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Competitiveness of Indonesian Essential Oils in The International Market

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Abstract

The limitation of technology poses a challenge in the essential oil industry in Indonesia. Indonesian essential oils are still exported in crude form, thus possessing low value-added. Meanwhile, Indonesia has 40 types of essential oils out of 80 traded globally, with 12 of them entering the global commercial market. Therefore, this research is intriguing to examine, aiming to 1) analyze the global market structure of essential oils, 2) analyze comparative competitiveness, and 3) the competitive advantage of Indonesian essential oils. The data consists of secondary data in the form of time series for the period 2012-2022. The data were analyzed using the Herfindahl Index, CR4, RCA, and EPD methods. The research findings indicate that the market structure of essential oils in the international market is oligopolistic with moderate concentration levels. Indonesia has a comparative advantage and strong competitiveness in all countries in this study. The condition of competitive advantage that occurred frequently during the period 2012-2022 in the five target countries is as follows: retreat, followed by rising star, then lost opportunity, and the least occurring is falling star.

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INTRODUCTION

The commodity of essential oils in the world trade is regarded as playing a strategic role in producing both primary and secondary products, whether for domestic consumption or export (Nurcahyani & Salqaura, 2023). Essential oils as non-oil export commodities have a broad market share in many industries such as pharmaceuticals or medicines, perfumes, cosmetics, and the food or beverage industry. The high global demand for essential oils makes it a promising export opportunity for Indonesia. Indonesia has vast opportunities with its natural resources, where there are 40 types of essential oils found in Indonesia out of the 80 types traded in the international market, with 12 of them already entering the global commercial market (Indonesian Essential Oils Council, 2017). The Indonesian essential oils that are in high demand in the global market are patchouli oil, clove, nutmeg, agarwood, and lemongrass. Indonesia is able to export patchouli oil at a rate of 1

200-1,500 tons per year. Indonesia is also one of the largest producers of cloves in the world. Based on data from the Food and Agriculture Organization (FAO), Indonesia's clove production reached 137,641 tons in 2021. The essential oils produced in Indonesia are still in crude form. The limitation of essential oil processing industries is the reason why Indonesia still produces crude essential oils. This lack of value-added enhancement is still not optimal in the essential oil industry in Indonesia due to the use of traditional technologies.

The export of Indonesian essential oils to the world continues to fluctuate annually. Based on data from the International Trade Center (ITC, 2022), the performance of Indonesian essential oil exports shows a fluctuating trend. In 2018, the value of Indonesian essential oil exports reached 199 million USD but experienced a decrease in 2019 to 185 million USD. In 2021, the export value surged again to 248 million USD. The global essential oil market is dominated by at least 10 countries, including India, the United States, France, China, Brazil, Indonesia, Germany, the Netherlands, the United Arab Emirates, and the United Kingdom. Indonesia ranks 6th as the world's largest exporter of essential oils.

The export value of Indonesian essential oils to major destination countries is not always stable and experiences fluctuations. However, overall, the trend shows positive growth. In 2021, the destination country with the highest export value was the United States with an export value of 43.915 million USD, followed by India with an export value of 41.614 million USD, then France with 30.463 million USD, followed by Spain with an export value of 25.570 million USD, and the Netherlands ranking last with an export value of 24.097 million USD. Interestingly, the countries that are the main

destinations for Indonesian essential oil exports are also major exporters of essential oils worldwide. Differences in needs and natural resources among countries lead to the creation of complementary relationships in the essential oil industry. Countries import and export various types of essential oils that cannot be produced domestically, known as intra-industry trade. Intra-industry trade is a part of international trade where trade relations between countries are dominated by exchanges of goods from relatively similar sectors (Simbolon et al., 2022).

