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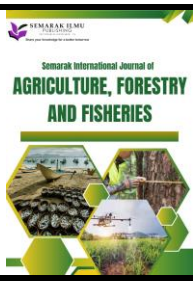

Analysis of Location Quotient of Cassava Commodity Potential Areas in North Sumatera

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ABSTRACT

The research was designed to identify the superior agricultural commodities in each regency and city within North Sumatra province. A descriptive research method was utilized to systematically describe and analyze the existing conditions in the region. The selection of North Sumatra as the research location was carried out deliberately, using a purposive sampling approach to ensure that the study focused on a region with diverse agricultural activities. The data collection process involved conducting surveys that relied on secondary data sources, which were systematically recorded and obtained from relevant government agencies and other authoritative databases. The collected data provided a comprehensive overview of agricultural production across the various regions within North Sumatra. For data analysis, the study employed the Location Quotient (LQ) analysis approach, a well-established method for assessing the relative concentration of specific economic activities within a region compared to a broader reference area. The LQ analysis is particularly useful in identifying whether a sector is a base sector (with an LQ greater than 1), indicating surplus production for export, or a non-base sector (with an LQ less than 1), where production primarily meets local demand. The results of the LQ analysis revealed that 17 regencies and cities within North Sumatra have a base sector, indicating strong agricultural production with potential for export. In contrast, 15 regencies and cities were identified as having a non-base sector, where agricultural production is largely geared towards meeting local needs, with limited surplus for export.

1. Introduction

Agricultural development serves as a fundamental pathway to enhance regional income and create prosperous living conditions for the population. The strategic utilization of natural resources and the optimization of regional potential are essential components of development plans that can achieve multiple objectives simultaneously. Among the various sectors contributing to development, agriculture stands out as one of the most pivotal. It plays a crucial role in driving economic growth, ensuring food security and promoting sustainable livelihoods, especially in rural areas where agriculture is often the primary source of income [1].

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One of the most critical segments within agriculture is the food crop sector. Food crops form the backbone of human sustenance as they are the primary source of energy. The diversity in food crops provides a range of carbohydrates necessary for human consumption, with cereals and tubers being the most significant contributors to the global food supply. In Indonesia, the government has prioritized the cultivation and production of four key food crops: rice, corn, soybeans and cassava. These crops are integral to the country's food security strategy, ensuring that the growing population has access to a stable and sufficient food supply [2].

The availability of food crops is paramount to meeting the nutritional needs of the population in a sustainable manner. Sustainable agriculture practices, coupled with effective management of food crop production, are crucial to maintaining a balance between supply and demand. This is particularly important in a country like Indonesia, where the agricultural sector plays a significant role in the economy and the livelihoods of millions of people [3].

North Sumatra province is a prime example of a region with substantial potential in food crop production, particularly cassava. As one of the leading cassava production centres in Indonesia, North Sumatra boasts a cultivation area of approximately 30,000 hectares, with an average productivity level of around 12 tons per hectare. Cassava, along with sweet potatoes, holds immense potential for development, especially in drylands and farmlands that are not suitable for rice cultivation due to limited irrigation. The region's diverse land typology which includes lowlands, highlands, flat terrains and hilly topographies provides an ideal environment for cassava cultivation. This adaptability to various land conditions makes cassava a highly valuable crop for the region's agricultural development [4].

To effectively plan and manage cassava production in North Sumatra, the Location Quotient (LQ) method is commonly employed. The LQ method is a well-established analytical tool used to determine the concentration of a particular commodity or activity within a region. It helps policymakers and researchers identify areas where specific commodities are predominant, allowing for targeted interventions and resource allocation. The LQ method is particularly efficient in evaluating the agricultural potential of multiple regions, enabling the identification of base areas that serve as production hubs [5].

The application of the LQ method in agricultural planning is grounded in economic theory, particularly in the analysis of comparative advantage. By using LQ, researchers can identify commodities that are superior in terms of supply, whether in production volume, land area or productivity. In the context of soil-based products such as food crops, horticultural crops and field crops, the calculation is based on metrics such as the area of land cultivated, the quantity of crops harvested or the overall productivity of the land [6].

In North Sumatra, the LQ method is applied to assess the productivity of food crops across various regencies and cities. This analysis is critical in identifying superior commodities in each region, allowing for the development of targeted strategies to enhance agricultural productivity and sustainability. By focusing on regions with a high LQ for specific crops, policymakers can allocate resources more effectively, support the growth of key agricultural sectors, and ultimately contribute to the overall economic development of the province [7].

