


Rice Availability Analysis in Kutai Kartanegara Regency 2023-2032

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 Submitted: 2023-05-22; Accepted: 2023-06-09; Published: 2023-06-25

Abstract— East Kalimantan Province is one of the provinces with rice self-sufficiency agenda. Kutai Kartanegara is a regency in East Kalimantan Province with an area of 18659 ha of rice fields and is the largest rice supplier in the East Kalimantan region. So far there has been no research that examines the level of rice availability partially in the districts of East Kalimantan Province. This study aimed to predict population growth and the level of rice food security in Kutai Kartanegara Regency in 2023-2032. Develop various possible policy scenarios to achieve rice food security in Kutai Kartanegara Regency in 2023-2032. This research was conducted in the scope of Kutai Kartanegara Regency. The treatment of the research location was carried out purposively (purposive method) from April to May 2023. This research focused on one food commodity, namely rice. The results showed that Kutai Kartanegara Regency is predicted to experience a rice deficit in 2023-2032 with an average deficit of 32836.47 tons. Implementation of the existing rice field intensification policy can reduce the rice deficit that will occur until 2032 by 55%. The implementation of the new paddy field policy can reduce the rice deficit that will occur by up to 92%. The combination of the two land intensification policies and the creation of new rice fields can make Kutai Kartanegara Regency experience a surplus of rice until 2032 with an average surplus of 15613.86 tons.

Keywords— Food, Rice, Paddy, rice fields, Population

I. INTRODUCTION

Food is a basic need that cannot be replaced to sustain human life. Adequate food availability is very important because food is a primary need that cannot be postponed in everyday life. In Indonesia, the importance of food security is a policy in UU RI NO 18, (2012) concerning Food, the Law it is stated that Food Security is "a condition for fulfilling Food for the country up to individuals which are reflected in the availability of sufficient food, both quantity and quality. , safe, diverse, paid, equitable, and affordable and does not conflict with the religion, beliefs, and culture of the community, to be able to live a healthy, active and productive life sustainably”..

Rice is still a staple food for most of the population in Indonesia. Data shows that the average per capita consumption of rice in Indonesia reaches 139.15

kilograms per year, with the amount of rice consumed directly by households of around 100.76 kilograms per year. Based on the estimated population of Indonesia in 2022, which is reach 273,879,750 people, multiplied by the average annual per capita need for rice of 139.15 kilograms, the need for rice will reach hundreds of millions of tons per day (Jiuhardi, 2023). This indicates the high demand for rice in Indonesia to meet the food needs of the population.

East Kalimantan Province, like most of Indonesia's people, makes rice a daily staple food. According to data from the Central Statistics Agency (2021), the average per capita rice consumption in East Kalimantan reaches 89.5 kilograms per year, higher than the national average of 81.60 kilograms per year. In 2025, the population of East Kalimantan is predicted to increase from 3.7 million in 2019 to 5.3 million due to plans for East Kalimantan to become Indonesia's new capital. With this significant population growth, the demand for rice in 2025 is expected to exceed 535,000 tons. (Adi, et al., 2021). According to (Supriadi, (2021) East Kalimantan's rice production capacity is only sufficient for 1,316,433 people, far from meeting the needs of all East Kalimantan people, totaling 3,721,400 people.

East Kalimantan Province is one of the provinces on the agenda to achieve rice self-sufficiency, as stated in the 2013-2018 East Kalimantan RPJMD in the East Kalimantan Governor Regulation Number 50 of 2016. The indicator for achieving rice self-sufficiency proclaimed by East Kalimantan Province under governor regulations is the ratio of rice needs fulfillment by 85 percent. Until now, this policy is still relevant to use considering that in the Regional Regulation of the Province of East Kalimantan Number 2 of 2019 concerning the RPJMD of the Province of East Kalimantan for 2019-2023, it continues to strive for food self-sufficiency and realize food security, especially rice. This policy is also supported by the establishment of three locations for rice commodity development areas in East Kalimantan, according to the Ministry of Agriculture (2018) mentioned above, namely Kutai Kartanegara Regency, North Penajam Paser Regency, and Paser Regency (Handani, et al., 2021).

