(RESEARCH ARTICLE)

Potential competitiveness of leading staple food commodities at marketable surplus stadia in Indonesia

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Abstract

Achieving a marketable surplus in leading food commodities (all types of food) is a crucial target for developing agricultural marketing and pricing policies, increasing imports and exports, expanding national food reserves, and advancing rural and national development. The competitiveness of superior food commodities, which includes all foods consumed in Indonesia, needs attention to achieve the Marketable Surplus stage for each superior food commodity in each region, with its specific characteristics, at both the food centre and national levels. This study is expected to meet the need for analytical data to increase the competitiveness of all types of superior food commodities at the Marketable Surplus stage, which is the dominant food commodity in every province in Indonesia. The research was conducted quantitatively. In this study, quantitative analysis was conducted use several analytical tools, namely the Location Quotient (LQ) method. The results of the LQ analysis of staple foods in Indonesia indicate that five main staple foods are growing and becoming centers of production: rice, corn, soybeans, cassava, and sweet potatoes. These are superior commodities, widely consumed and cultivated by the community. The results of the LQ analysis of the five most consumed staple food commodities in Indonesia show that the one with a competitive advantage and at the marketable surplus stage is Rice. For other food commodities that have become a basic sector, namely Corn, while other commodities, such as cassava and sweet potatoes, have not become basic sectors because they have not reached an LQ score of 1, they have still met local consumption. While soybean production is still very low, soybean consumption in Indonesia is currently quite high as a raw material for local foods such as soy sauce and tempeh which are typical local industries of Indonesia.

Keywords: Potential competitiveness; Staple Food; Leading Commodities; Marketable Surplus; Indonesia

1. Introduction

In a developing economy, the growth rate of the industrial sector depends on food availability from the rural agricultural sector (Grover et al., 2017). The agricultural sector plays a strategic role in the structure of economic development. The food crops subsector, as part of the agricultural sector, plays a crucial role in national economic growth (Martadona & Maifianti, 2019). Sustainable growth depends on agricultural competitiveness and its impact on food security (Bahta & Mbai, 2023). Analyzing the competitiveness of agricultural food products is a mandatory step in assessing the structure of agricultural production as a means of adapting to a free-market economy. Agricultural competitiveness is linked to agricultural sectoral transformation and broader agricultural productivity (Popescu et al., 2017). The main food crops cultivated globally are rice, corn, wheat, and potatoes (Ganeshkumar et al., 2017). Achieving a marketable surplus in leading food commodities (all types of food) is a crucial target for developing agricultural marketing and pricing policies, increasing imports and exports, expanding national food reserves, and advancing rural and national development.

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Main commodities are strategically positioned based on technical considerations (soil and climate conditions) and socioeconomic and institutional factors (skills, human capacity, infrastructure, and cultural conditions of the local community). These are superior commodities that occupy a strong position and region (Syahrial et al., 2023). The development of the agricultural sector, particularly food crops, is significant for the growth of agricultural economic activities in rural areas (Jauhari, 2020). The development of superior commodities in the food crops and horticultural subsectors should focus on production centre (superior) that have the capacity to support their development, to increase output or productivity, ultimately achieving agricultural and regional economic development. Superior commodities produced are used in a region at relatively lower cost due to the region's natural resource potential (Khairad, 2020).

The competitiveness of superior food commodities, which includes all foods consumed in Indonesia, needs attention to achieve the Marketable Surplus stage for each superior food commodity in each region, with its specific characteristics, at both the food centre and national levels. That certainly requires a data study that can present analytical results for the central regions of all potential food types, which are producers of the superior food commodities in Indonesia. This study expects to demonstrate the potential competitiveness of all types of superior food commodities, enabling them to reach the Marketable Surplus Stage in each province in Indonesia, thereby meeting domestic food needs and supporting export orientation. This study is expected to meet the need for analytical data to increase the competitiveness of all types of superior food commodities at the Marketable Surplus stage, which is the dominant food commodity in every province in Indonesia.

2. Material and methods

2.1. Types of research

The research was conducted quantitatively. Quantitative research uses careful measurement of specific variables to answer questions, yielding generalizable conclusions regardless of time, situation, or the type of data collected, particularly quantitative data.

This quantitative research, used to develop a theory related to the problem studied, involved conducting static measurements and analyses. In this study, quantitative research was conducted using quantitative methods, including formula-based data analysis and the datasets required for the analysis. In this study, quantitative analysis was conducted use several analytical tools, namely the Location Quotient (LQ) method.

