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# SPATIAL FRUITS PRODUCTION CONCENTRATION ACROSS DISTRICTS IN SLEMAN REGENCY

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## ABSTRAK

Pertumbuhan populasi dan perubahan pola konsumsi menjadikan buah-buahan sebagai komoditas strategis dalam mendukung ketahanan dan kemandirian pangan, serta pertumbuhan ekonomi wilayah. Produksi buah cenderung terkonsentrasi secara geografis, menciptakan klaster produksi yang efisien. Indonesia memiliki kondisi edafik dan iklim yang mendukung pengembangan produksi buah. Strategi pengembangan berbasis data dan analisis aglomerasi diperlukan guna memperkuat klaster produksi dan mewujudkan pengembangan wilayah berkelanjutan. Penelitian ini bertujuan untuk mengidentifikasi dan menganalisis konsentrasi spasial produksi buah di Kabupaten Sleman. Bahan penelitian terdiri dari data produksi buah-buahan dalam satuan kuintal. Analisis data meliputi Locational Quotient (LQ), Localization Index (LI) dan Specialization Index (SI). Unit analisis adalah kecamatan-kecamatan di Kabupaten Sleman. Hasil penelitian menunjukkan bahwa Kabupaten Sleman memproduksi 802.998 kuintal buah-buahan pada 2023, dengan salak sebagai komoditas dengan produktivitas tertinggi, khususnya di Kecamatan Turi. Kecamatan Minggir menunjukkan nilai LQ tertinggi untuk mangga, Cangkringan untuk durian, Kecamatan Sleman untuk jeruk, Godean untuk pisang, Ngemplak untuk pepaya, Mlati untuk nangka dan rambutan untuk Berbah. Dalam menginterpretasikan adanya konsentrasi produksi buah berdasarkan LI dan spesialisasi atau diversifikasi berdasarkan SI perlu dikonfirmasi pada data produk buah bahan analisis. Umumnya produksi buah-buahan terkonsentrasi di kecamatan-kecamatan tertentu dan sebagian besar kecamatan memiliki kekhasan komoditas buah. Produksi buah-buahan di Kabupaten Sleman menunjukkan pola spasial terkonsentrasi dengan klaster komoditas unggulan, terutama salak di Kecamatan Turi. Pola ini membuka peluang pengembangan kawasan sentra buah berbasis wilayah. Diperlukan penguatan produksi, mitigasi serangan hama, dan peningkatan infrastruktur untuk efisiensi pengumpulan serta distribusi hasil panen.

***Kata Kunci: Berkeunggulan komparatif, Konsentrasi produksi buah, Spesialisasi komoditas buah***

## *ABSTRACT*

*Population growth and changes in consumption patterns make fruits a strategic commodity in supporting food security and independence, as well as regional economic growth. Fruit production tends to be geographically concentrated, creating efficient production clusters. Indonesia has edaphic and climatic conditions that support the development of fruit production. Data-based development strategies and agglomeration analysis are needed to strengthen production clusters and realize sustainable regional development. This study aims to identify and analyze the spatial concentration of fruit production in Sleman Regency. The research materials consist of fruit production data in quintal units. Data analysis includes Locational Quotient (LQ), Localization Index (LI) and Specialization Index (SI). The units of analysis are sub-districts in Sleman Regency. The results showed that Sleman Regency produced 802,998 quintals of fruit in 2023, with salak as the commodity with the highest productivity, especially*

*in Turi District. Minggir District showed the highest LQ value for mango, Cangkringan for durian, Sleman District for orange, Godean for banana, Ngemplak for papaya, Mlati for jackfruit and rambutan for Berbah. In interpreting the concentration of fruit production based on LI and specialization or diversification based on SI, it is necessary to confirm the data on fruit products of the analysis material. Generally, fruit production is concentrated in certain districts and most districts have unique fruit commodities. Fruit production in Sleman Regency shows a concentrated spatial pattern with superior commodity clusters, especially salak in Turi District. This pattern opens up opportunities for the development of regional-based fruit center areas. Strengthening production, mitigating pest attacks, and improving infrastructure are needed for efficient collection and distribution of harvest results.*

***Keywords: Comparative advantage, Fruit production concentration, Fruit commodity specialization***

## INTRODUCTION

With the growth of the global population and shifting consumption patterns, fruit has increasingly been recognized as a strategic commodity, not only playing a vital role in supporting food security but also in strengthening livelihoods (Abobatta, 2020; Macieira, Barbosa and Teixeira, 2021). However, rapid urban expansion has led to the conversion of fruit plantation areas into residential zones, negatively impacting the productivity of this sector (Akaeze and Nandwani, 2020). As a result, the decline in fruit production has become a pressing concern. FAOSTAT, (2025) data reveals a significant global decrease of 39.98% in fruit production, from 951.91 million tons in 2000 to 571.17 million tons in 2023. This situation presents a major challenge, particularly for regions whose economies heavily depend on fruit production as a cornerstone of regional economic development (Egorov *et al.*, 2021).

Fruit production tends to be spatially concentrated in certain areas due to the complex interplay of geographic, economic, and policy-related factors (Qiu *et al.*, 2025). This spatial concentration forms production clusters that can significantly enhance efficiency in both cultivation and the distribution of produce to markets. Regions with favorable natural conditions, such as nutrient-rich volcanic soil and tropical or subtropical climates, provide ideal environments for fruit cultivation (Yuniarti *et al.*, 2022). From an economic perspective, factors such as competitive labor costs (Wu *et al.*, 2024), efficient logistics networks that enable fast and low-damage transport (Hao *et al.*, 2022), and easy access to both local and international markets as well as post-harvest processing facilities, are key determinants of optimal production locations (Szymańska and Rysz, 2022). Adequate transport infrastructure, including roads, ports, and cold storage facilities, further enhances the

competitiveness of fruit-producing regions (De, 2018). Moreover, government policies, both at the regional and national levels, play a crucial role in shaping the distribution patterns of fruit production. Supportive policies can strengthen production clusters and drive agribusiness innovation, while weak regulations or administrative barriers may hinder regional development potential (Qiu *et al.*, 2025).

As a tropical country, Indonesia possesses ecological advantages that support the cultivation of a wide variety of fruits. The country's soil, significantly shaped by volcanic activity (Hakim, 2023), is highly fertile, providing an ideal foundation for robust fruit production. In regional planning, commodity-based development strategies often serve as a key component of policy formulation, with implementation typically overseen by local agricultural agencies (Hastuti, 2013; Juarsyah, Muani and Suyatno, 2015; Sari *et al.*, 2017; Sanjaya, Ginting and Effendi, 2019; Sahri, Sunariyanto and Anadza, 2024). Given the strong market demand and natural production advantages, fruits hold considerable potential for development. To support fruit-based development strategies, it is generally necessary to examine the competitiveness of the commodity (Budi *et al.*, 2023; Rizqy, Setyadi and Harya, 2025). This involves not only analyzing fruit productivity data in a given area but also assessing the presence or absence of competitive dynamics in fruit commodity development within that region.