The study conducted by Kartika et al. (2023) traced the development trends of Indonesian essential oils in five importing countries and the competitiveness of Indonesian essential oils in the top five importing countries from 2011 to 2020. The results showed that Indonesian essential oil commodities hold a highly competitive position due to having a comparative advantage or RCA value >1 in all target countries under study, including the United States, India, France, China, and Singapore. The study by Nurcahyani & Salqaura (2023) indicated that the average Export Competitiveness Index (ECI) for Indonesian essential oils is 1, signifying that Indonesia possesses a competitive advantage in essential oils. The novelty of this study lies in analyzing the competitiveness of Indonesian essential oils viewed through comparative advantage using the RCA method, competitive advantage analyzed using the EPD method, and the market structure of essential oils in the international market using the CR_4 and Herfindahl Index (HI) methods. The objectives of this study were 1) to analyze the market structure of essential oils in the international market, 2) to analyze the comparative competitiveness of Indonesian essential oils in the international market, and 3) to analyze the competitive advantage of Indonesian essential oils in the international market.

RESEARCH METHODS

This study employed the Secondary Data Analysis method with the research location in Indonesia. Indonesia was chosen as the research location primarily because it is one of the world's largest exporters and producers of essential oils. The research was conducted between October and December 2023. The type of data used was secondary data in the form of time series covering the period from 2012 to 2022 from five destination countries for Indonesian essential oil exports, including the United States, India, France, Spain, and the Netherlands. The data on Indonesian essential oils were based on the entity code HS 330129 (Essential oils, whether or not terpeneless, including concretes and absolutes) sourced from Statistics Indonesia (BPS), Dewan Atsiri Indonesia or the Indonesian Essential Oils Council (DAI), the International Trade

Center (ITC), the United Nations Commodity Trade Statistics Database (UN Comtrade), and other supporting literature studies.

The data analysis method was based on the research objectives. The first research objective was to analyze the market structure of essential oils using the Herfindahl Index (HI) and CR_4 analysis methods. HI analysis was used to determine the commodity market structure in the international market to asses market concentration levels and measure market share dominance in each country (Panorama, 2016). This method involves summing the squares of each country's market share. The HI analysis was expressed through the following mathematical equation:

$$HI=Si1^2+Si2^2+Si3^2+...+Sin^2$$

Where:

HI = Herfindahl Index Value

Si = Market share of the essential oil commodity of country i in the global essential oil trade

n = Number of countries involved in the trade

The Herfindahl Index (HI) value ranges from 0 to 1 (or 10,000, which is the square of 100%). A HI value closer to 0 indicates a more competitive industry market, whereas a HI value closer to 1 (or 10,000) indicates a more monopolistic market structure and uneven market share distribution. The Herfindahl Index (HI) values can be summarized as follows

Table 1. Market Concentration Levels

Levels	HI Values
Unconcentrated	0 – 1,000
Moderately concentrated	1,000 – 1,800
Highly concentrated	1,800 – 10,000

Source: Hanafi & Tinaprilla (2017)

The Concentration Ratio indicates the level of market concentration by measuring the percentage of market share controlled by the top n producers in an industry. The concentration ratio can be calculated by summing the market shares of exporters in the destination countries (Sleuwaegen & Dehandschutter, 1986). The calculation of the Concentration Ratio is expressed through the following mathematical equation:

$$CR_4= Si_1+ Si_2+Si_3+Si_4$$

Where:

CR_4 = Percentage value of Concentration Ratio 4

Si = Market share of the essential oil commodity of country i in the global essential oil trade

A lower CR_4 value indicates a higher level of market competition. Conversely, a higher CR_4 value signifies the dominance of producers in the market (Sembiring & Syaukat, 2021). The Concentration Ratio 4 (CR_4) values can be summarized as follows:

Table 2. Concentration Ratio Criteria

CR	Market concentration levels	Market Structure
---%---		
0 – 50	Unconcentrated	Perfectly competitive market
50 – 80	Moderately concentrated	Oligopoly competition
80 – 100	Highly concentrated	Oligopoly to monopoly competition