In August 2019, the President of Indonesia announced plans to move the nation's capital from Jakarta to East Kalimantan Province. The new capital city of Indonesia will be located in parts of North Penajam Paser Regency

and parts of Kutai Kartanegara Regency (KOMINFO, 2019). One important aspect that needs to be considered regarding the capital city move is the availability of rice in the areas that will host the new capital, in this case, Kutai Kartanegara Regency and North Penajam Paser Regency. To find out the availability of rice in an area, it is necessary to know the level of rice consumption and the population in that area. The need for rice consumption is an important aspect to measure how much rice is needed to meet the consumption needs of the population in accordance with the existing population. This condition causes the number of needs for rice consumption cannot be separated from the population in a region (Sari, 2018). According to Santoso (2016), Population is an important factor for measuring the need for rice in a region, the greater the population, the greater the consumption of rice in that region.

So far, studies on the availability of rice in East Kalimantan Province have focused on the area of East Kalimantan Province in general. There is no research that examines the level of rice availability partially in districts. Meanwhile, the main supplier of rice in the East Kalimantan region is at the district level. Apart from being one of the areas designated as the location for the development of rice commodities in East Kalimantan (Ministry of Agriculture RI, 2018), Kutai Kartanegara Regency is also the largest rice-producing area in East Kalimantan. In 2021, KUKAR contributes 40% of the total rice production in East Kalimantan (East Kalimantan BPS, 2022).

Kutai Kartanegara Regency is one of the regencies located in East Kalimantan with an area of 27263,10 square kilometers. It is divided into eighteen districts namely: Samboja, Muara Jawa, Sanga-Sanga, Loa Janan, Loa Kulu, Muara Muntai, Muara Wis, Kota Bangun, Tenggara, Sebulu, Tenggara Seberang, Anggana, Muara Badak, Marangkayu, Muara Kaman, Kenohan, Kembang Janggut dan Tabang (BPS Kutai Kartanegara, 2022). The standard area of rice fields in Kutai Kartanegara Regency is based on the Decree of the Minister of Agrarian Affairs and Spatial Planning/Head of the National Land Agency number 686/2019 concerning the Determination of the Area of National Rice Field Standards in 2019, which is 18659 ha (BAPEDA KALTIM Province, 2020).

Based on the description above, it is important to analyze the availability of rice in Kutai Kartanegara Regency in the next few years to obtain information related to rice food conditions that will occur in Kutai Kartanegara Regency as part of the new Republic of Indonesia Capital region which is also the largest rice supplier for the East Kalimantan province. The purpose of this study is to predict population growth and the level of rice food security in Kutai Kartanegara Regency in 2023-2032. develop various possible policy scenarios to achieve rice food security in Kutai Kartanegara Regency in 2023-2032. This research is expected to be a source of information for policy makers in Kutai Kartanegara Regency. to make a rice food security policy in Kutai Kartanegara Regency ahead of the move to the capital city

of the Republic of Indonesia in 2024

II. METHODOLOGY

This research was conducted in the scope of Kutai Kartanegara Regency regarding the availability of rice. The research location planning was carried out purposively (purposive method) with the consideration that Kutai Kartanegara Regency is the largest producer and supplier of rice in East Kalimantan Province. The research was conducted from April to May 2023. In this study, the analysis focused on food self-sufficiency for one food commodity, namely rice. According to Supriadi (2021), among various food commodities, the availability of rice production and consumption data is more sufficient for analysis.

A. Data Types and Sources

The type of data used in this research is secondary data obtained through various literature studies and from related institutions. Complete types and sources of data in this study can be seen in Table 1

Table 1. Main data types and sources

Data Type	Data source	Year
Total population	East Kalimantan in Numbers. BPS	2012-2022
Paddy Production and Harvested Area	East Kalimantan in Numbers. BPS	2012-2022
Consumption of rice	Central Bureau of Statistics	2017

B. Processing and analysis of data

1. Population Projection

To determine the projected population growth of a certain area, it is necessary to collect data on the population growth of that area for at least the last three years. After the population data is obtained, the population growth rate can be calculated using the formula in equation (1):

$$\text{Population Growth Rate} = \frac{(\text{Year B Population} - \text{Year A Population})}{\text{Year A Population}} \quad (1)$$

Population data were obtained from the Central Bureau of Statistics of East Kalimantan Province, collected from 2012 to 2022. After obtaining the data, population trends can be analyzed and compared over the selected period. To estimate the rate of population growth one year ahead, assumptions can be made based on the difference in population growth from one year to the next. After obtaining the average difference in population growth over the last five years, it can be assumed that the population growth rate will increase by the difference in the average population growth over the last five years.