Commodity production data serve as a fundamental basis for planning and developing regions in alignment with their food and agricultural sector potential. To promote sustainable fruit cultivation in Sleman Regency, empirical studies on production concentration patterns are crucial. Such studies can employ analytical approaches such as the Location Quotient, Localization Index, and Specialization Index. Analyses of leading fruit commodities have been widely conducted at the provincial level. For instance, Rudani, Mulyo and Sugiyarto, (2023) identified mangosteen and avocado as leading fruit commodities in West Java Province; Novita, Rinanda and Ilham Riyadh, (2022) found rose apple, siam orange, and snake fruit to be key commodities in North Sumatra Province; and Hippy and Aisyah R, (2023) determined coconut and cacao as the top fruit commodities in Gorontalo Province. However, studies at the provincial scale tend to be aggregative and often fail to reveal the detailed spatial distribution and production clustering at the local level. This results in limited information for formulating development strategies that

are specific and grounded in real field potential. Therefore, district-level studies using district (kecamatan) units as the basis of comparison are essential for identifying actual production centers.

Sleman Regency, known for its fertile land (Putra and Sugiartawan, 2019), plays a central role in the production of various fruit types. This soil fertility is largely attributed to the positive effects of Mount Merapi eruptions, which deposit nutrient-rich volcanic ash (Aji *et al.*, 2021). Such inherent potential positions Sleman as a prime candidate for fruit-based economic development. However, the formulation of effective development strategies must be grounded in empirical data and analytical insights. To ensure sustainable development, policy efficiency should focus on strengthening existing production clusters through agglomeration analysis, thereby supporting local economic growth. This study aims to identify and analyze the spatial concentration of fruit production across Sleman Regency, offering valuable insights into comparative advantages at the sub-district level and revealing trends in commodity clustering. The findings are expected to serve as a foundation for targeted policy interventions to optimize regional strengths and enhance agricultural productivity.

## RESEARCH METHODOLOGY

The study was conducted in Sleman Regency, located in the Special Region of Yogyakarta, Indonesia (Figure 1), with a population of 1.168.471 people according

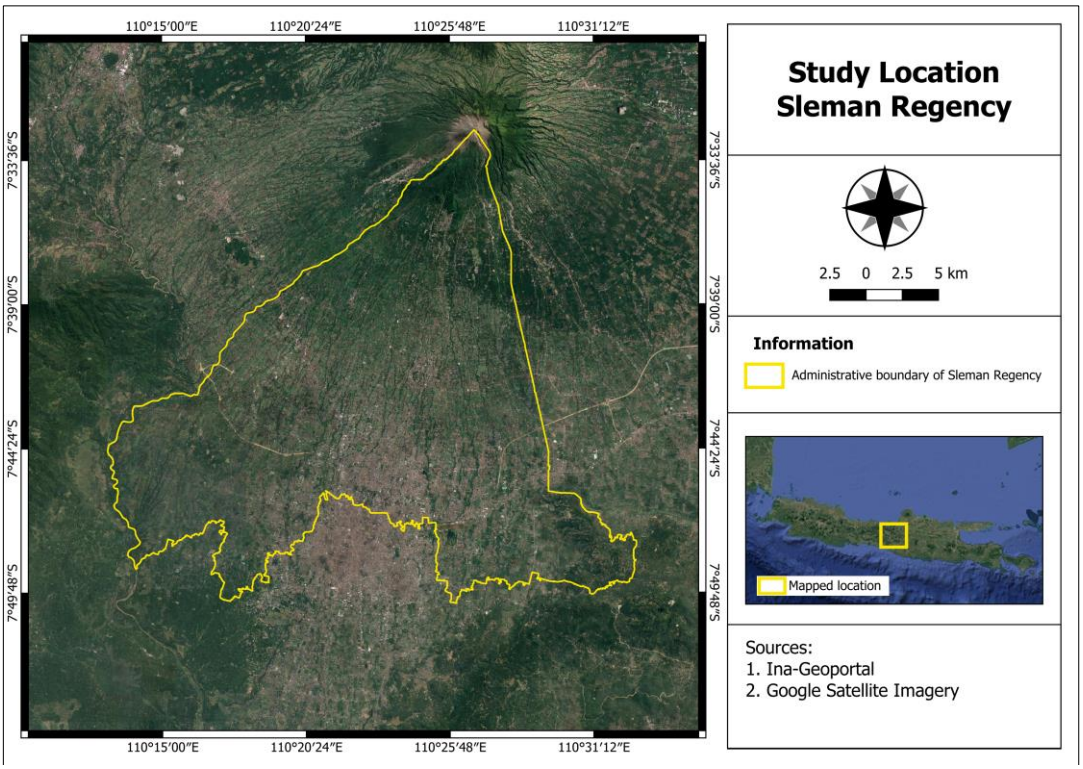



Figure 1. Study location
Source: Ina-Geoportal and Google Satellite Imagery (2025)

to BPS of Sleman Regency, (2024). The analysis covered all districts in Sleman Regency, including Berbah, Cangkringan, Depok, Gamping, Godean, Kalasan, Minggir, Mlati, Moyudan, Ngaglik, Ngemplak, Pakem, Prambanan, Seyegan, Sleman, Tempel, and Turi. The research used 2023 fruit production data (in quintals) provided by Statistics Indonesia (BPS) of Sleman Regency, covering seven fruit commodities: mango (*Mangifera indica* L.), durian (*Durio zibethinus* Murr.), orange (*Citrus sinensis* (L.) Osbeck), banana (*Musa* spp.), papaya (*Carica papaya* L.), salak (*Salacca zalacca* (Gaertn.) Voss), and rambutan (*Nephelium lappaceum* L.).

The data analysis employed three methods: Location Quotient (LQ) to identify comparative advantages, Localization Index (LI) to measure spatial concentration patterns, and Specialization Index (SI) to assess production specialization at the district level. The LQ method was selected because it allows for the comparison of the proportion of a particular activity in a specific area with its proportion in a broader reference area. This enables the identification of comparative advantages based not merely on absolute production volumes but also on the relative potential of a district to develop distinctive fruit commodities compared to other districts within the same unit of analysis or against the reference region.

