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Will Indonesia's Frozen Cephalopod Commodities Be a Leading Product in China's Market Trade Competition?

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ABSTRACT

Cephalopods are the third most significant export commodity among Indonesian fishery products traded in the Chinese market. This study aimed to improve the competitiveness of Indonesian cephalopod commodities in the Chinese market by applying policy strategies based on Michael Porter's Diamond theory. The analysis utilized multiple linear regression and the Analytical Hierarchy Process (AHP). The results of the multiple regression analysis revealed that industrialization, product strategy, and the role of government significantly impact the competitiveness of Indonesian cephalopods in China. According to the AHP analysis, the first recommended strategy is facilitating regulatory Memoranda of Understanding (MoUs) in destination countries. The second is applying product diversification to increase added value, followed by eliminating cost barriers to enhance export product standards. The fourth strategy involves improving product specification infrastructure, product quality, and sustainability. Finally, the fifth recommendation is the application of Good Hygiene Practices (GHP), Hazard Analysis and Critical Control Points (HACCP) on board and at fish processing units, along with traceability and preventive measures for hazards such as heavy metals and microbes. The results of this study offer new policy recommendations for the Indonesian government to help improve the country's competitiveness in the cephalopod commodity trade in the Chinese market.

INTRODUCTION

The potential food sourced from marine products is one of the main food sources that has an important role in maintaining national food security in the face of climate change and food crises that aim to maintain world food nutrition **(Ministry of Trade, 2019; David *et al.*, 2020)**. Cuttlefish octopus squid is a seafood that has a high nutritional content with high-quality protein content, fat-soluble nutrient content and omega 3 polyunsaturated essential fatty acids that have a positive role in human health **(Ahmad *et al.*, 2019)**. The cuttlefish octopus squid commodity is one of the leading export commodities of fishery products after crustaceans and skipjack tuna.

The export destination of these commodities is China the market destination country **(Mursit, 2022; Sol Zamuz *et al.*, 2023)**.

One of the drivers of industrial and economic growth in a country is export trade activities. The government must make regulatory and bureaucratic changes to improve economic efficiency to face international trade competition so the development and implementation of the right export strategy are needed **(Maharani Tristi *et al.*, 2021; Rahmansyah *et al.*, 2021; Jiang *et. al.*, 2023)**.

Indonesia's competitor countries in the cephalopod export trade to China are India, Malaysia, Pakistan, and Vietnam. These countries are Asia's five largest cephalopod-producing countries **(Khine *et al.*, 2020; Bhowmik *et al.*, 2021)**. The enormous demand for cephalopod exports to China has made China a barometer of the world cephalopod trade. China's trade rules and agreements are absolute requirements that must be met for countries that market their products in the country **(Muñiz *et al.*, 2022; Tian *et al.*, 2024)**. The demand for exports to China can be seen in Table (1).

Table 1. List of cephalopod exporting countries to China (quantity and currency)

Unit : Imported quantity, Tons

Eksportir	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
World	344,031	362,246	398,654	326,091	145,186	29,016 1	237,840	405,133	319,225	494,110	353,516
Indonesia	16,977	30,485	27,834	39,011	50,591	51,850	82,487	82,274	71,880	92,596	89,208
India	3,194	2,863	1,816	5,859	1,108	673	6,476	23,717	21,138	20,643	19,899
Malaysia	3,610	3,462	3,139	3,690	2,381	828	8,192	20,236	20,838	21,477	24,629
Pakistan	2,171	1,709	2,062	834	1,968	1,922	2,338	14,634	11,063	17,983	14,431
Vietnam	343	269	341	350	457	626	953	4,279	12,447	14,594	27,322

Unit : Imported value in US Dollar

Eksportir	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
World	571,221	600,470	625,059	468,176	33,371 3	629,543	687,478	1,045,373	783,057	1,128,443	1,044.368
Indonesia	28,252	46,620	39,935	71,307	119,559	132,356	227,850	234,477	201,988	265,565	309,762
India	5,729	5,137	3,043	8,687	2,747	1,788	12,061	39,454	34,694	39,600	49,601
Malaysia	5,602	5,053	5,458	6,343	4,780	2,519	19,403	47,386	46,279	50,068	69,944
Pakistan	5,600	3,088	3,808	1,548	4,488	3,998	7,886	28,911	21,306	37,118	37,065
Vietnam	1,731	1,564	1.,999	1,745	1,922	3,002	4,575	9,536	33,976	36,886	75,698

Trade Map, 2023

Data in Table (1) show the trend of exports of cuttlefish octopus squid products destined for China by several countries from 2012 to 2022. The export value of cephalopod commodities to China has increased in terms of export quantity, although there have been fluctuations in the number of exports for several years simultaneously. In general, China's export demand is increasing. The consistent increase in exports indicates a growing demand for frozen cephalopod

commodities in the Chinese market, and this is possible due to several factors, namely population increase, changes in consumption patterns, and the growth of the cephalopod processed food industry in the destination market **(Banerjee *et al.*, 2020)**. The trend of cephalopod exports to China in terms of the value of the US Dollar trading currency has also seen a considerable increase from 2012 to 2022. The price value of cephalopod products to China varies from various exporting countries even though the market destination is the same, namely China. The value of Indonesian commodities tends to be lower or cheaper when compared to other competitor countries; this has implications for the competitiveness of these commodities in the Chinese market, whether the price of Indonesian commodities will be an attraction or Indonesia is just selling commodities at low prices because of their inferior quality. The price value of a product is influenced by the quality and usefulness of the commodities exported by these countries **(Distefano *et al.*, 2018)**.

