

## COMPETITIVENESS OF INDONESIAN NON-HUMAN CONSUMPTION SEAWEED IN THE CHINA MARKET

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### *Abstract*

*China is the largest importer of seaweed globally, and Indonesia is one of the countries that exports seaweed to China. Other exporting countries such as Chile and Peru also supply seaweed to China. This study aims to analyze the competitiveness of Indonesian seaweed (HS 121229) in comparison to seaweed from other exporting countries and to investigate the demand for Indonesian seaweed and other seaweed-exporting countries in the Chinese market. The study utilized export data from exporting countries that supplied China's seaweed requirements between 2012 and 2021. Revealed Symmetric Comparative Advantage (RSCA) and Almost Ideal Demand System (AIDS) were used for data analysis. The findings revealed that Indonesian seaweed (HS 121229) has a comparative advantage in the Chinese market. However, Indonesian seaweed's comparative advantage is still lower than its competitors. The demand for Indonesian seaweed in the Chinese market is inelastic. Therefore, to increase Indonesian seaweed's export income, exports should be increased rather than lowering prices. To reinforce Indonesia's position in the Chinese seaweed market, Indonesia should collaborate with other exporting countries that complement Indonesia's efforts, such as Chile.*

**Keywords:** AIDS, Export Competitiveness, RSCA, Seaweed

### 1. INTRODUCTION

Seaweed has become a crucial commodity globally, not just for food but also for various industries. According to Ferdouse et al. (2018), about 40% of hydrocolloids used in the food, cosmetic, and pharmaceutical industries worldwide are derived from seaweed extracts, particularly *Eucheuma* spp., *Kappaphycus* spp., and *Gracilaria* spp. Indonesia is one of the leading producers of seaweed and contributes 63.28% to the global supply of hydrocolloid seaweeds, focusing on the development of these three types of seaweed (FAO, 2021). Indonesia, as a significant exporter of seaweed raw materials, plays a vital role in providing for many importing countries and industries worldwide (Stievany & Jalunggono, 2022).

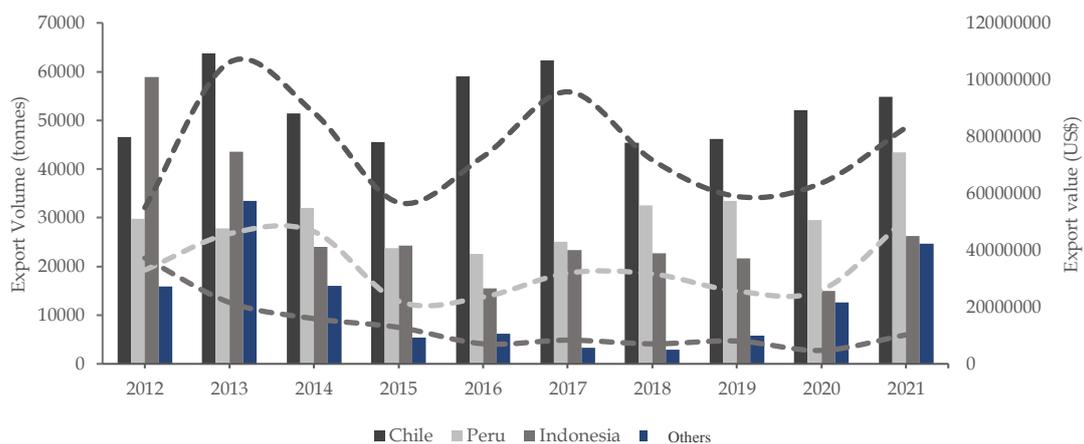
Despite being a significant contributor to the global seaweed market, the Indonesian seaweed industry has yet to develop optimally. Most of the Indonesian seaweed production is exported to countries with more developed seaweed industries, such as China, America, Japan, and Korea (Ferdouse et al., 2018; Langford et al., 2022). Indonesia exports two categories of seaweed, fit for human consumption (HS code 121221) and unfit for human consumption (HS code 121229), to several countries, including China, Korea, America, and Vietnam (Trademap, 2022).

