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DETERMINANTS OF INDONESIA'S CINNAMON EXPORT PERFORMANCE: A SEM–PLS ANALYSIS

Elpawati[1], Dita Milih Anggraini[2*]
[1.2*] Syarif Hidayatullah State Islamic University Jakarta
**Corresponding author*: ditajurnalagri@gmail.com
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Abstract

Indonesia is the world's largest cinnamon exporter by volume, but still lags behind Sri Lanka in terms of export value. This study aims to analyze the factors influencing the competitiveness of Indonesian cinnamon exports in the 2014-2024 period.. Using UN Comtrade data and the SEM-PLS approach, this study identified four main constructs: Product Innovation, Product Quality, Cost Efficiency, and Export Competitiveness. The results show that Product Innovation has a significant effect on Product Quality (β=0.742, p<0.001), which in turn affects Export Competitiveness (β=0.658, p<0.001). Cost Efficiency is also proven to have a significant effect on Export Competitiveness (β=0.284, p<0.05). The model is able to explain 67.3% of the variance in Indonesian cinnamon Export Competitiveness.

Keywords*: Cinnamon, Export, Competitiveness, SEM-PLS, Indonesia.*

INTRODUCTION

Cinnamon (*Cinnamomum burmannii*) is one of Indonesia's leading spice commodities with high economic value. This commodity has become one of the leading products of the Indonesian plantation sector, contributing to the country's foreign exchange. The Indonesian cinnamon market shows very positive and sustainable prospects, in line with its position as the world's largest cinnamon producer with an annual production of 35,000–40,000 tons, or around 40% of the global supply. Most of this production comes from Sumatra and parts of Java, which have an ideal tropical climate for the cultivation of Cassia cinnamon, a variety with a strong aroma and high oil content that is in high demand in the international market (Kaur, 2025).

Economically, the growth of the Indonesian cinnamon market is estimated to increase significantly, with a growth rate reaching 13.69% in 2025 and increasing to 15.73% in 2029, indicating a stable and sustainable expansion trend (6Wresearch, 2022). In 2023, the value of Indonesian cinnamon exports reached USD 53.83 million with a volume of 13,426 tons (World Integrated Trade Solution, 2023). In 2025, it was reported that the value of Indonesian cinnamon exports was recorded at USD 172 million, while imports were only around USD 13 million, resulting in a strong trade surplus for the national spice sector (6Wresearch, 2022). This performance confirms Indonesia's strategic position as one of the world's main exporters of cinnamon, a mainstay of the global market.

This increase in competitiveness is driven by the continuing rise in global demand for natural spices and herbal-based products, along with healthy lifestyle trends and a growing preference for natural food ingredients. Furthermore, government export policy support and market expansion to Europe, East Asia, and the Americas have strengthened the resilience and future prospects of Indonesian cinnamon exports (6Wresearch, 2022; Kaur, 2025). However, despite its superior export volume, Indonesia still lags behind in value per unit due to intense competition with other major exporting countries, particularly Sri Lanka. The international cinnamon market structure exhibits characteristics of an oligopoly with a high degree of concentration, where a few large exporting countries dominate the global market. This indicates the complexity of factors influencing the export competitiveness of this commodity in the international market (Rochdiani & Wulandari, 2023; Saputra et al., 2025). This situation creates challenges for Indonesia to improve its competitive position in the international market.

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Increasing the added value of Indonesian cinnamon is achieved through a product diversification strategy. Indonesia exports not only raw cinnamon (HS code 090611) but also processed cinnamon powder (HS code 090620) (Saputra et al., 2015). Since 2012, the export value of Indonesian cinnamon powder has even exceeded that of raw cinnamon, demonstrating success in creating added value through processing activities and product innovation (Rochdiani & Wulandari, 2023). Despite this, Indonesia's cinnamon export performance still exhibits significant fluctuations from year to year. This condition is exacerbated by increasingly fierce global competition, particularly from major producing countries such as Sri Lanka and Vietnam. This phenomenon indicates the need for a more in-depth analysis of the factors influencing the competitiveness of Indonesian cinnamon exports. A comprehensive understanding of the determinants of export competitiveness, including innovation, product quality, cost efficiency, and economic policy support, is crucial.