Indonesia has consistently been the largest supplier in the Chinese market in terms of quantity, but there is a GAP with the amount of export value in currency, indicating a specification problem that causes the value of the commodity price to differ lower among several other exporting countries **(Salam & Chishti, 2022)**. The disparity in export value is influenced by several factors, namely product specifications, where competitor countries offer specifications that align with Chinese consumer preferences, such as size, quality, and type of packaging. Added value will affect the selling price, where further processing of the cephalopods will increase the selling value. The strength of product branding from competing countries is also possible to have a stronger brand in the Chinese market to make the product more attractive **(Owolabi *et al.*, 2021; Li *et al.*, 2022)**.

The emergence of the COVID-19 outbreak led to significant changes in the export trade system, including increased surveillance, stricter product certification requirements, and tighter issuance of approval numbers. Tariff and non-tariff barriers were also impacted by these changes in the trade system **(Lating *et al.*, 2021; Ngatno *et al.*, 2021)**.

The large number of Indonesian frozen cephalopod commodity exports marketed in China is influenced by several factors, as stated in Michael Porter's 1990 diamond theory where there are six determinants of competitiveness, namely natural resource conditions, demand conditions, industrialisation, product strategy, market opportunities and the role of government **(Dawut & Tian, 2021; Huang & Su, 2023)**. The results of the analysis are used as the basis for creating strategies to improve the competitiveness of Indonesian frozen cephalopod commodities in facing trade competition in the Chinese market. Based on this, this research formulates the problem as follows:

- What are the most dominant factors affecting the competitiveness of cephalopod commodities in the Chinese market?
- What are the specifications of cephalopod products that are most in-demand by consumers in the Chinese market?
- How to anticipate tariff and non-tariff barriers by Indonesian cephalopod businesses in increasing their export value?

- What policies can the government implement to support the increase of cephalopod exports in the Chinese market?

The results of this study are up-to-date and can be used as recommendations for Indonesian cephalopod commodity trade policy papers in the Chinese market.

MATERIALS AND METHODS

1. Time and place

The research was conducted for 5 months from March to July 2023 in Makassar, Jakarta, Surabaya, and Bali.

2. Sampling data collection method

The research instrument was in the form of a questionnaire given to 38 respondents and a key person in the core issue of the competitiveness factor of frozen Cephalopod export to China. The 38 respondents consisted of 18 business actors or cephalopod exporters, 18 government actors, and 2 people who were third parties to the frozen cephalopod export trade activities. The questionnaire contained primary data in a Likert scale for further simple linear regression analysis. This study also used an AHP (Hierarchy process analysis) questionnaire in the form of expert choice questions to determine the direction of policy strategies in improving the competitiveness of Indonesia's frozen cephalopod commodities.

3. Data analysis methods

3.1 Multiple regression analysis

Regression analysis is a statistical analysis tool that provides information about the relationship pattern or model between two or more dependent and independent variables. The multiple linear regression analysis has several dependent variables, namely the dependent factor in increasing the Competitiveness of Indonesian Cephalopod export commodities (Y). Cephalopod commodity condition factors (X1), Cephalopod demand conditions (X2), Cephalopod product related and supporting industries (X3), Cephalopod product strategy (X4), Cephalopod product export opportunities (X5), government role (X6).

The multiple linear regression analysis model used in this study was:

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6\ \mu i \quad (1)$$

Explanation:

Y : Increased Competitiveness of Indonesian frozen cephalopod commodities

βo : Intercept/constant

X1 : Basic factor conditions (natural resources, human resources, demographics/distance, sustainability, knowledge, capital, facilities and infrastructure)

X2 : Cephalopod demand conditions (Price competition)

X3 : Product industrialization (related and supporting products)

X4 : Cephalopod product strategy (product quality, food safety, traceability and product innovation) GHP, GMP-SSOP, HC, HACCP

X5 : Cephalopod product export opportunities (changes/shifts beyond the control of exporters, buyers and government); covid outbreak -19

X6 : Government role (trade policy); export tax, moratorium on new number approval, logistics system)

β1....β3 : Slope or direction of the regression line which states the value of Y as a result of a change in one unit of X

μi : Residual error that represents other factors that affect Y but are not included in the model.

Hypotheses are tested simultaneously (F test) and partially (t-test) to determine the influence between the independent and dependent variables.

