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# ANALYSIS OF TRADE, INVESTMENT, AND GLOBAL VALUE CHAIN ON THE GROSS DOMESTIC PRODUCT OF FISHERIES SECTOR IN INDONESIA

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**ABSTRACT**

**Purpose:** This study aims to analyze the indicators that play a role in the Indonesian marine and fisheries sector's development (investment in the fisheries sector, trade openness, fisheries net exports, global value chain (GVC) and fish production) towards the gross domestic product (GDP) of the fisheries sector.

**Theoretical framework:** The theoretical framework builds on the New Trade Theory (NTT), a sustainable ocean economy, and global value chains.

**Design/methodology/approach:** The panel vector autoregressive (PVAR) method is used to achieve the research gols. The data used is panel data for groups of provinces in Indonesia.

**Findings:** The results of the estimated PVAR show that the investment of the fisheries sector has a negative and significant impact on the GDP of the fisheries sector, and GVC and fish production has a positive and significant impact on fisheries GDP. Whereas, Net-export and Trade openness have an insignificant impact on the GDP of fisheries.

**Research, Practical & Social implications:** There is a need for an effective maritime policy to reduce the environmental impact of the development of coastal resources and preserve the diversity of fish production to face future threats. This is due to the constraints of international trade in the form of information or communication, technology, and regulations.

**Originality/value:** Research related to the effect of investment in the fisheries sector, trade openness, fisheries net exports, GVC, and fish production on the GDP fishery in Indonesia and the data used is panel data for groups of provinces in Indonesia have never been done by other researchers.

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# ANÁLISE DO COMÉRCIO, DO INVESTIMENTO E DA CADEIA DE VALOR GLOBAL SOBRE O PRODUTO INTERNO BRUTO DO SETOR PESQUEIRO NA INDONÉSIA

**RESUMO**

**Objetivo:** Este estudo tem como objetivo analisar os indicadores que desempenham um papel no desenvolvimento do setor marinho e pesqueiro da Indonésia (investimento no setor pesqueiro, abertura comercial, exportações líquidas do setor pesqueiro, cadeia de valor global (GVC) e produção de peixe) em relação ao produto interno bruto (PIB) do setor pesqueiro.

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**Estrutura teórica:** A estrutura teórica se baseia na Nova Teoria do Comércio (NTT), em uma economia oceânica sustentável e em cadeias globais de valor.
**Projeto/metodologia/abordagem:** O método de painel vetorial autorregressivo (PVAR) é usado para atingir os objetivos da pesquisa. Os dados usados são dados de painel para grupos de províncias na Indonésia.
**Conclusões:** Os resultados do PVAR estimado mostram que o investimento do setor pesqueiro tem um impacto negativo e significativo sobre o PIB do setor pesqueiro, e o GVC e a produção de peixe têm um impacto positivo e significativo sobre o PIB do setor pesqueiro. Por outro lado, a exportação líquida e a abertura comercial têm um impacto insignificante sobre o PIB do setor pesqueiro.
**Implicações sociais, práticas e de pesquisa:** Há necessidade de uma política marítima eficaz para reduzir o impacto ambiental do desenvolvimento dos recursos costeiros e preservar a diversidade da produção de peixes para enfrentar ameaças futuras. Isso se deve às restrições do comércio internacional na forma de informação ou comunicação, tecnologia e regulamentações.
**Originalidade/valor:** Pesquisas relacionadas ao efeito do investimento no setor pesqueiro, abertura comercial, exportações líquidas de pescado, GVC e produção de peixe no PIB pesqueiro na Indonésia e os dados usados são dados de painel para grupos de províncias na Indonésia nunca foram feitos por outros pesquisadores.

**Palavras-chave:** Setor Pesqueiro, Cadeia de Valor Global, Comércio Internacional, Abertura Comercial, Investimento, Indonésia.