RESEARCH METHODS

Research Type and Design

This study uses a *mixed methods approach*, a combination of quantitative and qualitative methods, with a predominance of secondary data. This mixed approach was chosen to provide a comprehensive understanding of the factors influencing the competitiveness of Indonesian cinnamon exports through the integration of data-driven statistical analysis and empirical insights from industry players. Primary and secondary data were obtained from the UN Comtrade Database, covering export value (USD), export volume (kg/ton), bilateral trade data, and export trends for at least 10 years using standardized HS Codes. Other sources include Bank Indonesia, which provides data on exchange rates, inflation, and macroeconomic indicators, and the World Bank, which provides data on the Global Competitiveness Index (GCI), innovation, and ease of doing business as a comparison with competing countries such as Sri Lanka.

The completeness of secondary data was supplemented through primary research based on a survey of 150 cinnamon exporters in Indonesia to obtain variables not available in secondary data, validate the analysis results, and understand the strategies and challenges faced by exporters. The study population included all cinnamon-exporting companies registered with the Indonesian Ministry of Trade, Average Efficiency Index (AEI) and Global Performance Efficiency Index (GPEI), with an estimated 500–700 companies. Sampling used purposive sampling with the following criteria: (1) the company has been operating for at least 5 years, and (2) has an official export permit. The sample size was set at 150 respondents based on the Slovin formula with a margin of error of 0.05 (5%), fulfilling SEM-PLS requirements (10 times the number of indicators), and anticipating the non-response rate of 20–30%.

In this study, the variables are defined operationally as follows: **(1) Product Innovation (INV)**, which is the company's ability to develop and implement new ideas/technology, measured through R&D investment (INV1), number of new product variants (INV2), packaging innovation (INV3), and adoption of processing technology (INV4). **(2) Product Quality (Kualitas Produk / KP)** is the level of quality that meets international standards, measured through certification (KP1), essential oil content (KP2), quality consistency (KP3), and hygiene standards (KP4). **(3) Cost Efficiency (Efisiensi Biaya /EB)** is the ability to reduce costs without reducing quality, measured through production costs (EB1), supply chain efficiency (EB2), labor productivity (EB3), and operational cost control (EB4). **(4) Export Competitiveness (Daya Saing Ekspor /DCE)** is the ability to maintain a position in the global market, measured by export volume (DCE1), export value (DCE2), international market share (DCE3), and diversification of destination countries (DCE4).

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Location and Time of Research

This research was conducted at cinnamon-exporting companies operating in Indonesia's production centers, primarily North Sumatra, West Java, and South Sulawesi, the largest cinnamon-producing and processing regions. The primary survey was conducted online and offline at companies meeting the sample criteria, while secondary data collection was conducted through access to international and national databases. The research was conducted in June 2025 and included data collection, processing using SEM-PLS, and interpretation of the results.

Data Analysis Technique

Data analysis was conducted using Structural Equation Modeling–Partial Least Squares (SEM–PLS) with SmartPLS 4.0 software, chosen because it is capable of handling complex models, accommodating reflective and formative indicators, does not require data normality, and is suitable for medium sample sizes (Hair et al., 2022). The analysis stages include (1) Evaluation of the Measurement Model (Outer Model) to assess construct validity and reliability with the following criteria: loading factor > 0.70; Average Variance Extracted (AVE) > 0.50; Composite Reliability (CR) and Cronbach's Alpha > 0.70; and discriminant validity was tested using the Fornell–Larcker criterion, cross-loadings, and HTMT value < 0.85. (2) Structural Model Evaluation (Inner Model), coefficient of determination (R^2 and Adjusted R^2) to see the model's explanatory ability, measurement of effect size (f^2) with a threshold of small = 0.02; medium = 0.15; large = 0.35, and predictive relevance ($Q^2 > 0$). (3) Hypothesis testing is carried out through a bootstrapping procedure with a 95% confidence level; the hypothesis is considered significant if the p-value < 0.05, the t-statistic > 1.96, and the confidence interval does not contain zero. All results are interpreted in an integrated manner between measurement and structural evaluations to ensure valid and accountable conclusions.