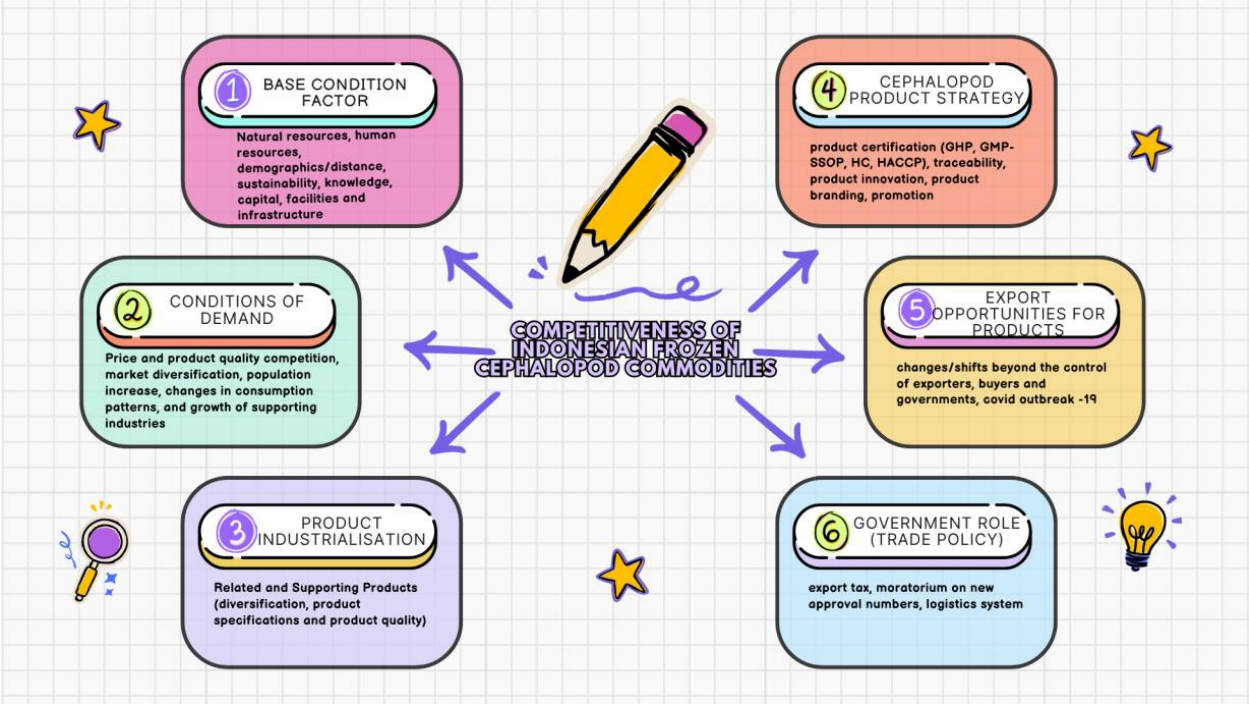

Fig. 1. Illustration of factors affecting the competitiveness of Indonesian cephalopods in the Chinese market

3.1.1 Multicollinearity test (Classic assumption test)

This multicollinearity test was used to determine whether there is a deviation from the classical assumption of multicollinearity, namely in the form of a linear relationship between independent variables in the regression model.

3.1.2 Normality test (Classic assumption test)

This Kolmogorov-Smirnov normality test is part of the classic assumption test, which aims to determine whether the residual value is usually distributed; a good regression model is to have normally distributed residuals.

3.1.3 Heteroscedasticity test (Classic assumption test)

The heterokedasitisitas test using Glejser aims to test whether, in the regression model, there is an inequality of variance from the residuals of one observation to the residuals of another observation. In contrast, the basis for making decisions from this test is if the significance value

is more significant than> 0.05. It can be concluded that there is no heterokedastisitas problem, but if the significance value <0.05, then there is a heterokedastisitas problem. A reasonable assumption in the regression model is that there is no heteroscedasticity problem.

3.2 AHP analysis

Analytical Hierarchy Process (AHP) is an analytical process that helps us take one option from a list of choices by experts. This study was conducted to find a policy strategy to increase the competitiveness of Indonesian cephalopod products. Each option offered has several parameters attached to it, and there is a weight value for each parameter of the choice; the AHP will get the best choice from the list of available options. The strength of AHP is that it considers many different parameters for many alternatives that will give the most appropriate results according to the existing parameters. The analytical hierarchy process (AHP) was developed by Thomas L. Saaty in the 1970s **(Padmowati, 2019; Setiyawan *et al*., 2020)**. AHP is an analytical approach aiming to model problems with no structure. This analysis is usually applied to solve measurable (quantitative) issues, as well as problems that require opinion (judgment); AHP is widely used in decision-making for many criteria, planning, resource allocation and prioritization of strategies owned by the parties involved (actors) salam conflict situation **(Brudermannt, 2021)**.

In this AHP analysis, several steps must be taken:

a. Determine or present the problem at hand and determine what decisions will be given as a solution by selecting the criteria that can be used to determine requirements for making these policy decisions.
b. Presenting priorities in each element that will affect the taking of the objectives of the decision.
c. AHP analysis will connect each of these priorities and get the best results among several alternative decisions **(Yi *et al.*, 2018; Notohamijoyo *et al.*, 2020; Sulistyowati & Nurhasanah, 2021)**.