China represents the world's seaweed industry in terms of total cultivated and consumed production. The Chinese national government has been encouraging and

supporting the growth of China's seaweed industry since 1950, resulting in the development of nurseries, cultivation, processing, and markets on a large scale. This has led to high demand for seaweed raw materials for the industry. From 1950-1990, around 80-98% of China's seaweed production was still used for consumption, with the remaining percentage for industrial needs. By 1990-2000, competition for seaweed between consumption and industrial needs emerged, with the alginate industry using 60% of seaweed raw materials, leaving the remaining 40% for consumption (Ballassa, 1965). After 2005, the market demand for seaweed food and aquaculture feed steadily increased, absorbing 60% and 20% of seaweed raw materials, respectively. Meanwhile, China's alginate industry had to invest overseas to outsource seaweed raw materials from exporting countries. This high demand for seaweed has made China the world's largest seaweed importer since 2012 (Zhang, 2018).

One of the countries that export seaweed to China is Indonesia. In 2021, Indonesia exported 157,931 tons (84.23% of the total seaweed exports) with HS code 121221 and 19,936 tons (92.93% of total seaweed exports) with HS code 121229 to China (Trademap, 2022). This means that China is the primary market for Indonesian seaweed. Besides Indonesia, other major exporting countries such as Korea, Philippines, Chile, and Peru also supply China's seaweed needs.

Indonesia has a better position in the Chinese market for seaweed with HS code 121221 than it does for seaweed with HS code 121229. In terms of seaweed with HS code 121221, Indonesia has a higher export volume and value compared to other exporting countries. However, for seaweed with HS code 121229, the export volume and value tend to be lower than its competitors, namely Chile and Peru (Trademap, 2022). Furthermore, the volume and value of Indonesian seaweed exports have tended to decline during the 2012-2021 period, while the quantity and value of seaweed exports from Peru and Chile have tended to be higher and more volatile (Figure 1). These trends suggest competitiveness issues for Indonesian seaweed with HS code 121229.



Source: (Trademap, 2022)

**Figure 1. Volume and Value of Seaweed Exports with HS Code 121229 from Major Exporting Countries to the China Market, 2012-2021**

Based on the fact that Indonesian seaweed with HS code 121229 faces competitiveness problems in the Chinese market as it competes with seaweed from other exporting countries, this research aims to analyze the competitiveness of Indonesian seaweed and other exporting countries with HS code 121229 in the Chinese market. Additionally, the research aims to analyze the demand for Indonesian seaweed and other exporting countries in the Chinese market. The research seeks to provide information on the size or value of the competitiveness of Indonesian seaweed and other exporting countries in the Chinese market, explain the competition among exporting countries, and determine how changes in Chinese demand or changes in demand and prices from one exporting country affect other exporting countries. The information obtained from this research can help decision-makers develop strategies to strengthen the competitiveness of Indonesian seaweed in the Chinese market.

Several studies have analyzed the competitiveness of Indonesian seaweed in the international market. Majus Rajagukguk (2009) used Pooled OLS, Fixed Effect, and Random Effect panel data regression to analyze the competitiveness of Indonesian seaweed in several importing countries and found that Indonesian seaweed was competitive in Hong Kong, the Philippines, Spain, and Denmark. However, for China, Indonesia only became competitive after 2004. Tombolotutu et al. (2019) used mixed methods to analyze the factors affecting Indonesia's seaweed competitiveness in the world market and found that interest rates, exchange rates, economic growth, raw material prices, farmer wage rates, product differentiation, and liberalization policies have a positive influence on Indonesia's seaweed competitiveness. Iszah (2020) analyzed the competitiveness of Indonesian seaweed in the Chinese market using Revealed Comparative Advantage (RCA) and the Index of Trade Specialization (ISP) and found that Indonesian seaweed had competitiveness in the Chinese market in 2014-2018, with an RCA value  $> 1$ . Based on the ISP value, Indonesia is included in the exporting specialization and is in the export expansion stage, with an average ISP value between 0.01-0.08.

This research uses the same approach as previous studies, analyzing competitiveness using the comparative advantage value index or RCA. However, the analysis continues by calculating the Revealed Symmetric Comparative Advantage (RSCA), a modified form of RCA. Saleh & Widodo (2010) found that RSCA can reduce the outlier problem in RCA, making the model more statistically reliable. Empirically, RSCA is also more suitable for analyzing the competitiveness of ASEAN countries than RCA because ASEAN countries have shown de-specialization. Additionally, this research attempts to analyze competition among exporting countries using the An Almost Ideal Demand System (AIDS) model, which provides an overview of competition among exporting countries in a particular commodity market.