2.2. Location Quotient (LQ) Analysis

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To analyze the leading food commodities in Indonesia's food-producing regions, a quantitative analysis was conducted using the Location Quotient (LQ) method. The Location Quotient (LQ) method is used to identify or determine whether a commodity is a superior commodity (Martadona & Maifianti, 2019). The LQ formula is as follows:

$$LQ_{ij} = \frac{X_{ij} / X_{i.}}{X_{.j} / X_{..}}$$

Description:
$LQij$: LQ Value of Superior Commodities
Xij: Harvested area of commodity i at the provincial level
Xi: Harvested area of all commodities in the province
$X.j$: Harvested area of commodity i at the national level
$X..$: Harvested area of all commodities in the national level

LQ Assumption:

According to Pribadi (2021), an LQ value greater than 1 indicates that the growth rate of the observed sector in a district exceeds that of the same sector in the provincial/reference economy. That also indicates that the sector serves as the region's economic base. An LQ value less than 1 indicates that the growth rate of the observed sector in a district is

slower than the growth rate of the same sector in the provincial/reference economy. In other words, the sector is not the region's economic base.

3. Results and discussion

Indonesia's food commodities are highly diverse, and staple food consumption patterns vary across regions. The location of Indonesia's leading food commodities can be identified by calculating the Location Question (LQ), which can then inform policy recommendations for key staple foods. One method for identifying whether an economic sector or subsector is classified as basic or non-basic is the Location Quotient (LQ) method (Basorudin et al., 2021). LQ shows the importance of considering natural resource potential in regional development planning, and the need for community involvement and support from the public and private sectors in implementing development plans to support sustainable life (Abadi et al., 2024).

3.1. Leading Stapple Food Commodities in Food Centre Regions in Indonesia

The diversity of local staple foods in Indonesia is traditional food produced and consumed by local communities based on their respective potential and local wisdom. These local staple foods consist of various processed staple foods, including rice, cassava, sweet potatoes, soybeans, and corn, processed according to local knowledge (Fioletta & Bambang, 2018.). The availability of staple food crops grown in each province will be spread across various regions and not concentrated in any one region, although each region has its own superior commodities. This is due to differences in climate, temperature, humidity, and irrigation availability (Riptanti et al., 2018).

3.1.1. The results of the LQ analysis of staple foods in Indonesia indicate that five main staple foods are growing and becoming centers of production: rice, corn, soybeans, cassava, and sweet potatoes. These are superior commodities, widely consumed and cultivated by the community.
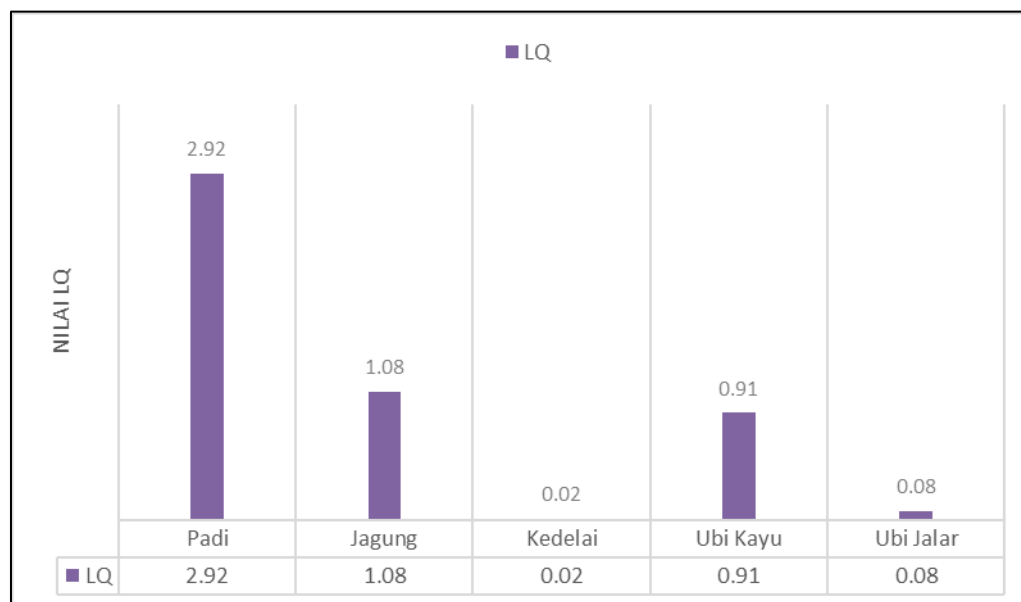