2. Rice Availability

In this study, the analysis of rice availability used the guidelines outlined in the Regulation of the Minister of Agriculture Number 43/Permentan/OT.140/&/2010

concerning Guidelines for Food Security and Nutrition Systems. The equation (2) to (4) used to calculate the need for rice is as follows:

$$\text{Seed Requirement (s)} = P \times 0.9\% \quad (2)$$

$$\text{Animal Feed Requirement (f)} = P \times 0.44\% \quad (3)$$

$$\text{Loss and Spillage (w)} = P \times 5.4\% \quad (4)$$

Calculation of grain shrinkage aims to change the change of grain into milled rice. This conversion considers losses due to the use of rice as animal feed, rice spilled or lost during the milling process, and the utilization of some rice as seed for further planting. (Pratama, et al., 2019).

Furthermore, the calculation of net rice production (Rnet) is carried out using the Food Security Agency Guidelines (2014), which can be seen in equations (5) and (6):

$$P_{\text{net}} = P - (s + f + w) \quad (5)$$

$$R_{\text{net}} = C \times P_{\text{net}} \quad (6)$$

Where (5) (6)

Q: Rice production

C: Conversion of paddy into rice (63%)

P_{nett}: Net paddy production (kg)

R_{nett}: Net rice production (kg) C: 0.632 (kg)

3. Rice Needs

Rice demand analysis was carried out by processing statistical data in the form of the population of Kutai Kartanegara Regency and the conversion of the rice consumption needs of the Indonesian population per year per capita. The equation used can be seen in equation (7):

$$\text{Rice Consumption Needs} = \text{Population} \times 113.48 \text{ kg/capita/year} \quad (7)$$

The value of 113.48 kg/capita/year is a standard measure of rice consumption needs per capita set by BPS (2017). This value indicates that each need 113.48 kg of rice per year. This study assumes that everyone has the same rice consumption needs. The assumption used is that the availability of rice in a region is entirely used to meet the demand for rice consumption in that region. If the availability of rice is greater than the need for rice consumption, then the area is considered to have sufficient rice supply. However, if the availability of rice is lower than the need for rice consumption, then the area is considered to have a shortage of rice supply. (Abdullah, et al., 2022).

C. Research Stages

The research was conducted by collecting secondary data from agencies with population data, production data, rice harvest area and regional consumption. After the data has been collected, data analysis is then carried out to obtain prediction results for the population, rice availability and rice demand in Kutai Kartanegara Regency until 2023. After that, several policy scenarios

are compiled that might be implemented by the government so that the availability of rice in Kutai Kartanegara Regency is in a surplus state. until 2032. The stages of this research can be seen in Figure 1

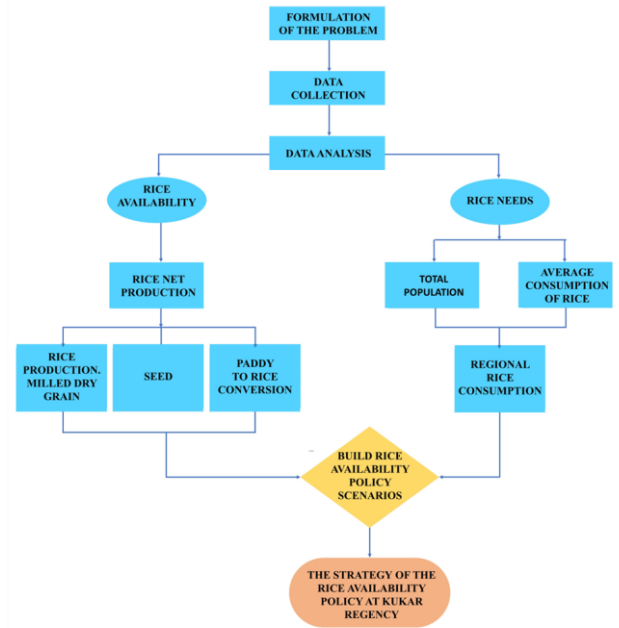


Figure 1. Stages of Research Activities

III. RESULTS AND DISCUSSION

A. Total Population of Kutai Kartanegara Regency in 2012-2022

Based on population data obtained from 2012 to 2022 from the Central Bureau of Statistics, the population of Kutai Kartanegara Regency has continued to increase from 665,489 people in 2012 to 786,100 people in 2019. The population has decreased from 786,100 people in 2019 to 729,382 people in 2020. The population will start to increase again from 2020 to 2022, this increase will reach 738,190 people in 2022. The population of Kutai Kartanegara Regency from 2012 to 2022 can be seen in Figure 2.