According to Saaty, there are 3 principles in solving problems using hierarchical process analysis, namely:

a. Hierarchical arrangement or decomposition, namely the existing problem, will be solved by decomposing it into several criteria and several alternatives, which are the purpose of solving the problem contained in the hierarchical structure.
b. Assessment of criteria and alternatives that are assessed through pairwise comparisons using a scale of 1 to 9.
c. Determination of priorities for each criterion and alternative research objectives is carried out by pairwise comparisons, which will produce comparison weights and priorities. These values will then be processed to determine the relative ranking of all alternatives.
d. Logical consistency or Logical consistency all elements are grouped logically and ranked consistently according to a logical criterion **(Wiyono & Solihin, 2016; Rizwan *et al.*, 2020)**.

In the AHP analysis, there is a hierarchical structure that describes the relationship between goals, criteria or objectives, and alternatives. Decision-making on policy strategies for frozen cephalopod product standards in improving competitiveness in the Chinese market was carried out with respondents with critical persons experts, namely exporters or entrepreneurs, government and the associations third parties.

Fig. 2. Illustration of the research framework for the Indonesian cephalopod trade in the Chinese market

RESULTS

The policy to enhance the competitiveness of Indonesian frozen cephalopod commodities in the Chinese market involves determining the impact of various competitiveness factors on these commodities. These factors, as outlined by **Porter (1990)**, include the basic conditions of Indonesia's natural resources, the demand for cephalopod products, product industrialization, commodity product strategies, market opportunities, and the role of the government **(Huu Tran Ai, 2018; Yusuf *et al*., 2021; Tirumalaisamy *et al*., 2023)**.

The six factors were further elaborated and specified as items influencing the competitiveness criteria of Indonesian frozen cephalopod commodities. These items were incorporated into a questionnaire, which contained 40 questions using a Likert scale. The questionnaire was distributed to respondents, who are key figures in the competitiveness of Indonesian frozen cephalopods.

The validity test was conducted to determine whether the questionnaire could accurately measure and obtain research data from respondents. For data to be valid, it must effectively reflect what is being measured. The reliability test was carried out after confirming the validity of the question items, to assess the consistency of the questionnaire. This ensures that the results would be dependable even if the same questionnaire were used repeatedly over time.

Out of the 40 question items tested for validity, 36 were found to have a significance value of less than 0.05, indicating that they were valid. However, four question items were found to be insignificant (with values greater than 0.05) and were therefore excluded as outliers. The detailed validity test results can be found in Appendix 1, which presents the validity test for the Indonesian frozen cephalopod commodity competitiveness questionnaire.

Next, the reliability test was performed. Based on the data, the Cronbach's Alpha value was found to be 0.967, which is greater than the threshold of 0.70, indicating that the questionnaire is reliable. Therefore, the research instruments were deemed good and the study can proceed to the classical assumption tests.

3.1 Multicollinearity test

The basis for taking the multicollinearity test is by looking at the tolerance value greater than> 0.10, it can be concluded that there is no multicollinearity, or by looking at the VIF value, namely if the VIF value is smaller than <10.00, it is concluded that there is no multicollinearity.

3.2 Normality test

Based on the results of the normality test, the significance value is 0.200> 0.05, it can be concluded that the residual value is normally distributed.

3.3 Heteroscedasticity

The decision-making basis of the test is if the significance value is greater than > 0.05, it can be concluded that there is no heteroscedasticity problem, but if the significance value < 0.05, there is a heteroscedasticity problem.

3.4 Multiple regression

3.4.1 Coefficient of determination

The output of the multiple regression analysis using the SPSS program is presented in the summary table, as shown in Table (7). This table includes the coefficient of determination, which indicates the competitiveness of the frozen cephalopod commodity. In the table, the adjusted R square value is 0.524, meaning that the independent variables (X) collectively explain 52.4% of the variation in the dependent variable (Y).

Therefore, it can be concluded that the competitiveness of Indonesia's frozen cephalopod commodities is influenced by a combination of factors, including the role of government, product strategy, product demand, natural resource factors, market opportunities, and product industrialisation. The remaining 47.6% of the competitiveness is influenced by other factors not included in this analysis.

3.4.2 F-test

This F-test analysis aims to determine whether there is a simultaneous influence (together) given by the independent variable (X) on the dependent variable (Y).

The regression model in the ANOVA table is a table used to determine whether the regression model has been declared fit or not, if the significance value of the table is <0.05 then the regression model is declared fit. As seen in the ANOVA table above, there is a significance value of 0.000, meaning that the regression model has been declared fit. This significance value also means that the value of the independent variable (X) has a significant effect simultaneously on the dependent variable (Y).

3.4.3 T-test

In multiple regression analysis, the t-test is used to determine whether there is a partial (individual) effect of each independent variable (X) on the dependent variable (Y). The criteria for significance are as follows: if the significance value is less than 0.05, it indicates a significant effect. If the significance value is exactly 0.05, the influence of the independent variable is assessed by comparing the t-table value with the t-count value.

The results of the t-test for each variable are as follows:

Fish resource factor: The significance value is 0.737, which is greater than 0.05. This means that the fish resource factor does not have a significant influence on the competitiveness of Indonesia's frozen cephalopod commodities.

Product demand factor: The significance value is 0.421, which is greater than 0.05. Therefore, it can be concluded that the product demand factor does not significantly influence the competitiveness of Indonesia's frozen cephalopod commodities.

