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Article

Dynamics of Competitiveness and Performance in the Indonesian Whole Pepper Export Market

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ABSTRACT

Pepper, known as the king of spices, is one of Indonesia's leading export commodities. With the largest cultivated area and ranking second in global production after Vietnam, Indonesia exported 93% of its pepper in whole form in 2023. However, its export value has declined in recent years, especially in major markets. This study aims to examine the competitiveness of Indonesia's whole pepper and to evaluate its export performance in key international markets over the period 2012–2023. The analysis employs the Revealed Comparative Advantage (RCA) and Export Product Dynamics (EPD) methods to assess competitiveness, while the X-Model is used to analyze export market performance. The RCA analysis shows that Indonesian whole pepper is highly competitive in ten major destination countries. Meanwhile, the EPD results indicate that the competitiveness of Indonesian whole pepper across export destinations fluctuated over the analysis period. In period 1, the "rising star" position was achieved in Singapore and Taiwan; in period 2, in Vietnam, the United States of America, the Netherlands, and France; in period 3, only in China; and in period 4, in Japan and Taiwan. Furthermore, the X-Model analysis of Indonesia's whole pepper export market performance indicates that Japan and Taiwan show strong market performance, while Vietnam, Singapore, India, and China show potential. In contrast, the USA, Germany, the Netherlands, and France show less potential market.

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INTRODUCTION

International trade plays a crucial role in driving economic growth (Muslika & Tamami, 2019; Ningsih, 2018). Within Indonesia's agricultural sector, the plantation subsector contributed the largest share (36,87%) during 2019-2021, highlighting its strategic importance and strong potential in global trade (BPS, 2022; Putra et al., 2023). Spices, as key plantation commodities, have high economic value and are widely used. Among them, pepper is one of the most globally demanded spices, with strong export potential, as reflected in the high global demand in 2023 (Spence, 2024; Trade Map, 2025). Indonesia is a major producer and exporter of pepper, with exports accounting for a significant share of its production due to low domestic consumption, thereby contributing notably to national export performance (Permana et al., 2022; FAO, 2023; Trade Map, 2025; IPC, 2023).

Indonesia exports pepper in two forms: whole, unground pepper (HS 090411) and ground, unground, and crushed pepper (090412), with whole pepper accounting for the majority of exports (Trade Map, 2025). Export volumes for both types of pepper have fluctuated over the past two decades (2004–2023), with a downward trend in export volumes since 2021. The significant difference between the export volumes of whole and ground pepper is due to a stronger global preference for whole pepper. ITC data (2024) shows that global imports of whole pepper averaged 317.810,3 tons and ground pepper 84.429,9 tons during 2011–2020, indicating that demand for whole pepper dominates the market.

The average value of Indonesia's whole pepper exports over the past 10 years has reached 233,95 million USD, with a global market share of 12,37%. However, since 2017, Indonesia's export value has shown a downward trend, and its position has been overtaken by Brazil, whose export value reached 273,89 million USD, surpassing Indonesia's 228,36 million USD. During the 2004–2023 period, Vietnam was the largest exporter of whole pepper by volume with an average of 130.199 tons per year, followed by Brazil at 50.516 tons and Indonesia at 43.654 tons (Trade Map, 2024). Although Indonesia briefly surpassed Brazil between 2007 and 2016, Brazil has regained the second position since 2017. This decline in the value and volume of exports could weaken the competitiveness of Indonesian whole pepper in the global market, particularly amid increasing global supply, which reflects increasingly intense competition among exporting countries (Farlian & Masthura, 2021; Jamil, 2019).

During the 2012–2023 period, Vietnam was also the primary destination for Indonesia's whole pepper exports, with an average export value of 68,28 million USD, followed by the United States (55,54 million USD) and Singapore (25,69 million USD). Data from Trade Map (2024) indicates that from 2019 to 2022, over 55% of Indonesia's whole pepper exports were concentrated in five major destination countries: Vietnam, the United States, Singapore, India, and Germany. This high dependence on these key markets poses a risk of export instability should economic shocks occur in those countries (Winarsih, 2021).

