010	-	1,977,345	-	34,70	-
2004	625,013	9.65%	2,260,793	14.33%	36,20	4.32%
2005	626,849	0.29%	2,320,110	2.62%	37.00	2.21%
2006	646,927	3.20%	2,456,251	5.87%	38.00	2.70%
2007	691,467	6.88%	2,753,044	12.08%	39.80	4.74%
2008	718,797	3.95%	2,971,286	7.93%	41.30	3.77%
2009	746,465	3.85%	3,125,236	5.18%	41.90	1.45%
2010	769,478	3.08%	3,272,451	4.71%	42.50	1.43%
2011	784,820	1.99%	3,384,670	3.43%	43,10	1.41%
2012	769,725	-1.92%	3,299,047	-2.53%	44,29	2.76%
Average	694,955	3.44%	2,782,023	5.96%	39.88	2.76%

Source: [8]

It can be seen in Figure 1. that rice production increased almost every year during the 2003–2012 period, and rice consumption remained stable as it had in the previous years. However, there were years that experienced a decline in consumption. The decline was due to the success of the food diversification program and changes in people's tastes for commodities other than alternative carbohydrate sources, such as wheat, potatoes, and other tubers. The decline in rice

consumption shows the success of food diversification if the population switches to other food alternatives such as potatoes or other tubers such as sweet potatoes or cassava, which are Indonesian local foods, and grain groups such as corn and wheat, which are non-rice foods. Therefore, it is expected to reduce the dependency of the Indonesian people on rice, including the people of South Sumatra. In fact, food diversification is more focused on the consumption of wheat (flour, wheat, bread, and especially noodles). Therefore, it cannot be said to be successful because the wheat plant is a sub-tropical plant and is not a local Indonesian food, so it is not suitable for cultivation in Indonesia. The decline in rice consumption in Indonesia is caused by the population's desire for a more varied diet, which changes with increasing welfare [9].

In the period 2003–2012, rice production was increased through agricultural revitalization, so that the production obtained is as shown in Table 3.1. During this period, rice production was further increased by increasing the harvested area and productivity, respectively, by 3.44 percent per year and 2.76 percent per year. So that rice production increases with an average growth rate of 5.96 percent per year.

Table 3 Total Population, Individual Rice Consumption, and Total Rice Consumption in South Sumatra, 2003-2012 Period

Year	Total population (Soul)	Growth (%)	Rice Consumption (Kg/Cap/Year)	Growth (%)	Total Rice Consumption (Tons)	Growth (%)
2003	6,518,791	-	108,40	-	706,636.94	-
2004	6,628,416	1.68%	106.99	-1.30%	709174.22	0.36%
2005	6,755,900	1.92%	105,27	-1.61%	711,193.59	0.28%
2006	6,899,892	2.13%	103.99	-1.22%	717,519.76	0.89%
2007	7,019,964	1.74%	103.05	-0.90%	723,407.29	0.82%
2008	7,121,790	1.45%	102.89	-0.16%	732,760.97	1.29%
2009	7,222,635	1.42%	102,21	-0.66%	738,225.52	0.75%
2010	7,450,394	3.15%	100.74	-1.44%	750,552.69	1.67%
2011	7,593,425	1.92%	100.86	0.12%	765,872.84	2.04%
2012	7,714,326	1.59%	97.64	-3.19%	753,226.79	-1.65%
Average	7,092,553	1.89%	103,20	-1.15%	730,857.06	0.72%

Source: [8]

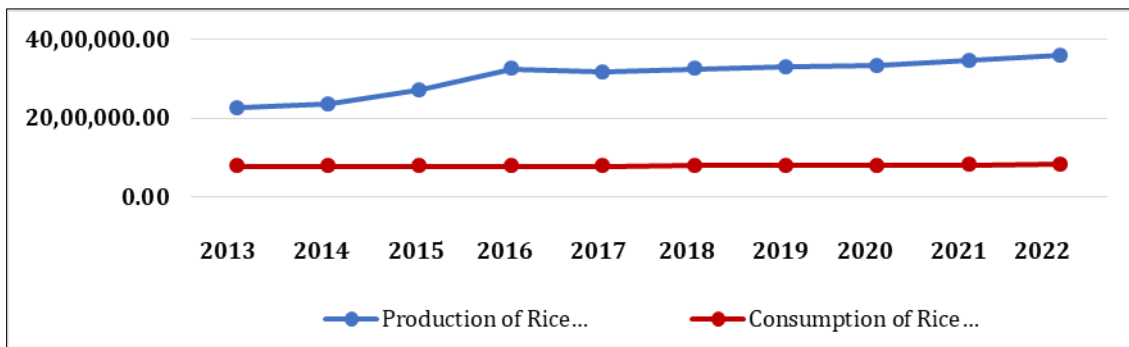
Based on Table 3. it can be seen that individual rice consumption has decreased every year with a growth rate of -1.15 percent per year, and the average individual rice consumption is 103.20 kilograms per capita per year. This is due to the success of the food diversification program. While the population has increased every year with a growth rate of 1.89 percent per year. So that the average total rice consumption in South Sumatra is 730,857.06 tons per year.