To complement the LQ analysis, the LI was employed to quantify the extent to which an activity is spatially dispersed or concentrated within the study area. An LI value reflects whether a particular activity is uniformly distributed across all districts (dispersion) or concentrated in specific areas (local concentration) (Rizal *et al.*, 2017). Additionally, SI was applied as a quantitative tool to measure the extent to which a district exhibits specialization in a certain activity compared to others (Lubis and Purba, 2020). This index helps determine whether the structure of economic activity in a given district is specialized or diversified. In this study, the activity in question is fruit production, with the district as the unit of analysis and Sleman Regency serving as the reference region. Overall, the combination of LQ, LI, and SI represents a widely adopted and empirically validated approach for identifying agglomeration clusters (Wantasen, Umboh and Endoh, 2020; Rahadiansyah *et al.*, 2022; Wiwaha *et al.*, 2022; Fironika *et al.*, 2023; Gustia, Mulatsih and Gunawan, 2024).

The LQ formula used in this study is presented in the following equation:

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

When $LQ_{ij} > 1$, the fruit commodity demonstrates comparative advantage, indicating it is the most competitive among other fruit commodities within that specific analytical unit (district). If $LQ_{ij} = 1$, the fruit commodity is considered neutral - neither comparatively advantaged nor disadvantaged. Values of $LQ_{ij} < 1$ signify that the commodity lacks comparative advantage in that particular district.

The LI is employed to identify whether spatial concentration patterns exist for specific fruit commodities within the region. The LI formula is expressed as follows:

$$\text{LI} = {}^{1}/_{2} \sum_{i=1}^{n} \left| \frac{X_{ij}}{X_{.j}} - \frac{X_{i.}}{X_{..}} \right|$$

A fruit commodity is considered evenly distributed (or completely uniform across all regions) when the LI value approaches 0. Conversely, when the LI value approaches 1, it indicates the fruit commodity is spatially concentrated in specific regions.

The SI serves to identify regions exhibiting distinctive sectoral concentration patterns. The SI formula is presented in the following equation:

$$\text{SI} = {}^{1}/_{2} \sum_{i=1}^{n} \left| \frac{X_{ij}}{X_{i.}} - \frac{X_{.j}}{X_{..}} \right|$$

An analytical unit (e.g., district) is considered to have indifferent fruit commodity distribution (showing no distinct specialization compared to other regions) when the SI value approaches 0. Conversely, an SI value approaching 1 indicates the presence of fruit sector specialization within that particular unit.

LI and SI should be understood as providing preliminary indications rather than definitive conclusions.

**RESULT**

The total fruit production in Sleman Regency reached 802.998 quintals. Tables 1 and 2 show the fruit production data for each district in Sleman Regency. Although 9 out of 17 districts reported no production of snake fruit, it remained the fruit with the highest production volume, amounting to 487.563 quintals or more than half of the total fruit production in the region. The most significant contribution came from Turi District, producing 323.862 quintals. In addition to snake fruit, various other fruits also contributed to the total output across several districts.

Cangkringan District was recorded as the main center of durian production in Sleman Regency, with a total output of 22.646 quintals, followed by banana production of 7.763 quintals. Meanwhile, Pakem District recorded an orange production of 3.122 quintals, and Ngemplak District produced 5.927 quintals of papaya. The highest jackfruit production was found in Sleman District, with 7.284

quintals, while the highest rambutan production was recorded in Kalasan District with 9.436 quintals. The highest mango production occurred in Minggir District, reaching 7.509 quintals.

Table 1. Fruit production in 2023 by district

| | Manggo | Durian | Orange | Banana |
|---|---|---|---|---|
| Berbah | 118 | 336 | 0 | 364 |
| Cangkringan | 0 | 22646 | 1519 | 7763 |
| Depok | 0 | 3354 | 1687 | 7140 |
| Gamping | 1519 | 6286 | 919 | 3247 |
| Godean | 1440 | 705 | 535 | 6762 |
| Kalasan | 2310 | 7133 | 170 | 4172 |
| Minggir | 7509 | 2804 | 188 | 2242 |
| Mlati | 1239 | 1768 | 10 | 724 |
| Moyudan | 4661 | 2478 | 934 | 720 |
| Ngaglik | 142 | 972 | 231 | 581 |
| Ngemplak | 931 | 209 | 48 | 2.033 |
| Pakem | 1.099 | 3.001 | 3.122 | 1.670 |
| Prambanan | 5.770 | 8.284 | 20 | 2.857 |
| Seyegan | 814 | 3.042 | 68 | 701 |
| Sleman | 487 | 1.449 | 2.625 | 1.369 |
| Tempel | 236 | 862 | 496 | 338 |

Source: BPS of Sleman Regency (2024)

Table 2. Fruit production in 2023 by district (continued)

| | Papaya | Snake fruit | Jackfruit | Rambutan |
|---|---|---|---|---|
| Berbah | 0 | 0 | 0 | 1.296 |
| Cangkringan | 5.530 | 1.878 | 3.277 | 7.852 |
| Depok | 3.540 | 1.833 | 3.050 | 2.462 |
| Gamping | 3.438 | 0 | 4.287 | 3.682 |
| Godean | 1.231 | 0 | 1.394 | 3.401 |
| Kalasan | 316 | 0 | 2.916 | 9.436 |
| Minggir | 586 | 0 | 756 | 3.722 |
| Mlati | 660 | 0 | 5.490 | 3.179 |
| Moyudan | 637 | 0 | 2.990 | 3.728 |
| Ngaglik | 1.626 | 257 | 259 | 4.840 |
| Ngemplak | 5.927 | 56 | 4.653 | 7.549 |
| Pakem | 1.251 | 31.350 | 4.844 | 4.517 |
| Prambanan | 929 | 0 | 3.341 | 6.349 |
| Seyegan | 1.548 | 0 | 3.629 | 4.426 |
| Sleman | 1.184 | 6.527 | 7.284 | 2.937 |
| Tempel | 5.154 | 121.800 | 377 | 949 |
| Turi | 395 | 323.862 | 4.402 | 1.099 |

Source: BPS of Sleman Regency (2024)

LQ analysis shows that several districts in Sleman Regency possess a comparative advantage in producing specific types of fruit (Table 3 and 4). Overall, LQ values in the region ranged from 0 to 11,92. The highest LQ was recorded for mango in Minggir District, at 11,92. This indicates that mango is a highly dominant fruit commodity in the district compared to other fruits produced in Minggir. Cangkringan District also demonstrated a comparative advantage in durian production, with an LQ value of 4,96, indicating a higher supply of durian relative to other fruits in the district. Meanwhile, Sleman District showed a comparative advantage in orange production (LQ = 6,86). Godean District stood out in banana production (LQ = 8,11). On the other hand, Ngemplak District had a comparative advantage in papaya production (LQ = 6,55).

