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A STUDY ON MAPPING THE POTENTIAL OF RICE PRODUCTION IN BANGGAI REGENCY

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ABSTRACT

The background of this research is the need to improve regional food security amidst conditions where land degradation, land use changes, and reduced labor can disrupt the proper exploitation of agricultural resources. This study aims to analyze the potential of rice as a food crop in Banggai Regency, Central Sulawesi, which is focusing on the harvested area, production, productivity, and production base by sub-district. Research data were collected from the Central Statistics Agency (BPS, 2024) and the Food Crops, Horticulture, and Plantation Service of Banggai Regency. The analytical approach uses descriptive statistics to describe the harvested area, production, and productivity of rice, and the Location Quotient (LQ) to determine the main production base. The results of this study indicate that West Toili District has the largest harvested area (12,035 hectares), followed by Toili (11,605 hectares) and Moilong (5,038 hectares). Toili is the largest rice-producing district (67,309 tons) with an average productivity of 5.80 tons/ha. Toili, West Toili, Moilong, and Masama are the main rice production bases with LQ values > 1.00, with other sub-districts contributing to lower distribution. Less productive sub-districts need to improve cultivation technology and irrigation networks, thereby providing production facilities. Mapping can be used as a strategic reference for local governments in developing agricultural policies to achieve sustainable food security.

Keywords: Rice, Potential Mapping, Productivity, Location Quotient.

INTRODUCTION

The primary principle in implementing comprehensive and integrated regional development is the ability to identify existing regional potential for development through various development program inputs. One strategy currently available for regional economic development through the agricultural sector is the development of superior regional commodities.

Banggai Regency, part of Central Sulawesi Province, covers an area of 9,672.70 km^2 and possesses substantial natural resource potential spreadout across

24 sub-districts. However, these resources have not been managed optimally. In several rice production centers, such as Toili and Batui Sub-districts, land is no longer intensively cultivated, and many young households have chosen to work in the oil and gas industry or migrate. Furthermore, several villages have reported a decline in the economic well-being of farming households. Several factors contribute to this, including the neglect of agricultural land due to labor losses (Jiang and Song, 2022), deteriorating socioeconomic conditions (Meyfroidt et al., 2016), and environmental constraints (Deng et al., 2018; Ojha et al., 2022), which have led to a significant decline in food production and threats to food security 2023).

Increasing food demand will require higher agricultural yields in the near future (Foley et al., 2011). Other cumulative factors putting pressure on agricultural production include urban expansion, land degradation, extreme weather events, water scarcity, and others (Behera et al., 2018; Ewert et al., 2005). These pressures impact natural ecosystems, water and energy balances, and cause landscape degradation at multiple scales (Matin et al., 2019; Rey Benayas and Bullock, 2012), underscoring the need for monitoring land use change to facilitate sustainable land management (Schwilch et al., 2011).

These global challenges are increasingly evident in regions such as Banggai, where agricultural land plays a central role in supporting local food supply, making any disruption to land conditions or production capacity a direct threat to household and regional food security. Food access, food security, and food production have been key factors driving human progress since ancient times, often resulting in conflict and peace negotiations. The current global situation has heightened food-related concerns to unprecedented levels. To ensure sufficient and high-quality food supplies, special attention must be paid to crop production, as well as to the timely and accurate monitoring of crops. Accurate agricultural mapping (crop mapping and land use mapping) is crucial for supporting decision-makers in creating optimal policies that ensure food security (Blickensdörfer et al., 2022).

Based on this, research on Food Crop Potential Mapping in Banggai Regency is highly appropriate. This mapping is conducts to reconcile existing planning documents with current economic conditions, as well as supporting facilities and infrastructure. Therefore this study aims to (1) analyze the characteristics of rice crop potential in Banggai Regency based on land area, production, and productivity; and (2) analyze the rice crop production base in each sub-district within Banggai Regency.