3.1.2. Development of Rice Production and Consumption in South Sumatra for the 2013-2022 Period

The development of rice production and rice consumption for the 2013–2022 period is the same as the previous period, namely experiencing fluctuations. The average rice production in that period was 2,081,494.57 tons per year, and the average growth was 3.05 percent per year. And rice consumption averages 784,262.81 tons per year, with a relatively low growth rate of only 0.92 percent per year.

It can be seen in Figure 2. that rice production in general increased almost every year during the 2013–2022 period, and rice consumption remained stable as it had for several years in the previous period. However, in the 2016–2017 period, rice production decreased by 2.59 percent. The decline in rice production in 2017 was 3,164,554.05 tons from the previous year's 3,248,767.88 tons, caused by crop failure in a number of areas, especially in swamp-contoured rice fields. The crop failure was caused by the rain, which continued to flush the agricultural land so that it was continuously submerged in water. Of the approximately 600,000 hectares of agricultural land in South Sumatra Province, around 72.2 percent are swamps and tidal swamps. This condition makes agricultural areas in South Sumatra very prone to flooding due to climate change [10]. Therefore, the government of South Sumatra Province continues to try to register farmers who plant in swampy areas to enter agricultural insurance. his is so that when farmers experience crop failure, they can

still farm in the next planting season. Aside from the weather conditions, the difficulty in obtaining affordable fertilizers is also the reason for the declining yields. The price of fertilizer has doubled, so the fertilizer has been replaced with animal manure. However, production has fallen. Therefore, the role of all parties is needed to help farmers, especially extension agents and banks, educate farmers. This is so that farmers are not trapped, especially in the field of financing.



Source: [8]

Figure 2 Rice Production and Consumption in South Sumatra 2013-2022 Period

Table 4 Harvest Area, Productivity and Rice Production in South Sumatra Province 2013-2022 Period

Year	Harvest Area (Ha)	Growth (%)	Rice Production (Tons)	.Growth .(%)	Productivity (Tons/Ha)	..Growth ..(%)
2013	800036	3.94%	3,535,738	7.17%	47,74	7.79%
2014	810,900	1.36%	3,670,434	3.81%	45,26	-5.19%
2015	872,737	7.63%	4,247,922	15.73%	48,67	7.53%
2016	1,014,351	16.23%	5,074,614	19.46%	50.03	2.79%
2017	999,972	-1.42%	4,943,071	-2.59%	49,43	-1.20%
2018	1,038,064	3.81%	5,076,131	2.69%	87,28	76.57%
2019	1,087,572	4.77%	2,603,396	-48.71%	48,27	-44.70%
2020	1,139,836	4.81%	2,743,060	5.36%	49.75	3.07%
2021	1,194,855	4.83%	2,552,443	-6.95%	51,44	3.40%
2022	1,252,630	4.84%	2,759,343	8.11%	53.45	3.91%
Average	1,021,095	5.08%	3,720,615	0.41%	53,13	5.40%

Source: [8]

Table 4. shows that in the 2013–2022 period, rice production has increased as a result of agricultural intensification programs such as increasing planting intensity, implementing intercropping, and crop rotation, with the support of irrigation and production technology and facilities, such as agricultural machinery, seeds, fertilizers, and medicines. In this period, rice production increased with an average growth rate of 0.41 percent per year.

Based on Table 5. it can be seen that individual rice consumption has decreased every year with a growth rate of -0.24 percent per year, and the average individual rice consumption is 94.75 kilograms per capita per year. This is due to the success of the food diversification program. While the population has increased every year with a growth rate of 1.16 percent per year. So that the average total rice consumption in South Sumatra is 784,262.89 tons per year.

