Mapping and Future Potential of Cocoa Commodity Base Regions in Indonesia

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ABSTRACT

Cocoa is a prominent global export with strong competitiveness in the international market. During the 2019-2022 period, there was positive growth in cocoa exports while domestic cocoa production declined. The variability of cocoa production across provinces is due to the different levels of cocoa development in each region. This study aims to map cocoa base and non base regions in Indonesia and examine the characteristics of cocoa distribution across the provinces of Indonesia. This study is important because there have been limited studies about regional mapping of cocoa at the national level. It is also important to know the condition of regional mapping in the future. The regions observed in this study include 33 provinces in Indonesia that produce cocoa. The study uses secondary data which includes variables related to cocoa production and production of superior plantation commodities for seven years (2017-2023). The analysis used to answer the primary objective is Location Quotient (LQ) and Dynamic Location Quotient (DLQ) analysis, while the secondary objective uses Localisation and Specialisation analysis. The findings reveal 10 provinces as cocoa base regions, with Southeast Sulawesi exhibiting the highest LQ. North Sulawesi province has been identified as potential areas for future development. While 18 provinces have shifted from base regions to non base regions or are not prospective in the future. Localisation and Specialisation indices below 1 indicate that cocoa cultivation is geographically dispersed, with no single region dominating production.

INTRODUCTION

The plantation subsector has been observed to contribute the highest agricultural sector GDP, averaging at 3.63% in 2018-2023 (Badan Pusat Statistik, 2023). Cocoa is one of Indonesia's leading commodities whose products, both raw and processed, have the potential to be exported to international markets. Indonesia is ranked as the 3rd largest cocoa producing country in the world, but as a world cocoa exporting country Indonesia is only ranked 13th (Badan Pusat Statistik, 2022). Palm oil remains the leading commodity in terms of exporting its derivative products, with a substantial volume of 26,547,755 tonnes per year.

This is followed by rubber, coconut, and coffee. Cocoa is also a top export for Indonesia, ranking fifth with an average annual export volume of 377,059 tonnes (Direktorat Jenderal Perkebunan , 2023b). The foreign exchange value of cocoa exports in 2022 amounted to US$ 1,259,655. Furthermore, a positive growth of 2.47% in cocoa export volume was experienced between 2019 and 2022. Conversely, Indonesia's cocoa production declined by 3.43% during the same period.

The observed rise in export volume is largely attributable to the concurrent rise in production. This is because production exerts a positive influence on export volume (Muttoharoh et al., 2018); (Oktavian & Maulana, 2019); (Alam et al., 2021). However, in reality, the development of cocoa production actually decreased by 3.43% in the same period. The decline in cocoa land area is partly responsible for this. The cocoa land area in 2019 was 1,560,944 hectares and decreased to 1,421,009 hectares in 2022. In accordance with this trend, cocoa production, which stood at 734,793 tonnes in 2019, experience a decline to 667,294 tonnes in 2022 (Direktorat Jenderal Perkebunan , 2023b).

The decline in cocoa production can be attributed to two main factors: firstly, the decrease in the area of suitable land; and secondly, the low productivity and quality of cocoa. Specifically, cocoa productivity from 2018 to 2022 was recorded at 0.481 tonnes per hectare. In addition to these challenges, various obstacles at the farm level have been identified

(Tunggul et al., 2021). Cocoa production in each province varies depending on how the region develops its cocoa commodity.

The average cocoa production in Indonesia during 2019-2022 averaged at 700,921 tonnes per year. Central Sulawesi Province has demonstrated the highest level of cocoa production during the 2019-2022 period, with an average of 128,224 tonnes per year (Direktorat Jenderal Perkebunan, 2023b). The variation in cocoa production across Indonesian regions is attributable to the differing development of cocoa commodities in each area. The uneven distribution of cocoa production across Indonesia results in the formation of cocoa commodity base regions that are concentrated in specific areas. Regional potential, which influences commodity development, varies across Indonesia based on geography, resource diversity, and environmental capacity. (Isdianto & Syathori, 2022). As posited by Jauhari(2020), the planning of regional development is, in general, closely related to the agricultural sector. The agricultural sector is regarded as a fundamental economic activity, provided that agricultural production is sufficient to meet the needs of the region, as well as those of other regions. The agricultural sector can be regarded as superior if it performs well in international, regional, and national comparisons.

The superior commodities of the country play a significant role in its economic development. The criteria for determining a commodity as superior include its capacity to meet regional production targets, generate added value, generate employment opportunities,

utilise local resources, enhance income, potentially boost productivity, and stimulate regional investment (Julianto et al., 2020). Superior commodities can be a base commodity when the commodity is able to meet the needs of a region as well as outside the region, while it is said to be a non-base commodity when it is not able to meet the needs of a region let alone outside (Zaini, 2019a).

In the context of regional economic analysis, a base commodity is defined as a commodity that not only fulfills local demand but also produces a surplus for export, thereby increasing regional income. In Indonesia, cocoa are classified as base commodities in a certain province and have shown to have a significant impact on regional development and income. The theory of spatial competitiveness and regional development can provide insights into the causes of the emergence of cocoa base regions. Provinces that are cocoa base regions become centers of growth for the cocoa sector. Consequently, these regions are required to continuously increase productivity to maintain their advantage in national and global markets (Zaini, 2019b).

