

Mapping of Leading Commodities in the Agricultural Sector in Buol Regency Using a Geographic Information System

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Abstract

The agricultural sector is an important sector in a region because it is the main milestone of the community's economy, including in Buol Regency. This study aims to analyze and map the distribution of the agricultural base sector in Buol Regency with the help of Geographic Information System (GIS) analysis. The research method used is a quantitative descriptive approach with Location Quotient (LQ) analysis techniques, localization analysis, and specialization analysis. The analysis is supported by primary data and secondary data obtained from various sources, both government and private agencies. The results of the LQ analysis show that rice fields and corn are the main commodities that have the widest distribution of advantages, while other commodities tend to be superior in certain regions. Localization analysis shows that all agricultural commodities have a relatively even distribution pattern and are not concentrated in one area. Meanwhile, the analysis of specialization shows that only paddy rice is classified as a special commodity, while other commodities have not shown a high level of regional specialization. Thus, it can be concluded that paddy rice is a commodity based on the agricultural sector in Buol Regency which is spread almost throughout the sub-district.

Keywords: agricultural sector, Location Quotient, localization, specialization, GIS



INTRODUCTION

The agricultural sector is an important part of regional economic development, especially in areas where the economy is still heavily dependent on the primary sector. Agriculture has a crucial role in providing food, absorbing the labor force, and increasing the income of rural communities. To maximize the agricultural potential in an area, planning based on local potential is needed so that the development of commodities carried out can be competitive and sustainable (Todaro & Smith, 2015; Tarigan, 2014).

Buol Regency, which is located in Central Sulawesi Province, has the ability in terms of soil resources and agricultural climate that can support the progress of various types of agricultural products. However, the agricultural sector in this region still faces the problem of a lack of spatial information that shows the distribution and advantages of agricultural commodities as a whole. This results in existing agricultural policies that have not been fully prepared based on regional characteristics and local potential of each sub-district (BPS Buol Regency, 2021).

Determining the main product is a crucial step in planning the development of the agricultural sector in an area. The main product is a type of commodity that has relative advantages and can play a big role in having an impact on the regional economy. Determining the right key products can be the basis for setting priorities in agricultural development, resource distribution, and increasing the effectiveness of development programs (Tarigan, 2014; Widiatmaka et al., 2016). Rahman (2015) argues that land use planning that focuses on superior commodities is a type of planning that can be applied in the decision-making process to implement agricultural land use plans, especially in areas with very high agricultural potential. However, the main commodity products in a region need to be supported by technology that can identify the location points that are the basis in each region in the form of geographic information system technology.

The development of Geographic Information Systems (GIS) opens up significant opportunities in supporting the analysis of agricultural potential based on the region. GIS allows the combination of spatial data with attribute data, so that it can be used to evaluate the geographical distribution of agricultural commodities and find areas that have advantages compared to certain commodities (Prahasta, 2014; Longley et al., 2015). GIS is an information system that manages data with geographic coordinates, which has the ability to combine various land resource data (Suryani & Tarigan, 2019). The use of Geographic Information Systems in mapping key commodities has been proven to be successful in aiding a more precise decision-making process in the development of the agricultural sector (Zein & Arsyad, 2018). The GIS approach was chosen because it is

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able to integrate spatial data and attribute data so that it can provide comprehensive, accurate, and easy-to-understand information in supporting regional agricultural sector development planning.

Although many studies have been conducted on the mapping of superior commodities using GIS, studies that specifically map superior commodities in the agricultural sector in Buol Regency are still very few. In addition, there has not been much research that integrates the analysis of commodity advantages with a spatial approach at the sub-district level. Therefore, the purpose of this study is to map the leading commodities of the agricultural sector in Buol Regency through the use of Geographic Information Systems. It is hoped that the results of this study will provide appropriate spatial information as a basis for planning and decision-making in sustainable agricultural development in the area.