	Padi	Jagung	Kedelai	Ubi Kayu	Ubi Jalar
■ LQ	2.92	1.08	0.02	0.91	0.08

Figure 1 LQ Value of Staple Foods in Indonesia

The graph above displays the Location Quotient (LQ) values for several staple crops in Indonesia. An LQ value > 1 indicates a region has a specialization advantage in that commodity, while an LQ value < 1 indicates that the commodity is less prominent in that region.

The interpretation of the above data is as follows:

- Rice (LQ = 2.92)

Rice has the highest LQ value, at 2.92. This indicates that Indonesia has a very strong specialization advantage in rice production compared to other staple crops. Rice production in Indonesia is very dominant and far greater than in other regions.

- Corn (LQ = 1.08)

Corn also has an LQ above 1, although not as high as rice. An LQ of 1.08 indicates that Indonesia is slightly ahead of the national average in corn production, though the difference is not significant.

- Soybeans (LQ = 0.02)

Soybeans have an LQ of 0.02, reflecting minimal production and low importance in Indonesia's agriculture. The country does not specialize in this crop.

- Cassava (LQ = 0.91)

Cassava has an LQ of 0.91, indicating that its production is relatively balanced with the national average. However, Indonesia is not considered to have a specialization advantage in cassava.

- Sweet Potato (LQ = 0.08)

The results of the LQ analysis of the five most consumed staple food commodities in Indonesia show that the one with a competitive advantage and at the marketable surplus stage is Rice, but its LQ score is still relatively small to be considered export-oriented, namely 2.92. Rice is likely already in surplus, so it can be traded in Indonesia. For other food commodities that have become a basic sector, namely Corn, it is still relatively small and can only meet domestic consumption, as indicated by an LQ score of 1.08. While other commodities, such as cassava and sweet potatoes, have not become basic sectors because they have not reached an LQ score of 1, they have still met local consumption. While soybean production is still very low, indicated by a soybean LQ score = 0.02 which indicates a condition that is still very short of production and has not been able to meet local consumption needs so that it still has to be imported, even though soybean consumption in Indonesia is currently quite high as a raw material for local foods such as soy sauce and tempeh which are typical local industries of Indonesia.

3.2. Comparison of LQ Indonesia

3.2.1. Paddy commodity

Rice is Indonesia's primary staple food and a leading commodity. This indicates that, in addition to being a staple food, rice also has considerable export potential. Overall, Indonesia's rice has the highest LQ value among staple foods.
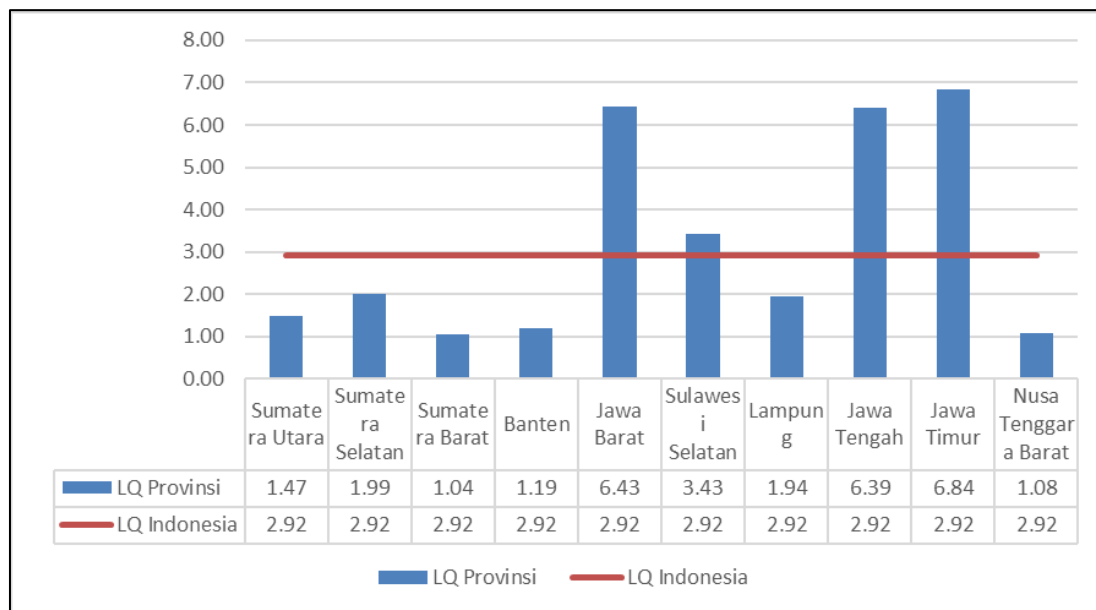