**ANÁLISIS DEL COMERCIO, LA INVERSIÓN Y LA CADENA DE VALOR MUNDIAL EN EL PRODUCTO INTERIOR BRUTO DEL SECTOR PESQUERO EN INDONESIA**

**RESUMEN**
**Objetivo:** Este estudio pretende analizar los indicadores que intervienen en el desarrollo del sector marino y pesquero de Indonesia (inversión en el sector pesquero, apertura comercial, exportaciones netas del sector pesquero, cadena de valor global (CVG) y producción pesquera) en relación con el producto interior bruto (PIB) del sector pesquero.
**Marco teórico:** El marco teórico se basa en la Nueva Teoría del Comercio (NTT), la economía oceánica sostenible y las cadenas de valor mundiales.
**Diseño/metodología/enfoque:** Para alcanzar los objetivos de la investigación se utiliza el método autorregresivo vectorial de panel (PVAR). Los datos utilizados son datos de panel para grupos de provincias de Indonesia.
**Conclusiones:** Los resultados estimados del PVAR muestran que la inversión en el sector pesquero tiene un impacto negativo y significativo en el PIB del sector pesquero, y que las CVM y la producción pesquera tienen un impacto positivo y significativo en el PIB del sector pesquero. Por otro lado, las exportaciones netas y la apertura comercial tienen un impacto insignificante en el PIB del sector pesquero.
**Implicaciones sociales, prácticas y de investigación:** Es necesaria una política marítima eficaz para reducir el impacto medioambiental del desarrollo de los recursos costeros y preservar la diversidad de la producción pesquera para hacer frente a futuras amenazas. Esto se debe a las restricciones del comercio internacional en forma de información o comunicación, tecnología y normativa.
**Originalidad/valor:** La investigación relacionada con el efecto de la inversión en el sector pesquero, la apertura comercial, las exportaciones netas de pescado, las CVM y la producción pesquera sobre el PIB pesquero en Indonesia y los datos utilizados son datos de panel para grupos de provincias de Indonesia nunca ha sido realizada por otros investigadores.

**Palabras clave:** Sector Pesquero, Cadena de Valor Mundial, Comercio Internacional, Apertura Comercial, Inversión, Indonesia.

## INTRODUCTION

Indonesia has a large maritime zone, approximately 6.32 million km2, which includes territorial waters, islands, and the Indonesian coastline EEZ, which extends for more than 99,093 km (Ministry of Marine Affairs and Fisheries & Japan International Cooperation Agency, 2017). Other great potentials from the Indonesian fishery sector are aquaculture, inland

open-water fisheries and the development of marine biotechnology. According to the Decree of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia, Number 19 of 2022, concerning the Estimation of Potential Fish Resources, the estimated potential for fish resources in Indonesian fisheries management areas in 2022 is 12.01 million tonnes (Ministry of Marine Affairs and Fisheries Republic of Indonesia, 2022).

The primary source of fish production in Indonesia is aquaculture and capture fisheries. Before 2014, aquaculture productivity increased significantly, reaching more than 20% annually, while fisheries production dropped. Both sources of fish production can be encouraged by increasing the availability of fisheries resources and making more land and water resources available for cultivation (Suadi & Eiichi Kusano, 2019). However, there are a number of obstacles to the development of the seafood industry, including the infrastructure for production and enabling regulations.

The study focuses on the New Trade Theory (NTT), which evolved from the New Growth Theory (NGT). The development and implementation of new knowledge's externalities, as well as technical advancement, are highlighted by NGT as explicit factors that affect economic growth (Lam, 2015). NTT was developed to explain the high level of intra-industrial trade and the large proportion of world trade that occurs between similar countries (Deraniyagala & Fine, 2001; Greenaway, 1991). The GVC paradigm which is one of the indicators of this research is a new trade theory (World Bank, 2017).