RESEARCH METHODS

Location and time of the study

This research was carried out in Buol Regency, Central Sulawesi Province. Administratively, Buol Regency consists of several sub-districts with different regional characteristics and agricultural potential. The stages of research include data collection, data processing, analysis, and preparation of research results.

Types And Data Sources

The data used in this study consisted of spatial data and attribute data. Spatial data is in the form of administrative maps of the Buol Regency area that have geographical references, while attribute data is in the form of non-spatial data that describes the characteristics of agricultural commodities, including harvest area, production, and productivity at the sub-district level. All data used are secondary data obtained from the Central Statistics Agency (BPS) of Buol Regency in 2012-2022, the Buol Regency Agriculture Office, and the Regional Development Planning Agency (Bappeda) of Buol Regency. In addition, this study also utilizes administrative maps from the Geospatial Information Agency (BIG) or related agencies as well as relevant literature and previous research results as data to support the analysis.

Data Methods and Analysis

This study uses a quantitative descriptive approach with a spatial analysis method based on Geographic Information System (GIS). A descriptive approach was used to

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describe the condition and potential of leading commodities in the agricultural sector in Buol Regency, while spatial analysis was used to map the geographical distribution of agricultural commodities based on administrative areas.

Determination of Superior Commodity

The determination of superior commodities is carried out using the **Location Quotient (LQ)**. This method is used to identify commodities that have a comparative advantage in a region compared to the wider region.

Rumus Location Quotient (LQ):

$$LQ = \frac{(P_{ij}/P_i)}{(P_j/P)}$$

Description:

- P_{ij} = Commodity production in sub-districts ji
- P_i = Total production of all commodities in the sub-district i
- P_j = Commodity production in Buol Regency j
- P = Total production of all commodities in Buol Regency

LQ assessment criteria:

- $LQ > 1$: Leading commodities (base)
- $LQ = 1$: Commodities are quite superior
- $LQ < 1$: Non-Flagship Commodities

Localization Analysis

This analysis was used to measure the distribution or relative concentration of commodities in Buol Regency. The formula used for localization analysis is:

$$\alpha = (v_i/V_i) - (v_t/V_t)$$

where :

v_i = land area or commodity production at the sub-district level

V_i = land area or commodity production at the district level

V_T = total land area or commodity production at the sub-district level

v_t = total land area or commodity production at the district level

α = localization coefficient

The localization coefficient is obtained by adding $(v_i/V_i) - (v_t/V_t)$ which is marked positive, with the following conditions:

$\alpha \geq 1$: commodities are concentrated in one region, and



$\alpha < 1$: Commodities spread in several regions

Specialization Analysis

This analysis is used to see Buol Regency's specialization in commodities with the following formula:

$$\beta = (en/vt) - (Vi/Vt)$$

where :

v_i = land area or commodity production at the sub-district level

V_i = land area or commodity production at the district level

VT = total land area or commodity production at the sub-district level

Vt = total land area or commodity production at the district level

B = specialization coefficient

The specialization coefficient is obtained by adding $(v_i/vt) - (V_i/Vt)$ which is marked positive with the conditions:

$\beta \geq 1$: a region specializing in commodities

$\beta < 1$: Not Specialized

Analysis of Geographic Information Systems

Spatial analysis was carried out using arcgis software version 10.8. to classify agricultural commodities based on the Location Quotient (LQ) value so that commodities that are classified as superior in each sub-district can be identified. Furthermore, spatial analysis was used to describe the distribution pattern of superior commodities in all sub-districts in Buol Regency.

RESULTS AND DISCUSSION

Analysis of the leading commodities of the agricultural sector of food crops.

The results show that the agricultural commodities produced in Buol Regency are quite diverse, especially in the food crop sector. These products exist in almost every sub-district in Buol Regency. Even so, each sub-district has different superior commodities, which are influenced by the large role of the community in developing these commodities. The results of the analysis of the leading commodities of food crops in Buol Regency can be seen in Table 1.