RESULTS AND DISCUSSION

Indonesian cinnamon exports showed an upward trend from 2014 to 2024 (**Table 1**). Indonesian cinnamon exports increased by 76.3% in the last 10 years, from USD 32.45 million (2014) to USD 57.2 million (2024). Export volume also increased from 10,200 tons to 13,800 tons, a 35.3% increase. The higher increase in export value compared to volume indicates an increase in product prices and quality. The price per kilogram increased from USD 3.18 to USD 4.14 (a 30.2% increase), indicating that Indonesian products are now more valued in the international market. Fluctuations occurred in 2015, when export value fell by 11.6% due to global economic conditions and an unstable rupiah exchange rate. However, since 2016, export performance has recovered and continued to increase, indicating that the Indonesian cinnamon industry is becoming stronger and more competitive.

Measurement model analysis (outer model) was conducted first to ensure that each construct in this study had adequate validity and reliability before being tested in the structural model. The test results showed that all indicators had outer loading values above 0.7, thus meeting the convergent validity criteria (**Table 2**). In addition, the Average Variance Extracted (AVE) values for all constructs were above 0.5, and the Cronbach's Alpha and Composite Reliability (CR) values exceeded 0.8, indicating a good level of internal consistency and high construct reliability. The analysis results show that the Product Innovation (INV) construct has the best performance, indicated by the new product development indicator (0.847) and R&D investment (0.824). The Product Quality (KP) construct is also strong through international certification (0.853) and quality consistency (0.834). Meanwhile, Cost Efficiency (EB) shows good validity with labor productivity (0.825) and supply chain efficiency (0.806). The Export Competitiveness (DCE) construct is a superior dependent variable through the export value indicator (0.882) and export volume (0.867).

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Table 1. Indonesian Cinnamon Commodity Data

Year	Mark Export (USD)	Volume (Ton)	Price/Kg (USD)	Growth (%)
2014	32,450	10,200	3.18	-
2015	28,670	9,800	2.93	- 11.6
2016	31,280	10,500	2.98	9.1
2017	35,840	11,200	3.20	14.6
2018	41,250	11,800	3.50	15.1
2019	38,920	11,350	3.43	- 5.6
2020	42,180	11,900	3.54	8.4
2021	46,730	12,400	3.77	10.8
2022	49,850	12,800	3.89	6.7
2023	53,830	13,426	4.01	8.0
2024*	57,200	13,800	4.14	6.3

(Source: UN Comtrade, 2025)

Table 2. Convergent Validity Results

Construct	Indicator	Loading	AVE	Cronbach's α	CR
INV	INV1	0.824	0.673	0.839	0.892
	INV2	0.847			
	INV3	0.798			
	INV4	0.812			
KP	KP1	0.853	0.695	0.856	0.901
	KP2	0.821			
	KP3	0.834			
	KP4	0.825			
EB	EB1	0.789	0.641	0.812	0.877
	EB2	0.806			
	EB3	0.825			
	EB4	0.784			
DCE	DCE1	0.867	0.718	0.883	0.927
	DCE2	0.882			
	DCE3	0.829			
	DCE4	0.811			

(Source: UN Comtrade, 2025)

The results of the discriminant validity test using the Fornell-Larcker Criterion approach are presented in **Table 3.** The square root of the AVE value on the diagonal (bold numbers) is higher than the correlation between other constructs, indicating that each construct has the ability to differentiate itself from other constructs well. Thus, the model meets the criteria for discriminant validity, and each construct is proven to measure different concepts empirically. Next, a coefficient of determination (R2) analysis was conducted to measure the extent to which exogenous variables explain the endogenous variables in the model. The Export Competitiveness (DCE) construct has the highest R^2 value of 0.673, indicating that 67.3% of the variability in DCE can be explained by the variables of product innovation, product quality, and cost efficiency (**Table 4**). This value is included in the moderate-strong category, which means the model has a fairly strong explanatory ability regarding the export competitiveness of Indonesian cinnamon products.