Table 5 Total Population, Individual Rice Consumption, and Total Rice Consumption in South Sumatra for the 2013-2022 Period

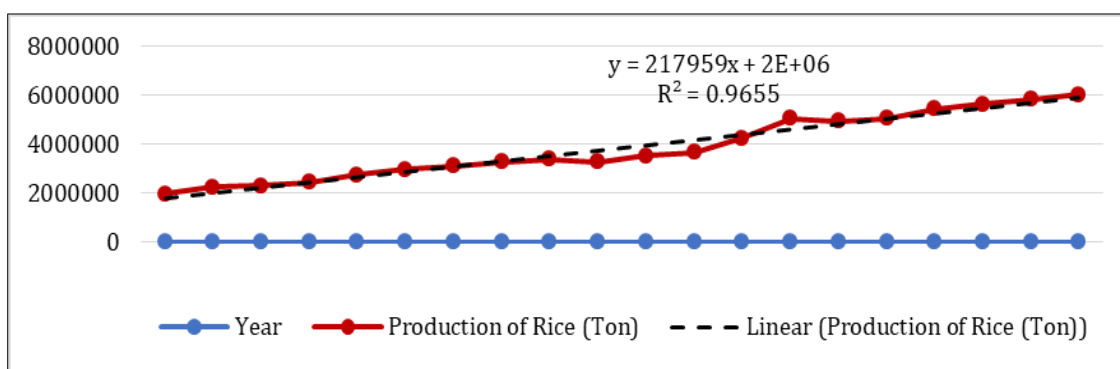
Year	Total population (Soul)	Growth (%)	Rice Consumption (Kg/Cap/Year)	Growth (%)	Total Rice Consumption (Tons)	Growth (%)
2013	7,828,740	1.48%	97.40	-0.25%	762,519.27	1.23%
2014	7,941,495	1.44%	97.20	-0.21%	771,913.31	1.23%
2015	8,052,315	1.40%	96.05	-1.18%	773,424.85	0.20%
2016	8,160,901	1.35%	95.42	-0.66%	778,713.17	0.68%
2017	8,266,983	1.30%	93.70	-1.80%	774,616.30	-0.53%
2018	8,391,489	1.51%	93.30	-0.43%	782,539.78	1.02%
2019	8,497,196	1.26%	92.80	-0.54%	788,539.78	0.77%
2020	8,467,432	-0.35%	92.00	-0.86%	779,003.74	-1.21%
2021	8,550,849	0.99%	94.30	2.50%	806,345.06	3.51%
2022	8,657,008	1.24%	95.30	1.06%	825,012.86	2.32%
Average	8,281,441	1.16%	94.75	-0.24%	784,262.81	0.92%

Source: [8]

3.2. Trends in Rice Production and Consumption in South Sumatra Province

3.2.1. Rice Production Trend in South Sumatra Province 2003-2022

Rice is an important commodity in the province of South Sumatra as a staple food, so rice production is expected to always increase in line with the increasing need for rice consumption. Based on the results of trend analysis using the least squares method, the equation for the trend line of rice production in South Sumatra Province is $Y' = 217959x + 2E + 06$. When viewed from the regression coefficient, the trend of rice production shows a positive value of 217,959, which means that the direction of the trend line of rice production in South Sumatra Province tends to increase. The graph of the trend of rice production in South Sumatra Province from 2003 to 2018 can be seen in the following figure:



Source: Processed secondary data, 2023.

Figure 3 Rice Production Trends in South Sumatra for the 2003-2022 period

In the 2003–2022 period, rice production in South Sumatra Province has shown an increasing trend, namely an increase of 217,959 tons per year from an average production of 3,398,009 tons per year. This fact indicates that rice farmers in the region have been able to manage rice farming better. In addition, there are central and regional government policies that provide subsidies in the form of seeds and fertilizers, as well as the success of agricultural extension workers in supporting the intensification of rice farming.

The increase in rice production is influenced by the area of land, the number of workers, and the price of rice. Land area has a significant effect on rice production, as does the number of workers. The price of rice also has a positive and

significant effect on rice production. The results showed that there was a positive relationship between the total price of rice and rice production. Thus, any increase in the price of rice will lead to higher rice production [11].