Table 3. Fruit LQ values by district

| | Manggo | Durian | Orange | Banana |
|---|---|---|---|---|
| Berbah | 1,58 | 1,76 | 0,00 | 3,20 |
| Cangkringan | 0,00 | 4,96 | 1,88 | 2,86 |
| Depok | 0,00 | 1,61 | 4,56 | 5,75 |
| Gamping | 1,84 | 2,97 | 2,45 | 2,58 |
| Godean | 2,63 | 0,50 | 2,16 | 8,11 |
| Kalasan | 2,47 | 2,98 | 0,40 | 2,93 |
| Minggir | 11,92 | 1,74 | 0,66 | 2,34 |
| Mlati | 2,68 | 1,50 | 0,05 | 1,03 |
| Moyudan | 8,16 | 1,70 | 3,61 | 0,83 |
| Ngaglik | 0,45 | 1,21 | 1,62 | 1,21 |
| Ngemplak | 1,23 | 0,11 | 0,14 | 1,76 |
| Pakem | 0,61 | 0,65 | 3,83 | 0,61 |
| Prambanan | 5,92 | 3,33 | 0,05 | 1,92 |
| Seyegan | 1,62 | 2,37 | 0,30 | 0,91 |
| Sleman | 0,58 | 0,67 | 6,86 | 1,06 |
| Tempel | 0,05 | 0,07 | 0,24 | 0,05 |
| Turi | 0,01 | 0,24 | 0,05 | 0,03 |

Source: BPS of Sleman Regency (2024), analyzed

Snake fruit showed the strongest comparative advantage in Turi District, which recorded the highest LQ value in Sleman Regency at 1,58. The advantage in jackfruit production was shown by Mlati District, with an LQ of 6,37, while Berbah District demonstrated rambutan as a fruit

with a comparative advantage, having an LQ of 6,89.

Table 4. Fruit LQ values by district (continued)

| | Papaya | Snake fruit | Jackfruit | Rambutan |
|---|---|---|---|---|
| Berbah | 0,00 | 0,00 | 0,00 | 6,89 |
| Cangkringan | 2,59 | 0,06 | 0,98 | 1,75 |
| Depok | 3,63 | 0,13 | 2,01 | 1,20 |
| Gamping | 3,48 | 0,00 | 2,78 | 1,77 |
| Godean | 1,88 | 0,00 | 1,37 | 2,47 |
| Kalasan | 0,28 | 0,00 | 1,67 | 4,01 |
| Minggir | 0,78 | 0,00 | 0,64 | 2,35 |
| Mlati | 1,19 | 0,00 | 6,37 | 2,73 |
| Moyudan | 0,93 | 0,00 | 2,81 | 2,60 |
| Ngaglik | 4,32 | 0,05 | 0,44 | 6,11 |
| Ngemplak | 6,55 | 0,00 | 3,30 | 3,96 |
| Pakem | 0,58 | 1,02 | 1,44 | 1,00 |
| Prambanan | 0,80 | 0,00 | 1,84 | 2,59 |
| Seyegan | 2,57 | 0,00 | 3,87 | 3,50 |
| Sleman | 1,17 | 0,45 | 4,63 | 1,38 |
| Tempel | 0,94 | 1,54 | 0,04 | 0,08 |

Source: BPS of Sleman Regency (2024), analyzed

Based on the LI values, several commodities had scores close to 1 or above 0,5, including mango (0,71), orange (0,64), banana (0,59), rambutan (0,55), and durian (0,54), reflecting a tendency toward concentrated production. Other fruits with LI values above 0,50 include papaya (0,49) and snake fruit (0,33). The interpretation suggests that fruit commodities with LI values below 0,50 are not spatially well-distributed, although they still exhibit comparative strength in specific districts with LQ values above 1. The mango LI value of 0,71 indicates that mango production is highly concentrated in a single district within Sleman Regency. From the LQ values, several districts showed LQ values above 1, including Berbah, Gamping, Godean, Kalasan, Minggir, Mlati, Moyudan, Ngemplak, Prambanan, and Seyegan. The highest LQ for mango (11,92) was found in Minggir. In terms of production volume, Minggir contributed 26,44% of the total mango output in Sleman, indicating the district's strong potential as a mango production center.

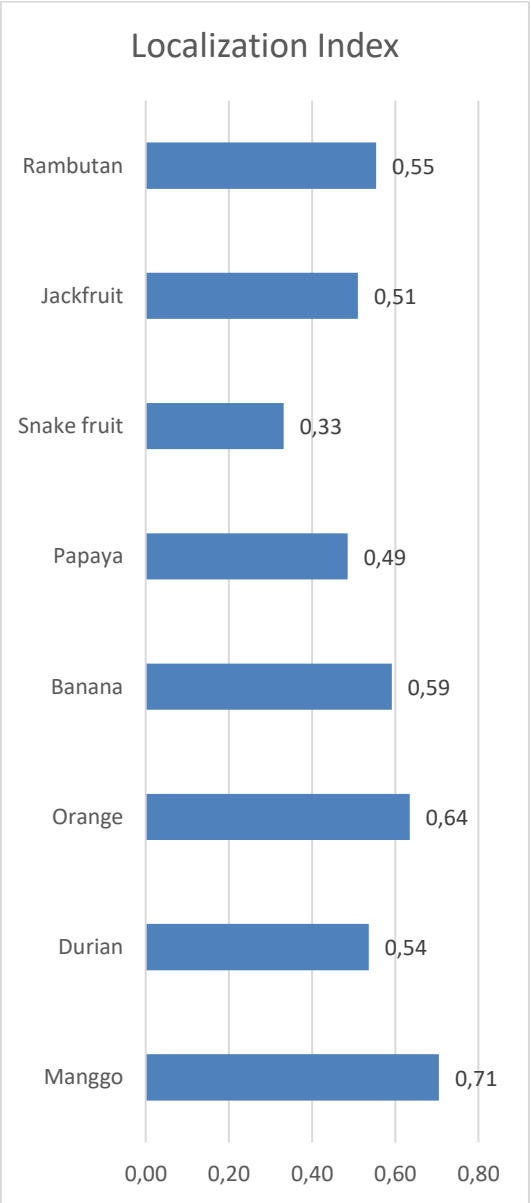



Figure 2. LI of fruits
Source: BPS of Sleman Regency (2024), analyzed

Orange had an LI value of 0,64, suggesting a potential concentration of production in areas with a comparative advantage in orange cultivation. Based on LQ values, oranges had an LQ above 1 in the districts of Cangkringan, Depok, Gamping, Godean,

Moyudan, Ngaglik, Pakem, and Sleman. The highest LQ for orange (6,86) was recorded in Sleman District. However, in terms of production volume, Pakem had the highest output with 3.122 quintals (Figure 2). Banana had an LI value of 0,59, indicating the possibility of concentrated production in a specific district. Based on LQ values, the highest LQ for banana (8,11) was recorded in Godean District, suggesting the potential for banana production to be centered there. In terms of production volume, Cangkringan recorded the highest yield, with 7.763 quintals.