Product industrialization factor: The significance value is 0.046, which is less than 0.05. This indicates that the product industrialisation factor has a significant influence on the competitiveness of Indonesian frozen cephalopod commodities.

Product strategy factor: The significance value is 0.012, which is also less than 0.05. Therefore, it can be concluded that the product strategy factor significantly influences the competitiveness of Indonesia's frozen cephalopod commodities.

Market opportunities factor for frozen cephalopods: The significance value is 0.805, which is greater than 0.05. This means that market opportunities do not significantly influence the competitiveness of Indonesia's frozen cephalopod commodities.

Government role factor: The significance value is 0.021, which is less than 0.05. This shows that the role of the government has a significant influence on the competitiveness of Indonesia's frozen cephalopod commodities.

Analysis of multiple regression equations of commodity competitiveness, namely the regression equation obtained is 1.252 - 0.077X1 + 0.158X2 + 0.362X3 + 0.429X4 + 0.046X5 + 0.402X6.

Analysis of the constant value obtained is 1.252, which means that if the independent value is 0 or constant, the dependent variable is 1.252. The regression coefficient value of variable X1 is negative amounting to -0.077, which means that if variable X1 increases, variable Y will decrease, and vice versa. The regression coefficient value of the X2 variable is positive, namely 0.158, which means that if the X2 variable increases, the Y variable will also increase, and vice versa. The regression coefficient value of variable X3 is positive, namely 0.362, which means that if variable X3 increases, variable Y will also increase, and vice versa. The regression coefficient value of variable X4 is positive, namely 0.629, which means that if variable X4 increases, variable Y will also increase, and vice versa. The regression coefficient value of variable X5 is positive, namely 0.046, which means that if variable X5 increases, variable Y will also increase, and vice versa. The regression coefficient value of the X6 variable is positive, namely 0.402, which means that if the X6 variable increases, the Y variable will also increase, and vice versa.

3.5 Analyses hierarchy process

This research was conducted using AHP analysis, namely conducting pairwise comparison assessment techniques or pairwise comparison of elements at a hierarchical level that have been given numerical weighting to each element. In this study there are several criteria obtained from the factors that influence competitiveness based on diamond potters, more clearly the hierarchical structure chart scheme is as follows:

Level 1: Goal or objective that is the focus of the problem to be solved by the AHP method, namely the policy strategy for improving the competitiveness of frozen Cephalopod products in the Chinese market.

Level 2: things that become determinants of increasing competitiveness (Factors)

Criteria

SDI : Fish resources
PPH : Demand and price competition
IDS : Industrialisation (Downstream products)
SMP : Quality standards and product certification
RPA : Trade regulations

Level 3: Objectives to be achieved in improving cephalopod competitiveness (Objectives)

ERH : Elimination of regulatory non-tariff barriers
MKK : Improve the quality and quantity of cephalopod export products
EBR : Reducing inappropriate costs
PHL : upgrading the standard of frozen cephalopod products
USI : Quality assurance and safety of frozen cephalopod products in destination countries

Level 4: Items formulated as options to be recommended as outcomes to achieve the research objectives (Alternatives)

A. : Facilitate MoU regulation in the destination country.

B. : Facilitate infrastructure for export facilities to destination countries.
C. : Eliminate cost barriers to reduce the standardised COGS of export products.
D. : Implementation of product diversification to obtain added value
E. : Implementation of GHP, HACCP on board and fish processing unit, traceability and preventive measures on hazards (heavy metals, microbes).