Research into the regionalisation of cocoa commodities has been conducted in several areas, including Parigi Regency (Zikria, 2022), Gunung Kidul Regency (Nurlina et al., 2024), Pinrang Regency (Fitriwati & Djaya, 2022), and East Java Province (Harya et al., 2018). The research states that cocoa commodities in several regions are classified as cocoa base region. However, previous research that discusses the regionalisation of cocoa commodities has only been conducted in specific regions, and no similar research has been found that examines all provinces in Indonesia. Therefore, this research is important because there is limited research on regional mapping of cocoa commodities at the national or Indonesian level.

In addition, this research is important because the cocoa sector in Indonesia still has serious challenges regarding declining national production, stagnant productivity, and production that is still concentrated in certain regions. This may be the cause of structural imbalance and lack of integrated regional planning in cocoa development. This will threaten cocoa's role in national agricultural security and the global market. From the government's perspective, investment policies and allocations often lack spatial accuracy due to limited national-scale data on commodity base areas.

This provides the interest for researchers in identifying cocoa commodity regions in Indonesian provinces nationally, as well as seeing how the condition of the region will be in the future. Based on the background and problems of cocoa commodity as Indonesia's leading commodity, the purpose of this study is to identify the mapping of cocoa commodity base and non-base regions in Indonesian provinces and examine the characteristics of cocoa commodity distribution in Indonesia.

METHODS

A study was conducted to map the areas of Indonesia in which cocoa

is produced. Based on data sources from the Badan Pusat Statistik and the Directorate General of Plantations, there are a total of 34 provinces in Indonesia, but only 33 provinces will be examined in the study. The Province of DKI Jakarta was excluded as it did not produce cocoa throughout the year. The selection of research locations in Indonesia uses the Census technique. Because 33 provinces are cocoa producers in Indonesia, Indonesia is one of the main cocoa producing countries in the world. In addition, the selection of locations in all Indonesian provinces is due to the difference in cocoa production in each province, which will create base and non-base regions. Provinces with high cocoa production may not necessarily be base regions, and conversely provinces with low production may not necessarily be non base regions. The research method utilised is descriptive quantitative. The research data to be used is secondary data taken from several sources, namely Cocoa Statistics 2017-2023 by the Central Bureau of Statistics and Featured Plantation Statistics 2017-2023 by the Directorate General of Plantations. The research variables include cocoa production (tonnes) and the production of superior plantation commodities (tonnes) in each of the 33 provinces over a period of seven years (2017-2023). The 2017-2023 timeframe is used due to the limited data obtained from the sources used. The 7 years period from 2017 to 2023 was chosen because in these years there was an increase and also a decrease in cocoa production in Indonesia. Additionally, this period includes the COVID-19 pandemic, allowing the study to consider its potential impact on cocoa production trends.

To address the research objectives, the analyses used are *Location Quotient* (LQ), *Dynamic Location Quotient* (DLQ), Localisation analysis and Specialisation analysis using *Microsoft Excel* software. The analysis to answer the first objective is LQ and DLQ analysis, while to answer the second objective is localisation and specialisation analysis.

Location Quotient (LQ) Analysis

Location Quotient (LQ) analysis is a method used to classify region as a base or non base region of a sector. The LQ calculation is based on the capacity of a region in terms of its activities or potential (Tutupoho, 2019). This study utilises LQ analysis to ascertain whether the cocoa commodity is a base or non-base commodity in each province in Indonesia. A region is designated as a cocoa base if it can meet its own production needs and also export to other regions. Conversely, a region is designated as a non-base cocoa region if it is unable to meet its own cocoa production needs, let alone export externally. The LQ analysis formula employed in the study is as follows (Manuhutu, 2016).

$$LQ = \frac{vi/vt}{Vi/Vt} \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Description:

LQ : Location Quotient

Ni : Cocoa production in province i (tonnes)

vt : Total production of all plantation commodities in province i (tonnes)

Vi : Cocoa production in Indonesia (tonnes)

Vt   : Total production of all plantation commodities in Indonesia (tonnes)

Decision-making criteria:

LQ ≥ 1   Province i is a cocoa base region. Cocoa production is able to fulfil the needs in the region and even out side the region.

LQ < 1   Province i is a non-base region. Cocoa production is unable to fulfil the demand in its own region.

LQ = 1   Cocoa production is able to fulfil the needs of province i but cannot export to other regions

The LQ method has been criticised on the grounds that it is only able to describe conditions at a certain time without the ability to predict future developments. Subsequent refinement of the LQ method by the Dynamic Location Quotient (DLQ) method allows for forecasting the potential of cocoa commodities in each region (Tutupoho, 2019). The DLQ analysis aims to determine whether a sector will continue to be a base in the region or become non-base in the future (Harmaidi et al., 2024); (Pujiyanto et al., 2022). The formula used is (Pribadi & Nurbiyanto, 2021):

$$DLQ = \frac{(1+gij)/(1+gj)}{(1+gip)/(1+gp)} \quad \text{..............} \quad (2)$$

DLQ :Coefficient of sector i in city j

gij :Average growth of cocoa commodity in province j

gj :Average growth of total plantation commodities inprovince j

gip :Average growth of cocoa commodity in Indonesia

gp :Average growth of total plantation commodities in Indonesia

Decision-making criteria:

DLQ ≥ 1   Cocoa commodity in province i has the potential to be developed (prospective)

DLQ < 1   Cocoa commodity in province i has no potential for development (not prospective)

The analysis results of the LQ and DLQ methods can be combined and grouped into provinces that are cocoa commodity base regions (Table 1).