RESEARCH METHODS

This study was conducted in the subdistricts of Banggai Regency. Banggai Regency is a lowland area with an average elevation of 84 meters above sea level, located between 00°30'–02°22' South Latitude and 122°23'–124°20' East Longitude. Geographically, Banggai Regency comprises 23 districts: Toili, Toili Barat, Moilong, Batui, Batui Selatan, Bunta, Nuhon, Simpang Raya, Kintom, Luwuk, Luwuk Timur, Luwuk Utara, Luwuk Selatan, Nambo, Pagimana, Bualemo, Lobu, Lamala, Masama, Mantoh, Balantak, Balantak Selatan, and Balantak Utara (BPS, 2024).

The research employs agricultural data on food crops in Banggai Regency, specifically harvested area, production, and rice productivity (BPS, 2024). The analysis maps these data across districts to generate insights that support government decision-making which aims to improve both the quantity and quality of rice production. Mapping food crop potential uses several analyses:

1. To achieve the first objective (analysing the characteristics of rice production potential in Banggai Regency based on land area,

production, and productivity), the study applies descriptive statistical analysis. The data obtains from the Banggai Regency Office of Food Crops, Horticulture, and Plantation.

2. To achieve the second objective (analysing the production base of food crops in each district of Banggai Regency), the study applies Location Quotient (LQ) analysis, with data also sourced from the Banggai Regency Office of Food Crops, Horticulture, and Plantation.

The Location Quotient (LQ) analysis uses to identify food crop groups. The analysis helps to conclude specific crop clusters, to identify trends, and to address agricultural needs. The calculation of LQ analysis as follows: (1) calculate the percentage of local production in a specific sector, (2) calculate the percentage of national production in the same sector, and (3) divide the percentage of local production by the percentage of national production in the same sector.

$$LQ = \frac{Si/Ni}{S\ /\ N}$$

Description:

Si : Total Food Crop Production X in District (i)

Ni : Total Food Crop Production in District (i)

S : Total Food Crop Production x in Banggai Regency

N : Total Food Crop Production in Banggai Regency

The LQ value provides information on two important conditions: 1) An LQ greater than 1 (one) indicates that the sector is an export activity and is an important link to the external economy (the Regency). 2) An LQ less than 1 (one), specifically 0.75 or less, indicates that the sector does not meet local needs and there may be gaps in local production. Our analysis of the sustainability of superior food crops uses linear trend analysis with the Linear Regression Algorithm.

RESULTS AND DISCUSSION

Characteristics and Potential of Rice Crops Based on Harvested Area

Rice is a major commodity in Banggai Regency, with the largest harvested area in West Toili District (12,035 hectares), followed by Toili District (11,605 hectares), and Moilong District (5,038 hectares). Other districts, such as South Batui, Batui, and Masama, also make significant contributions, with a total harvested area of 46,083.81 ha in Banggai Regency. Rice is the dominant crop and the foundation of food security in Banggai Regency. The potential for rice development is substantial, given that West Toili, Toili, and Moilong have significant harvested areas and relatively good agricultural infrastructure. Optimizing agricultural technology and irrigation systems can increase rice production in these areas. Graphical analysis can provide a more precise visualization of the distribution of rice-harvested areas across districts. The following graphical analysis can be explained based on Figure 1.

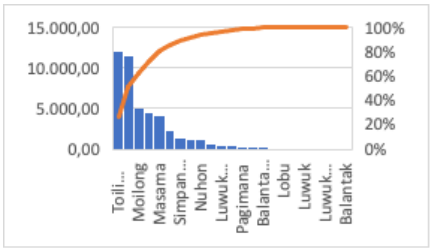

Figure 1. Pareto Diagram for Rice Harvest Area, 2023

Figure 1 illustrates the distribution of rice harvested area across districts. West Toili District registers the largest harvested area, markedly surpassing that of all other districts. The figure further highlights that

rice harvesting is concentrated in several districts endowed with adequate infrastructure and land potential. Moreover, Figure 1 underscores the role of West Toili and Toili as the primary rice production centers in Banggai Regency, each recording harvested areas exceeding 11,000 hectares. Although Moilong and South Batui Districts also demonstrate considerable potential, their harvested areas remain substantially lower than those of the two leading districts. The figure further reveals that opportunities for expanding harvested areas lie in districts with less than 4,000 hectares, particularly from Batui to Lobu (Figure 1).