Table 1. Results of analysis of Agricultural Superior Commodities in Buol Regency

Commodities	Districts										
	Lakea	Karamat	Biau	Momunu	Tiloan	Bukal	Bokat	Bunobogu	Gadung	Paleleh Barat	Paleleh
Corn	.02	1.09	.67	0.36	0.98	.01	.71	0.73	1.41	1.70	.07
Rice Paddies	1.13	0.77	1.78	2.54	1.16	1.16	1.69	1.65	0.02	0.00	0.83
Soybeans	0.00	0.00	4.32	0.00	0.69	3.68	7.78	0.00	0.00	0.00	0.15
Peanuts	1.31	2.67	0.00	0.07	0.49	10.55	0.48	0.59	0.00	0.00	0.72
Green Beans	0.00	28.41	0.00	0.00	0.00	0.00	2.03	1.25	0.00	0.00	0.00
Sweet Potato	4.87	3.96	0.00	0.81	0.48	0.00	1.41	0.23	0.00	0.00	3.40
Cassava	0.00	4.62	0.00	0.94	0.90	1.26	1.65	1.35	0.00	0.00	3.48

The results of the LQ calculation show that corn is the leading commodity in several sub-districts, namely Lakea (1.02), Karamat (1.09), Bukal (1.01), Gadung (1.41), West Paleleh (1.70), and Paleleh (1.07). The high value of LQ in West Paleleh District indicates that corn production in the area is quite concentrated compared to other areas, so it has the potential to become a center for corn production.

Rice paddy commodities show the widest distribution of excellence among sub-districts. LQ values that exceeded one were recorded in Lakea (1.13), Biau (1.78), Momunu (2.54), Tiloan (1.16), Bukal (1.16), Bokat (1.69), and Bunobogu (1.65) Districts. Momunu District recorded the highest LQ value, which indicates that paddy rice is a major mainstay commodity with a strong level of specialization in the Location. This finding indicates the strategic role of paddy fields as the main commodity in the agricultural structure of the region studied, in accordance with the results of other studies that show rice as the driving force of the local agricultural economy (Jafar and Meilvidiri, 2021).

In soybean commodities, comparative advantage was only detected in a few sub-districts, such as Biau (4.32), Bukal (3.68), and Bokat (7.78). The relatively high LQ value, especially in Bokat District, reflects a significant concentration of soybean production. This reflects the pattern of specialization in the area, where soybean development will be more effective if directed to sub-districts with high LQ values.

Peanut commodities showed a very prominent advantage in Bukal District with an LQ value of 10.55, while Lakea (1.31) and Karamat (2.67) Districts showed a more moderate advantage. The very high LQ value in Bukal indicates the existence of a strong



production specialization, so this sub-district has the potential to be developed as a peanut center. Meanwhile, mung bean commodities displayed a highly focused pattern of specialization, with the highest LQ value in Karamat District (28.41), followed by Bokat (2.03) and Bunobogu (1.25). The high LQ value in Karamat District shows that mung beans are the main commodity that is very dominant and has the potential to become a flagship in the region.

In the tuber commodity group, sweet potatoes are the main commodity in Lakea (4.87), Karamat (3.96), Bokat (1.41), and Paleleh (3.40) Districts. On the other hand, cassava showed an LQ value above one in Karamat (4.62), Bukal (1.26), Bokat (1.65), Bunobogu (1.35), and Paleleh (3.48) Districts. These findings show that tubers have a significant role as the main commodity in certain sub-districts.

Overall, the LQ analysis shows that paddy fields and corn are the leading commodities with a fairly wide distribution of bases among sub-districts. In contrast, other commodities such as soybeans, peanuts, and mung beans tend to show strong patterns of specialization. This pattern emphasizes the importance of the direction of development of the agricultural sector in the area studied, which should be focused on strengthening mainstay commodities in each sub-district to increase production efficiency, encourage the development of commodity centers, and strengthen the contribution of the agricultural sector to the regional economy (Sofiana and Sari, 2022). The results of commodity distribution based on the LQ calculation are shown in Figure 1.