Localisation and Specialisation Analysis

Localisation analysis is a geospatial technique used to determine the distribution of sectors in an area. The distribution is used to identify locations with potential for the development of specific sectors (Vaulina & Khairizal, 2016). In this study, calculations were carried out using localisation analysis so that the distribution of cocoa commodities in the Indonesian region could be determined. The analysis yielded results that indicated whether the cocoa commodity was concentrated in a single province or dispersed across multiple provinces in Indonesia. The formula employed is as follows:

$$\alpha = \frac{Si}{Ni} - \frac{\sum Si}{\sum Ni} \quad \text{..................}(3)$$

Table 1. Combined Quandrant of LQ and DLQ Analysis

	DLQ ≥ 1	DLQ < 1
LQ > 1	Base and Prospective Areas	Base and Non-prospective areas
LQ < 1	Non-base and Prospective areas	Non-base and Non-prospective areas

Source : (Pribadi & Nurbiyanto, 2021)

Description:

α   :Cocoa commodity localisation coefficient

S_i :Cocoa production in province i (tonnes)

N_i :Cocoa production in Indonesia (tonnes)

ΣS_i :Total production of all plantation commodities in province i (tonnes)

ΣN_i :Total production of all plantation commodities in Indonesia (tonnes)

Decision-making criteria:

α ≥ 1   Cocoa production is concentrated in one region of the province

α < 1   Cocoa production is spread across several provinces

Specialisation analysis is a tool used to examine the degree of specialisation within specific sectors in a region. In the event of a region demonstrating specialisation in a particular sector, it is posited that the region will consequently possess a competitive advantage as a result of that specialisation (Syahputra et al., 2015). The results of this analysis indicate whether provincial regions in Indonesia have specialised in the cocoa commodity business as a leading commodity. The following formula is employed for the specialisation analysis:

$$\beta = \frac{S_i}{\sum S_i} - \frac{N_i}{\sum N_i} \quad ....(4)$$

Description:

β   :Sector specialisation coefficient

S_i :Cocoa production in province i (tonnes)

N_i :Cocoa production in Indonesia (tonnes)

ΣS_i :Total production of all plantation commodities in province i (tonnes)

ΣN_i :Total production of all plantation commodities in Indonesia (tonnes)

Decision-making criteria:

β ≥ 1   Provincial regions have specialised in cocoa business

β < 1   Provincial regions have not yet specialised in cocoa commodity businesses

RESULTS AND DISCUSSION
Mapping of Base and Non-Base Regions of Cocoa Commodity in Indonesia

Cocoa commodity production is relatively uniform across Indonesian provinces, with the exception Province of DKI Jakarta, which does not engage in cocoa commodity production. Despite overall uniformity, the variation in production across these regions gives rise to the distinction between cocoa base and non-base regions. The utilisation of LQ analysis in mapping these areas facilitates the determination of each region's capacity to produce cocoa.

A region is designated as a cocoa base if the LQ value is greater than 1, and as a non-cocoa base if the LQ value is less than 1. The LQ analysis results indicate an average trend from 2017 to 2023 (Figure 1).

Figure 1 indicates that Indonesia is a cocoa commodity base region. This is evidenced by the production LQ value obtained throughout the year greater than 1 with an average obtained of 3.488. The cocoa commodity in Indonesia is considered a leading commodity because its products can fulfil domestic needs and have even
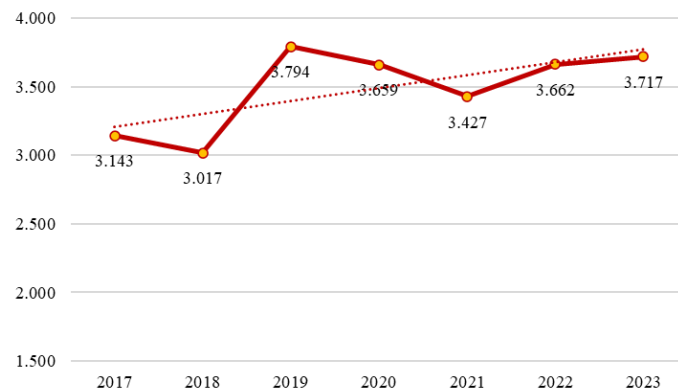
Figure 1. Development of Location Quotient Value of Cocoa Commodity as a Base Commodity in Indonesia 2017-2023 (Source: Data processed, 2024)
Description: LQ > 1 Cocoa Base Region ; LQ < 1 Cocoa Non-Base Region

been exported to international markets for a long time. Between 2017-2023, Indonesian cocoa has an average export volume of 368,576 tonnes/ year. Cocoa is the 5th highest exported commodity after palm oil, rubber, coconut, and coffee (Ministry of Agriculture, 2022). Based on this statement, it is not surprising that Indonesia's cocoa export volume takes advantage of opportunities to increase its export volume to the international market.