## **2. RESEARCH METHODS**

The data used in this study were secondary data, in the form of volume and value of seaweed exports with HS 121229 from Indonesia, Chile, Peru and Rest of World to China. These countries were the main exporting countries of seaweed with HS 121229 to China. Export data from each country was obtained from the International Trade Center website (trademap.com). The data taken from the website were yearly time series and

monthly time series data from 2012 to 2021. Yearly time series data was used to analyze the annual SRCA value of each exporting country and monthly time series data was used to analyze China's seaweed demand for each exporting country.

The competitiveness of Indonesian seaweed in the Chinese market was analyzed using RCA and RSCA. RCA was one method that could measure the comparative advantage of a commodity in a particular region (Balassa, 1965). However, the results of RCA calculations tended to provide inconsistent, biased, and less precise results. RCA tended to show a strong comparative advantage for exporting countries with a low export market share. Another weakness of RCA was its asymmetric property. The RCA value had a fixed lower bound from 0 to 1 as the neutral point of comparative advantage, while the upper bound was generally unconstrained. As a result, the average RCA value of a country or commodity was generally not the same. In other words, the same average RCA value could have different levels of comparative advantage. This made RCA values less comparable between competing exporting countries or commodities (Yu et al., 2009). To overcome these weaknesses, the calculation of RCA in this study was continued with the calculation of RSCA. RSCA was a modified form of RCA developed by Dalum et al. (1998) to overcome the problem of property asymmetry in RCA. The distribution of RSCA values symmetrically ranged from -1 to +1 with 0 being the point to determine the neutral comparative advantage of a country or commodity (Yu et al., 2009). Statistically, RSCA provided more consistent and comparable results than RCA (Saleh and Widodo, 2010). RCA and RSCA could be calculated using the following mathematical equation:

$$RCA_j^i = \frac{X_j^i / X_n^i}{X_j^w / X_n^w}$$
$$RSCA_j^i = \frac{RCA_j^i - 1}{RCA_j^i + 1}$$

Description:

$RCA_j^i$  : Comparative advantage of commodity i of a country in country j

$X_j^i$  : Export value of commodity i from a country to country j

$X_n^i$  : Total export value of commodity i from all exporting countries to country j

$X_j^w$  : Total export value of all commodities from a country to country j

$X_n^w$  : Total export value of all commodities from all exporting to country j

$RSCA_j^i$  : Symmetric comparative advantage of commodity i of a country in country j

Furthermore, the demand for Indonesian seaweed and other exporting countries in the Chinese market was analyzed using the AIDS model. This model was developed by Deaton & Muellbauer (1980) to analyze the import demand for a particular commodity from a specific importing country. Rifin (2013) stated that the parameter estimation results of the AIDS model could provide an overview of the competition among competing exporting countries in a particular commodity market. This model has also been widely used to analyze demand because it is theoretically consistent and flexible in its use. The mathematical equation of the AIDS model used in this study is as follows:

$$W_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \ln P_j + \beta_i \ln \left( x/p^* \right)$$

Description:

$W_i$  : Export share of the exporting country i to China

$P_j$  : Exporting country's origin price

$x$  : Total import value of China

$p^*$  : Stone's geometric price index  $\sum w_i, p_i$

In the AIDS model, the analysis of the competitive relationship between seaweed exporting countries in the Chinese market was accommodated by calculating the value of expenditure elasticity and demand elasticity, both compensated and uncompensated demand elasticity (Juanda, 2009). The mathematical equation for each elasticity is as follows:

$$\begin{aligned} \text{Expenditure } \eta_i &= 1 + \frac{\hat{\beta}_i}{\bar{w}_i} \\ \text{Compensated } e_{ij} &= -\delta_{ij} + \frac{\hat{\gamma}_{ij}}{\bar{w}_i} - \hat{\beta}_i \left( \frac{\bar{w}_j}{\bar{w}_i} \right) \\ \text{Uncompensated } e_{ij}^* &= -\delta_{ij} + \frac{\hat{\gamma}_{ij}}{\bar{w}_i} + \bar{w}_j \end{aligned}$$