Indonesia's export volumes to Vietnam, India, Singapore, and Germany in 2022, as recorded in Trade Map, saw significant declines of 29,6%, 28,9%, 34,8%, and 51%, respectively, indicating market saturation in those countries due to declining demand for Indonesian whole pepper (Adetya & Irwandi, 2025). In contrast, exports to the United States actually increased by 10,97%. The development of Indonesia's whole pepper exports demonstrates significant dynamics, with substantial opportunities for optimization in countries with stable and growing demand, driven by high global demand in the food and beverage industry. However, the phenomenon of intensifying global competition demands enhanced competitiveness to maintain its position in the international market (Yudiarosa, 2009). This situation underscores the importance of a strategy to diversify Indonesia's whole pepper export markets in order to reduce dependence on specific destination countries.

Several previous studies have highlighted issues regarding the competitiveness and export dynamics of Indonesian whole pepper. Balqis (2020) found that Indonesian whole pepper are highly competitive in international markets, though they still lag behind those of major exporting competitors such as Vietnam and Sri Lanka (Anggraeni & Budiarti, 2023; Zahira & Renaldi, 2024). In fact, Irawan (2021) found that the projected volume of Indonesia's whole pepper exports to the United States is expected to decline. The dynamics of Indonesia's whole pepper export competitiveness vary by destination country: the French, U.S., Dutch, and German markets are in a competitive yet non-competitive state (falling star); Singapore is in a position of lost market expansion (lost opportunity); while the Indian, Malaysian, and Vietnamese markets are in the best position (rising star) (Anggraeni & Budiarti, 2023; Azahari et al., 2021; Sitepu & Nainggolan, 2024). The declining competitiveness of Indonesia's pepper exports calls for a thorough analysis of how competitive dynamics have shifted across periods, alongside export performance, to pinpoint and categorize promising

target markets. This step is essential to lessen reliance on traditional key markets while paving the way for diversification and expanded exports of whole pepper to countries with greater potential and stronger competitive prospects.

To date, existing studies on the export competitiveness of Indonesian pepper remain limited to pepper products in aggregate form Brahmana & Novianti (2022); Juhari et al. (2024) Nurhayati et al. (2018) Sitepu & Nainggolan (2024) Ulhaq et al. (2021) with analyses focused on aggregated international markets (Adetya & Irwandi, 2025; Amorita et al., 2021; Diamonds et al., 2024) or restricted to only three to five primary export destinations (Azahari et al., 2021; Trilarasati et al., 2023; Zahira & Renaldi, 2024). Moreover, previous research examining shifts in competitiveness dynamics has largely relied on analyses covering extended time periods, leaving shorter-term or more granular trends underexplored (Azahari et al., 2021; Balqis & Yanuar, 2021; Safitri et al., 2025; Tarigan et al., 2024; Ulhaq et al., 2021).

This study employs a quantitative approach that integrates three analytical methods: Revealed Comparative Advantage (RCA), Export Product Dynamics (EPD), and the X-Model for Potential Export Products. RCA is applied to assess the competitiveness level of Indonesia's whole pepper in each target market, while EPD is used to examine shifts in competitiveness across different periods. The results from the RCA and EPD analyses are then combined within the X-Model framework to map export performance in destination countries and to categorize potential export markets for Indonesia's whole pepper. Applying the X-Model analysis as a tool to evaluate export performance is also crucial for pepper commodities, given the need for more specific, performance-driven market mapping to effectively support export development strategies. Meanwhile, previous studies on the analysis of export performance for Indonesia's strategic plantation commodities using the X-Model approach from the Ministry of Trade (2013) have been limited to rubber (Meliany et al., 2025), tea (Putro et al., 2024), nutmeg (Wijaya, 2023), coffee (Andriani et al., 2025), as well as cinnamon and cloves (Nurhayati, 2018).

Previous studies have revealed certain limitations, including a lack of detail at the level of export products due to the continued use of commodity aggregates, the failure to identify the potential of specific export destination countries because the analysis remains global in scope, and the failure to capture short-term competitiveness dynamics. For this reason, this research gap needs to be addressed through an approach that integrates the dynamics of competitiveness and export market performance. This study aims to analyze the level and dynamics of competitiveness as well as the export market performance of Indonesian whole pepper in 10 major destination countries that, over the past 20 years, have served as primary markets with high import values amid intense competition with Malaysia, Vietnam, Brazil, and Sri Lanka. The results of this study are expected to provide insights into the focus of expanding Indonesian whole pepper exports to more promising destination countries.