	Sumatera Utara	Sumatera Selatan	Sumatera Barat	Banten	Jawa Barat	Sulawesi Selatan	Lampung	Jawa Tengah	Jawa Timur	Nusa Tenggara Barat
LQ Provinsi	1.47	1.99	1.04	1.19	6.43	3.43	1.94	6.39	6.84	1.08
LQ Indonesia	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92

Figure 2 LQ Value of Rice Commodities in Indonesia

The graph above shows a comparison of the Location Quotient (LQ) of rice between several leading provinces in Indonesia, with Indonesia's LQ value (which stands at 2.92). The horizontal red line indicates the national LQ as a reference, while the blue graph shows the rice LQ for each province. The LQ calculations based on the largest rice-producing provinces show that the average LQ for rice remains below the national average.

- West Java (LQ = 6.43) and East Java (LQ = 6.84)

These two provinces have the highest LQ among other provinces, well above the Indonesian average (2.92). It indicates that West Java and East Java are major rice-producing provinces in Indonesia, with a strong specialization in rice production compared to other provinces.

- South Sulawesi (LQ = 3.43)

South Sulawesi also shows a significant advantage in rice production, with an LQ of 3.43, which is higher than the Indonesian average. It indicates that South Sulawesi has a reasonably high level of specialization in rice production.

- South Sumatra (LQ = 1.99), North Sumatra (LQ = 1.47), Lampung (LQ = 1.94)

These three provinces have LQs below the Indonesian average, but still demonstrate a fairly strong involvement in rice production. Although not as large as West and East Java, they remain important rice-producing regions.

- Banten (LQ = 1.19), West Sumatra (LQ = 1.04), West Nusa Tenggara (LQ = 1.08)

These provinces have LQs lower than the Indonesian average and are close to an LQ of 1. It indicates that although rice production exists in these regions, they are not the most dominant provinces in Indonesia.

Based on this LQ analysis, the main rice-producing areas in Indonesia are Central Java and East Java, which have entered the marketable surplus stage, while other provinces have become superior commodities; however, the orientation remains to fulfill domestic consumption.

3.2.2. Corn Commodity

Corn is a high-demand commodity. Corn is not only food for humans but also a raw material for animal feed, so corn production in base locations needs attention. In Indonesia, on average, farmers plant corn only as an intercrop after the rice harvest, so corn production is certainly still below rice production. Corn is the second most valuable food commodity with a relatively high LQ value, and it still has potential for development in Indonesia. This commodity can become a staple food source in several corn-producing regions in Indonesia.
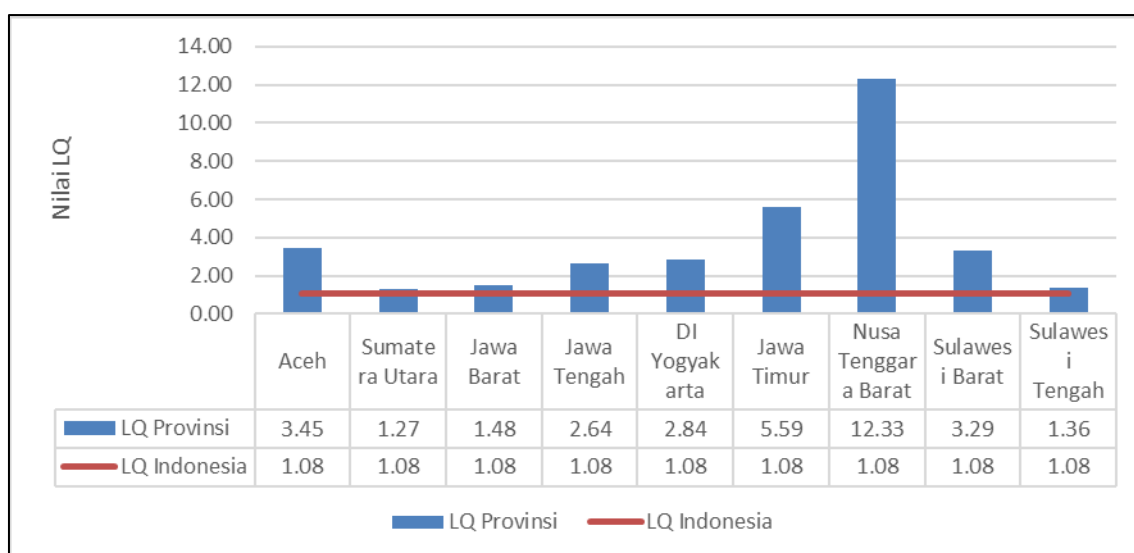