The identification of superior commodities through the LQ method also has broader implications for regional development. It enables the creation of specialized production zones that can serve as centres of excellence for specific crops. These zones can attract investment, foster innovation and promote best practices in agriculture, leading to increased productivity and higher incomes for farmers. Moreover, the development of such zones can create job opportunities, reduce poverty and enhance food security, contributing to the overall well-being of the population [8].

2. Methodology

The research method employed in this study was descriptive in nature. Descriptive research is characterized by the ability to systematically and logically outline the stages and steps of the research process [9,10]. In this approach, the researcher meticulously explains the progression of the research, ensuring that each stage is connected coherently with the others. Unlike other research methodologies, descriptive research does not involve hypothesis testing. This means that no hypotheses are proposed or tested within the scope of this study [11,12].

The selection of the research location was done purposively, with a deliberate focus on North Sumatra as shown in Figure 1. The purposive sampling technique ensured that the research was concentrated on an area that is highly relevant to the study's objectives.

Fig 1. Map of North Sumatra

Data collection in this study relied on secondary data, which was systematically recorded and obtained directly from pertinent government agencies. The data collection process involved conducting surveys that gather essential information and knowledge. This included the acquisition of concepts, theories, models and frameworks that were drawn from a variety of sources such as journals, papers, research reports and books. These sources provided comprehensive discussions relevant to the research problem being investigated.

The data utilized in this study was a time-series data, encompassing annual records from 2017 to 2021, spanning a period of five years. The secondary data was sourced from documents provided by the Central Statistics Agency of North Sumatra and the Food Crops and Horticulture Office of North Sumatra province. This data formed the basis for analyzing trends and patterns in the region's agricultural sector, providing insights that were crucial for the study's objectives. The use of such comprehensive and systematically collected data ensured the reliability and validity of the research findings.

2.1 Data Analysis

The determination of agricultural commodities produced by each district in North Sumatra into the categories of basic (superior) and non-basic (non-superior) food crops was achieved using the LQ analysis. This method is an essential tool in regional economic studies, helping to identify which commodities hold a comparative advantage in specific areas. The LQ analysis allows for a clear distinction between commodities that are produced in sufficient quantities to meet local demand (non-basic) and those that are produced in excess, contributing to exports and broader economic growth (basic or superior).

According to Rachmat Hendayana [13], the LQ formula is instrumental in this classification process. It is expressed through a specific equation that compares the ratio of a commodity's production in a particular district to the total production of that commodity in the broader region. This ratio is then compared to the same ratio for the overall region. If the LQ value exceeds 1, the commodity is considered a basic (superior) sector, indicating a specialization in that commodity within the district. Conversely, an LQ value below 1 indicates a non-basic (non-superior) sector using the Eq. (1):

$$LQ = \frac{Pi/Pt}{Pi/Pt} \tag{1}$$

where,
LQ = Value Location Quotient sweet potato plant wood in Regency / City, North Sumatra province.
Pi = Value of planting/production area of cassava plants at level Regency / City at North Sumatra Province (Hectare).
Pt = The total value of the area planted/produced by food crop commodities at the level of regency at North Sumatra province (Hectare).
Pi = Value of planting/production area of cassava plants at the level of North Sumatra province.
Pt = Total value of planting/production area of food crop commodities at the provincial level of North Sumatra (Hectare).

Indicator,

i. LQ > 1, meaning that the food crop sub-sector commodity is a base commodity. The production of food crop sub-sector commodities is able to meet the needs of its own region and the surplus can be sold to other regions.
ii. LQ = 1, meaning that the commodity is a base commodity. The production of commodities in the food crop sub-sector is only able to meet the needs of its own region and cannot be sold to other regions.

iii. LQ < 1, meaning that the sub-sector commodities of food crops are non-base commodities. The production of commodities in the food crop sub-sector unable to meet the needs of their own region and their shortcomings are fulfilled from outside the region.

3. Results and Discussion

LQ analysis is a widely used tool in regional economic studies to identify which sectors within an economy are core sectors with export potential and which sectors are not. The LQ method provides a quantitative measure that compares the relative concentration of a particular economic activity in a specific region to a broader reference area, typically the national or regional economy. When the LQ value for a sector is greater than one (LQ > 1), it indicates that the sector is a base sector, meaning that it is more concentrated in the region compared to the broader reference area. This suggests that the sector not only meets local demand but also has the capacity to export its surplus, thereby contributing significantly to the regional economy.