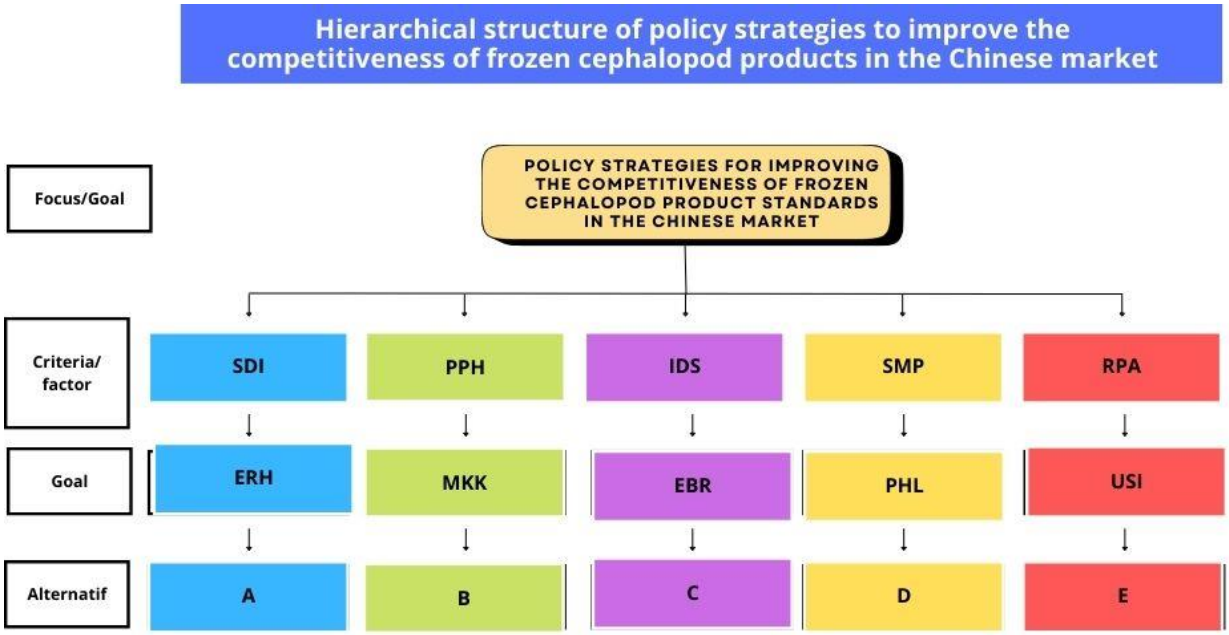

Fig. 3. Hierarchical structure of policy strategies to improve the competitiveness of frozen cephalopod products in the Chinese market

This research is based on a fundamental scale, specifically focusing on the competitiveness criteria. These criteria aim to identify and evaluate alternative policy options that align with the objectives of improving the competitiveness of Indonesian frozen cephalopod commodities. By applying these criteria, several alternative strategies will be formulated and recommended to enhance the competitiveness of these commodities in the market.

1. Determining the comparison value or compare wise of the criteria or alternatives available from the questionnaires of experts who are competent in it in the form of quantitative values as shown in the criteria table below, which then also does the same thing for each alternative of the criteria.

Table 2. Comparison between criteria

	Fish Resources	price competition	Industrialization	Quality standards	Trade regulation
Fish Resources	1.0	2.50	2.50	2.0	1.10
price competition	0.417	1.0	2.50	1.50	4.0
Industrialization	0.417	0.417	1.0	2.0	2.50
Quality standards	0.50	0.750	0.50	1.0	2.0
Trade regulation	0.50	0.267	0.417	0.50	1.0
Amount	2.833	4.933	6.917	7.0	10.60

2. Then the normalized eigenvalue was calculated by dividing and multiplying each factor value by the number of factors.

Table 3. Comparison between alternatives

Fish Resources	Price competition	Industrialization	Quality standards	Trade regulation	Amount	Average
0.353	0.507	0.361	0.286	0.104	1.611	0.322
0.147	0.203	0.361	0.214	0.377	1.303	0.261
0.147	0.084	0.145	0.286	0.236	0.898	0.180
0.176	0.152	0.072	0.143	0.189	0.732	0.146
0.176	0.054	0.060	0.071	0.094	0.457	0.091

3. The normalized Eigenvalue was calculated by multiplying the amount in each column of criteria or alternatives by the average value of the Eigen in the row of criteria or alternatives.

Table 4. Eigen normality

Fish Resources	price competition	Industrialization	Quality standards	Trade regulation	Amount (P vektor)	Average /bobot	eigen value
1.0	2.50	2.50	2.0	1.10	1.611	**0.322**	**0.913**
0.417	1.0	2.50	1.50	4.0	1.303	**0.261**	**1.285**
0.417	0.417	1.0	2.0	2.50	0.898	**0.180**	**1.242**
0.50	0.750	0.50	1.0	2.0	0.732	**0.146**	**1.025**
0.50	0.267	0.417	0.50	1.0	0.457	**0.091**	**0.968**
2.833	**4.933**	**6.917**	**7.0**	**10.60**		**1.0**	**5.433**

4. The maximum Eigen was determined by the symbol λ max obtained by multiplying the cumulative result of each line on the matrix of comparison pairs with the normalized own vector.
   λ max = (2,833 x 0,322)+(4,933 x 0.261)+(6,917 x 0,180)+(7,0 x 0,146) + (10,60 x 0,091) = 5,433
5. The value of the consistency index (CI) was determined based on equation I, as follows: CI = $\frac{(\lambda \text{ maks} - n)}{(n-1)}$ = CI = $\frac{(5{,}433 - 5)}{(5-1)}$ = 0,108

6. The consistency ratio (CR) was determined using an IR value of 1.12 for a 5x5 matrix, as shown in Appendix 2, Consistency Ratio (CR) table.

$$CR = \frac{CI}{IR} = \frac{0{,}108}{1{,}12} = \mathbf{0{,}97}$$

7. Calculating policy priorities was done by ranking the value of criteria for each alternative policy strategy to increase the competitiveness of frozen cephalopod commodities for the Chinese state market, which will be selected as the top priority. The final result value was obtained by summing the results of multiplying alternative values on each required criterion. From the results of the overall analysis, the following values were obtained.