RESEARCH METHOD

This study uses quantitative secondary data obtained from the Central Bureau of Statistics (BPS), the Indonesian Ministry of Trade, Satu Data Pertanian, the International Trade Centre (ITC), the International Pepper Community (IPC), and the FAO. The data used consists of a 12-year time series, from 2012 to 2023, and cross-sectional data covering 10 destination countries for Indonesia's whole pepper exports: Vietnam (VNM), the United States (USA), Singapore (SGP), India (IND), China (CHN), Germany (DEU), the Netherlands (NLD), Japan (JPN), France (FRA), and Taiwan (TWN). The commodity examined in the study focuses on whole pepper with HS code 090411 or pepper, neither crushed nor ground. Data processing was performed using Microsoft Excel.

Revealed Comparative Advantage (RCA) is a method to determine a commodity's comparative advantage by comparing a country's share of exports in that commodity to its share of the global market. Developed by Balassa (1965), this method produces an RCA index interpreted such that a value >1 indicates a comparative advantage. In this study, RCA is applied to assess the export competitiveness of Indonesia's whole pepper in target markets throughout the analysis period. The higher the RCA value, the stronger the commodity's competitive position. Below is the RCA calculation formula used in this research:

$$RCA = (X_{ij} / X_{tj})/(W_{ij} / W_t) \quad (1)$$

Information: $\mathbf{X_{ij}}$ (value of Indonesia's whole pepper exports to country j (USD)); $\mathbf{X_{tj}}$ (total value of Indonesia's commodity exports to country j (USD)); $\mathbf{W_{ij}}$ (value of global whole pepper exports to country j (USD)); $\mathbf{W_t}$ (total value of global commodity exports to country j (USD)); **j** (target countries: Vietnam, United States, Singapore, India, China, Germany, Netherlands, Japan, France, and Taiwan).

Export Product Dynamic (EPD) method is used to measure the export market position of a product from one country to a specific target market. Unlike RCA, which tends to provide a static picture and is less capable of representing the dynamics of changes in competitiveness across periods (Ozcelik & Erlat, 2013), EPD is capable of dynamically tracking changes in a commodity's market share (Esterhuizen, 2006). Therefore, the EPD in this study was used to project the market position of Indonesian whole pepper in destination countries over a specific period. The results of the EPD analysis grouped trade positions into four categories, which were graphically visualized in four quadrants.

The four market position categories in Figure 1 represent the growth in market share for whole pepper products (X-axis) and the growth in export market share (Y-axis). The "rising star" position indicates that Indonesian whole pepper is dynamic in a competitive target market; "falling star" indicates that whole pepper trade is increasing but is not competitive; "lost opportunity" indicates a loss of market expansion; and "retreat" indicates a decline in demand for Indonesian whole pepper in the target country. The following is the EPD equation:

$$\text{X-axis: } \frac{\sum_{t=1}^{t}\left(\frac{X_{ij}}{W_{ij}}\right)_t \times 100\% - \sum_{t=1}^{t}\left(\frac{X_{ij}}{W_{ij}}\right)_{t-1} \times 100\%}{T} \quad (2)$$

$$\text{Y-axis: } \frac{\sum_{t=1}^{t}\left(\frac{X_{tj}}{W_t}\right)_t \times 100\% - \sum_{t=1}^{t}\left(\frac{X_{tj}}{W_t}\right)_{t-1} \times 100\%}{T} \quad (3)$$

The X-Model method is a combination of the results of RCA and EPD analyses used to categorize the potential for export product development. In this study, the method was applied to identify the export market potential for Indonesian whole pepper by assessing comparative and competitive advantages, which interpret the export performance of Indonesian whole pepper (Table 1). Optimistic and potential markets are recommended as primary export targets, while less potential and non-potential markets are not recommended as export development priorities.