Characteristics and Potential of Rice Crops Based on Production

Toili District is the largest rice producer, producing 67,309 tons of GKP, followed by West Toili District (63,785.5 tons), and Moilong District (27,709 tons). This indicates that these areas have optimal conditions for rice production, both in terms of land and climate. Conversely, several districts, such as Kintom, Luwuk, North Luwuk, South Luwuk, Nambo, and Balantak, have no recorded rice production. Graphical analysis can provide a more precise visualization of the distribution of rice production across districts. The following graphical analysis can be explained based on Figure 2.

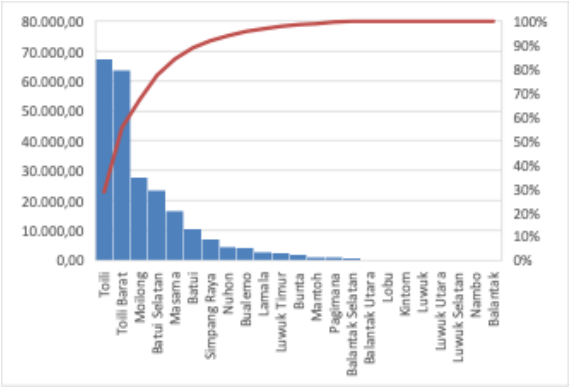

Figure 2. Pareto diagram for rice production, 2023

Figure 2 displays a Pareto diagram of rice production by district in Banggai Regency in 2023. Pareto diagrams generally aims to visualize the distribution of production by showing the contribution of each district to total rice production in the area. The Pareto diagram illustrates the 80/20 principle, where the majority of rice production typically originates from a small number of sub-districts. In contrast, most other sub-districts contribute only a small portion to the total production. Figure 2 highlights several key points:

Sub-districts with the Highest Production: Based on the pattern in the Pareto diagram, several sub-districts contribute the largest share of rice production (Toili, West Toili, and Moilong). This indicates significant potential in certain areas with better agricultural conditions, in terms of land, soil quality, water availability, and agricultural infrastructure. These sub-districts can be a primary focus for rice development. Furthermore, to ensure increases in rice production, the strategic position must be maintained.

Production Inequality Between Sub-districts: Figure 2 also highlights the inequality between sub-districts in terms of their contribution to rice production. Some sub-districts face constraints, including limited access to water, less fertile soil conditions, or suboptimal agricultural technology. Therefore, these areas require special attention from local governments and policymakers to increase their production capacity, whether through technical assistance, irrigation, or other policies that support rice cultivation.

Agricultural Planning and Management: By identifying which sub-districts contribute most to rice production, the local government can focus more on optimizing resources in those areas. For example, sub-districts with potential land can receive more assistance in the form of modern agricultural technology, fertilizers, and superior seeds. Furthermore, effective optimization of production results requires

consideration of infrastructure such as irrigation and transportation.

Impact on the Regional Economy: Banggai Regency relies heavily on rice production to support food security and the local economy. Sub-districts with high rice production (Toili, Toili Barat, Moiling, Batui, Batui Selatan, Bunta, Nuhon, Simpang Raya, Luwuk Timur, Nambo, Pagimana, Bualemo, Lobu, Lamala, Masama, Mantoh, Balantak Selatan, Balantak Utara) become centers of the agricultural economy, driving regional economic progress. Economic growth is driven by the agricultural sector, supported by policies that encourage production efficiency, commodity diversification, and the use of technology.