This study focuses on fisheries and the marine sector, particularly those that are connected to economic activity. This is based on prior empirical gaps such as Alshubiri et al. (2019) explaining that marine fish production has a positive and significant effect on the sea trade balance and Emam et al. (2021) finding analytical evidence that fish exports have a significant positive impact on the long-term growth of the agricultural sector. On the other hand, research in Indonesia Sitompul et al. (2018) explains that improving trade infrastructures can enhance exports of fisheries in Indonesia (port infrastructure, quality of electricity supply, governance and increasing the efficiency of cross-border trade). Other suggested strategies for the growth of the Indonesian fisheries industry are described by Miar et al. (2020) and include enhancing sectoral coordination, identifying and synchronizing industrial policies, developing regions with more than one Location Quotient (LQ) as the foundation for national fisheries, and picking the appropriate industrial scale under sustainable resources and regional advantages. On the other hand, according to the International Labor Organization (International Labour Organization, 2019), the welfare of fishermen is crucial for Indonesia's economy and export

trade to ensure strong enforcement of labour laws and protection of human rights for fishermen and their workers, particularly given how closely buyers and trading partners are monitoring labour practices in the fisheries sector. Hence variables of production, trading activities, and industrial regulations are essential instruments that need to be researched further.

This study is also based on a gap analysis conducted by Abe et al. (2017), which investigated how trade openness affected national-level fisheries productivity and found that current overfishing has an effect on future production via stock dynamics. The elasticity of trade in fishery catches is dominated by scale-technique effects (ST) and the indirect effect of trade intensity through income (ITC). While ST implies that trade will have an impact on overfishing. Research by Eegunjobi & Ngepah (2022) explains that trade openness has a positive effect on economic growth. Seung (2022) explains that for some of the 10 countries, the share of global value added from fish production recorded by foreign countries increased significantly during the period 2000 – 2014, indicating their greater dependence on inputs sourced from overseas. Thus, further testing is needed for Indonesia because previous studies have shown that economic openness and global economic uncertainty affect the economic productivity of the fisheries sector. The goal of this study is to identify the variables that are important for the economic development of the fishing industry, particularly in Indonesia, which is well known for its vast oceanic area and abundant marine resources. It also aims to identify strategic ideas for establishing a sustainable maritime economy.

## LITERATURE REVIEW

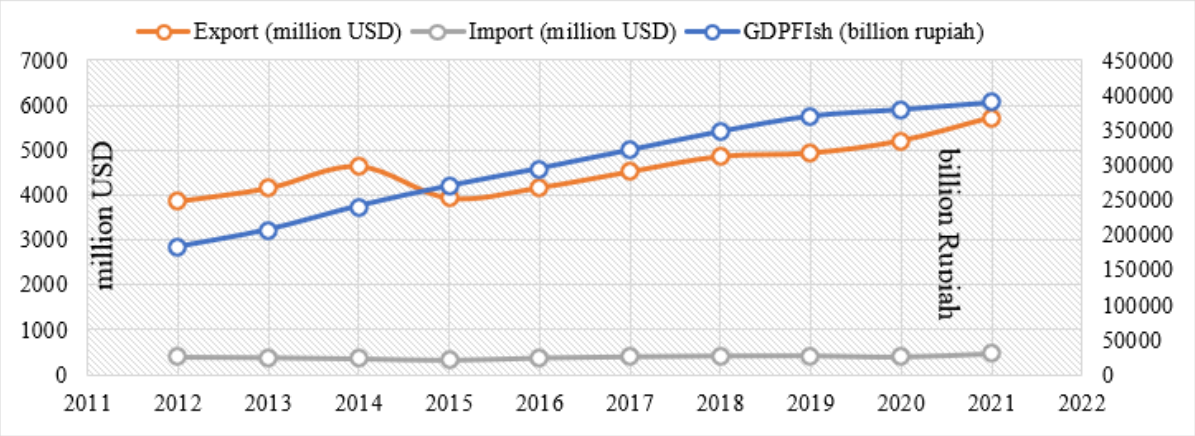
Since Ricardo established the theoretical underpinnings of international trade two centuries ago, mainstream thought has been based on three classical premises, including Heckscher-Ohlin and Samuelson (Lam, 2015; Verter, 2015). These three premises are that markets are extremely competitive, producers operate with constant returns to scale, the industry is composed of homogeneous producers, the country only trades the final product, and each product is made using factors of production only from the exporting country. Thus, the theoretical basis of international trade becomes one of the basic ideas in this research to study international trade in marine and fishery products in achieving a sustainable ocean economy.