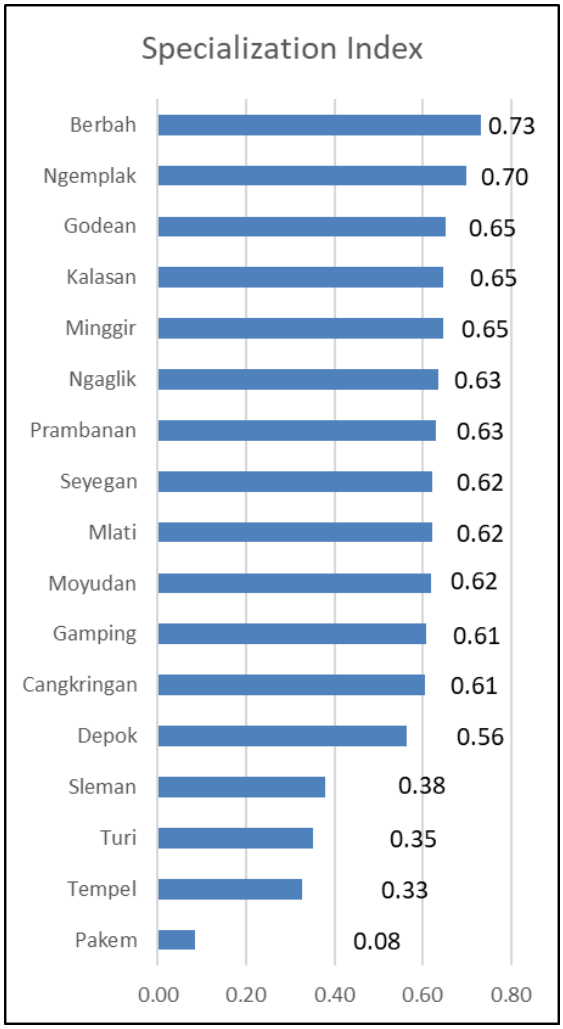



Figure 3. SI of districts
Source: BPS of Sleman Regency (2024), analyzed

Rambutan has LI value of 0,55, indicating a concentration of production in a particular area. This is supported by the highest LQ value (6,89) found in Berbah, suggesting that rambutan production is concentrated in this district. However, in terms of total production, the highest output of rambutan was recorded in Kalasan, reaching 9.436 quintals. Durian has an LI value of 0,54, also indicating production concentration in a specific area. This is reflected in the highest LQ value (4,96) in Cangkringan, which contributes 31,20% of the total durian production in Sleman Regency. Jackfruit has an LI value of 0,51, indicating a concentration of production in a specific district. The highest LQ value for jackfruit (1,59) was recorded in Turi, which supplies 66,42% of Sleman Regency's total jackfruit output.

The SI values for each district in Sleman Regency are presented in Figure 3. An SI value close to 1, or greater than 0,5, suggests a strong potential for specialization, which may lead to better development outcomes compared to other regions. These include Berbah (0,73), Ngemplak (0,70), Godean (0,65), Kalasan (0,65), Minggir (0,65), Ngaglik (0,63), Prambanan (0,63), Seyegan (0,62), Mlati (0,62), Moyudan (0,62), Gamping (0,61), Cangkringan (0,61), and Depok (0.56). On the other hand, districts with SI values

below 0,5 or closer to 0, like Sleman (0,38), Turi (0,35), Tempel (0,33), and Pakem (0,08) indicate a lack of commodity fruit specialization. When linked to total fruit production, Berbah, Ngemplak, Kalasan, Ngaglik, and Seyegan are specialized in rambutan; Godean and Depok in banana; Minggir and Moyudan in mango; Prambanan, Gamping, and Cangkringan in durian; and Mlati in jackfruit. Districts with low SI values, such as Sleman, Turi, Tempel, and Pakem, do not exhibit notable fruit commodity specialization.

**DISCUSSION**

In the context of regional development, fruit production plays a vital role in supporting food security and facilitating economic circulation. In terms of volume, the district with the highest fruit production is Turi, which extends from the slopes of Mount Merapi. This reflects the optimal utilization of the region's natural conditions, as sloped land near volcanic foothills, if still arable, is more suitable for plantation-based agriculture or fruit cultivation. As a result, snake fruit has emerged as a highly appropriate commodity for development in Turi District.

Generally, regions with high productivity also exhibit high LQ values, as seen with mangoes in Minggir and durians in Cangkringan. However, high fruit production in a given area does not automatically correspond with a high LQ for the most-produced commodity. This is evident in the case of orange production: while the highest volume is found in Pakem District (3,122 quintals), Sleman District, with slightly lower production (2,625 quintals), actually records a higher LQ of 6.86 compared to 3.83 in Pakem.

A high production volume indicates a region's actual capacity to generate output, whereas a high LQ, typically interpreted as values greater than one, signifies the region's comparative advantage relative to a broader reference area. However, it is important to note that a high LQ does not inherently represent spatial concentration or agglomeration in terms of absolute volume. Instead, it highlights the structural proportion of a particular commodity within the region's production composition compared to the overall area. Thus, the identification of key fruit commodities is largely determined by the analytical approach employed. When absolute production volume is used as the basis, the spatial concentration of production activities can be visualized, as illustrated in Figure 4. In contrast, if LQ values are used as the primary indicator, the resulting maps reflect the relative comparative advantage of specific commodities in certain districts, as shown in Figure 5. This distinction implies that

using LQ as the sole metric for identifying production agglomeration may lead to biased interpretations, as LQ does not measure absolute spatial intensity. This analytical gap has been largely overlooked in previous studies (Kurniawan, 2016; Sufriadi, 2017; Basorudin *et al.*, 2021). Therefore, the term "agglomeration" is more appropriately applied when referring to the concentration of production based on actual volume, whereas LQ should be interpreted as an indicator of structural differentiation and relative advantage across commodities and regions.

A high or low LI value does not inherently carry a positive or negative connotation. In the context of identifying fruit production concentration, an LI value approaching one indicates a tendency for production to cluster in specific areas, suggesting that these areas have the potential to serve as production hubs. Conversely, an LI value approaching zero reflects a relatively dispersed distribution of production across multiple regions. This interpretation helps reveal the presence or absence of concentration or localization potential (Rizal, Pasaribu and Khan, 2019; Biyatmoko, Susanti and Rostini, 2024). The implications are neutral, so long as fruit production remains concentrated in areas that are agroecologically suitable, such concentration should be maintained as it enhances efficiency in harvest collection and further distribution.