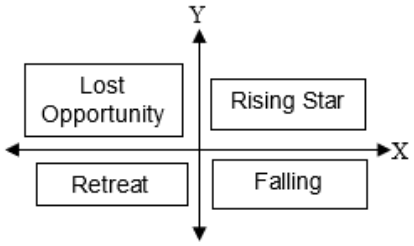


Figure 1
EPD Quadrant Matrix
Source: Esterhuizen, 2006

Table 1
X-Model Clustering

RCA	EPD	X-Model
> 1	Rising star	Optimistic Market
	Lost opportunity	Potential Market
	Falling star	Potential Market
	Retreat	Less Potential Market
< 1	Rising star	Potential Market
	Lost opportunity	Less Potential Market
	Falling star	Less Potential Market
	Retreat	Non-Potential Market

Source: Ministry of Trade, 2013

Table 2
RCA Value of Indonesian Whole Pepper in Main Export Destination Countries

Year	Country									
	VNM	USA	SGP	IND	CHN	DEU	NLD	JPN	FRA	TWN
2012	46,6	66,8	7,3	12,4	56,6	37	18,2	7	52,6	10,7
2013	43,6	37,7	8,5	7,1	33,5	31,8	32,8	7,9	101,6	8,5
2014	41,3	17,7	8,4	6,1	27,9	50,3	18,9	7,7	70,9	15,8
2015	52,7	25	9,3	5,4	58,8	45,8	35,4	9,6	74,3	13,4
2016	62,5	22,3	15,3	9,3	31,8	35,5	43,4	9,4	141	25,7
2017	60,7	17,1	15,2	4	10,2	34,4	23,9	4,6	100,2	18,6
2018	59,9	11,3	10,8	5	13,4	39,8	23,3	6,7	66,3	22,2
2019	35,1	12,4	6,9	8,1	40,4	45,3	20,7	7,6	62,2	21,3
2020	33,7	13,9	12,7	6,4	32,9	35,6	27,3	10,4	68,1	23,3
2021	20,1	10	18	5,5	19,3	39,3	33,5	11,2	95,3	18,1
2022	7,9	9,7	13,6	2,6	23,6	22,8	11,4	7,5	89,9	18,5
2023	7,2	12,1	15,7	3,2	17,5	28,6	24,4	8,7	84,9	21,1
Ave	39,3	21,3	11,8	6,3	30,5	37,2	26,1	8,2	83,9	18,1

Source: Data Processed

Table 3
Result of EPD Analysis of Indonesian Whole Pepper in Destination Countries

Country	Period 1	Period 2	Period 3	Period 4
VNM	Retreat	Rising Star	Lost Opportunity	Lost Opportunity
USA	Lost Opportunity	Rising Star	Lost Opportunity	Retreat
SGP	Rising Star	Falling Star	Retreat	Falling Star
IND	Lost Opportunity	Lost Opportunity	Falling Star	Lost Opportunity
CHN	Retreat	Lost Opportunity	Rising Star	Lost Opportunity
DEU	Falling Star	Retreat	Retreat	Retreat
NLD	Retreat	Rising Star	Retreat	Retreat
JPN	Retreat	Retreat	Falling Star	Rising Star
FRA	Falling Star	Rising Star	Lost Opportunity	Retreat
TWN	Rising Star	Retreat	Falling Star	Rising Star

Source: Data Processed

RESULTS AND DISCUSSION

Based on the results of the RCA analysis, Indonesia's exports of whole pepper demonstrate a strong comparative advantage in its ten main destination countries, with an average RCA value consistently above one throughout the 2012–2023 period. Although there were significant variations among countries, particularly during the COVID-19 pandemic, the comparative advantage remained intact.

France is Indonesia's largest export market for whole pepper, with the highest average RCA value and a positive growth trend of 0,12% per year. France's RCA value peaked in 2016 at 141. This result stemmed from a significant surge in exports to France, both in value, rising from USD 10.099 thousand to USD 18.698 thousand, and in volume, which jumped from 895 tons to 1.997 tons, making it the market with the highest potential (Trade Map, 2025). Meanwhile, only India, the Netherlands, and Taiwan showed similar upward trends.