Source: Sleuwagen (1989)

The second research objective was to analyze the comparative competitiveness of Indonesian essential oils using the Revealed Comparative Advantage (RCA) analysis method. The RCA index is a tool for measuring the competitiveness of a sector in actual economic conditions. RCA compared the export market share of a specific sector in the world market with the total export share of that country (Narulita et al., 2014). RCA was calculated using the following formula (Pratama et al., 2020):

$$RCA = \frac{Xij/Xi}{Xwj/Xw}$$

Where:

Xij = Value of Indonesian essential oil exports to importing countries of Indonesian essential oils (USD)

Xi = Total value of Indonesian product exports to importing countries of Indonesian essential oils (USD)

Xwj = Value of global essential oil exports to importing countries of Indonesian essential oils (USD)

Xw = Total value of global exports to importing countries of Indonesian essential oils (USD)

The RCA value smaller than 1 approaching 0 indicates weak product competitiveness. If the RCA value is less than 1, it signifies that a country is not competitive as a producer and exporter of a commodity (Nursodik et al., 2022). An RCA value greater than 1 indicates relative strength in product competitiveness, where the higher the RCA value, the greater the level of competitiveness (Lindung & Jamil, 2014). The RCA index can also be classified into four categories: weak (RCA < 0.8), moderate (0.8 ≤ RCA ≤ 1.25), strong (1.25 ≤ RCA ≤ 2.5), and very strong (RCA > 2.5) (Yu & Qi, 2015).

The third research objective is to analyze the competitive advantage of Indonesian essential oils in the international market using the Export Product Dynamic (EPD) analysis method. EPD helps analyze and identify the competitive advantage (competitiveness) of a commodity. EPD also helps determine whether a commodity has dynamic performance or not (Pratama et al., 2020). EPD analysis utilizes a combination of market attractiveness and business strength, which will be interpreted into four position categories (Akbar, 2022). The EPD analysis matrix is depicted in the figure below:

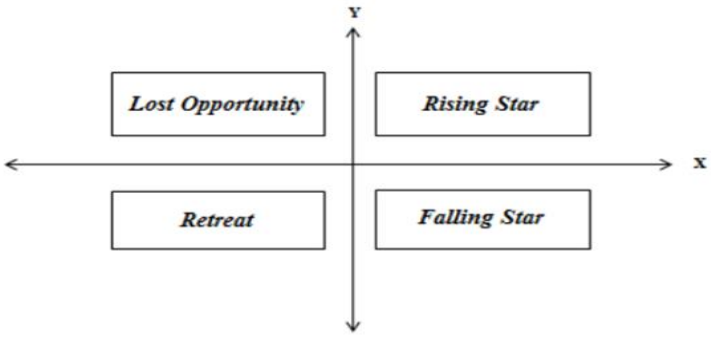

Figure 1. Quadrants on the EPD Matrix

Source: Estherhuizen (2006)

The Export Product Dynamic (EPD) can be calculated using the following formula:

X-axis: Growth of export market share of essential oils

$$\frac{\sum_{t-1}^{t}\left(\frac{Xij}{Wij}\right) \times 100\% - \sum_{t-1}^{t}\left(\frac{Xij}{Wij}\right)t\text{-}1 \times 100\%}{T}$$

Y-axis: Growth of product market share

$$\frac{\sum_{t-1}^{t}\left(\frac{Xt}{Wt}\right) \times 100\% - \sum_{t-1}^{t}\left(\frac{Xt}{Wt}\right)t\text{-}1 \times 100\%}{T}$$

Where:

Xij = Value of Indonesia's essential oil exports to the export destination country (USD)

Xt = Total value of all Indonesian commodity exports to the export destination country (USD)

Wij = Value of global essential oil exports to the export destination country (USD)

Wt = Total value of all commodity exports from the world to the export destination country (USD)

T = Number of years analyzed

t-1 = Previous year

i = Essential oil commodity

j = Indonesia and/or all countries

RESULTS AND DISCUSSION

Market Structure of Essential Oil in The International Market

The analysis of the Herfindahl Index (HI) was employed to discern the market structure of a commodity in the international market. The HI value ranges from 0 to 10,000, where a smaller or closer to 0 HI value indicates that the structure of the world essential oil industry market tends towards perfect competition, while a HI value nearing the maximum boundary suggests a monopolistic market structure for the essential oil industry with highly uneven market share distribution.