Production Increase Strategy: For sub-districts (Kintom, Luwuk, Luwuk Utara, Luwuk Selatan, Nambo, Balantak) with lower production, a production increase strategy typically involves several key elements. First, an in-depth study of the problems faced, both agronomically and socioeconomically, is necessary. After that, developing agricultural technology, providing access to superior seeds, and providing training for farmers can be crucial steps to increasing production.

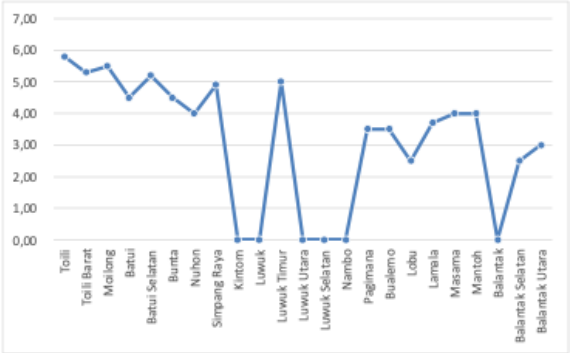

Figure 3. Rice Productivity, 2023

Figure 3 illustrates the variation in rice productivity across districts in 2023. Figure 3 shows that Toili District have the highest productivity at 5.80 tons/ha, followed by Moilong with 5.50 tons/ha, and West Toili with 5.30 tons/ha. This productivity indicates that these areas have significant potential for rice production in Banggai Regency. Conversely, several sub-districts have lower productivity, such as South Balantak and North Balantak, which only reached 2.5 tons/ha and 3 tons/ha, respectively. In fact, several areas, such as Kintom, Luwuk, North Luwuk, South Luwuk, Nambo, and Balantak, have no rice crops at all during this period. Based on this data distribution, it can be concluded that the potential for rice production in Banggai Regency varies significantly between sub-districts, which is influenced by geographic conditions, water availability, soil type, and access to agricultural technology. Areas with high productivity can serve as examples for other regions to increase production through optimizing cultivation techniques or implementing agricultural innovations.

Rice crop production base

Rice production base listed in Table 1

Kecamatan	LQ			
	2016	2019	2023	Total
Toili	**1,14**	**1,31**	**1,16**	**1,21**
Toili Barat	**1,18**	**1,51**	**1,28**	**1,33**
Moilong	**1,17**	**1,50**	**1,21**	**1,30**
Batui	**1,13**	**1,04**	0,91	**1,02**
Batui Selatan	**1,11**	**1,05**	0,78	0,96
Bunta	0,26	0,16	0,28	0,23
Nuhon	0,59	0,70	0,44	0,59
Simpang Raya	0,97	0,61	0,86	0,77
Kintom	-	-	-	-
Luwuk	-	-	-	-
Luwuk Timur	0,91	0,99	0,48	0,80
Luwuk Utara	-	-	-	-
Luwuk Selatan	-	-	-	-
Nambo	-	-	-	-
Pagimana	0,40	0,29	**1,03**	0,40
Bualemo	0,71	0,60	0,66	0,61
Lobu	-	-	0,25	0,03
Lamala	0,79	0,80	0,83	0,81
Masama	**1,18**	**1,45**	**1,27**	**1,30**
Mantoh	0,43	0,26	0,50	0,34
Balantak	-	-	-	-
Balantak Selatan	-	-	0,16	0,05
Balantak Utara	-	-	0,42	0,05

Table 1 shows that Toili, West Toili, Moilong, and Masama Districts consistently have LQs above 1.00, indicating that these four districts are significant centers for rice production in Banggai Regency. In 2016, Toili had an LQ of 1.14, which increased to 1.31 in 2019; however, it experiences a slight decline to 1.16 in 2023. West Toili, Moilong, and Masama also shows a similar trend to Toili District. In contrast, Batui and South Batui Districts show a decline. Batui had an LQ of 1.13 in 2016, but this gradually decreased to 1.04 in 2019 and 0.91 in 2023. Similarly, South Batui District experienced a decline in LQ. The results indicate that the contribution of these two districts to rice production is decreasing, both comparatively and in terms of production quantity.