	Aceh	Sumatera Utara	Jawa Barat	Jawa Tengah	DI Yogyakarta	Jawa Timur	Nusa Tenggara Barat	Sulawesi Barat	Sulawesi Tengah
LQ Provinsi	3.45	1.27	1.48	2.64	2.84	5.59	12.33	3.29	1.36
LQ Indonesia	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08

Figure 3 LQ Value of Corn Commodities in Indonesia

This graph shows the LQ (Location Quotient) of corn across several leading provinces in Indonesia, compared to the Indonesian average (1.08, indicated by the red line). The data above show that the average LQ in the central corn-producing provinces remains above the national average. That is because many regions in Indonesia do not grow corn, so the national LQ is lower than that in corn-growing provinces.

The following is an interpretation of the data:

- West Nusa Tenggara (LQ = 12.33)

West Nusa Tenggara has a very high LQ value of 12.33. That indicates that this province is highly dominant in corn production in Indonesia, with a much higher level of specialization than the Indonesian average.

- East Java (LQ = 5.59)

East Java also shows extreme specialization in corn production, with an LQ value of 5.59, well above the national average. It takes place in East Java, one of Indonesia's central provinces that produces corn.

- Aceh (LQ = 3.45) and West Sulawesi (LQ = 3.29)

These two provinces have LQs well above 3, indicating a relatively high level of specialization in corn production, though not as high as in West Nusa Tenggara and East Java.

- Special Region of Yogyakarta (LQ = 2.84) and Central Java (LQ = 2.64)

Although their LQs are lower than those of West Nusa Tenggara and East Java, these two provinces still demonstrate a relatively strong specialization in corn production compared to the national average. Corn is a leading commodity in West Nusa Tenggara and East Java, where local communities consume it as a staple food, replacing rice. However, corn is also consumed as a staple food by other local communities in Indonesia, such as Aceh and West Sulawesi. Corn is also a raw material for animal feed, so increasing corn production is necessary in all base areas.

3.2.3. Soybean Commodity

The results of the LQ calculation for soybean commodities indicate that the National LQ remains very low compared to the Provincial LQ. That indicates that soybean production is generally below the level needed to meet soybean consumption in Indonesia. Therefore, efforts are needed to develop soybean production in regions that have the potential to become soybean producers in Indonesia.
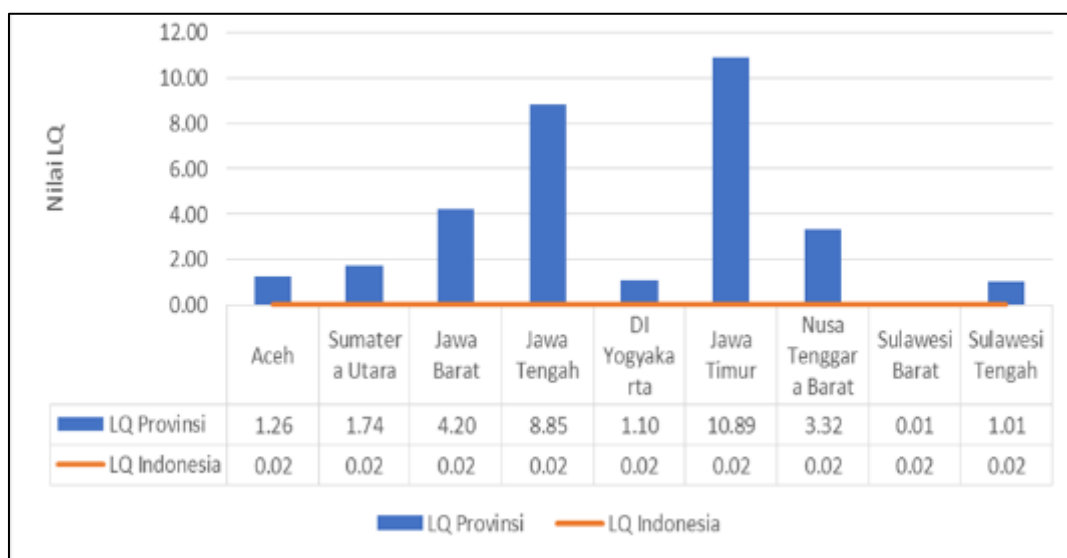