The development trend of the LQ value of cocoa production in Indonesian provinces during 2017-2023 appears to be modestly increasing as shown by the dotted line. For instance, the value increased from 3.143 in 2017 to 3.717 in 2023 (Figure 1). Despite the decline in the area dedicated to cocoa production in Indonesia, there has been a concomitant increase in productivity. The increase in cocoa productivity was observed in 2017 at 386 kilograms per hectare, rising to 404 kilograms per hectare in 2023. Productivity is one of the factors or characteristics of a commodity said to be superior (Julianto et al., 2020). Consequently, it can be concluded

that the potential for cocoa cultivation in the province of Indonesia remains significant, with the capacity to meet the needs of the region and other areas. The LQ analysis on production indicators show that not all Indonesian provinces are included in the category of cocoa commodity base regions and can be divided into cocoa commodity base and non-base regions (Table 2). Based on the results of the LQ analysis calculation, it was found that out of 33 provinces, 19 Indonesian provinces are classified as cocoa base region from 2017 to 2023 as indicated by the average LQ value of more than 1 (Table 2) and dark green colour in region map (Figure 2). Provinces that are cocoa base regions include Aceh, West Sumatra, Lampung, Banten, Special Region of Yogyakarta, East Java, Bali, West Nusa Tenggara, East Nusa Tenggara, North Sulawesi, Gorontalo, Central Sulawesi, South Sulawesi, West Sulawesi, Southeast Sulawesi, Maluku, North Maluku, Papua, and West Papua. A province is classified as a cocoa base region if it can fulfil its own cocoa demand and even export to other regions. Classification of base or non-base

regions is seen from the comparison of cocoa commodities with other plantation commodities. A comparative example from previous research about the plantation commodities of coffee in Colombia, 65.2% of cities in Colombia are coffee base areas and 33.2% of cities are non-base areas. Areas that are coffee bases deserve to be prioritized in coffee agrisbinical development, while non-base areas are targets for commodity expansion or diversification (Villalobos & Rojas, 2025).

The criteria to determine a commodity base are: the potential resources present in the area, the production and productivity of the commodities, and the contribution of commodities to regional economic growth (Sihombing et al., 2020). It is known that the growth value of plantation GRDP in Indonesia during 2017-2023 has an average growth of 9.57% each year. This proved that increasing cocoa production can increase economic growth (Badan Pusat Statistik, 2022). The potential for cocoa commodities to enhance the regional economy is evident. In order to maintain its status as the primary economic sector in the region, it is essential that the cocoa base region continues to develop and consolidate its cocoa production. A potential strategy could be the implementation of a policy aimed at increasing cocoa production and value-added activities, with the aim of enhancing the welfare of cocoa farming communities, particularly the farmers (Rifani & Sa'roni, 2020).

Figure 2 illustrates the spatial distribution of cocoa base and non-base regions across Indonesia. A total of 14 provinces has an LQ value below 1, which is shown in light green. These provinces are classified as non-base region for cocoa commodity (Table 2). One of the factors inhibiting an area from being recognised as a base is when there is land conversion, especially agricultural land, which is converted into non-agricultural land. This conversion is usually caused by an increase in population, resulting in the need for settlement and infrastructure development as non-agricultural land. In addition, what causes farmers to convert cocoa land to other crops is due to declining production due to natural disasters such as floods and infestations (Prihantini et al., 2024); (Ariningsih et al., 2019). In 2023, pest infestation on cocoa plants affected 132,968 ha of land in all provinces of Indonesia. The infestation if not immediately controlled will continue to have an impact on production which will continue to decline ((Direktorat Jenderal Perkebunan , 2023a). Another factor in cocoa land conversion is price. Research conducted by (Pinandito et al., 2023) the selling price of cocoa is unstable and fluctuates. Farmers' perceptions indicate that oil palm sales are more straightforward than cocoa which require fermentation and drying processes.

Most of the cocoa production centres in Indonesia are located on the island of Sulawesi as indicated by its high average LQ values compared to other provinces (Table 2). High production in Sulawesi Island is influenced by the number of farmers. The number of farmers cultivating cocoa commodity in Sulawesi Island

Table 2. Average Results of *Location Quotient* Analysis of Cocoa Commodity in Indonesia in 2017-2023