Although ten countries demonstrated competitiveness based on an RCA value greater than 1, there was a significant downward trend in several countries, such as Vietnam, the United States, and India. Although Vietnam leads in terms of export volume and value, it has seen a declining RCA trend of 0,11% per year, with an average RCA of 39,3. This decline is linked to Vietnam's use as a re-export country and Indonesia's decreasing participation in global value chains Juhari et al. (2024) as well as the challenges of meeting international quality standards such as Good Agricultural Practices (GAP) (Azahari et al., 2021). In 2019, there was a shift in the market from Vietnam to China, marked by an increase in the volume of Indonesian whole

pepper imports to China from 1.093 tons to 6.662 tons. China demonstrated positive growth in competitiveness, with an average RCA of 30,5 and an upward trend of 0,10% per year. The RCA value of Indonesian whole pepper in the United States showed a downward trend of 0,10% per year, although the average RCA value during 2012–2023 still indicated a competitiveness level of 21,3. A sharp decline occurred after 2012, with Vietnam and Brazil dominating the market since 2014. Indonesia's export volume fell significantly, while Vietnam's exports increased dramatically (Trade Map, 2025).

The competitiveness of Indonesian whole pepper in the Indian market is relatively weak and unstable, as reflected by an average RCA value of just 6,27. A low RCA value indicates that Indonesia is not competitive in the Indian market, primarily because the increase in consumption in that country is dominated by derivative products such as oleoresin (IPC, 2023). The German market, with an average RCA of 37,2, ranks third highest, but has experienced stagnant growth of 0,01% per year. The decline in export volume, driven by the dominance of Vietnam and Brazil and the low value added of Indonesian products, is the cause of weak competitiveness in this market. Traditional export markets such as the Netherlands, Taiwan, Singapore, and Japan exhibit varying levels of competitiveness. The Netherlands recorded the highest RCA growth trend at 0,18% per year, with an average RCA of 26,1, making it a potential export market. Taiwan also showed positive growth, with an average RCA of 18,10 driven primarily by imports from Indonesia (Lestari, 2024). Singapore has the second-highest growth trend at 0,13% per year and an average RCA of 11,8, indicating potential for market growth. In contrast, Japan has low competitiveness, with an average RCA of just 8,2 and a growth trend of 0,06% per year, as pepper is not popular in local cuisine. Overall, the competitiveness of Indonesia's whole pepper exports varies significantly across destination countries, influenced by the dominance of competing countries, consumption trends, and the form of the exported product.

The EPD analysis in this study is divided into four three-year periods based on the differing conditions in each year, as well as to analyze in greater detail the dynamics of changes in the competitiveness of Indonesian whole pepper over time. Period 2012–2014, representing the heyday of the Indonesian pepper industry, characterized by high cultivation area, production, and productivity; 2015–2017, depicting the pre- , 2018–2020, capturing the impact of the global COVID-19 shock, and 2021–2023, showing the new normal and post-pandemic phases.

The competitiveness of Indonesia's whole pepper in the global market has fluctuated. In the Vietnamese market, Indonesia's position has declined from "rising star" to "lost opportunity" over the past two periods, reflecting its inability to maintain market share amid intensifying global competition. This is supported by the findings of Safitri et al. (2025) and Trilarasati et al. (2023) which indicate negative growth for Indonesian whole pepper in the Vietnamese market. Additionally, driven by declining Vietnamese import demand, competition with regional competitors namely Vietnam, which is also an exporter (Trade Map, 2025), as well as increasing exports from competitors such as Brazil and Cambodia, supported by Geographical Indication status (IPC, 2023), and a surge in production by Cambodia.

Meanwhile, in the United States, Indonesia saw an increase in competitiveness during the second period but then declined again, falling back to a lower position by the fourth period. This weak performance was due to the continuous decline in the market share of Indonesian pepper exports to the U.S. since 2017, reaching only 7,18% in 2019 (PUSDATIN, 2020). Although there has been bilateral cooperation through the U.S.-Indonesia Commercial Dialogue, since 2018, market dominance has shifted to Vietnam, which has successfully displaced Indonesia. The high demand for pepper from Vietnam is driven by the positive correlation between the price of whole Vietnamese pepper and exports to the United States, making Vietnamese pepper more competitive than Indonesian pepper and the minimal impact of domestic pepper production on Indonesia's exports (Brahmana & Novianti, 2022). As a result, Indonesia risks losing market access in the world's largest pepper-importing countries.