	Aceh	Sumatera Utara	Jawa Barat	Jawa Tengah	DI Yogyakarta	Jawa Timur	Nusa Tenggara Barat	Sulawesi Barat	Sulawesi Tengah
LQ Provinsi	1.26	1.74	4.20	8.85	1.10	10.89	3.32	0.01	1.01
LQ Indonesia	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Figure 4 LQ Value of Soybean Commodities in Indonesia

This graph shows the Location Quotient (LQ) of soybeans in several leading provinces in Indonesia relative to the Indonesian average (0.02, indicated by the red line). The following is an interpretation of the data:

- East Java (LQ = 10.89)

East Java has a very high LQ value of 10.89. That indicates that this province is highly dominant in soybean production in Indonesia, with a high degree of specialization, well above the Indonesian average of 0.02.

- Central Java (LQ = 8.85)

Central Java also shows extreme specialization in soybean production, with an LQ value of 8.85, far above the Indonesian average of 0.02. That places Central Java among the leading soybean-producing provinces in Indonesia.

- West Java (LQ = 4.20)

West Java province has an LQ value significantly above 4, indicating a relatively high level of specialization in soybean production, although not as high as East Java and Central Java.

- West Nusa Tenggara (LQ = 3.32)

West Nusa Tenggara also demonstrates a significant advantage in soybean production, with an LQ of 3.32, significantly higher than the Indonesian average. That also indicates that West Nusa Tenggara has a relatively high level of specialization in soybean production.

- Aceh (LQ = 1.26), North Sumatra (LQ = 1.74), Yogyakarta Special Region (LQ = 1.10), and Central Sulawesi (LQ = 1.01)

The four provinces mentioned above, Aceh, North Sumatra, Yogyakarta Special Region, and Central Sulawesi, have LQ values above 1.00, which is relatively high compared to the Indonesian average. However, the values of these three provinces are significantly lower than those of other provinces.

- West Sulawesi (LQ = 0.01)

Soybeans also have a very low LQ of 0.01, indicating that soybean production in West Sulawesi is insignificant and that it is not a major producer compared to other provinces.

Increasing soybean production is absolutely necessary considering that soybean producing areas in Indonesia are still limited to meet domestic consumption which is still inadequate. In several central soybean-producing areas, the LQ score obtained is quite high, but because the need for soybean consumption in Indonesia is also high, the amount of production is only able to meet local needs, and even then, when viewed as a national total, it is still very low and far from being able to meet domestic needs.