Province	LQ value							Ave-rage	Growth (%)
	2017	2018	2019	2020	2021	2022	2023		
Aceh	1.802	2.058	2.252	2.545	2.662	2.643	2.494	**2.351**	5.81
North Sumatra	0.335	0.360	0.431	0.477	0.508	0.547	0.510	0.453	7.54
West Sumatra	2.295	2.301	2.878	2.119	2.075	2.138	2.151	**2.279**	0.08
Riau	0.030	0.024	0.008	0.013	0.008	0.009	0.008	0.014	-9.11
Riau Islands	0.001	0.002	0.007	0.013	0.023	0.017	0.023	0.012	89.79
Jambi	0.023	0.021	0.019	0.022	0.027	0.027	0.025	0.023	1.84
South Sumatra	0.054	0.059	0.061	0.075	0.066	0.065	0.075	0.065	6.21
Bangka Belitung	0.016	0.019	0.012	0.013	0.030	0.030	0.033	0.022	21.74
Bengkulu	0.229	0.184	0.299	0.236	0.254	0.184	0.225	0.230	4.00
Lampung	1.730	2.251	2.882	3.012	2.820	2.901	2.791	**2.627**	9.23
West Java	0.438	0.388	0.542	0.690	0.208	0.223	0.209	0.385	-2.29
Banten	1.667	1.628	1.966	1.952	1.827	1.858	1.878	**1.825**	2.35
Central Java	0.334	0.433	0.282	0.271	0.276	0.255	0.269	0.303	-1.54
Special Region of Yogyakarta	1.222	1.464	2.249	2.481	2.264	2.537	2.350	**2.081**	13.28
East Java	4.452	1.213	3.657	1.214	1.142	1.180	3.879	**2.391**	48.00
Bali	2.764	2.911	4.030	4.056	4.152	4.414	4.258	**3.798**	8.26
West Nusa Tenggara	1.175	1.192	1.475	1.605	1.656	1.657	1.735	**1.499**	6.99
East Nusa Tenggara	6.446	7.980	9.109	9.132	9.594	10.453	9.748	**8.923**	7.58
West Kalimantan	0.050	0.045	0.034	0.027	0.027	0.014	0.025	0.032	-4.08
Central Kalimantan	0.009	0.014	0.015	0.014	0.018	0.015	0.015	0.014	12.06
South Kalimantan	0.003	0.003	0.005	0.007	0.003	0.004	0.003	0.004	8.48
East Kalimantan	0.052	0.062	0.048	0.069	0.053	0.053	0.052	0.055	2.55
North Kalimantan	0.324	0.215	0.285	0.150	0.137	0.128	0.143	0.198	-8.57
North Sulawesi	0.322	1.322	1.495	1.650	1.469	1.586	1.813	**1.380**	57.52
Gorontalo	3.256	2.880	2.500	2.767	1.747	1.842	1.845	**2.405**	-7.55
Central Sulawesi	10.603	11.131	13.597	12.603	13.225	13.627	13.543	**12.619**	4.53
South Sulawesi	19.525	18.201	21.860	20.460	18.180	19.970	19.342	**19.648**	0.41
West Sulawesi	6.613	8.052	12.012	12.433	11.707	12.040	13.235	**10.870**	13.56
Southeast Sulawesi	25.883	23.927	31.152	31.720	28.778	31.688	29.412	**28.937**	3.02
Maluku	4.387	2.948	3.826	3.720	3.828	4.116	3.916	**3.820**	-0.04
North Maluku	2.522	2.312	3.117	3.088	2.843	2.825	2.923	**2.804**	3.41
Papua	2.761	1.723	1.495	0.996	0.883	1.053	0.900	**1.402**	-15.14
West Papua	2.411	2.221	1.585	1.113	0.616	0.734	2.833	**1.645**	32.38
Indonesia Average	**3.143**	**3.017**	**3.794**	**3.659**	**3.427**	**3.662**	**3.717**	**3.488**	**9.77**

Source: Data processed (2024)

has the highest number among other provinces with an average of 168,276 farmer households. This aligns with studies by Sarini (2017), R. Malik et al. (2021), and Alkamalia et al. (2017), which found that increased labor
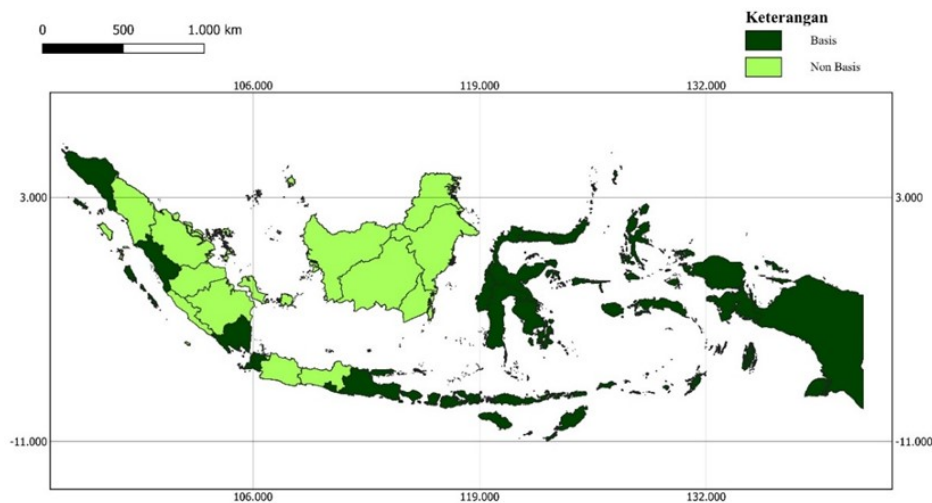
Figure 2. Map of Cocoa Base and Non-Base Regions in Indonesia
(Source: Data processed, 2025)

availability significantly boosts cocoa production. Labour is needed in the continuity of commodity cultivation, especially labour with good productivity. Each stage requires an adequate amount of labour aligned to its demands.