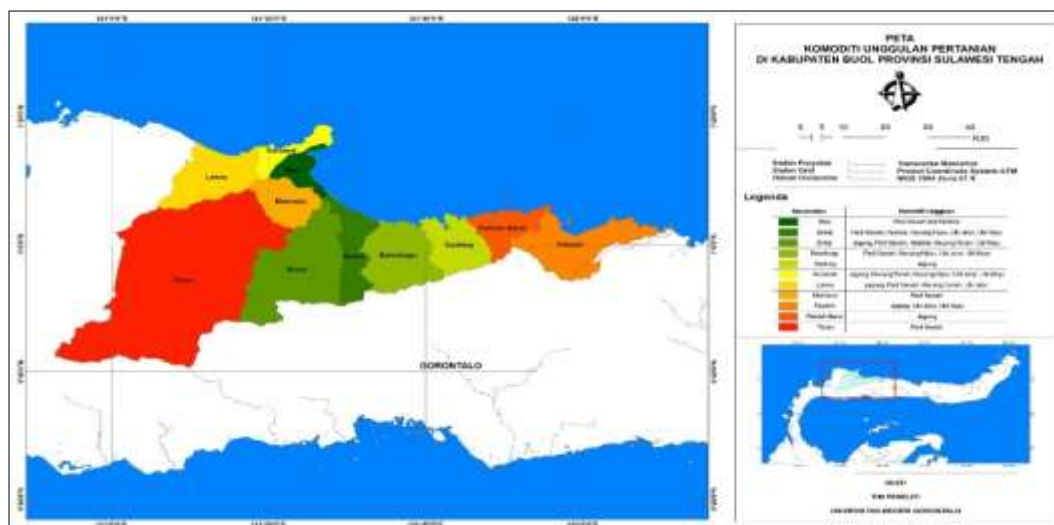


Figure 1. Distribution Map of Leading Commodities in Buol Regency

Localization Index and Specialization Index Analysis

Analysis of localization and specialization shows that the distribution pattern of all food crop commodities tends to be evenly distributed among different regions. This can be seen from the value of the localization index for all commodities included in the dispersed category. This situation suggests that food crop production is not focused on a specific area, but is spread across many sub-districts, so there is no strong dominance in one particular area. The results of the analysis of the localization index coefficient and the specialization index coefficient of the competitiveness and excellence of corn and paddy rice commodities in Buol Regency are described in table 2.

Table 2. Analysis of the Localization Index and the Agricultural Sector Specialization Index in Buol Regency

Commodities	Locationization		Spesialisasi	
	Value	Category	Value	Category
Corn	0.1432	Spread	0.3836	Not Special
Rice Paddies	0.3449	Spread	1.0710	Special
Soybeans	0.7702	Spread	0.0031	Not Special
Peanuts	0.6893	Spread	0.0030	Not Special
Green Beans	0.8355	Spread	0.0012	Not Special
Sweet Potato	0.5363	Spread	0.0009	Not Special
Cassava	0.4341	Spread	0.0006	Not Special

The results of the analysis showed that only rice fields were classified as a special commodity, with a specialization index value of 1.071. Meanwhile, corn, soybeans, peanuts, mung beans, sweet potatoes, and cassava are classified as non-special because they have a low specialty index value. These findings show that the agricultural structure of the study area tends to be diversified, with paddy rice as the main commodity that has a dominant role, while other commodities function as supporting commodities in the regional agricultural system.

CONCLUSION

Paddy rice and maize stand out as the primary superior commodities, with a fairly uniform distribution across regions, according to the LQ analysis, localization, and specialization results. While some degree of regional specialization is evident in the case



of paddy rice, this is not the case for all food crop commodities. A diverse agricultural system with paddy rice as its key commodity is shown in this state.

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