### 3. RESULTS AND DISCUSSION

#### 3.1. Competitiveness of Indonesian Seaweed in the China Market

The competitiveness of Indonesian seaweed in the Chinese market can be assessed by calculating the Relative Specialization Competitive Advantage (RSCA) value. According to Yu et al. (2009), a country has a comparative advantage over certain commodities if the RSCA value is greater than 0 ( $0 < \text{RSCA} < 1$ ), whereas a country does not have a comparative advantage over certain commodities if the RSCA value is smaller than 0 ( $-1 < \text{RSCA} < 0$ ). Table 1 shows the results of the RSCA calculation for Indonesian seaweed with HS code 121229 and other exporting countries in the Chinese market.

Indonesia's RSCA value for seaweed with HS code 121229 ranged from 0.44 to 0.88 during 2012-2021, which is relatively smaller compared to its competitors, Chile and Peru. Meanwhile, the RSCA value of Chile and Peru during the same period ranged from 0.94 to 0.97. These findings indicate that Indonesian seaweed has a relatively lower comparative advantage than seaweed from Chile and Peru with the same HS code in the Chinese market.

**Table 1. RSCA Value of Seaweed Exporting Countries with HS Code 121229 in China Market from 2012 to 2021**

Year	RSCA Exporting Country		
	Chile	Peru	Indonesia
2012	0.95	0.96	0.88
2013	0.96	0.96	0.75
2014	0.96	0.97	0.78
2015	0.96	0.96	0.84
2016	0.97	0.95	0.66
2017	0.97	0.94	0.59
2018	0.96	0.95	0.59
2019	0.96	0.95	0.67
2020	0.95	0.95	0.44
2021	0.95	0.95	0.47

Judging from their ability to maintain their comparative advantage, the three main exporting countries were able to sustain their competitive position in the Chinese market throughout 2012-2021. This can be inferred from their RSCA values that remained greater than zero during the period. In contrast, Indonesia experienced a declining RSCA trend, with its RSCA value dropping from 0.88 in 2012 to 0.47 in 2021. Meanwhile, the RSCA values of Chile and Peru were more stable within the range of 0.94-0.97. Therefore, it is crucial for Indonesia to make improvements and devise the right strategy to enhance the competitiveness of its seaweed with HS code 121229 in the Chinese market in the future.

### 3.2. Demand for Indonesian Seaweed in The China Market

The comparison of RSCA values between exporting countries, as discussed in the previous section, only reflects the competitiveness of each exporting country against other exporting countries. The RSCA value cannot fully explain the competition that occurs among these exporting countries. Therefore, an AIDS analysis was conducted to determine China's demand for seaweed from each exporting country, providing a clearer picture of the competition between Indonesia and other exporting countries in the Chinese market. This analysis considered the market share of each exporting country, China's expenditure elasticity on seaweed for each exporting country, the compensated and uncompensated price elasticity.

#### 3.2.1. Market Share of Exporting Countries

The market share of exporting countries demonstrates the relative seaweed sales volume from exporting countries to the Chinese market. Based on the analysis, Indonesia's export market share for seaweed with HS code 121229 is 10% (Table 2). This means that 10% of the total seaweed with HS code 121229 imported by China comes from Indonesia. In comparison, Indonesia's market share is the smallest, while Chile holds a market share of 59% and Peru holds a market share of 26%. These findings indicate that Indonesia has a lower competitiveness for seaweed with HS code 121229 in the Chinese market. This result is consistent with the RSCA calculation, which also shows that

Indonesia has a lower comparative advantage than Chile and Peru. Therefore, Indonesia needs to adopt an appropriate strategy to enhance its competitiveness in the Chinese market.