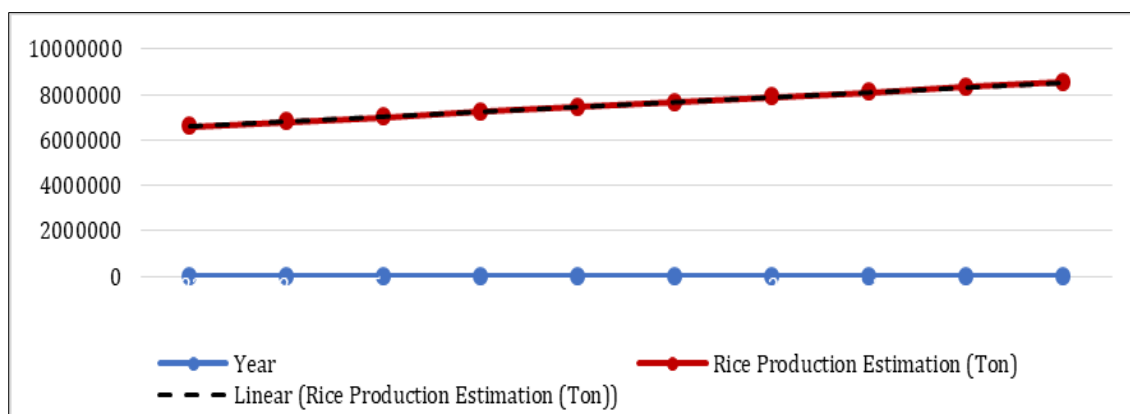
3.2.2. Estimated Rice Production in South Sumatra Province in 2023-2032

Estimation of rice production in South Sumatra Province for 2023–2032 was obtained by trend analysis using the Least Squares method (least squares) through regression based on rice production development data for 2003–2022, so the following trend equation is obtained: $Y' = 217959x + 2E + 06$ with an estimated increase in the amount of rice production each year of 217,959 tons. From this equation, it can be seen that rice production in South Sumatra Province will increase for the years 2023–2032 by replacing the X value that has been set for that year. This equation means that every one-year increment will be multiplied by the value of the line direction coefficient so that the result will be obtained whether the estimated line goes up or down. The X value has previously been converted into notation (1, 2, 3, etc.). Estimated rice production in South Sumatra Province for 2023–2032 is as follows:

Table 6 Estimated rice production in South Sumatra Province in 2023-2032

Year	Year Notation (X)	Production (Y') $Y' = 217959x + 2E + 06$	Growth (%)
2023	21	6,577,139	8.74%
2024	22	6,795,098	3.31%
2025	23	7,013,057	3.21%
2026	24	7,231,016	3.11%
2027	25	7,448,975	3.01%
2028	26	7,666,934	2.93%
2029	27	7,884,893	2.84%
2030	28	8,102,852	2.76%
2031	29	8,320,811	2.69%
2032	30	8,538,770	2.62%
Average			5.28%

Source: Processed secondary data, 2023.



Source: Processed secondary data, 2023.

Figure 4 Estimated Rice Production in South Sumatra for the 2023-2032 period

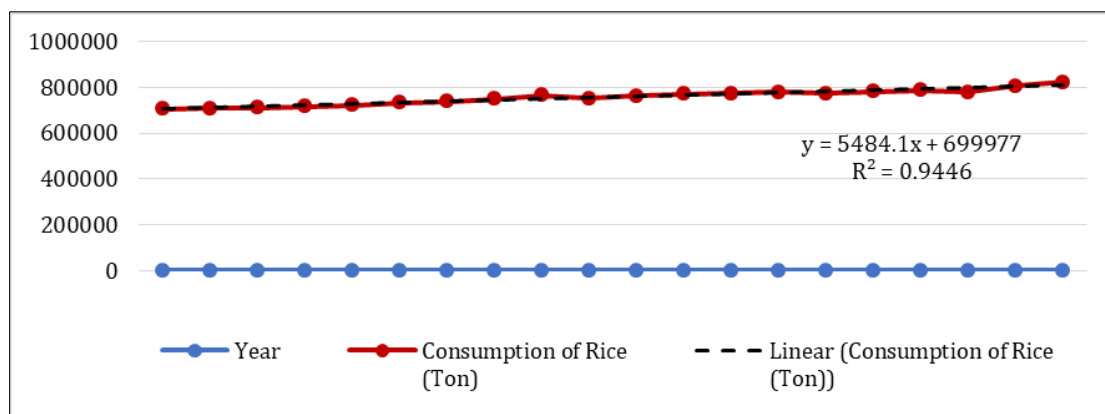
Based on Table 6, it can be seen that the estimated rice production in South Sumatra Province has an average growth of 5.28 percent per year starting from 2023, which is around 6,577,139 tons; in 2024, around 6,795,098 tons; in 2025, approx. 7,013,057 tons; in 2026, approx. 7,231,016 tons; in 2027, approx. 7,448,975 tons; in 2028, approx. 7,666,934 tons; in 2029 to 2032, namely around 7,884,893, 8,102, 852, 8,320,811, and 8,538,770 tons. The graph of estimated rice production in South Sumatra Province in 2023–2032 can be seen in Figure 4.