The competitiveness of Indonesia's whole pepper exports in Singapore has shown volatility, with the EPD shifting from "rising star" to "falling star", then retreating, and returning to "falling star". This indicates a decline in Indonesia's export performance despite continued growth in the product's market share. Fierce competition from fellow ASEAN countries, particularly Malaysia, which offers more competitive prices and more consistent product quality, is the primary cause (Sitepu & Nainggolan, 2024). To address this, Indonesia needs to optimize its use of the CEPT-AFTA scheme, which allows for low tariffs in intra-ASEAN trade. In the Indian market, EPD trends indicate a dominant "lost opportunity" position, signaling the weak competitiveness of Indonesian whole pepper despite market growth. The decline in exports is attributed to the increasing competitiveness of Sri Lankan and Vietnamese competitors (Trade Map, 2025), Indonesia's

inability to maintain market share, and the significant impact of India's per capita GDP on Indonesia's export volume.

Meanwhile, in China, Indonesia's competitiveness improved temporarily, reaching "rising star" status in the third period, but weakened again to "lost opportunity" in the final period. This decline was influenced by the Zero-COVID policy, which reduced demand (World Bank, 2022), as well as competition from cheaper Brazilian products (Trade Map, 2025) and a shift in the Chinese market's preference toward processed pepper. This highlights the importance of adapting Indonesia's export strategy to market dynamics and the policies of destination countries.

EPD analysis results indicate that the competitiveness of Indonesia's whole pepper in European markets, specifically Germany, the Netherlands, and France, has declined significantly, with positions largely categorized as retreat during the 2021–2023 period, consistent with findings reported by Balqis & Yanuar (2021). This decline is attributed to intense competition from Vietnam and Brazil (IPC, 2023), as well as an inability to meet European quality standards and certification requirements (Shepherd & Wilson, 2013), as well as market sensitivity to price (Mahdi & Suprehatin, 2021). In France, despite previously holding a rising star position, competitiveness has since declined. These three countries also serve as key re-export hubs, where whole pepper is imported into the European market for processing and subsequent resale.

In contrast, in the Japanese and Taiwanese markets, the competitiveness of Indonesian whole pepper has shown a positive trend. In Japan, its position has gradually improved, reaching "rising star" status in the fourth period due to quality improvements and adaptation to market standards. Meanwhile, in Taiwan, despite a temporary decline, Indonesia managed to recover and return to the "rising star" position. Both of these markets are considered promising for long-term expansion, with a focus on quality improvement, product differentiation, and increased national productivity through the implementation of Good Agricultural Practices (GAP) and Good Manufacturing Practices (GMP) (Sulaiman & Darwis, 2018).

An analysis of Indonesia's whole pepper export market performance was conducted using the X-Model method, which integrates the results of RCA (competitiveness) and EPD (market position). The results of the X-Model analysis provide a comprehensive overview of export market potential through clustering based on a two-sided evaluation of competitiveness (Meliany & Novianti, 2022). In this study, the X-Model analysis focuses on the 2021–2023 period to capture the short-term dynamics of Indonesia's whole pepper export performance in a specific and relevant manner, serving as a basis for developing market expansion strategies.

Based on the X-Model analysis, Japan and Taiwan are categorized as optimistic markets for Indonesian whole pepper exports because they are highly competitive and have achieved "rising star" market status. The Indonesia-Japan bilateral trade agreement (IJ-EPA) presents significant opportunities for Indonesia, as it provides duty-free access to the Japanese market for Indonesian pepper. On the contrary, Indonesia's export competitors in the Japanese market, such as Vietnam and Malaysia, are still subject to an export duty of 2,10%, while Indonesia's rate is 0%. This situation benefits Indonesia's position, as the price of Indonesian whole pepper becomes more competitive. Additionally, growing health awareness in Japan is driving the growth of whole pepper consumption, which aligns with the positive trend in Indonesia's export volume and value, positioning it as the leading supplier after Malaysia.