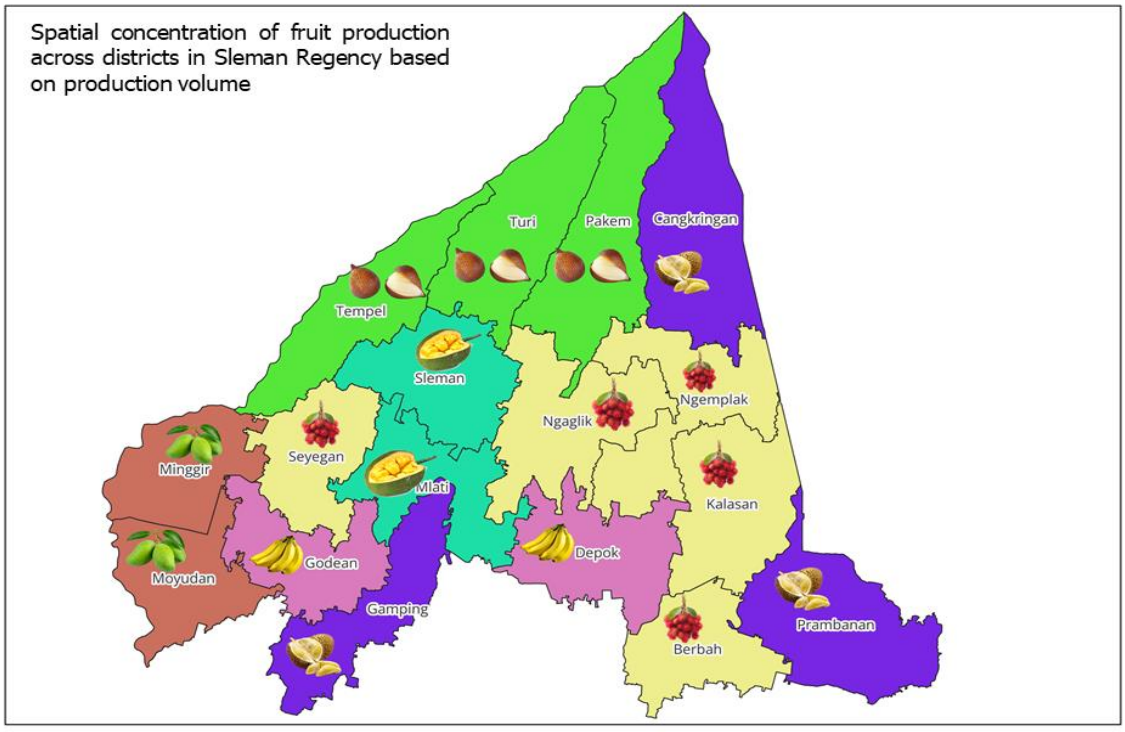



Figure 4. Spatial concentration of fruit production across districts in Sleman Regency based on production volume
Source: BPS of Sleman Regency (2024), analyzed

Another perspective from Aljaninansya, Marwanti and Barokah, (2022) suggests that dispersed production of a commodity, rather than concentrating it in one area, may be advantageous for pest and disease control. Given that the analysis indicates a tendency toward clustering in fruit production across Sleman Regency, pest management efforts become critically important. According to Kusumo, (2024), pest infestations frequently affect snake fruit. This presents a potential challenge for Turi District, the primary center of snake fruit production in Sleman.

SI indicates the potential for production specialization. In this study, the SI values reveal the degree to which districts within Sleman Regency exhibit specialization in fruit production. Since the SI reflects specialization tendencies, it must be interpreted alongside actual production data to determine where specific fruit types are highly concentrated in particular districts. The highest specialization, based on SI, is observed in Berbah District. This is confirmed by production data, which show a significant gap between rambutan production and other fruit types. Rambutan production reached 1,296 quintals, whereas the next highest, bananas, totaled only 364 quintals.

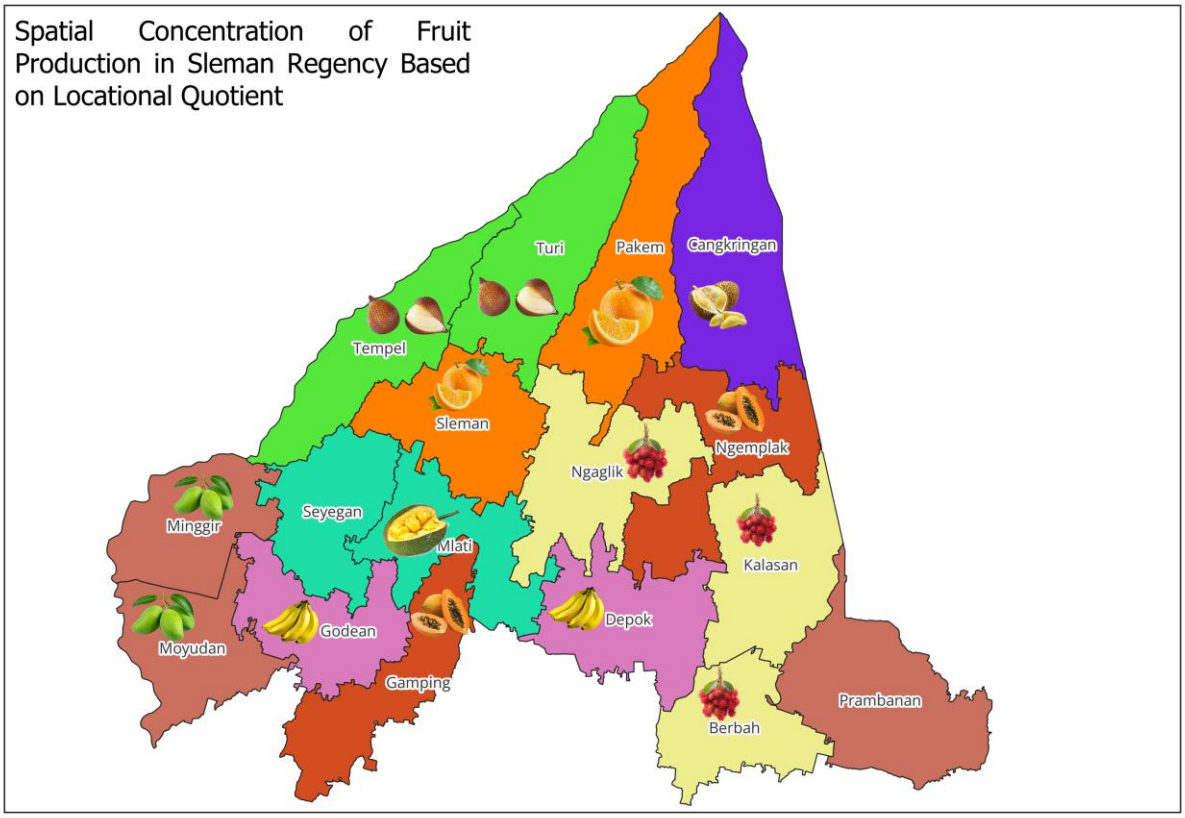



Figure 5. Spatial concentration of fruit production across districts in Sleman Regency based on Location Quotient
Source: BPS of Sleman Regency (2024), analyzed

Other fruits commonly found in other districts, such as oranges, papayas, snake fruit, and jackfruit, are entirely absent in Berbah. This pattern is understandable, given that Berbah exhibits suburban characteristics and its economic activities are not solely reliant on agriculture (Arif and Lessy, 2019).