Table 3. HI Values and CR_4 of Essential Oil in the International Market

No	Year	HI	CR_4
			---%---
1	2012	1,624.14	47.8
2	2013	1,613.48	47.9
3	2014	1,646.70	53.4
4	2015	1,754.18	57.2
5	2016	1,651.48	53.9
6	2017	1,546.18	50.7
7	2018	1,588.04	51.2
8	2019	1,589.06	50.4
9	2020	1,621.26	48.1
10	2021	1,708.54	47.7
11	2022	1,715.02	45.2
	Average	**1,641.64**	**50.32**

Source: Compiled from UN Comtrade data (2023)

Based on the Herfindahl Index analysis calculation in Table 3, the average value obtained is 1,641.64, indicating that the market structure of the world's essential oil is of moderate concentration oligopoly. The average number of essential oil exporters from 2012 to 2022 is 121, indicating that the essential oil export market has a relatively large number of exporters. Countries with significant market shares hold a substantial portion of the total market share, while smaller exporting countries with numerous counts collectively contribute less. The implications of the essential oil industry with a moderate concentration oligopoly market structure on market competition are that several countries with significant dominance can influence the market but not entirely dominate it. According to McConnel et al. (2018), the consequence of an oligopoly market structure with a moderate concentration on market competition is the presence of product differentiation, where countries or

companies take action to distinguish their products from competitors. According to Bikker & Haaf (2002), the weakness of the Herfindahl Index method lies in its insensitivity to changes in the number of players in industries with a large number of players.

The market structure of essential oils can also be ascertained using the Concentration Ratio (CR) method. The Concentration Ratio is indicated by the CR_4 value, which is obtained by summing the market shares of the four largest producers in a product market. A decreasing CR_4 value signifies a higher level of market competition, whereas an increasing CR_4 value indicates the presence of essential oil producers or exporters dominating the global essential oil export market. Based on the calculation results in Table 3, it is known that the average CR_4 value of the four largest exporting countries during the period 2012-2022 is 50.32%. According to Sleuwagen (1989), an industry with a CR_4 value of 50.32% exhibits an oligopoly market structure with moderate concentration. An oligopoly with moderate concentration indicates that producers or countries have a low level of power in influencing the market. The highest CR_4 value of essential oils in the international market was 57.2% in 2015, and the lowest value was 45.2% in 2022.

Fluctuations in the CR_4 value of essential oils in the international market can be caused by various factors such as changes in demand, changes in competition, and technological advancements. Fluctuations in the CR_4 value of essential oils can be attributed to various factors such as changes in demand, changes in competition, and technological advancements, in line with previous research by Vonna et al. (2020) which stated that several factors can influence the CR_4 value, including technological advancements in the extraction and refining of patchouli oil, leading to increased efficiency and reduced production costs, thereby resulting in higher concentration ratios for companies adopting such technology. Additionally, fluctuations in prices are dependent on the patchouli alcohol (PA) content in patchouli oil, where higher PA levels command higher prices, thus yielding higher concentration ratios for producers able to meet such demands.

Comparative Competitiveness of Indonesian Essential Oils

The comparative competitiveness of Indonesian essential oils can be computed and analyzed using the Revealed Comparative Advantage (RCA) method. RCA compares the export market share in a specific sector to the overall export share of the country concerned in the global market. Major importing countries for

Indonesian essential oils under study include the United States, France, India, Spain, and the Netherlands.