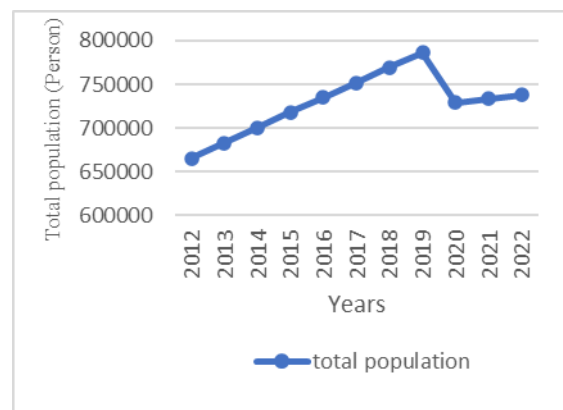


Figure 2. Graph of the Total Population of Kutai Kartanegara Regency in 2012-2022

B. Availability of Rice Food in Kutai Kartanegara Regency in 2012-2022

Food is the most important basic need for humans, and the fulfillment of food is a basic right for every citizen according to the Law of the Republic of Indonesia No. 18 of 2012. Based on the results obtained (Figure 3), the condition of rice in Kutai Kartanegara Regency experienced a surplus from 2012 to 2017, even though there was a deficit in 2016. But in 2017 it was returned to a surplus condition. The trend of rice surplus in Kutai Kartanegara Regency from 2016 to 2017 shows a decreasing trend. On the other hand, the increasing population has led to a significant increase in rice consumption. As a result, from 2018 to 2022, the availability of rice will no longer be sufficient to meet the consumption needs of the people of Kutai Kartanegara Regency. In other words, the district experienced a rice deficit during this period, with an average deficit of 21,599.51 tons per year.

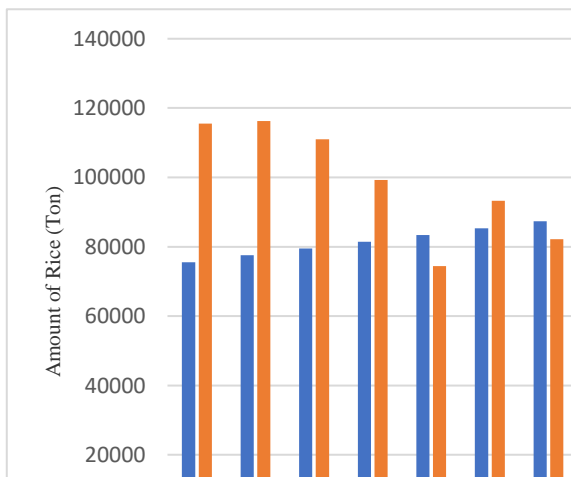


Figure 3. Conditions of Rice Food Availability in Kutai Kartanegara Regency in 2012-2022

C. Prediction of Population and Rice Consumption in the Kutai Kartanegara Regency in 2023-2032

Rice is a strategic food commodity whose availability needs to be guaranteed because it can affect economic conditions and national development and requires intervention from the government. So far, the food adequacy of the Indonesian people has been predominantly fulfilled from rice as the main food commodity (Santosa & Sudrajat, 2017).

Regional rice consumption refers to the amount of rice consumed by the population of a specific area during a certain period. It encompasses the total amount of rice consumed by individuals, households, or the community in that region. Based on the obtained results (Table 2), the estimated rice consumption in Kutai Kartanegara Regency for the year 2023 is 84,380.51 tons, and it will continue to increase as the population grows. By the year 2032, the predicted rice consumption in Kutai Kartanegara Regency is 107,703.49 tons.

Table 2. Prediction of Population and Rice Consumption of Kutai Kartanegara Regency in 2023-2032

Year	Number of Population (Person)	Rice Consumption Region (Tons)
2023	743572	84380.51
2024	752004	85337.42
2025	763578	86650.79
2026	778422	88335.32
2027	796707	90410.35
2028	818649	92900.28
2029	844510	95835.03
2030	874609	99250.63
2031	909323	103189.92
2032	949097	107703.49
Average	823047,1	93399,37

D. Prediction of Rice Food Availability in Kutai Kartanegara Regency in 2023-2032

Rice availability refers to the quantity of rice that is available in the market or a specific area during a certain period. It encompasses the supply of rice that is accessible for consumption by individuals, households, or the community. Sufficient rice availability is crucial to meet food needs and ensure food security. Inadequate rice supply can lead to rice scarcity, price hikes, and hunger.