The results of the predictive relevance (Q^2) test in Table **5** show that all constructs have positive Q^2 values, indicating the model's predictive ability is quite good. The highest value was obtained for the Export Competitiveness construct (0.476) in the large category, followed by

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Product Quality (0.372, medium) and Cost Efficiency (0.241, small–medium). Thus, the model is considered empirically relevant and able to explain phenomena predictively.

Table 3. Results of the Discriminant Validity Test (Fornell-Larcker Criterion)

Construct	INV	KP	EB	DCE
INV	**0.821**			
KP	0.742	**0.834**		
EB	0.623	0.611	**0.801**	
DCE	0.654	0.679	0.598	**0.847**

(Source: Primary Data Analysis, 2025)

Table 4. R^2 Value of Endogenous Constructs

Construct	R^2	Category
Product Quality (KP)	0.551	Moderate
Cost Efficiency (EB)	0.388	Weak–Moderate
Export Competitiveness (DCE)	0.673	Moderate–Strong

(Source: Primary Data Analysis, 2025)

Table 5. Q^2 (Predictive Relevance) Value

Construct	Q^2	Category
Product Quality (KP)	0.372	Medium
Cost Efficiency (EB)	0.241	Small–Medium
Export Competitiveness (DCE)	0.476	Large

(Source: Primary Data Analysis, 2025)

The results of the hypothesis testing were conducted through path coefficient analysis (**Table 6**). The results of the SEM PLS visualization can be seen in **Figure 1**. All relationships between variables were significant with a t-statistic value > 1.96 and a p-value < 0.05, indicating that all hypotheses were accepted. The analysis results showed that Product Innovation had a significant positive effect on Product Quality (β = 0.742). This means that increased R&D activities, design innovation, and processing technology can improve product quality and durability. This finding aligns with Khalikussabir & Sudarmiatin (2024), who emphasized that product innovation is a catalyst for the international expansion of MSMEs because it strengthens the differentiation and reputation of Indonesian products in the global market.

Table 6. Path Coefficient Test Results

Hypothesis	Connection	Path Coefficient	t-statistic	p-value	Information
H1	Product Innovation → Product Quality	0.742	14.25	0.000	Significant
H2	Product Innovation → Cost Efficiency	0.623	11.37	0.000	Significant
H3	Product Quality → Export Competitiveness	0.658	12.64	0.000	Significant
H4	Cost Efficiency → Export Competitiveness	0.284	6.81	0.000	Significant

(Source: Primary Data Analysis, 2025)

Furthermore, Product Innovation also significantly impacts Cost Efficiency (β=0.623). The application of technology and supply chain digitalization contribute to increased productivity and reduced operational costs. This indicates that innovation not only creates new products but also optimizes production processes to be more efficient. Xaviera et al., (2024) confirmed that

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innovation combined with efficient logistics and cost management capabilities provides a competitive advantage. On the other hand, the utilization of digitalization in business models, as reflected by Wang et al., (2023), demonstrates that the adoption of digital technology and innovative business models can accelerate the production process.

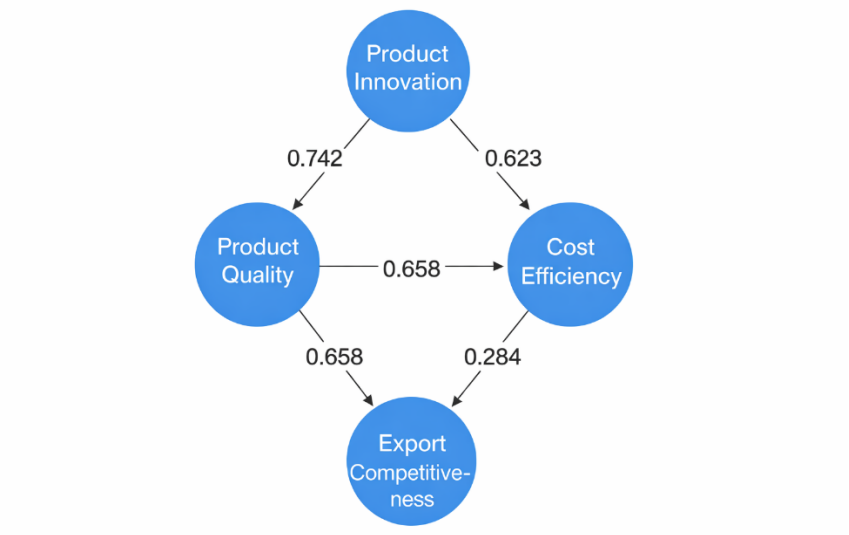

Figure 1. SEM PLS visualization
(Source: Primary Data Analysis, 2025)