Based on Figure 4. It can be seen that in the next ten years, rice production in South Sumatra Province will continue to increase from year to year, with an average rice production growth rate of 5.28 percent per year. The increase in rice production is highly expected to achieve self-sufficiency in rice, so in the future it will be necessary to carry out a strategy to prevent a decrease in rice production.

There are several strategies to support increased rice production and achieve self-sufficiency in rice in South Sumatra Province, starting with the utilization of tidal swamp land. South Sumatra has a total rice field area of 470,602 hectares (ha), which is dominated by 212,426 ha of tidal land. However, the problem of swamp land is very diverse. Starting from the condition of the swamp land, the average soil acidity is high, the infrastructure is still limited, and the community culture is still traditional. Thus, it results in being highly dependent on climate, a low cropping index, and low production and productivity. The role of tidal swamp land in the supply of paddy and rice in South Sumatra Province can be increased through five strategies: (1) increased productivity; (2) increase in cropping index; (3) expansion of the planting area; (4) securing yields through the use of tolerant varieties; management of water systems; fertilization; tillage; control of pest organisms; and (5) improving the socio-economic aspects of farmers. The role of these five strategies is to increase the supply of paddy and rice, and swamp land is expected to be the main companion in the utilization of rice cultivation.

3.3. Trend of Rice Consumption in South Sumatra Province in 2003-2022

Based on the results of the analysis using the least squares method, the regression equation for the trend of rice consumption in Central Kalimantan Province is $Y' = 5484.1x + 69997$. The graph of the trend of rice consumption in South Sumatra Province from 2003 to 2022 can be seen in Figure 5.



Source: Processed secondary data, 2023

Figure 5 Trend of Rice Consumption in South Sumatra for the 2003-2022 period

In the 2003–2022 period, rice consumption in South Sumatra Province has shown an increasing trend, with an increase of 5,484.1 tons per year from the average rice consumption, which reached 757,559.94 tons per year. When viewed from the perspective of the difference between production and consumption of rice, there is a surplus of 1,667,457 tons of rice production per year in this region. Therefore, South Sumatra has been able to become a supplier of rice to Indonesia.

Many factors led to an increase in rice consumption in the province of South Sumatra. One of them is the population that grows every year. Support the provincial community. South Sumatra, which prepares rice as a staple food, encourages the notion that rice consumption increases almost every year. Income has a significant effect on rice consumption. Income level affects purchasing power. High purchasing power means more choices for consuming high-quality rice. On the other hand, a decrease in income weakens the quality and quantity of rice purchased. The number of family members can also increase the rice consumption of a household, i.e., the larger the number of households, the higher the household's rice consumption. The level of education also affects rice consumption. The adequacy of rice consumption refers to the fact that households with higher education are able and smarter to choose higher-quality rice for their household consumption compared to households with relatively low or short education. Including efforts to achieve good nutritional status at home. A higher level of education certainly facilitates the acquisition and application of knowledge in daily behavior and lifestyle, especially in fields related to health and nutrition.