Table 5. Policy priorities

Alternative options	Final result value	Ranking
Facilitating regulatory MoUs in destination countries	0.311	**1**
Facilitation export infrastructure to destination countries	0.171	**4**
Eliminate cost barriers to reduce COGS standards for export products	0.189	**3**
Application of product diversification to get added value	0.222	**2**
Applying GHP and HACCP on board and in the fish processing unit and traceability and preventive measures on hazards (heavy metals, microbes) is also essential.	0.107	**5**

Thus, the results of the hierarchy process analysis on policy strategies to improve the competitiveness of Indonesia's frozen cephalopod commodities, with a focus on prioritizing the Chinese market, are as follows:

1. The government should facilitate regulatory MoU activities with export destination countries, particularly China, addressing constraints and obstacles faced by business actors in frozen cephalopod trade. This includes providing solutions to resolve issues and mediate problems encountered by business operators in the Chinese market.
2. The government should implement diversification of frozen cephalopod products to obtain added value, enhancing the benefits and uses of these commodities.
3. The government should eliminate cost barriers to reduce the sales costs of export products, particularly focusing on retribution cost barriers and logistics cost barriers between islands, regions, and domestic areas in Indonesia.
4. The government should facilitate the development of fisheries infrastructure by increasing the number of export gates in several potential areas. This will enable more effective direct export activities to destination countries, ensuring product specifications, quality, and sustainability are maintained.

5. The government should emphasize the implementation of GHP (Good Handling Practices) and HACCP (Hazard Analysis Critical Control Point) on board and in fish processing units. This will help maintain product quality and facilitate traceability and preventive measures for identified hazards (such as heavy metals and microbes), ensuring the avoidance of commodity rejection due to contamination.

DISCUSSION

The first factor is the resource factor, which does not have a significant effect on the competitiveness of Indonesian frozen cephalopod commodities. This is due to the abundant supply of frozen cephalopod fish resources, as seen in the consistent number of exports each year to global markets, particularly the Chinese market. Indonesian frozen cephalopod commodities continue to dominate in terms of export volume **(Pang *et al.*, 2018; Arkhipkin *et al.*, 2020)**. However, the adequacy of these cephalopod natural resources must be carefully managed to maximize catches while ensuring the sustainability of their populations through bioeconomic management. The increasing presence of foreign squid boats in Indonesian waters and incidents of illegal fishing highlight the need for effective resource management and enforcement **(Mohsin *et al.*, 2018; Dao-Min Peng *et al.*, 2019; Ainsworth *et al.*, 2023)**.

Table 6. Indonesia cephalopods national production data

Commodities	Production Kg				
	2019	**2020**	**2021**	**2022**	**2023***
Capture	226,441,039	230,350,753	249,003,499	230,385,391	284,185,280
Squids	194,299,038	193,583,839	204,336,212	191,714,569	234,681,071
Cuttlefish	20,647,002	17,596,295	25,568,924	20,158,551	26,986,955
Octopus	11,494,999	19,170,619	19,098,362	18,512,271	22,517,254
Tottal	226,441,039	230,350,753	249,003,499	230,385,391	284,185,280
Commodities	Production Value IDR				
	2019	2020	2021	2022	2023*
Capture	8,790,908,506,263	8,785,908,670,653	10,041,328,083,827	10,547,279,543,028	13,480,991,414,396
Squids	7,750,674,887,022	7,648,415,297,008	8,740,820,956,270	9,004,579,248,872	11,345,916,346,844
Cuttlefish	591,126,777,309	564,406,748,340	751,594,560,842	807,813,425,017	1,250,967,555,499
Octopus	449,106,841,933	573,086,625,305	548,912,566,715	734,886,869,139	884,107,512,053
Tottal	8,790,908,506,263	8,785,908,670,653	10,041,328,083,827	10,547,279,543,028	13,480,991,414,396

Source: **KKP (2024)**

The demand factor for frozen cephalopod products aimed at the Chinese market does not significantly affect the competitiveness of Indonesian frozen cephalopod commodities. While there is a large demand, it has not been able to compete with commodities from countries like India and Vietnam, which can achieve higher selling prices despite smaller export volumes. Although Indonesia exports a large quantity of frozen cephalopod commodities to China, this has not significantly impacted the currency generated from these exports because the selling price of Indonesian commodities remains relatively low compared to competitors. To enhance

competitiveness, steps must be taken to increase the selling price, surpassing the prices of competitors and the global price for frozen cephalopod commodities **(Asche *et al.*, 2017; Joshua *et al.*, 2021)**.

The low export price of Indonesian frozen cephalopods to China is influenced by several complex factors, including product quality and quality standards. Indonesian cephalopod products have not yet fully met the quality requirements of the Chinese market in terms of size, freshness, and hygiene. Inconsistent product quality across shipments reduces consumer confidence and lowers the product's value in the Chinese market. Additionally, a stable and sustainable product supply, as well as the application of technology in processing, significantly affects product quality and shelf life. Attractive and informative packaging can also increase Chinese consumers' willingness to pay **(Sayeed *et al.*, 2021)**.

The product industrialization factor significantly influences the competitiveness of Indonesian frozen cephalopod commodities in the Chinese market. Therefore, every frozen cephalopod product to be traded must undergo value-added processing to increase its competitiveness against products from competitor countries. Product industrialization not only boosts the selling price but also contributes to domestic economic growth, which, in turn, increases the country's GDP **(Globefish, 2020; Moore *et al.*, 2020)**.