3.2.4. Cassava Commodity

The results of the cassava commodity calculations show that the national LQ remains below the LQ in cassava-producing centers. It is because cassava is not a primary staple food in Indonesia; it is used only as a snack and as a raw material for flour production. This condition indicates that cassava's potential still does not meet the criteria to become a primary staple commodity in Indonesia that can be developed for export. In developing countries that produce cassava, cassava cultivation is only carried out as a staple food source and on average do not have adequate resources to convert this starch-producing plant into value-added products to increase the country's economic income (Fu, 2021).
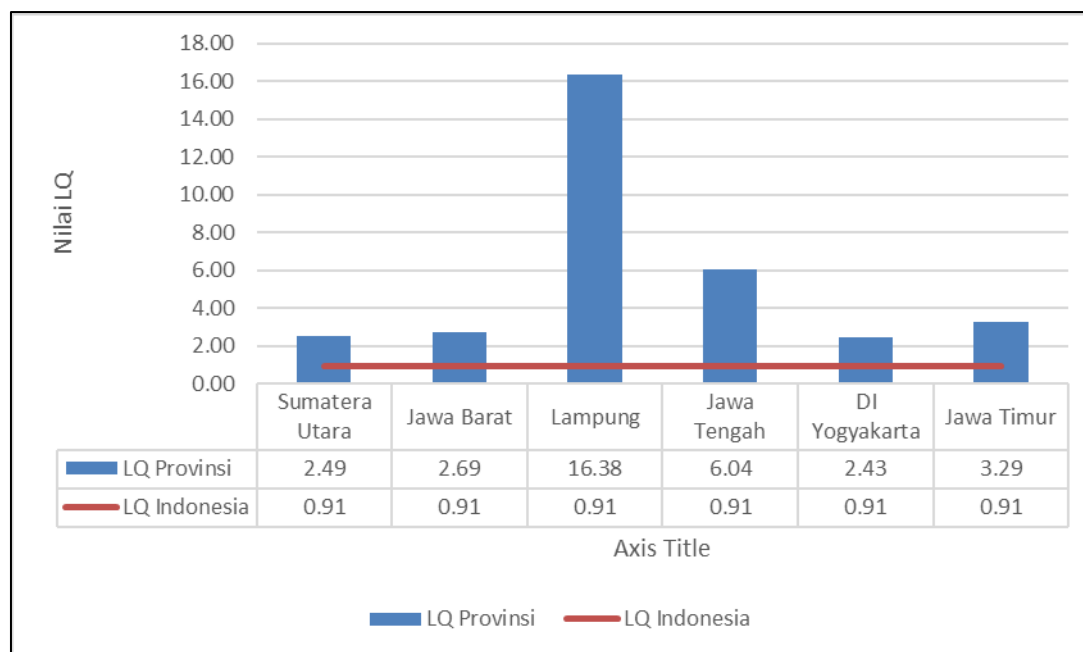
Figure 5 LQ Value of Cassava Commodities in Indonesia

This graph displays the Location Quotient (LQ) of cassava across several leading provinces in Indonesia, compared to the Indonesian average (0.91, indicated by the red line). The following is an interpretation of the data:

- Lampung (LQ = 16.38)

Lampung has a very high LQ value of 16.38. That indicates that this province is highly dominant in cassava production in Indonesia, with a high degree of specialization, well above the Indonesian average of 0.91.

- Central Java (LQ = 6.04)

Central Java also demonstrates extreme specialization in cassava production, with an LQ of 6.04, well above the Indonesian average of 0.91. That places Central Java among the leading soybean-producing provinces in Indonesia.

- East Java (LQ = 3.29)

East Java Province has an LQ above 3, indicating a relatively high level of specialization in soybean production, though not as high as in Lampung and Central Java.

- Yogyakarta Special Region (LQ = 2.43), North Sumatra (LQ = 2.49), and West Java (LQ = 2.69)

The three provinces mentioned above, Yogyakarta Special Region, North Sumatra, and West Java, have LQ values above 2, which is relatively high compared to the Indonesian average. However, the scores of these three provinces are significantly lower than those of the other provinces.

The central cassava production bases are Lampung and Central Java, with relatively high LQ scores indicating a marketable surplus and potential for export. In other regions, cassava LQ has also demonstrated its trade potential, achieving relatively high LQ scores. Therefore, cassava is now commercially viable, and downstream cassava processing should be a priority, given that production already exceeds domestic demand and is export-oriented.