Bunta, Nuhon, and Simpang Raya Districts: These three districts have an LQ below 1.00, which means that rice production in these areas is lower compared to other areas in Banggai Regency. Bunta shows fluctuations with an LQ of 0.26 in 2016, dropping to 0.16 in 2019, but then rising again to 0.28 in 2023. Nuhon experienced similar fluctuations, from 0.59 in 2016 to 0.70 in 2019, then dropping to 0.44 in 2023. Simpang Raya, although not

significant, shows an increase in LQ of 0.97 in 2016, followed by a decrease to 0.61 in 2019, and then rose to 0.86 in 2023.

Pagimana District showed a significant increase from an LQ of 0.40 in 2016 to 1.03 in 2023, indicating significant growth in rice production in the region. Bualemo District, meanwhile, experienced slight fluctuations with an unstable LQ, but remained between 0.60 and 0.71. Mantoh has a low LQ of 0.43 in 2016, 0.26 in 2019, and a slight increase to 0.50 in 2023.

Lobu District only received LQ data in 2023, with a value of 0.25, which is still low. North Balantak and South Balantak also only received data in 2023, with LQs of 0.42 and 0.16, respectively, indicating their relatively minor role in rice production in Banggai Regency. Overall, districts with LQs above 1.00, such as Toili, West Toili, Moilong, and Masama, indicate that these areas are the main bases for food crop production, particularly rice, in Banggai Regency. Meanwhile, other districts with lower LQs tend to require intervention or improvements in agricultural infrastructure to strengthen their contribution to rice production (Figure 4).

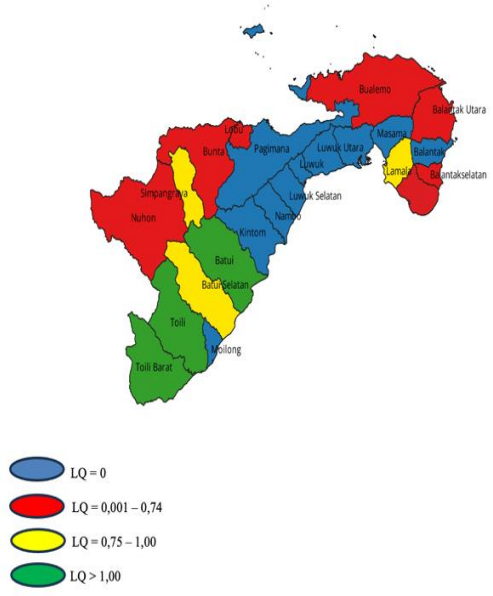

Figure 4. Rice base in Banggai Regency

CONCLUSION

Toili District has the highest productivity of 5.80 tons/ha, followed by Moilong with 5.50 tons/ha and West Toili with 5.30 tons/ha. This productivity shows that this area has great potential for rice production in Banggai Regency. Conversely, several sub-districts have lower productivity, such as South Balantak and North Balantak, which only achieve 2.5 tons/ha and 3 tons/ha, respectively. Sub-districts with lower production require in-depth studies to address the issues they face, both agronomically and socio-economically. Developing agricultural technology, providing access to superior seeds, and offering training to farmers can be crucial steps in increasing production. These areas require special attention from local governments and policymakers to enhance their production capacity through technical assistance, irrigation, and other policies that support rice development. Toili, West Toili, Moilong, and Masama sub-districts consistently have LQs above 1.00, indicating that these four sub-districts are significant centers for rice production in Banggai Regency. Batui sub-district also serves as a rice production base, albeit at a lower level.

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