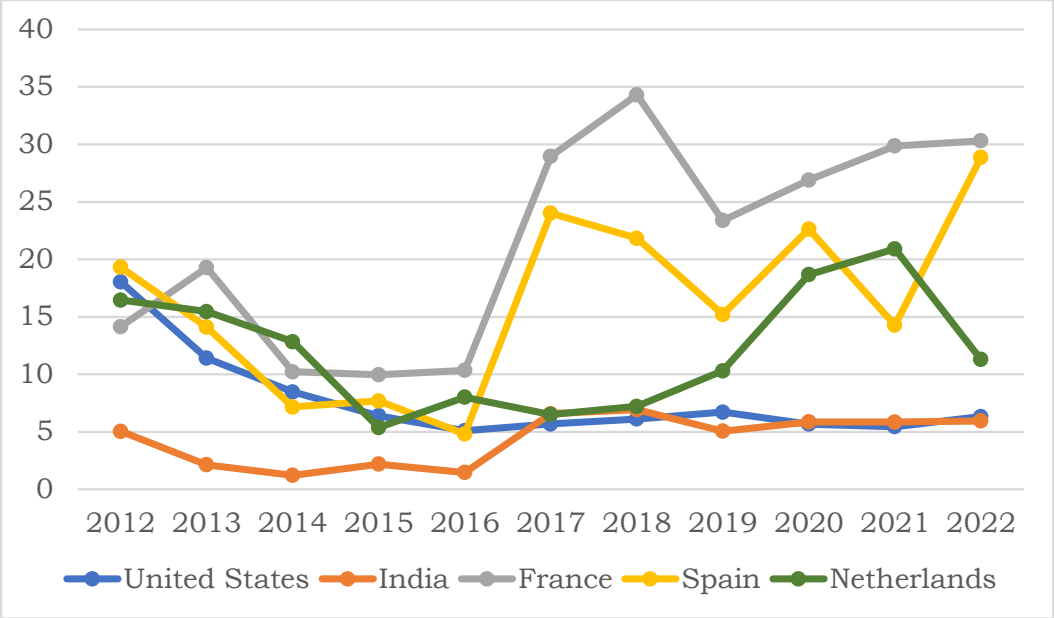

Figure 2. RCA of Indonesian Essential Oils in Importing Countries

Source: Processed from ITC data (2023)

The overall RCA value of Indonesian essential oils to the five major importing countries during the period 2012-2022 consistently remained above 1. If the RCA value is greater than one (RCA > 1), it signifies that Indonesia possesses a comparative advantage and relatively strong competitiveness in the essential oil commodity; the higher the RCA value, the greater the level of comparative advantage or competitiveness. This is in line with the views of Nurcahyani & Salqaura (2023), stating that an RCA value greater than one also indicates that the country has a higher level of efficiency in the production and export of essential oils compared to other countries. Indonesia has a comparative advantage in the essential oil commodity with France as the main market, having the highest average RCA value of 21.609. However, there are still opportunities to enhance competitiveness in other markets such as India, where the average RCA value is the lowest at 4.388. This indicates that Indonesia has the potential to become a major player in this sector and stands to gain greater benefits in terms of international trade.

The lowest RCA value in the United States was obtained at 5.091 in 2016, and the highest value reached 18.051 in 2012. The trend in the RCA value of the United States consistently decreased during the period 2012-2016 with a range of values above 10, while during the period 2017-2022, the trend tended to fluctuate with a range of values below 2. Indonesian essential oils imported by the United States include patchouli oil, cloves, lemongrass, and others. The Ministry of Agriculture,

Directorate General of Plantation (2020), stated that Indonesia exports patchouli oil ranging from 1,200-1,500 tons per year to destinations including the United States, Singapore, France, Switzerland, the United Kingdom, Spain, and many other countries.