3.3.1. Estimation of Rice Consumption in South Sumatra Province in 2023-2032

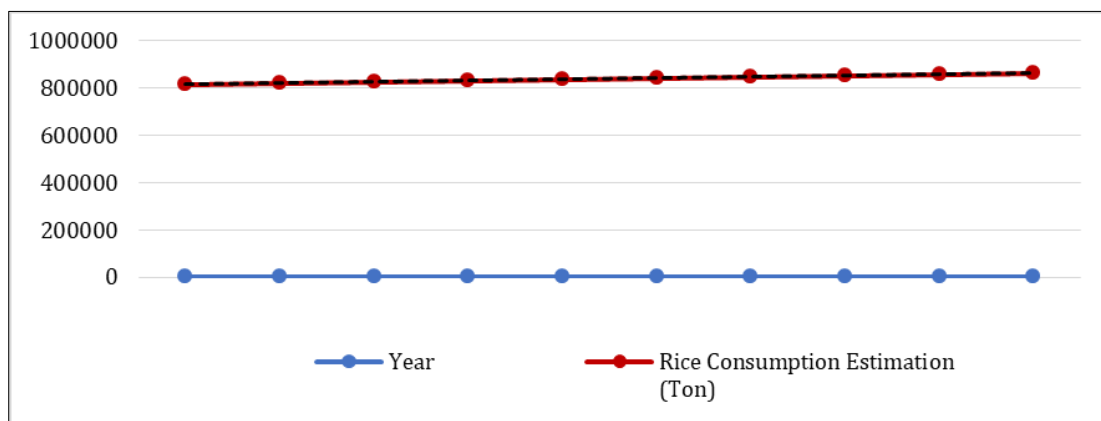
Estimation of fallow consumption in South Sumatra Province for 2023–2032 was obtained by trend analysis using the Least Squares method (least squares) through regression based on data on the development of rice production for 2003–2022, so that the following trend equation is obtained: $Y' = 5484.1x + 69997$ with an estimated increase in the amount of rice consumed each year of 202,432 tons. From this equation, it can be seen that rice production in South Sumatra Province will increase for the years 2023–2032 by replacing the X value that has been set for that year. This equation means that every one-year increment will be multiplied by the value of the line direction coefficient so that the result will be obtained whether the estimated line goes up or down. The X value has previously been converted into notation (1, 2, 3, etc.). Estimated rice production in South Sumatra Province for 2023–2032 is as follows:

Table 7 Estimation of rice consumption in South Sumatra Province in 2023-2032

Year	Year Notation (X)	Consumption (Y') $Y'=5484.1x + 69997$	Growth (%)
2023	21	815143.10	-1.20%
2024	22	820,627.20	0.67%
2025	23	826111.30	0.67%
2026	24	831,595.40	0.66%
2027	25	837,079.50	0.66%
2028	26	842,563.60	0.66%
2029	27	848047.70	0.65%
2030	28	853,531.80	0.65%
2031	29	859,015.90	0.64%
2032	30	864,500.00	0.64%
Average			0.47%

Source: Processed secondary data, 2023.

Based on Table 7. it can be seen that the estimated rice consumption in South Sumatra Province has an average growth of 0.47 percent per year starting from 2023, which is around 815143.10 tons; in 2024, approx. 820,627.20 tons; in 2025, approx. 826111.30 tons; in 2026, approx. 831,595.40 tons; in 2027, approx. 837,079.50 tons; in 2028, approx. 842,563.60 tons; in 2029 to 2032, namely around 848,047.70, 853,531.80, 859,015.90, and 864,500.00 tons. The graph of estimated rice consumption in South Sumatra Province in 2023–2032 can be seen in Figure 6.



Source: Processed secondary data, 2023

Figure 6 Estimated Rice Consumption in South Sumatra for the 2023-2032 period

The results of the estimated rice consumption estimation equation show that the provisional estimates are as expected. Figure 3.6 shows that the direction of the trend line is straight from the bottom left to the top right, which means that in the next ten years rice consumption in South Sumatra Province will continue to increase every year with an average

rice consumption growth rate of 0.70 percent per year. This can happen because the population of South Sumatra and the demand for rice in South Sumatra Province continue to increase almost every year. Based on existing data, the population in South Sumatra Province from 2003 to 2022 has increased almost every year (as can be seen in the attachment), so an increase in population can increase consumption of rice, bearing in mind that rice is the staple food of the population of South Sumatra Province, thus enabling a continuous increase. continuous consumption of rice in South Sumatra Province in 2023–2032.

3.4. The Implications for Rice Self-Sufficiency in South Sumatra Province

Rice self-sufficiency will be achieved if rice production can meet the consumption needs of the region. Rice production is obtained through the conversion of paddy to rice with a yield value of 63.75 percent plus the use of rice plants for non-food purposes and the use of non-food rice.