Southeast Sulawesi Province is ranked first with an LQ value of 28.937 (LQ>1). Throughout 2017 to 2023 the LQ value obtained was above 20.00. This shows that South-east Sulawesi is a cocoa base region that is able to meet the needs of the region to export to other regions. While Central Sulawesi leads in total output, Southeast Sulawesi is the highest cocoa base region. Southeast Sulawesi Province provides various technology facilities to develop cocoa commodity production. The adoption of technology provided is in the form of environmentally friendly cocoa plant pest and disease control technology and fertilisation technology to increase cocoa plant productivity (Southeast Sulawesi Agricultural Technology Assessment Centre, 2019). Growing adoption of technological innovation is one of the factors that become a criterion for a commodity to be said to be superior (Alkamalia et al., 2017). In addition to technology, there are also farmer institutional facilities that aim to provide services in the provision of fertilisers and capital for farmers. With this institutional facility, it will facilitate farmers in increasing cocoa production in Southeast Sulawesi (Southeast Sulawesi Agricultural Technology Assessment Centre, 2019).

Central Sulawesi Province, the highest cocoa producer in Indonesia, also has a high LQ value of 12.619. Research by Rahayu et al. (2021) confirms that cocoa and other plantation commodities in Sigi Regency, Central Sulawesi have an LQ>1 value, which means they are cocoa base regions. Most of the cocoa in Central Sulawesi is exported to other countries, including Malaysia. Many large industries in the cocoa bean processing sector produce cocoa products to be marketed to

other countries. The existence of this industry is able to open optimal employment opportunities for farmers in Central Sulawesi. According to the Coordinating Ministry for Economic Affairs, one of the companies exporting plantation products in Central Sulawesi is able to buy the harvest of plantation commodities including cocoa from 400,000 farmers. It is also able to employ 1,400 employees and 1,150 seasonal workers. A commodity is said to be superior if it is able to absorb high labour for the surrounding community. Research conducted by (Novita et al., 2023) and (Alkamalia et al., 2017) states that employment generation is one of the criteria in the development of superior commodities.

The provinces with the lowest LQ values are South Kalimantan province at 0.004 and Riau Islands province at 0.012. The LQ value is far below 1, which means that the province is a non-base cocoa region because the region is not able to meet the cocoa needs in its own region, so it requires supplies from other regions. Based on the data, it is known that the provinces of South Kalimantan and Riau Islands are not among Indonesia's cocoa commodity producers. Cocoa production in Riau Islands during 2017-2023 was only 59 tonnes and cocoa production in South Kalimantan was 584 tonnes. This is the lowest total cocoa production in Indonesia out of a total of 4,846,765 tonnes of cocoa production in 2017-2023 (Ministry of Agriculture, 2022). Most of the

agricultural land in South Kalimantan is used for oil palm commodity farming with an area of 426,948 Ha in 2022 (Badan Pusat Statistik Provinsi Kalimantan Selatan, 2021). Indonesian provinces that are currently classified as cocoa commodity base or non-base region, may not necessarily be classified the same in the future. To address the weaknesses of the LQ analysis, the DLQ (Dynamic Location Quotient) analysis is employed to examine the growth rate of cocoa commodity production in each province. Based on the results of the DLQ analysis, the national DLQ value of cocoa commodities in Indonesia obtained an average of 1.826 (DLQ> 1). This means that cocoa commodity in Indonesia nationally has the potential to be developed in the future. However, when examined in each province, there are only 1 out of 33 provinces that have a DLQ value of more than 1, namely North Sulawesi (88.262). This means that only cocoa commodities in the North Sulawesi province have prospective or potential to be developed in the future. The province with the lowest DLQ value is in the Riau Islands province at -8.672. Indeed, cocoa production in Riau Islands is the lowest production contributor among other provinces, with a total production of only 59 tonnes during 2017-2023 (Direktorat Jenderal Perkebunan , 2023b). The results of the LQ and DLQ analyses will be combined into a quandrant. The following are the results of the combined LQ and DLQ analysis of cocoa commodities in Indonesia. Cocoa commodity mapping in

Indonesia, based on the integration of LQ and DLQ values, is categorized into four distinct quadrants (Table 3). Areas included in the cocoa base category and prospective for development are the provinces of North Sulawesi. There are 18 provinces included in the cocoa base and not prospective, while 14 provinces are included in the non-cocoa base region and have no potential for future development. There are no provinces in Indonesia that are categorised as non-cocoa base and prospective for future development.

Cocoa commodities in North Sulawesi are cocoa base regions and projected to maintain this status in the future as evidenced by the DLQ value of 88.262. This means that the cocoa commodity has the potential to be developed in the future. The high DLQ value obtained can be caused by the high average growth of cocoa in North Sulawesi, which is 66.86% when compared to other provinces. Cocoa production in North Sulawesi was recorded to have increased quite drastically in 2018 reaching 5,881 tonnes from the previous year 2017 of 1,153 tonnes. The amount of production has been stable in subsequent years. The increase in production can be attributed to an expansion in the cocoa land area, which increased by 16,104 hectares. During the same period, a decline in coconut-related land area was recordedat 9,922 hectares. Consequently, a shift in land use from coconut cultivation to cocoa cultivation is projected (Badan Pusat

Statistik Provinsi Sulawesi Utara, 2018). In addition to being influenced by production factors and land conversion, cocoa in North Sulawesi has demonstrated the highest productivity level compared to other provinces, with an average of 760 Kg/Ha during the period 2017-2023. Widjaya and Yanuarti (2024), in their study on coffee commodity mapping across Asia, identified Indonesia as a coffee base region with strong future potential. Countries that have LQ and DLQ values of more than 1 are required to consistently increase their production through intensification and better agricultural mechanisation. According to (Fadli et al., 2024) maintaining and developing a sector such as coffee further requires farmer-friendly policies, investing in modern agricultural technology, and continuing to introduce derivative products in domestic and international markets.