The RCA value in the destination country of India has not yet stabilized and fluctuates annually. There was a consecutive decrease in the RCA value in India during the period 2012-2014, attributed to the reduction in the value of Indonesian essential oil exports to India relative to the total world export value of essential oils to India due to an increase in the world export value of essential oils to India, leading to the decline in the RCA value in India. The RCA value of Indonesian essential oils in India increased in 2017 compared to 2016, rising from 1.462 to 6.581. This increase occurred due to a significant rise in the value of Indonesian essential oil exports to India from 4,387 thousand to 20,358 thousand USD, coupled with a decrease in the world export value of essential oils to India from 106,000 thousand to 97,489 thousand USD. Consequently, Indonesian essential oils were able to contribute 21% of India's total essential oil requirements, up from only 4% previously. However, in 2019, the RCA value experienced another decline due to decreases in all components of the RCA value, including the total export value from Indonesia to India, the export value of Indonesian essential oils to India, the world export value of essential oils to India, and the total world export value to India, attributed to prolonged conflicts in 2019 between India and Pakistan.

The RCA value of Indonesian essential oils in France was the highest compared to other countries in this study. This was due to the significant value of Indonesian essential oil exports to France compared to the world export value of essential oils. This high export value is attributed to the higher prices of Indonesian essential oils in France due to exports dominated by patchouli oil. From 2015 to 2018, the RCA value in France experienced an increasing trend, reaching its highest value in 2018 at 34.311. This achievement of the highest RCA value was also accompanied by the highest Indonesian essential oil export value to France at 19,551,142 USD. France plays a dual role as both a major importer and exporter because of its strong perfume industry, engaging in exports or re-exports of various types of essential oils to other European countries. As a supplier, France adds value to products such as refining, resulting in relatively high average export or re-export values.

The RCA value for Spain shows a trend of increase, although it experienced a decline in RCA value to its lowest point in 2016 at 4.809. The export share value of

Indonesian essential oils to Spain in 2016 was the smallest throughout the period 2012-2022, accounting for only 3% of the total world export value of essential oils to Spain. According to data from Statistics Indonesia (BPS), there was a 20.7% increase in demand for essential oils in Spain in 2017 compared to the previous year. In the following years, the RCA value in Spain experienced fluctuations but tended to be positive until reaching its highest value in 2022 at 28.873. This was due to an increase in the export value of Indonesian essential oils in Spain by 62% to 13,302,405 USD and a decrease in the world export value of essential oils by 4% to 100,241,014 USD.

The highest RCA value in the Netherlands was reached in 2021 at 20.914. This occurred due to the increased export value of Indonesian essential oils to the Netherlands, reaching 18,061,092 USD, an increase of 30% from the previous year, according to the World Bank (2022), the economic recovery of the Netherlands post-pandemic with a GDP growth rate of 6.2% from the previous year. The average RCA value in the Netherlands is 12.095, indicating that Indonesian essential oils have a comparative advantage and strong competitiveness compared to other countries.

Competitiveness of Indonesian Essential Oils

The competitiveness of Indonesian essential oils can be analyzed using the Export Product Dynamic (EPD) analysis method. This method is employed to comprehensively analyze the trade of Indonesian essential oils. EPD indicates the level of dynamism in the growth of Indonesian essential oil exports to various importing countries, which are then classified into 4 quadrants: Retreat, Lost Opportunity, Falling Star, and Rising Star.