**Table 2. China's Import Expenditure Share and Expenditure Elasticity of Seaweed with HS Code 121229**

Exporter Country	Expenditure Share (%)	Expenditure Elasticity
Chile	0.59	0.75
Peru	0.25	1.41
Indonesia	0.10	1.07

### 3.2.2. Expenditure Elasticity

Expenditure elasticity is the percentage change in import expenditure in response to changes in total imports. The value of expenditure elasticity can provide an overview of changes in the export market share of the exporting country if the importing country increases its imports by 1% (Fortunika et al., 2021). The analysis shows that Peru is the country that benefits the most when there is an increase in China's demand for seaweed. China's expenditure elasticity value for seaweed from Peru is the highest compared to other exporting countries, at 1.41. This means that a 1% increase in China's imports will result in a 1.41% increase in Peru's seaweed exports. The value of China's expenditure elasticity for seaweed from Indonesia is 1.07, while the value of China's expenditure elasticity for seaweed from Chile is 0.75 (Table 2). This condition indicates that Indonesia is not the most favored country if China increases its share of export expenditure. However, Indonesia will still benefit from an increase in China's demand for seaweed with HS code 121229. Therefore, Indonesia still needs to increase the quantity and quality of its exports.

### 3.2.3. Compensated Price Elasticity

Compensated price elasticity, also known as fixed utility, shows changes in import demand by isolating the effect of incomes so that the changes that occur are purely the result of the substitution effect (Hanani et al., 2012). Rifin (2013) stated that compensated price elasticity represents the effect of price changes and is compensated for changes in income. In other words, compensated price elasticity does not represent the income effect. The compensated price elasticity value of each exporting country for seaweed with HS code 121229 can be seen in Table 3. The three exporting countries, Chile, Peru, and Indonesia, have negative own-price elasticity values. This condition is in accordance with the law of demand, which states that an increase in the price of a commodity will reduce the demand for that commodity. The negative own-price elasticity values indicate that a 1% increase in the price of seaweed from Chile, Peru, and Indonesia will reduce China's demand for seaweed from each exporting country by 0.31%, 1.12%, and 0.44%, respectively.

**Table 3. Compensated Price Elasticity of Seaweed Exporting Countries with HS Code 121229 in China Market**

	Chile	Peru	Indonesia	Row
Chile	-0.315	0.388	-0.112	0.039
Peru	0.897	-1.127	0.093	0.136
Indonesia	-0.645	0.231	-0.441	-0.027

Judging from the elasticity category, seaweed from Chile and Indonesia have an inelastic demand. This can be seen from the own elasticity value of the two countries, which is smaller than 1. Inelastic demand means that price changes will not have a considerable influence on China's demand for seaweed from Chile and Peru. For both countries, an increase in the number of exports will have more effect on income than a decrease in the price of seaweed. On the other hand, Peru has its own price elasticity value greater than 1. This indicates that China's demand for seaweed from Peru is elastic. Price changes will have a significant influence on the amount of Chinese demand for Peruvian seaweed.

Judging from the value of cross-price elasticity among exporting countries, Chile and Peru have a mutually substitutable trade relationship. The relationship is characterized by a positive (+) cross elasticity between Chile and Peru. A 1% increase in Chilean seaweed prices would decrease China's demand for Peruvian seaweed by 0.89%, while a 1% increase in Peruvian seaweed prices would decrease China's demand for Chilean seaweed by 0.38%. In other words, Chile and Peru compete in the Chinese seaweed market with HS code 121229.

A mutually substitutable trade relationship is also found in the trade relationship between Peru and Indonesia. This can be seen from the value of cross-price elasticity between Peru and Indonesia or vice versa, which is positive (+). A 1% increase in the price of Peruvian seaweed will reduce China's demand for Indonesian seaweed by 0.23%, while a 1% increase in the price of Indonesian seaweed will reduce China's demand for Peruvian seaweed by 0.09%. Thus, the impact of an increase in the price of Peruvian seaweed will have a greater effect on China's demand for Indonesian seaweed than the impact of an increase in the price of Indonesian seaweed on China's demand for Peruvian seaweed. Indonesia still needs to improve its competitiveness.

In contrast to the trade relationship between Chile and Peru and the trade relationship between Peru and Indonesia, which is substitutive, the trade relationship between Indonesia and Chile is found to be complementary. This is characterized by the value of cross-price elasticity between Indonesia and Chile or vice versa, which is negative (-). A 1% increase in the price of Indonesian seaweed will increase China's demand for Chilean seaweed by 0.11%, while a 1% increase in the price of Chilean seaweed will increase China's demand for Indonesian seaweed by 0.64%. Thus, the impact of an increase in Chilean seaweed prices will have a greater effect on China's demand for Indonesian seaweed than the impact of an increase in Indonesian seaweed prices on China's demand for Chilean seaweed.