The calculation of rice availability in 2023 is based on the data of paddy production in Kutai Kartanegara Regency in 2022, which amounted to 106,117.23 tons. It is hoped and assumed that there will be no changes or decrease in paddy production from 2023 to 2032. However, considering the trend observed during the period from 2012 to 2022, paddy production in Kutai Kartanegara Regency has shown a declining trend. The decreasing productivity of paddy can be observed in (Figure 3) on the rice availability graph.

Based on the calculation of rice availability, it is determined that the rice availability in Kutai Kartanegara Regency in 2023 is 60,562.91 tons. It is assumed that this value will remain constant until 2032. Based on the analysis of the data (Table 3), it is determined that Kutai Kartanegara Regency will experience a rice deficit condition of -23,817.61 tons in 2023. The rice deficit condition in Kutai Kartanegara Regency will continue to occur and increase over time, with the rice deficit reaching -47,140.58 tons in 2032. The average annual rice deficit is estimated to be -32,836.47 tons.

Table 3. Prediction of Rice Food Availability in Kutai Kartanegara Regency in 2023-2032

Year	Rice Consumption Region (Tons)	Availability of Rice (Tons)	Surplus/Deficit (Tons)
2023	84380.51	60562.91	-23817.61
2024	85337.42	60562.91	-24774.51
2025	86650.79	60562.91	-26087.89
2026	88335.32	60562.91	-27772.41
2027	90410.35	60562.91	-29847.44
2028	92900.28	60562.91	-32337.37
2029	95835.03	60562.91	-35272.13
2030	99250.63	60562.91	-38687.72
2031	103189.92	60562.91	-42627.02
2032	107703.49	60562.91	-47140.58
Average	93399.37	60562.91	-32836.47

The rice deficit condition that will occur in Kutai Kartanegara Regency certainly requires special attention from the local government if they do not want to continuously remain in a vulnerable food situation, with the average percentage of vulnerability expected to increase over time. To address the rice deficit issue, several strategic scenarios can be implemented by policymakers, including: (1) Land intensification, (2) Land extensification, and (3) A combination of both scenarios.

E. Scenario 1. Existing Paddy Field Intensification Policy

Intensification refers to efforts aimed at maximizing the utilization of existing agricultural land. Initially, agricultural intensification was pursued through the Panca Usaha Tani program, which later evolved into Sapta Usaha Tani. Sapta Usaha Tani is a package consisting of 7 types of activities, namely: 1. Use of superior seeds, 2. Good land preparation, 3. Proper irrigation water management, 4. Fertilizer application, 5. Pest and disease control, 6. Harvest and post-harvest handling, 7. Marketing of harvest products (Salasiah, et al., 2016). The implementation of Sapta Usaha Tani is expected to increase rice productivity by up to 30% compared to previous production levels.

Based on the analysis of data regarding the food security situation of rice in Kutai Kartanegara District after implementing scenario 1 (Tabel 4). The results indicate that the rice deficit condition during the period of 2023-2032 can be reduced by 55%. Previously, the predicted rice food security condition for the years 2023-2032 showed an average rice deficit of -32,836.47 tons. However, after implementing scenario 1, the average rice deficit condition decreased to -14,667.60 tons compared to the condition without the scenario.

Table 4. Prediction of Rice Food Availability in Kutai Kartanegara Regency in 2023-2032 After Scenario 1 Policy is implemented

Year	Rice Consumption Region (Tons)	Availability of Rice (Tons)	Surplus/Deficit (Tons)
2023	84380.51	78731.78	-5648.73
2024	85337.42	78731.78	-6605.64
2025	86650.79	78731.78	-7919.01
2026	88335.32	78731.78	-9603.54
2027	90410.35	78731.78	-11678.57
2028	92900.28	78731.78	-14168.50
2029	95835.03	78731.78	-17103.25
2030	99250.63	78731.78	-20518.85
2031	103189.92	78731.78	-24458.14
2032	107703.49	78731.78	-28971.71
Average	93399.37	78731.78	-14667.60

F. Scenario 2. Land Extensification: Printing of New Paddy Fields

To achieve sustainable food security, efforts to increase rice production need to be continued and enhanced. Increasing rice production can be achieved by improving productivity by implementing better varieties

and cultivation techniques. Additionally, expanding the cultivated area through increased planting intensity and the establishment of new paddy fields is also necessary.

Paddy field printing is done to increase the harvested area of paddy fields so that rice production can also increase. Scenario 2 is carried out by printing new rice fields which cover 50% of the existing rice fields so that rice production also increases by 50% with the condition that the productivity of the rice fields to be printed is the same as the productivity of the existing rice fields and there is no conversion of paddy fields.