In contrast, Pakem District, which has the lowest SI (0.08), produces all major fruit types in relatively balanced volumes ranging from 1,099 to 4,844 quintals, except for snake fruit, which dominates at 31,350 quintals. Despite this, the overall pattern does not indicate a clear dominance of a single commodity or a strong tendency toward specialization.

An SI value approaching one is often considered positive as it reflects the distinctive identity of a district. However, an SI value near zero should not necessarily be interpreted negatively. This index also provides insights into the degree of diversification within a given area (Fracasso and Marzetti, 2017). As demonstrated in this study, Berbah District exhibits a strong specialization based on its SI value, which is nearing one, supported by the fact that its highest production volume comes from rambutan. Conversely, districts without a dominant specialization reflect a high level of diversification. Pakem, with an SI value of 0.08, is identified as the district with the most diverse fruit production. Although snake fruit is its primary commodity, Pakem also produces a wide variety of other fruits, thereby reducing dependency on external fruit supplies. Therefore, the application of SI analysis also directly measures the level of fruit production diversification across districts in Sleman Regency. While commodities that tend to be concentrated offer advantages in terms of efficient harvest accumulation, they are also at greater risk of rapid pest outbreaks. Hence, regular pest monitoring and control strategies are crucial to ensure the sustainability of production without compromising the quality and quantity of yields.

## CONCLUSION AND SUGGESTIONS

Snake fruit is the most abundantly produced fruit in Sleman Regency, with its primary concentration in Turi District, while mango exhibits the highest comparative advantage. Each district demonstrates a dominant fruit commodity, reflecting spatial specialization. LI values, generally exceeding 0.5, indicate a tendency toward spatial concentration of fruit production, whereas the high SI values reflect a clear pattern of commodity specialization across districts.

Accordingly, it is recommended that the Sleman Regency Government promote the development of fruit production zones

based on the comparative advantages of each area. This includes strengthening local production systems, enhancing pest management strategies to prevent crop failure, and improving infrastructure to support efficient post-harvest collection and distribution. Future research may focus on analyzing the performance of fruit supply chains, land suitability-based production zoning, and pest risk assessment for key fruit commodities.

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## REFERENCES

Abobatta, W.F. (2020) 'Healthy benefits of fruits', *EC Nutrition*, 15(11), pp. 1–8. Available at: https://doi.org/10.31080/ecnu.2020.15.00781.

Aji, A. *et al.* (2021) 'Study of the Merapi Volcano eruption and the impact on community agricultural landuse in Sleman Regency', in *IOP Conference Series: Earth and Environmental Science*, p. 012137. Available at: https://doi.org/10.1088/1755-1315/683/1/012137.

Akaeze, O. and Nandwani, D. (2020) 'Urban agriculture in Asia to meet the food production challenges of urbanization: a review', *Urban Agriculture and Regional Food Systems*, 5(e20002). Available at: https://doi.org/10.1002/uar2.20002.

Aljaninansya, H., Marwanti, S. and Barokah, U. (2022) 'Regional analysis of large chili commodities (Capsicum Annum L.) in Kolaka Regency', in *IOP Conference Series: Earth and Environmental Science*. Institute of Physics, p. 012060. Available at: https://doi.org/10.1088/1755-1315/1114/1/012060.

Arif, M. and Lessy, Z. (2019) 'Nurturing socio-religious harmony in Yogyakarta: a study of pivotal roles of KWT Dewi Sri in empowering local women', *Analisa Journal of Social Science and Religion*, 4(2), pp. 225–242. Available at: https://doi.org/10.18784/analisa.v4i02.912.

Basorudin, M. *et al.* (2021) 'Analisis location quotient dan shift share sektor pariwisata sebagai indikator leading sector di Indonesia', *ECOBISMA (JURNAL EKONOMI, BISNIS DAN MANAJEMEN)*, 8(1), pp. 89–101. Available at: https://doi.org/10.36987/ecobi.v8i1.1855.

Biyatmoko, D., Susanti, H. and Rostini, T. (2024) 'Integrating oil palm and cattle farming in South Kalimantan: opportunities and challenges', *Tropical Wetland Journal*, 10(2), pp. 30–37. Available at: https://doi.org/10.20527/twj.v10i2.135.

BPS of Sleman Regency (2024) *Jumlah penduduk menurut kecamatan dan jenis kelamin di Kabupaten Sleman*. Sleman Regency. Available at: https://slemankab.bps.go.id/id/statistics-table/2/ODAjMg==/jumlah-penduduk-menurut-kecamatan-dan-jenis-kelamin-di-kabupaten-sleman.html (Accessed: 14 April 2025).

Budi, W. *et al.* (2023) 'The potential development of leading fruit commodity agribusiness in

Samarinda City of East Kalimantan, Indonesia', *RJOAS: Russian Journal of Agricultural and Socio-Economic Sciences*, 138(6), pp. 92–100. Available at: https://doi.org/10.18551/rjoas.2023-06.13.

De, U.K. (2018) 'Road infrastructure and agricultural development: a policy intervention in a backward rural economy', *Society & Change*, 12(2), pp. 45–76. Available at: https://ssrn.com/abstract=3637231.

Egorov, E. *et al.* (2021) 'Sustainable development management of industrial fruit growing', in *E3S Web of Conferences*. EDP Sciences. Available at: https://doi.org/10.1051/e3sconf/202125410007.

FAOSTAT (2025) *Crops and livestock products*.

Fironika, M. *et al.* (2023) 'Location quotient analysis in determining cattle base in Aceh, Indonesia', *AGRISEP*, 22(2), pp. 363–376. Available at: https://doi.org/10.31186/jagrisep.22.2.363-376.

Fracasso, A. and Marzetti, G.V. (2017) 'Estimating dynamic localization economies: the inadvertent success of the specialization index and the location quotient', *Regional Studies*, 52(1), pp. 119–132. Available at: https://doi.org/10.1080/00343404.2017.1281388.

Gustia, E., Mulatsih, S. and Gunawan, A. (2024) 'Regional analysis of sheep business in Banjarnegara Regency', *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan*, 12(2), pp. 105–111. Available at: https://doi.org/10.29244/jipthp.12.2.105-111.