Table 5. EPD of Indonesian Essential Oils in Importing Countries

No	Year	*Export Product Dynamic* (EPD)				
		The United States	**India**	**France**	**Spain**	**Netherlands**
1	2012	Retreat	Retreat	Retreat	Retreat	Retreat
2	2013	Lost Opportunity	Lost Opportunity	Falling Star	Retreat	Retreat
3	2014	Lost Opportunity	Retreat	Retreat	Lost Opportunity	Retreat
4	2015	Lost Opportunity	Rising Star	Rising Star	Retreat	Lost Opportunity
5	2016	Lost Opportunity	Retreat	Retreat	Lost Opportunity	Falling Star

6	2017	Rising Star	Rising Star	Rising Star	Rising Star	Lost Opportunity
7	2018	Falling Star	Retreat	Falling Star	Retreat	Retreat
8	2019	Falling Star	Retreat	Lost Opportunity	Retreat	Falling Star
9	2020	Lost Opportunity	Rising Star	Rising Star	Rising Star	Rising Star
10	2021	Rising Star	Retreat	Retreat	Lost Opportunity	Rising Star
11	2022	Falling Star	Rising Star	Retreat	Falling Star	Lost Opportunity

Source: Processed from ITC data (2023)

The competitiveness position during the period 2012-2022 yielded different results compared to the RCA results, indicating that Indonesian essential oils are competitively strong in all destination countries. The results of the EPD method calculation on Indonesian essential oil commodities show a tendency towards variability. According to Hidayah et al., (2022), the Rising Star condition indicates that the exporting country gains market share and export demand growth of essential oils from importing countries. Lost Opportunity indicates an increase in demand for essential oils in that country, but there is a decrease in its market share or a missed opportunity to optimize the dynamic market for profit. According to Sinta et al. (2017), the Lost Opportunity condition is interpreted as the most undesirable market condition because it indicates that the country is experiencing a loss of market share in dynamic products. The Falling Star condition indicates an increase in export market share in a country, but overall demand for essential oils decreases. According to Augustin et al. (2022), the Retreat condition indicates a decrease in export market share and export demand in that country, depicting an undesirable market condition due to non-competitive essential oil exports. The most common competitiveness condition during the period 2012-2022 in the five destination export countries is retreat, followed by rising star, then lost opportunity, and the least occurring condition is falling star.

CONCLUSION

Based on the research findings, it is concluded that the market structure of essential oils in the international market is oligopolistic with moderate concentration. Indonesia demonstrates a comparative advantage and strong competitiveness in the five destination countries for Indonesian essential oil exports in this study, including

the United States, India, France, Spain, and the Netherlands, with the average calculation results of RCA throughout the period 2012-2022 consistently showing results above 1 (RCA > 1). The strongest comparative competitiveness is found in France, followed by Spain, the Netherlands, the United States, and India. The most common condition of competitiveness during the period 2012-2022 in these five destination export countries is retreat, followed by rising star, then lost opportunity, and the least occurring condition is falling star.

RECOMMENDATIONS

Indonesia ranks as the fourth largest exporter of essential oils in the world, and with its existing potential, Indonesia needs to maximize the quantity of exports accompanied by an increase in quality. Quality improvement can be achieved through further refining processes of essential oils, resulting in pure essential oils or their derivatives such as citronella esters, eugenol, menthol, and vanillin. The downstream essential oil industry has become the primary focus of the essential oil industry in Indonesia currently. Investors or business players are advised to focus on the development of downstream essential oil industries such as adding and improving essential oil refining technologies, so that Indonesian essential oils can be directly absorbed by domestic processing industries such as perfume, pharmaceuticals, cosmetics, etc., thus reducing the import value of Indonesian essential oils.

Market share expansion based on Export Product Dynamic (EPD) analysis results, especially in destination countries with rising star and lost opportunity quadrants. Indonesia needs to increase essential oil sales in countries experiencing lost opportunity positions achieved through essential oil product innovation such as selling derivative products and optimizing production to reduce selling prices, thus enhancing competitiveness. A limitation of this research is its failure to depict a more specific market structure because its calculations did not incorporate the complexity of market structures such as vertical characteristics, market barrier roles, and insensitivity to changes in the number of players in industries with a large number of players, necessitating additional methods for refinement in future research.

AUTHOR CONTRIBUTIONS

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