Product strategy factors also significantly influence the competitiveness of Indonesian frozen cephalopod commodities. This strategy includes how promotion and product quality assurance can be applied to cephalopod commodities in the destination market. Global issues surrounding cephalopod commodity marketing, such as climate change, heavy metal content, and other biological, climatic, and physical hazards, require strategies that address these concerns. Additionally, the product strategy should help tackle global issues such as food security, as outlined by the OECD FAO 2030, and contribute to achieving SDG-14 (healthy oceans) **(Naum *et al.*, 2016; Mouritsen, 2018; Silva *et al.*, 2021)**.

The market opportunity factor for frozen cephalopods does not significantly affect the competitiveness of Indonesian frozen cephalopod commodities. However, this factor is influenced by the type of product with unique added value resulting from product industrialization, which will in turn affect market opportunities **(Ainsworth *et al.*, 2023; Gillian *et al.*, 2023)**.

The role of the government significantly influences the competitiveness of Indonesian frozen cephalopod commodities in the Chinese market. Government efforts to increase competitiveness include controlling currency exchange rates, implementing policies on export taxes for frozen cephalopods, and managing domestic price policies. Government intervention in facilitating and supporting small and medium-sized enterprises in the cephalopod industry—from capture to processing—is also essential **(Darcy *et al.*, 2019)**.

To improve the competitiveness of Indonesian frozen cephalopod commodities, several policy recommendations were made based on hierarchical process analysis:

The government should facilitate regulatory MoUs with export destination countries like China to address trade constraints. This involves assisting with solutions for issues faced by

business actors in the frozen cephalopod trade, such as contamination rejections and facilitating export processes **(Love *et al.*, 2021; Ospina *et al.*, 2022)**.

The government should implement product diversification by introducing ready-to-eat or further-processed frozen cephalopod products to increase the added value of these commodities **(Lian *et al.*, 2021; Quinn *et al*., 2022)**. This will enhance competitiveness against other countries and will increase the selling price of the commodities.

The government must reduce retribution and logistics cost barriers, especially between islands and regions in Indonesia. This can be done by providing fuel subsidies for fishermen and simplifying logistics systems **(Pita *et al.*, 2016; Diedhiou *et al.*, 2019; Aragao *et al*., 2022)**.

The government should improve fisheries infrastructure, such as increasing the number of export gates in key areas, to facilitate direct exports and ensure product quality and sustainability **(Baudron *et al.*, 2019; Qian Hao *et al*., 2019; Verani *et al.*, 2019)**.

The government should assist business actors in implementing Good Hygiene Practices (GHP) and Hazard Analysis Critical Control Point (HACCP) systems on board and in processing units to maintain product quality and ensure traceability, preventing contamination issues that lead to rejections in the Chinese market **(Yi *et al.*, 2022; Wijaya *et al.*, 2023)**.

The government should support promotional activities, participate in trade shows, and assist in cooperation with distributors in destination countries. Additionally, it should improve product standardization and conduct market research to meet the specifications demanded by Chinese consumers **(Kibona *et al*., 2022; Cai *et al.*, 2024)**.

CONCLUSION

The competitiveness of Indonesian frozen cephalopod commodities needs to be improved in order to succeed in the competitive Chinese market, increase sales, and take advantage of greater market opportunities.

The dominant factors affecting the competitiveness of frozen cephalopods, based on Porter's theory, are industrialization factors, product strategies, and the role of the government. Industrialization factors are implemented by processing every product that will be exported. Downstreaming with product industrialization will positively impact the domestic economy by increasing the selling value, demand, and growth of these products, thereby contributing to the growth of GDP.

Product strategy factors are key to increasing competitiveness through the implementation of a promotion system and product quality assurance for frozen cephalopod commodities in market countries. Product strategies address critical issues, such as climate change, heavy metal contamination, nano plastics, and other biological, chemical, and physical hazards in frozen cephalopod products. Furthermore, these strategies align with the current global issues of food security, as indicated by the OECD FAO 2030 outlook, and play an active role in achieving SDG-14, which focuses on maintaining healthy oceans.

The specifications of frozen cephalopod commodities most in demand in China are those that meet the product quality standards required by the Chinese market, including size, freshness,

appearance, texture, and cleanliness. Additionally, consistency in product quality for each shipment, a stable and sustainable supply of products, and the use of attractive and informative packaging technology are also essential. The quality standards of Vietnamese frozen cephalopod commodities are higher, which contributes to their higher selling price in the market.

To anticipate tariff and non-tariff barriers, it is important to cooperate through regulatory MoUs with the destination country, form a consortium in the Asian region to streamline export coordination to China, and implement joint agreements for export activities to China. Additionally, establishing product quality standards for frozen cephalopod commodities exported to China is critical.

Government policies that support the increase in frozen cephalopod exports to China include facilitating regulatory MoUs in destination countries, promoting product diversification to achieve added value, eliminating cost barriers to reduce the standard cost of production (HPP) of frozen cephalopod export products, facilitating infrastructure for export facilities, and implementing Good Hygiene Practices (GHP) and Hazard Analysis Critical Control Point (HACCP) on board and in fish processing units. These measures will improve traceability and prevent contamination risks from heavy metals and microbes, ensuring that Indonesian frozen cephalopod commodities meet international quality standards.

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