A total of 18 provinces experienced a change from base to non-base, which is indicated by the LQ value obtained more than 1, while the DLQ value is less than 1. This means that in the future the cocoa commodity in these 17 provinces do not have prospects for development. One of the factors for cocoa commodity development is the availability of quality seeds. The use of quality seeds is currently low due to limitations and accessibility in cocoa development areas. The government's cocoa seed supply programme has decreased every year. This has caused cocoa production to continue to decline during 2017-2023. The realisation of the provision of superior cocoa seeds in 2020 reached

Table 3. Quadrant Analysis of Location Quotient and Dynamic Location Quotient of Cocoa Commodity in Indonesia 2017-2023

	DLQ > 1	DLQ < 1	
	Base and Prospective Areas	**Base and Non-prospective Areas**	
LQ > 1	North Sulawesi	Aceh West Sumatra Lampung Banten Special Region of Yogyakarta East Java Bali West Nusa Tenggara East Nusa Tenggara	Gorontalo Central Sulawesi South Sulawesi West Sulawesi Southeast Sulawesi Maluku North Maluku Papua West Papua
	Non-base and Prospective	**Non-base and Non-prospective areas**	
LQ < 1		North Sumatra Riau Riau Islands Jambi South Sumatra Bangka Belitung Bengkulu	West Java Central Java West Kalimantan Central Kalimantan South Kalimantan East Kalimantan North Kalimantan

Source: Data processed (2024)

14,774,500 sticks, down 37.8% to 6,244,560 sticks in 2022 (Direktorat Perbenihan Perkebunan , 2022). The decline in the use of quality seeds will affect the level of productivity and production of cocoa plants, resulting in the condition of the area that was originally a base will be threatened to become a non-base cocoa area in the future.

Research presented by (Ibnu, 2022) that Indonesian cocoa productivity is projected to decline in the future with an annual growth of -30.4%. If not addressed immediately, it is likely that in meeting domestic cocoa needs, Indonesia will increasingly rely on imports from other countries. The government must formulate policies regarding the availability of superior seeds and certified cocoa seedlings, which must be distributed evenly, especially in areas that are cocoa bases, so that these areas have the opportunity to remain bases in the future (Nde'oha et al., 2024).

Quadrant results from the LQ and DLQ analyses indicate that no Indonesian provinces that are non-basic cocoa (LQ<1) and prospective in the future (DLQ>1). This condratict findings from (Kurniawan et al., 2022) that cocoa commodities are included in non-base commodities in Ogan Komering Ulu Regency, South Sumatra Province, but will become superior commodities that have prospective development in the future. One of the factors supporting a commodity that was originally a non-base, then turned into a base in the future is the special attention given by the government

through seed distribution programmes and the addition of planting area (Frastika et al., 2023). If there are non-base areas, the strategy is to develop superior seeds, increase the capacity of farmers' human resources, develop supporting infrastructure, and establish institutions. This will certainly help an area to increase production and become a base area. A total of 14 provinces fall into the non-cocoa base category and are not prospective for future development.

In this quadrant, the cocoa commodity in these 14 provinces has experienced a decline in cocoa development in the region. So there is a possibility that the cocoa commodity is not reliable in the region (Amelia & Guswandi, 2021). For example, cocoa production in Riau Province has a high average negative growth in 2017-2023, which is -10.00. Sectors that are categorised as non-basic need to be strengthened to transition into bases in the future. Strategies include increasing investment, organising training for businesses or farmers, and providing ease of business licensing and capital (Tanjung et al., 2021).

Characteristics of Cocoa Commodity Distribution in Indonesia

The distribution of cocoa commodities in Indonesia can be identified throughlocalisation analysis. Localisation analysis aims to determine whether cocoa commodities are spread throughout the region or only concentrated in one region. If it is said to be concentrated, it shows that a commodity is not cultivated evenly throughout the region. The commodity is clustered closely in a region. Understanding the distribution of cocoa commodities helps identify which regions have the ability and potential to develop cocoa. The calculation results of localisation analysis on cocoa commodity in Indonesia can be seen on Table 4.

Based on Table 4, it can be concluded that from 2017 to 2023 the average localisation value is below 1, so it can be concluded that national cocoa commodities are spread across all provincial regions or can be said not to be concentrated in one provincial region. The average localisation value of cocoa commodity in Indonesia is very low at 0.00000. A total of 16 provinces produces localisation values that are negative or below 0, while the

Table 4. Average Value of Localisation Analysis of Cocoa Commodity in Indonesia 2017-2023

Year	Localisation Value	Criteria
2017	0,00000	Not Concentrated
2018	- 0,00000	Not Concentrated
2019	0,00000	Not Concentrated
2020	0,00000	Not Concentrated
2021	0,00000	Not Concentrated
2022	- 0,00000	Not Concentrated
2023	0,00000	Not Concentrated
Average of Indonesia	**0,00000**	

Source: Data processed (2024)

remaining 17 provinces are positive but still below 1. The province with the highest localisation value is in Central Sulawesi at 0.166, while the province with the lowest localisation value is Riau at -0.175.