Table 4
Result of the X-Model analysis of Indonesian whole pepper

Country	RCA	EPD	X-Model
VNM	11,74	Lost Opportunity	Potential Market
USA	10,58	Retreat	Less Potential Market
SGP	15,78	Falling Star	Potential Market
IND	3,79	Lost Opportunity	Potential Market
CHN	20,14	Lost Opportunity	Potential Market
DEU	30,25	Retreat	Less Potential Market
NLD	23,08	Retreat	Less Potential Market
JPN	9,15	Rising Star	Optimistic Market
FRA	90,02	Retreat	Less Potential Market
TWN	19,24	Rising Star	Optimistic Market

Source: Data Processed

Taiwan is a market with significant potential for Indonesia as a pepper exporter, given its high demand from the food industry. Additionally, Taiwan imposes a low import tariff of just 10% on whole pepper from Indonesia, which is lower than tariffs in other destination countries such as India (30%) and China (15%). The low import tariff in the Taiwanese market is accompanied by NTM exemptions for Indonesia, unlike in other destination countries, where Indonesia faces NTMs ranging from 11 to 133 regulatory requirements that must be met for whole pepper exports (Macmap, 2026). As stated by Jannah (2019), the Taiwanese market is in an "under-traded" position, meaning it has not yet reached market saturation.

Meanwhile, target markets such as Vietnam, Singapore, India, and China, although showing potential market performance with strong competitiveness, have not yet yielded optimal results for Indonesia's whole pepper export growth and market share, as they occupy the "falling star" and "lost opportunity" positions. This is due to a decline in demand from these countries and a decrease in Indonesia's export value as a result of losing out to competitors such as Vietnam and Malaysia. As found by Ariesha et al. (2019), Indonesia's position as a whole pepper exporter is threatened by Vietnam and Malaysia in the ASEAN market. Indonesia's weak competitiveness is due to limitations in technology, capital, and infrastructure, which reduce farmers' productivity and consequently have a negative impact on the performance of the national whole pepper exports (Kurnianto et al., 2016; Jannah et al., 2019).

Meanwhile, the markets in the United States, Germany, the Netherlands, and France are considered less promising for Indonesia because they are in a state of decline. This situation is concerning because Indonesia's whole pepper exports are low due to strict import certification requirements and product quality standards that Indonesia has not yet been able to fully meet in the European and U.S. markets (Trilarasati et al., 2023). As a result, Indonesia has not yet achieved optimal export performance, and the market is dominated by competitors who excel in meeting standards, quality, and competitive pricing in line with U.S. demand (Tarigan et al., 2024).This situation indicates that the market still lacks potential as a primary export destination for Indonesia's whole pepper.

CONCLUSION

The analysis results indicate that Indonesia's whole pepper exports are highly competitive in ten destination countries, as evidenced by an RCA value > 1. This finding is reinforced by the results of the EPD analysis, namely Indonesia's success in securing a "rising star" position in several destination countries during each analysis period, indicating that the growth in Indonesia's whole pepper export share is higher than the global average, thereby demonstrating that Indonesia's whole pepper sector has the potential for continued development. However, the EPD results also reveal fluctuating market dynamics during the 2012–2023 period that warrant attention. Indonesia's whole pepper exports to the United States, Germany, the Netherlands, and France show negative trends in export growth and market share, with a "retreat" position. A similar situation is observed in the Vietnam, Indian, and China markets, which are in a "lost opportunity" position, while the Singaporean market is in a "falling star" position. On the other hand, the Japan and Taiwan markets are in the best position, namely as "rising stars". Based on the results of the X-Model, which integrates RCA and EPD analysis, several destination countries showed the best market performance for Indonesian exports, while others experienced a decline in performance. Japan and Taiwan demonstrated optimistic market performance; Vietnam, Singapore, India, and China showed potential market performance; and the United States, Germany, the Netherlands, and France exhibited less-than-potential market performance. These results indicate that the Japanese and Taiwanese markets could be Indonesia's primary focus for increasing whole pepper exports, as Indonesia's whole pepper exports performed optimally during the analysis period while continuing efforts to improve quality to JAS organic standards and maintain production volume. As for the development of whole pepper exports to the markets of Vietnam, Singapore, India, and China, it is necessary to strengthen marketing strategies through competitive pricing, bilateral cooperation, and increased productivity. Conversely, for the markets of the United States, Germany, the Netherlands, and France, it is necessary to diversify export destinations toward more promising markets.

AI DISCLOSURE STATEMENT

During the preparation of this manuscript, the authors used Grammarly to assist with grammar checking, language editing, translation, and improving academic English writing. All outputs generated by these tools were carefully reviewed, verified, and revised by the authors to ensure the accuracy, clarity, and

appropriateness of the content. The authors take full responsibility for the integrity, originality, and final content of this manuscript.

DATA AVAILABILITY

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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