3.2.5. Sweet Potato Commodity

Sweet potatoes are a food crop that can be economically utilized to address global food shortages caused by climate change, particularly in developing countries. Sweet potatoes have been identified as a leading commodity in developing countries (Sapakhova et al., 2023). The results of the LQ calculation for Sweet Potatoes show that the national LQ value remains far below those of the provinces that produce Sweet Potatoes.
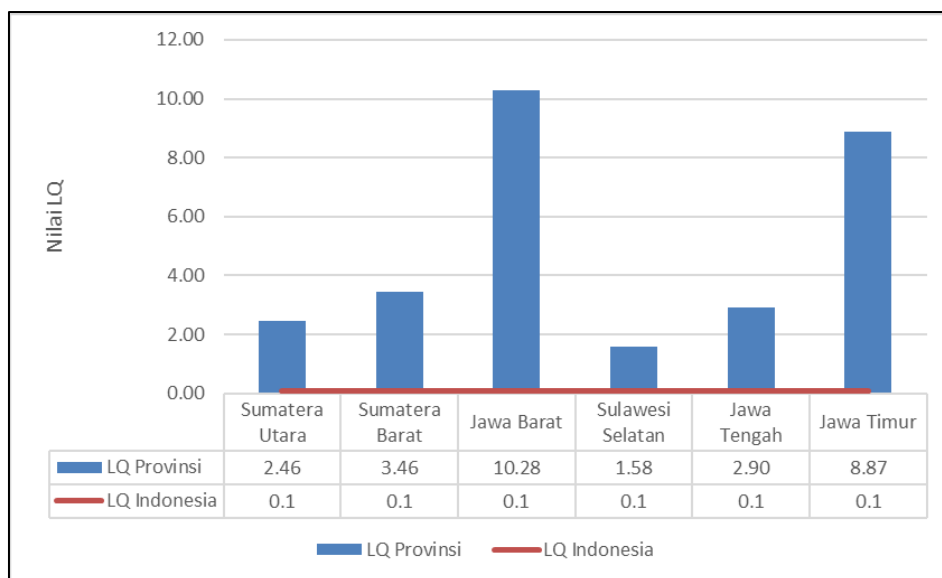
Figure 6 LQ Value of Sweet Potato Commodity in Indonesia

This graph shows the Location Quotient (LQ) of sweet potatoes across several leading provinces in Indonesia, compared with the Indonesian average (0.1, indicated by the red line). Here is an interpretation of the data:

- West Java (LQ = 10.28)

West Java has a very high LQ value of 10.28. That indicates that this province is highly dominant in sweet potato production in Indonesia, with a high degree of specialization, well above the Indonesian average of 0.1.

- East Java (LQ = 8.87)

East Java also shows extreme specialization in sweet potato production, with an LQ value of 8.87, far above the Indonesian average of 0.91. That places Central Java among the leading soybean-producing provinces in Indonesia.

- West Sumatra (LQ = 3.46)

East Java province has an LQ value significantly above 3, indicating a relatively high level of specialization in soybean production, although not as high as West Java and East Java.

- Central Java (LQ = 2.90) and North Sumatra (LQ = 2.46)

The two provinces mentioned above, Central Java and North Sumatra, have LQ scores above 2, which are quite high compared to the Indonesian average. However, these scores are significantly lower than those of the other provinces.

Sweet potatoes are a staple food for humans and livestock, and developing sweet potato production is essential for improving food security, economic growth, and enhancing nutrition and health benefits.

The results of the LQ analysis show that sweet potatoes have achieved very high LQ values in several sweet potato production centers in Indonesia, namely West Java and East Java. The obtained LQ values indicate that these two provinces have reached a marketable surplus in sweet potato production, making them suitable for export. In other regions, the average LQ value is also high, exceeding local consumption needs, making them suitable for trade.

4. Conclusion

The LQ analysis of the five most consumed staple food commodities in Indonesia show that the one with a competitive advantage and at the marketable surplus stage is Rice, for other food commodities that have become a basic sector, namely Corn, it is still relatively small and can only meet domestic consumption, other commodities, such as cassava

and sweet potatoes, have not become basic sectors. The soybean production is still very low, which indicates a condition that is still very short of production and has not been able to meet local consumption.

Based on this LQ analysis, the main rice-producing areas in Indonesia are Central Java and East Java, which have entered the marketable surplus stage, while other provinces have become superior commodities; however, the orientation remains to fulfill domestic consumption. Corn is a leading commodity in West Nusa Tenggara and East Java, corn is also consumed as a staple food by other local communities in Indonesia, such as Aceh and West Sulawesi. In several central soybean-producing areas, the LQ score obtained is quite high, but because the need for soybean consumption in Indonesia is also high, the amount of production is only able to meet local needs, and even then, when viewed as a national total, it is still very low and far from being able to meet domestic needs.

The central cassava production bases are Lampung and Central Java, with relatively high LQ scores indicating a marketable surplus and potential for export. The sweet potatoes have achieved very high LQ values in several sweet potato production centers in Indonesia, namely West Java and East Java. the average LQ value is also high, exceeding local consumption needs, making them suitable for trade.

Compliance with ethical standards

Disclosure of conflict of interest

Authors disclose conflict of interest with products that compete with mentioned in this manuscript.

Statement of informed consent

"Informed consent was obtained from all individual participants included in the study".

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