Based on the results and discussion, it can be seen that the Province of South Sumatra can be said to be experiencing self-sufficiency in food for the rice commodity until 2022 because paddy and rice production can meet the rice consumption needs of the population. Even until 2022, South Sumatra Province will experience a rice surplus that can be used for the following year.

Likewise, based on the estimation results obtained, within a period of ten years (2023–2032), rice production will continue to increase from year to year. Likewise, rice consumption also increases every year but tends to be stable. It can be interpreted that in 2023–2032, it is estimated that the Province of South Sumatra will experience a rice surplus, which means that the Province of South Sumatra will achieve food self-sufficiency for the rice commodity in 2023–2032. However, in reality, South Sumatra Province still supplies rice from various regions in Indonesia.

According to the South Sumatra Trade and Industry Office, it is necessary to supply rice from other regions to meet the various market tastes for rice. In addition, according to Bulog, the rice that is supplied needs to be stored as a stock or reserve in anticipation of unwanted things in the future, such as crop failure or natural disasters. In addition, rice marketing activities produced by residents of South Sumatra are sold to collectors from other areas, such as Lampung Province. There are no rice processing factories other than those in Bulog that will produce rice with a trademark from South Sumatra so that collectors from outside the area can easily buy rice from residents of South Sumatra Province. Then the purchased rice will be processed into packaged rice and given the trademark of their respective regions (e.g., Lampung Province) and will be resold to the territory of South Sumatra Province. This is a possible cause for the loss of the amount of rice production in the field during post-harvest, so it might result in the South Sumatra Province having to supply rice from other regions because rice from the South Sumatra Province indirectly belongs to other regions.

Of course, in order to achieve self-sufficiency, there are many things that must be considered and carried out in order to increase rice production. The following are efforts that can be made in the long term to achieve self-sufficiency in rice in South Sumatra Province, namely: 1) expanding the planting area, such as (a) Overcoming problems caused by land conversion; (b) Printing of new paddy fields in South Sumatra, which are centers of rice production, because it is estimated that there is idle land, most of which are located in central areas that have land conditions suitable for rice cultivation; (c) Optimizing land and increasing the planting index; (d) Improving the system of giving incentives to farmers so that they are right on target; 2) The population and GRDP of South Sumatra, the increase in population, and people's welfare have caused the need for the type and quality of food products to increase and vary. Controlling the consumption of this population can be approached by setting consumption per capita. Therefore, one of the targets of the ministry of agriculture is to decrease consumption by 1–5 percent per year, offset by increased consumption of tubers, animal foods, fruits, and vegetables; increase and Improve irrigation infrastructure; and increase productivity and technological innovation.

4. Conclusion

The results of the research conducted can be summarized as follows: 1) The development of rice production and consumption in South Sumatra Province tends to increase from year to year. Over a period of 20 years (2003–2022), rice production growth in South Sumatra Province was 6.20 percent per year. This figure is greater than the growth in rice consumption in South Sumatra Province of 0.47 percent per year. The average growth in rice production and rice consumption was 2,081,494.57 tons and 757,559.94 tons per year, respectively. Therefore, in general, rice production in 2003–2022 will be able to cover rice consumption in South Sumatra Province. South Sumatra Province has been able to be self-sufficient in rice, with a rice surplus of 1,323,935 metric tons per year. 2) The trend of rice production and rice consumption in South Sumatra Province in 2003–2022 was to increase, with an average growth in rice production of 5.96 percent and rice consumption of 0.82 percent per year. The trend line shows the movement of the line from the

bottom left to the top right, which explains that the average value of paddy production and rice consumption in South Sumatra Province in 2003–2022 tends to increase. In addition, rice production also determines rice production by converting the paddy into rice. In line with rice production, which tends to increase almost every year, rice production also tends to increase almost every year. Until 2022, South Sumatra Province will still experience a surplus of rice because the total production of rice still exceeds the total consumption of rice by the population, namely 1,323,935 tons. 3) Estimated rice production and rice consumption in South Sumatra Province for 2023–2032. It is known that in the next ten years, from year to year, rice production will continue to increase, with an average growth of estimated rice production and rice consumption of 5.28 percent and 0.47 percent per year, respectively.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors declare that there is no conflict of interest.

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