Based on the results of data analysis regarding the condition of rice food security in Kutai Kartanegara Regency after carrying out scenario 2 (Table 5). obtained the result that. The policy of printing new rice fields of 50% of the existing rice fields with the assumption that rice production will increase by 50% of rice production in 2022 will cause 2023-2027 Kutai Kartanegara Regency will experience a surplus of rice with an average surplus of 3821.48. However, in the following year, namely in 2028, Kutai Kartanegara Regency will again experience a rice deficit of -2055.92 tons and will continue to increase until 2032, the rice deficit will reach 16859.13 tons. If the scenario 2 policy is carried out by the district government, the rice deficit can be reduced by 92%.

Table 5. Prediction of Rice Food Availability in Kutai Kartanegara Regency in 2023-2032 After Scenario 2 Policy is implemented

Year	Rice Consumption Region (Tons)	Availability of Rice (Tons)	Surplus/Deficit (Tons)
2023	84380.51	90844.36	6463.85
2024	85337.42	90844.36	5506.94
2025	86650.79	90844.36	4193.57
2026	88335.32	90844.36	2509.04
2027	90410.35	90844.36	434.01
2028	92900.28	90844.36	-2055.92
2029	95835.03	90844.36	-4990.67
2030	99250.63	90844.36	-8406.27
2031	103189.92	90844.36	-12345.56
2032	107703.49	90844.36	-16859.13
Average	93399.37	90844.36	-2555.01

G. Skenario 3. Combination of All Scenarios

Of the several previous scenarios that the government of Kutai Kartanegara Regency could do to reduce the rice deficit, it turns out that these two scenarios have not been able to bring Kutai Kartanegara Regency out of a rice deficit condition until 2032. The combination of the two previous scenarios can be done, namely, the Government creates new paddy fields by land area of 50% of the existing paddy fields in Kutai Kartanegara Regency provided that no conversion of paddy fields occurs. And carry out land intensification on all paddy fields including newly minted paddy fields.

Based on the results of data analysis regarding the condition of rice food security in Kutai Kartanegara Regency after scenario 3 was carried out (Table 6). The results show that if scenario 3 is carried out, Kutai Kartanegara Regency will experience a surplus of rice from 2023-2032. In 2023 the rice surplus will reach

24632.72 tons, and in 2032 the rice surplus will be 1309.74 tons.

Table 6. Prediction of Rice Food Availability in Kutai Kartanegara Regency in 2023-2032 After Scenario 3 Policy is Implemented

Year	Rice Consumption Region (Tons)	Availability of Rice (Tons)	Surplus/Defisit (Ton)
2023	84380.51	120336.93	24632.72
2024	85337.42	120336.93	23675.81
2025	86650.79	120336.93	22362.44
2026	88335.32	120336.93	20677.92
2027	90410.35	120336.93	18602.89
2028	92900.28	120336.93	16112.95
2029	95835.03	120336.93	13178.20
2030	99250.63	120336.93	9762.60
2031	103189.92	120336.93	5823.31
2032	107703.49	120336.93	1309.74
Average	93399.37	120336.93	15613.86

Scenario 3 policy if carried out will indeed make Kutai Kartanegara Regency in a rice surplus condition until 2032. However, implementing this scenario is not easy, it requires support from various parties, especially from the central government to the regions in terms of financial assistance to technology. Support from researchers, especially in the agricultural sector, is also very much needed in terms of creating research and even the latest discoveries that can increase rice production in the Kutai Kartanegara Regency. Studies related to the quality of existing paddy fields are also needed to obtain up-to-date information about the current condition of the rice fields in Kutai Kartanegara Regency. Support from the lowland rice farmers is also very much needed as a party that will apply the technology later.

IV. CONCLUSION

Kutai Kartanegara Regency has experienced a rice deficit since 2018 and will continue until 2032. This rice deficit can be reduced by up to 55% if the government of Kutai Kartanegara Regency implements a policy of intensifying paddy fields with the assumption that rice production will increase by 30% after implementing this policy. By implementing a policy of printing new rice fields covering 50% of the existing rice fields, it can reduce the rice deficit by up to 92%, assuming the production of new rice fields is the same as the existing rice fields and there is no land conversion during the implementation of this policy. The implementation of a combination policy of intensifying paddy fields and printing new rice fields can make Kutai Kartanegara Regency experience a surplus of rice until 2032.

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