Hakim, D.L. (2023) *Primary soils of agriculture in Indonesia*. Bantul Regency: Jejak Pustaka.

Hao, H. *et al.* (2022) 'Research on agricultural logistics efficiency based on DEA and tobit regression models', *Journal Européen des Systèmes Automatisés*, 55(1), pp. 71–79. Available at: https://doi.org/10.18280/jesa.550107.

Hastuti, S. (2013) 'Strategi pengembangan salak pondoh Pronojiwo Kabupaten Lumajang', *Jurnal Ilmiah INOVASI*, 13(3), pp. 233–240.

Hippy, M.Z. and Aisyah R, S. (2023) 'Analisis komoditas unggulan sub sektor pertanian terpilih berdasarkan volume produksi di Provinsi Gorontalo', *Agrovital: Jurnal Ilmu Pertanian*, 8(1), pp. 83–90.

Juarsyah, R., Muani, A. and Suyatno, A. (2015) 'Kajian pengembangan agribisnis komoditas unggulan buah-buahan di Kabupaten Kubu Raya', *Jurnal Social Economic of Agriculture*, 4(1), pp. 56–69.

Kurniawan, B. (2016) 'Analisis sektor ekonomi unggulan Kabupaten Kerinci Provinsi Jambi', *Islamic Economics Journal*, 4(1), pp. 1–26.

Kusumo, H.J. (2024) 'Luasan lahan dan lalat jadi kendala petani salak di Sleman', *IDN Times*.

Lubis, N.P.S. and Purba, M.A.B. (2020) 'Analysis of competitive agricultural sector competitiveness in Langkat Regency hardwood subsector (plantation)', in *Proceedings of the 1st Unimed International Conference on Economics Education and Social Science*. Scitepress, pp. 497–504. Available at: https://doi.org/10.5220/0009503704970504.

Macieira, A., Barbosa, J. and Teixeira, P. (2021) 'Food safety in local farming of fruits and vegetables', *International Journal of Environmental Research and Public Health*, 18(9733). Available at: https://doi.org/10.3390/ijerph18189733.

Novita, D., Rinanda, T. and Ilham Riyadh, M. (2022) 'Determination of superior

agriculture commodities in North Sumatra Province', in *E3S Web of Conferences*. EDP Sciences. Available at: https://doi.org/10.1051/e3sconf/202233906003.

Putra, D.M.D.U. and Sugiartawan, P. (2019) 'Sistem informasi geografis tata guna lahan di Kabupaten Sleman', *Jurnal Sistem Informasi dan Komputer Terapan Indonesia (JSIKTI)*, 1(3), pp. 175–184. Available at: https://doi.org/10.33173/jsikti.32.

Qiu, L. *et al.* (2025) 'Production agglomeration and spatiotemporal evolution of China's fruit industry over the last 40 years', *Agriculture*, 15(634). Available at: https://doi.org/10.3390/agriculture15060634.

Rahadiansyah, A. *et al.* (2022) 'Analysis of the role of fisheries sector in regional development of Garut Regency of West Java', *Asian Journal of Fisheries and Aquatic Research*, 17(6), pp. 22–32. Available at: https://doi.org/10.9734/ajfar/2022/v17i630421.

Rizal, A. *et al.* (2017) 'Typology economic of fisheries commodities and fishery sector development status in the West Bandung Regency', *Jurnal Akuatika Indonesia*, 2(2), pp. 109–119.

Rizal, A., Pasaribu, R.H.R. and Khan, A.M.A. (2019) 'Analysis of fishery sectors linkages toward other sectors in Batubara District of North Sumatera Province, Indonesia', *WNOFNS*, 25, pp. 31–43. Available at: www.worldnewsnaturalsciences.com.

Rizqy, M., Setyadi, T. and Harya, G.I. (2025) 'Determination of leading fruit commodities in the horticulture subsector in Gresik Regency', *Asian Journal of Applied Research for Community Development and Empowerment*, 9(1), pp. 54–57. Available at: https://doi.org/10.29165/ajarcde.v9i1.590.

Rudani, A., Mulyo, J.H. and Sugiyarto (2023) 'Leading commodities of food crops and horticulture in West Java Province', *Journal of Agribusiness Management and Development*, 4(1), pp. 1–8. Available at: https://journal.ugm.ac.id/v3/JAMADEV/.

Sahri, L.E., Sunariyanto, S. and Anadza, H. (2024) 'Strategi pengembangan kelompok tani dalam mengatasi penurunan hasil pertanian buah apel (Studi pada Dinas Pertanian dan Ketahanan Pangan Kota Baru)', *Jurnal Respon Publik*, 18(1), pp. 41–48.

Sanjaya, B., Ginting, R. and Effendi, I. (2019) 'Identification of potential development and business feasibility of commodity agribusiness leading fruits in the City of Binjai', *AGRISAINS: Jurnal Ilmiah Magister Agribisnis*, 1(2), pp. 109–118. Available at: http://jurnalmahasiswa.uma.ac.id/index.php/agrisains.

Sari, R. *et al.* (2017) 'Agribusiness potential development of lime (Citrus aurantifolia) inTanah Datar Regency of West Sumatera', in *Prosiding Seminar Nasional Lahan Suboptimal*, pp. 632–637.

Sufriadi, D. (2017) 'Analisis transformasi struktural perekonomian Aceh', *Jurnal E-KOMBIS*, 3(2), pp. 14–22.

Szymańska, E.J. and Rysz, M. (2022) 'Determinants of changes in fruit production in farms in areas with a fragmented agrarian structure', *Agriculture*, 12(1767). Available at: https://doi.org/10.3390/agriculture12111767.

Wantasen, E., Umboh, S. and Endoh, E. (2020) 'Analysis of base sector, coefficient of localization and specialization to detect the superiorcommodity of livestock in Regency of South Bolaang Mongondow Province of North Sulawesi, Indonesia', *Jurnal Ilmu-*

*Ilmu Peternakan*, 30(1), pp. 19–28. Available at: https://doi.org/10.21776/ub.jiip.2020.030.01.03.

Wiwaha, D.P. *et al.* (2022) 'Analysis of regional potential and small medium industry potential using location quotient (lq), locational index (li), and specialization index (si) methods in Majalengka District (Case study: Majalengka Regency)', *JMM: Journal of Mechanical and Manufactur*, 1(2), pp. 120–127.

Wu, J. *et al.* (2024) 'Effects of land and labor costs growth on agricultural product prices and farmers' income', *Land*, 13(1754). Available at: https://doi.org/10.3390/land13111754.

Yuniarti, W. *et al.* (2022) 'Land suitability analysis for tropical fruit commodities as a conservation effort in highlands area, Indonesia', *International Journal of Sustainable Development and Planning*, 17(2), pp. 569–577. Available at: https://doi.org/10.18280/ijsdp.170222.