Product quality also has a positive and significant effect on export competitiveness (β=0.658). Products with international certification, high quality standards, and consistent quality provide greater confidence in the global market, thus strengthening Indonesia's export position, particularly for spice commodities such as cinnamon. A study of Indonesian spice commodities for the European Union market found that commodities such as nutmeg, pepper, and cloves, which have a Revealed Comparative Advantage (RCA) value > 1, still risk losing competitiveness if their quality does not meet the high production and productivity standards of the European Union market (Diamonds et al., 2024; Rambe & Malau, 2023) . Cost efficiency also has a significant effect on export competitiveness (β=0.284). Although its influence is smaller than product quality, cost efficiency remains important for maintaining competitive prices without compromising quality. In the context of a price-sensitive global market, a company's ability to reduce costs is a supporting factor for export excellence. Research by Putri et al., (2023) shows that efficiency in production input use positively impacts the added value and competitiveness of the Indonesian copra industry. Similar results were also found in the agricultural sector by Siagian & Soetjipto (2020), where increased cost efficiency can significantly increase productivity and reduce production costs.

Indirect path analysis was conducted to identify the extent of Product Innovation (INV)'s influence on Export Competitiveness (DCE) through intermediary constructs, namely Product Quality (KP) and Cost Efficiency (EB). In the SEM-PLS model, the indirect effect is obtained by multiplying the path coefficients between constructs that form the mediation relationship. Based on the path coefficients in Table 6 , it is known that the relationship between INV → KP has a coefficient of 0.742, while the relationship between KP → DCE is 0.658. Thus, the indirect effect of INV on DCE through KP is calculated as 0.742 × 0.658 = 0.488. This figure indicates that product innovation can significantly increase export competitiveness by improving product quality. This means that the higher the innovation activities such as research and development (R&D), new product design, and the implementation of international quality standards, the greater the impact on increasing competitiveness in the export market. Meanwhile, the mediation

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pathway through Cost Efficiency (INV → EB → DCE) shows that the coefficient of INV → EB is 0.623 and EB → DCE is 0.284. The multiplication of 0.623 × 0.284 = 0.177 illustrates the indirect effect of innovation on competitiveness through increased cost efficiency. Although the value is smaller than the pathway through product quality, this relationship remains significant and meaningful. This indicates that innovation activities, in addition to improving product quality, also help companies optimize production processes, reduce operational costs, and improve supply chains to make them more efficient.

When these two mediation pathways are combined, the total indirect effect of Product Innovation on Export Competitiveness reaches 0.488 + 0.177 = 0.665. This value confirms that innovation has a significant contribution to increasing export competitiveness, primarily through improving product quality and production cost efficiency. In other words, innovation functions as a strategic driver that not only produces high-value-added products but also encourages the creation of more efficient and sustainable processes.

CONCLUSIONS AND SUGGESTIONS

The results of the study indicate that the SEM-PLS model developed has a good level of goodness of fit, with the ability to explain 67.3% of the variance in the variable of Indonesian Cinnamon Export Competitiveness. This finding indicates that the model used is quite strong in mapping the relationship between variables. Of all the factors analyzed, Product Quality proved to be the most significant determinant in driving increased export competitiveness, followed by Product Innovation and Cost Efficiency. Therefore, strategies to increase competitiveness should not only focus on efficiency or cost reduction, but also be directed at investing in innovation that can produce continuous improvements in product quality. Although Indonesian cinnamon exporters have an advantage in terms of export volume, strengthening long-term competitiveness requires an orientation towards the development of value-added products to increase the selling price per unit and total export revenue.

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