### 3.2.4. Uncompensated price elasticity

Uncompensated price elasticity represents the impact of price changes that are influenced by both price and income effects (Rifin, 2013). In other words, uncompensated

price elasticity considers both price and income effects. The value of uncompensated price elasticity for seaweed-exporting countries in the Chinese market can be seen in Table 4. The three exporting countries - Chile, Peru, and Indonesia - have negative (-) own price elasticity values. This condition is in accordance with the law of demand, which states that an increase in the price of a commodity will reduce the demand for that commodity. The negative own price elasticity value indicates that an increase in the price of seaweed from Chile, Peru, and Indonesia by 1% will reduce the demand for Chinese seaweed from each of these exporting countries by 1.05%, 1.27%, and 0.34%, respectively.

**Table 8. Uncompensated Price Elasticity of Seaweed Exporting Countries with HS Code 121229 in China Market**

	<b>Chile</b>	<b>Peru</b>	<b>Indonesia</b>	<b>Row</b>
Chile	-1.055	0.068	-0.242	-0.017
Peru	0.550	-1.277	0.032	0.109
Indonesia	-1.192	-0.005	-0.345	-0.069

When viewed in terms of elasticity category, seaweed from Chile and Peru has an elastic demand, as indicated by their own elasticity values greater than 1. This means that price changes will have a significant impact on China's demand for seaweed from Chile and Peru. Conversely, seaweed from Indonesia has an elasticity value smaller than 1, making it inelastic. Price changes will not have a major impact on China's demand for seaweed from Indonesia. Therefore, increasing the number of exports will have a greater effect on revenue than reducing the price of seaweed.

Judging from the cross-elasticity values among the exporting countries, Chile and Peru have a substitution trade relationship, as indicated by their positive cross-elasticity value. A 1% increase in Chilean seaweed prices will reduce China's demand for Peruvian seaweed by 0.55%, while a 1% increase in Peruvian seaweed prices will reduce China's demand for Chilean seaweed by 0.06%. In other words, both countries are in a competitive position.

In contrast to the trade relationship between Chile and Peru, which is substitutive, the trade relationship between Indonesia and Chile is found to be complementary. This is indicated by the negative cross-price elasticity value between Chile and Indonesia, or vice versa. A 1% increase in the price of Chilean seaweed will increase the demand for Indonesian seaweed in the Chinese market by 1.19%, while a 1% increase in the price of Indonesian seaweed will increase the demand for Chilean seaweed by 0.24%. Both countries benefit from the price increase.

The trade relationship between Peru and Indonesia is two-way. When viewed in terms of changes in Peruvian prices, the trade relationship between Peru and Indonesia is complimentary. A 1% increase in the price of Peruvian seaweed will increase China's demand for Indonesian seaweed by 0.005%. However, when viewed in terms of changes in Indonesian prices, the trade relationship between Indonesia and Peru is substitutive. An increase in the price of Indonesian seaweed by 1% will reduce China's demand for Peruvian seaweed by 0.03%. Indonesia is the country that benefits the most from these conditions.

#### 4. CONCLUSION

Based on the analysis of Indonesian seaweed with HS code 121229, it can be concluded that Indonesia still has a lower comparative advantage than its competitors. In order to improve its position in the market, Indonesia must focus on increasing its comparative advantage. The study found that the demand for Indonesian seaweed in the Chinese market is inelastic, which implies that raising the amount of seaweed production and export would be more effective in increasing competitiveness than lowering the price.

Furthermore, the analysis also revealed that Indonesian seaweed has a complementary relationship with seaweed from Chile and a substitution relationship with seaweed from Peru. Therefore, to strengthen Indonesia's position in the Chinese market, it is recommended that Indonesia cooperates with Chile, which has complementary trade relations with Indonesia. Overall, this study highlights the need for Indonesia to prioritize increasing its comparative advantage in order to remain competitive in the global seaweed market.

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