Conversely, if the LQ value is less than one (LQ < 1), the sector is classified as a non-base sector. This indicates that the sector is less concentrated in the region and is primarily focused on serving local needs without significant export potential. These classifications help policymakers and economic planners to identify and prioritize sectors that can drive economic growth.

In the context of North Sumatra, the LQ analysis was applied to cassava production over a five-year period from 2017 to 2021. The results of this analysis, presented in the accompanying Table 1 provide insights into the role of cassava as a base or non-base sector in the region, thereby informing strategic agricultural development initiatives:

Table 1
Results of cassava LQ calculation in North Sumatra province in 2017 – 2021

No.	Regency/City	Average LQ value	LQ classification
1.	Nias	0.70	Non basis
2.	Mandailing Natal	0.76	Non basis
3.	South Tapanuli	0.38	Non basis
4.	Central Tapanuli	0.79	Non basis
5.	North Tapanuli	0.46	Non basis
6.	Toba Samosir	0.90	Non basis
7.	Labuhan Batu	0.81	Non basis
8.	Asahan	1.63	Basis
9.	Simalungun	1.26	Basis
10.	Dairi	0.14	Non basis
11.	Karo	1.71	Basis
12.	Deli Serdang	1.27	Basis
13.	Langkat	0.24	Non basis
14.	South Nias	1.52	Basis
15.	Humbang Hasundutan	0.41	Non basis
16.	Pakpak India	0.24	Non basis
17.	Samosir	0.29	Non basis
18.	Serdang Bedagai	2.72	Basis
19.	Coal	2.97	Basis
20.	North Padang Lawas	0.76	Non basis
21.	Padang Lawas	1.02	Basis
22.	South Labuhanbatu	2.28	Basis
23.	North Labuanbatu	1.32	Basis
24.	North Nias	1.54	Basis
25.	West Nias	0.71	Non basis

26.	Sibolga	-	Non basis
27.	Tanjungbalai	1.39	Basis
28.	Pematangsiantar	1.60	Basis
29.	High Cliff	2.77	Basis
30.	Terrain	1.11	Basis
31.	Binjai	0.56	Non basis
32.	Padangsidimpuan	1.97	Base
33.	Gunungsitoli	1.77	Base

In North Sumatra province which comprises of 33 districts/cities, food crop cultivation is actively pursued in 32 of these regions. The city of Sibolga is the exception as it has the lowest food crop production compared to other districts and cities. This is primarily because Sibolga City's economy is more heavily oriented toward the fisheries subsector, which has greater potential than the agricultural subsector. Consequently, Sibolga was excluded from this study, leaving 32 districts and cities as the focus of the research.

The analysis of these 32 regions revealed that 17 of them have a base sector in cassava production. In this context, the 17 districts/cities with a base sector for cassava include Asahan, Karo, Simalungun, Deli Serdang, South Nias, Serdang Berdagai, Batu Bara, Padang Lawas, Labuhan Batu Selatan, Labuhan Batu Utara, North Nias, Tanjung Balai, Pematang Siantar, Medan, Tebing Tinggi, Padangsidimpuan and Gunungsitoli.

Among these regions, three stand out with the highest LQ values for cassava production, indicating a particularly strong base sector. Batu Bara Regency (LQ of 2.97), Tebing Tinggi City (LQ of 2.77) and Serdang Berdagai Regency (LQ of 2.72), were the leading areas for cassava cultivation in North Sumatra. These regions not only meet the local demand for cassava but also have significant export potential, contributing to the economic growth of their respective areas. The high LQ values suggest that these regions have specialized in cassava production, making them suitable candidates for further development of this crop. By focusing on enhancing cassava cultivation in these areas, it is possible to increase the regional output and capitalize on the export opportunities, thereby boosting the income of local farmers and contributing to the overall economic development of North Sumatra.

On the other hand, the study also identified 15 districts and cities in North Sumatra where cassava production fell into the non-base sector category. In these regions, the LQ value was less than one (LQ < 1), indicating that cassava production was not sufficient to meet more than just the local demand, and there is little to no surplus for export. The districts and cities classified as non-base sectors for cassava include Mandailing Natal, Nias, South Tapanuli, Central Tapanuli, North Tapanuli, Toba Samosir, Labuhan Batu, Dairi, Langkat, Humbang Hasundutan, Pakpak Bharat, Samosir, North Padang Lawas, West Nias and Binjai.