Cocoa commodity is cultivated evenly in all provinces of Indonesia. This can be an advantage if a region has a crop failure as supply can be met from other regions. In accordance with the results of research by (Zikria, 2022) states that the cocoa plantation business in Parigi Moutong Regency is not concentrated in one sub-district area, but is spread across several sub-districts. In other plantation commodities such as coffee, it also states that coffee commodity businesses are scattered in several areas in Central Aceh Regency (Zikria, 2020) and in Cibuntu Village (Swantari et al., 2021). Meanwhile, the tobacco commodity is also not concentrated in the sub-district area in Jember Regency (Purwandhini et al., 2019). In contrast to the results of research from (Mora-Villalobos & Rendón Acevedo, 2024) that sugarcane commodities tend to cluster in several areas of the Colombian Coatamadya.

In addition to examining the distribution of cocoa commodities in Indonesia, further identification of whether a region has specialised in cocoa commodity cultivation is carried out. This identification can be assessed using specialisation analysis. Specialisation analysis aims to see the ability of a region to prioritise cocoa commodities in order to advance the economy of the region. The results of cocoa commodity specialisation analysis in Indonesia are shown Table 5.

Table 5 shows the average value of cocoa specialisation in Indonesia during 2017-2023 is below 1. This means that no province in Indonesia has specialised or prioritised cocoa commodity farming. The average value of cocoa specialisation analysis in Indonesia is 0.031. A total of 16 provinces has negative specialisation values, while the remaining 17 provinces produce positive values but are still below 1. The province with the highest specialisation value is Southeast Sulawesi at 0.359, while the provinces with the lowest specialisation value are Riau, Riau Islands, Jambi, Bangka Belitung, West Kalimantan, Central Kalimantan, South Kalimantan ,

Table 5. Average Value of Specialisation Analysis of Cocoa Commodity in Indonesia 2017-2023

Year	Spesialisation Value	Criteria
2017	0.02823	Not Specialised
2018	0.03238	Not Specialised
2019	0.03608	Not Specialised
2020	0.03445	Not Specialised
2021	0.02982	Not Specialised
2022	0.03071	Not Specialised
2023	0.03229	Not Specialised
Average of Indonesia	**0.03199**	

Source: Data processed (2024)

and East Kalimantan at -0.013. Previous research also states that there are no sub-district areas in Parigi Moutong Regency that specialise in cocoa commodity exploitation (Zikria, 2022). Other plantation commodities such as tobacco in Jember Regency are also not concentrated in one sub-district area, but are spread throughout Jember Regency (Purwandhini et al., 2019). Indonesian provinces do not solely focus on cocoa, but also other plantation commodities such as palm oil, coffee, rubber, coconut, sugarcane, tobacco, and others. The wide variety of plantation commodities makes the provinces do not prioritise cocoa in advancing the economy of their region. This is because cocoa is not the only com-modity that provides benefits in the region. An example is the palm oil commodity, where palm oil produc-tion in Indonesia is much more produc-tive than cocoa production. The average palm oil production in 2017-2023 was able to reach 43,357,312 tonnes compared to cocoa production which only reached 698,082 tonnes (Direktorat Jenderal Perkebunan , 2023b).

Likewise, other plantation commodi-ties that have higher production than cocoa are rubber, coconut, and coffee. The diversity in commodity cultivation car-ried out by the community aims to fulfil the needs in the region, so that the community does not depend on one commodity alone. '

CONCLUSIONS AND SUGGESTION

The national average LQ value of cocoa in Indonesia is 3.488, which means that Indonesia is a cocoa base region. There are 19 provinces that are categorised as base regions and the remaining 14 provinces are categorised as non-base regions. Southeast Sulawesi is the province with the highest LQ value due to the adoption of technology and institutional framework from the government. The non-base provinces face land conversion and plant infestation that disrupt production. When combined with the DLQ results, the provinces of North Sulawesi become base and prospective region in the future. Meanwhile, 18 provinces are base and not prospective regions in the future, and 14 provinces are non-base and not prospective region in the future. The decline in the use of quality seeds is a factor in the decline of cocoa production and productivity, causing an area to be threatened with becoming non-base in the future. Policy intervention is needed to ensure the availability and distribution of superior seeds and certified seedlings to support the sustainability of base regions. Localisation analysis states that the cocoa commodity is not concentrated or spread across all Indonesian provinces. While the specialisation analysis states that there is no provincial area that prioritises cocoa commodity cultivation only.

Non-base cocoa areas need more attention from the government. The government should undertake cocoa commodity development in non-base regions through cocoa land extensification to restore land that has been converted to other commodities. Areas that are no longer prospective in cultivating

cocoa commodities also need assistance from the government through the provision of production development facilities. Such facilities include pest and disease control technology and technology aimed at increasing cocoa crop production and productivity. In addition, the government should also increase the target and actual distribution of high-quality cocoa seeds to farmers. Farmers should increase their productivity in cocoa cultivation by regularly attending counselling and training on good cocoa cultivation procedures. For non-cocoa base areas, the government could provide small-scale processing grants and extension services to build the capacity of developing areas. Spatial mapping should be conducted to guide commodity revitalisation, value chain investment and incentives, to support equitable distribution of national agricultural resilience. The limitation of this study is limited to discussing the mapping and distribution of cocoa commodities; further research should continue with multiplier effect to identify the role of cocoa commodities in regional development using revenue indicators.

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