Among these, six districts have particularly low LQ values, underscoring their limited capacity for cassava production. Dairi Regency (LQ of 0.14), Langkat Regency (LQ of 0.24), Samosir Regency (LQ of 0.29), South Tapanuli Regency (LQ of 0.38) and North Tapanuli Regency (LQ of 0.46), were the regions with the lowest LQ values. These areas are classified as non-base sectors because their LQ values are significantly below one, indicating that cassava production in these regions is primarily focused on fulfilling local needs and lacks the capacity to generate a surplus for export.

The findings of this study have important implications for regional agricultural planning and policy development in North Sumatra. For the regions identified as having a strong base sector in cassava production, there is potential for targeted investments and support to further enhance their productivity and export capabilities. Such initiatives could include providing farmers with access to improved cassava varieties, better agricultural inputs and modern farming techniques. Additionally,

establishing infrastructure to support the processing and transportation of cassava could further bolster the economic impact of this crop in these regions.

Conversely, for the districts identified as non-base sectors, the focus should be on strategies that can improve local production efficiency and possibly diversify the agricultural portfolio to include other crops that might be better suited to the region's conditions. Agricultural extension services, training and the introduction of sustainable farming practices could help to increase the productivity of cassava and other crops in these areas, thereby improving food security and the livelihoods of local farmers.

4. Conclusions

The LQ analysis of cassava cultivation across North Sumatra province provided a detailed understanding of the regional disparities in the agricultural productivity of this critical crop. The LQ method, a well-established analytical tool, was applied to assess the relative concentration of a particular sector within a specific area, in this case, cassava farming. The results of this analysis revealed that cassava cultivation is notably more concentrated in certain regions of North Sumatra, identifying these regions as base sectors for cassava production.

According to the analysis, 17 regencies and cities within North Sumatra exhibit high LQ values for cassava, marking them as key production areas or base sectors. These regions include Simalungun, Asahan, Karo, Deli Serdang, South Nias, Serdang Berdagai, Batu Bara, Padang Lawas, Labuhan Batu Selatan, Labuhan Batu Utara, North Nias, Tanjung Balai, Pematang Siantar, Medan, Tebing Tinggi, Padangsidimpuan and Gunungsitoli. This surplus production capacity makes cassava a vital component of the local economy, driving agricultural activities and supporting the livelihoods of local farmers.

The presence of a strong base sector for cassava in these regions suggests that they are likely to be focal points for cassava-related economic activities, including cultivation, processing and distribution. The concentration of cassava production in these areas underscores their importance in regional economic growth, as the crop not only meets the dietary needs of the local population but also generates income through the export of surplus cassava to other regions. The economic significance of cassava in these base sectors highlights the need for targeted agricultural policies and investments that can enhance productivity, improve infrastructure and support the sustainable development of the cassava industry.

On the other hand, the LQ analysis also identified 15 regencies and cities where cassava does not play a significant economic role, categorizing them as non-base sectors. These regions include Mandailing Natal, Nias, South Tapanuli, Central Tapanuli, North Tapanuli, Labuhan Batu, Toba Samosir, Dairi, Langkat, Humbang Hasundutan, Pakpak Bharat, Samosir, North Padang Lawas, West Nias and Binjai. This shortfall implies that these regions may need to import cassava from the base sectors to satisfy local consumption needs. Alternatively, these regions might focus on cultivating other crops that are better suited to their local conditions and have a higher potential for productivity and economic contribution.

The clear distinction between base and non-base sectors for cassava production in North Sumatra underscores the importance of adopting targeted agricultural policies that consider regional strengths and weaknesses. For the base sectors, policies aimed at enhancing cassava production, improving supply chains and expanding market access can further strengthen their economic role. In contrast, for the non-base sectors, strategies might include diversifying agricultural activities, introducing alternative crops and providing support for local farmers to increase productivity in line with local environmental and economic conditions.

Overall, the LQ analysis offers valuable insights into the spatial distribution of cassava production in North Sumatra, highlighting regions with strong agricultural potential and those where improvements are needed. By focusing on these regional differences, policymakers can develop more effective strategies to optimize cassava production, ensure food security and support sustainable regional development across North Sumatra province.

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