A sustainable ocean economy emerges when economic activity is in balance with the capacity of an abundant and healthy marine ecosystem (An Economist Intelligence Unit, 2015). Achieving this goal requires complex and time-consuming reforms in policy and planning, investment, governance, and institutions as well as feasibility studies (Hayade et al., 2014;

Colgan, 2016). The ocean economy innovation network is an initiative that seeks to bring together diverse players (public research institutes, large corporations, small and medium enterprises, universities, and other public institutions) into a network that is flexibly managed (Colgan, 2016; OECD, 2019; UNCTAD, 2014).

Indonesia's main fishery exports are shrimp, tuna, skipjack, seaweed, crabs, and pearls. Indonesia also imports fish products such as fish meal, fresh or frozen fish, fish oil, mackerel, crab, salmon, trout, sardines, and so on. Figure 1 depicts the GDP growth of Indonesia's fisheries sector as well as the value of fishery exports and imports. From 2011 to 2017, the value of exports increased while the volume decreased. In 2015, due to various policies issued by the Ministry of Maritime Affairs and Fisheries (Kementerian Kelautan dan Perikanan Indonesia/ KKP), the export value decreased to US$3.77 billion, but in 2021 the export value reached US$5.72 billion. The value of GDPFish tends to increase, supported by increased productivity of fishing and aquaculture as well as trading activities. Figure 1 depicts the annual fluctuations in Indonesian fishery product import activity.

Figure 1: Growth of GDP Fisheries Sector (GDPFish), Exports and Imports of the Indonesian Fisheries Sector in 2012-2021



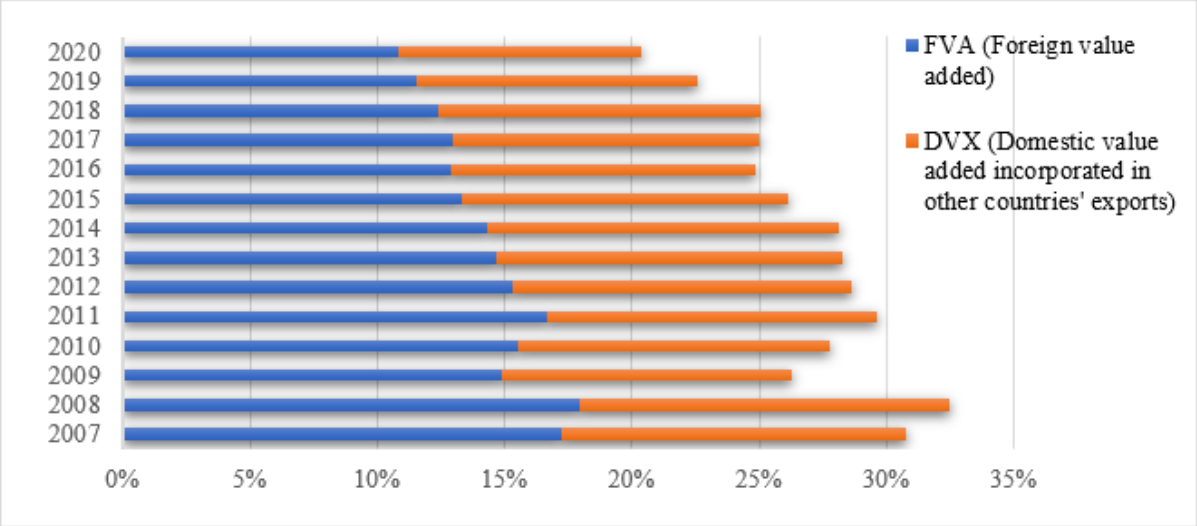

Source: (Central Bureau of Statistics, 2022; Ministry of Marine Affairs and Fisheries Republic of Indonesia, 2022)

This study also involved the GVC variable as one of the indicators related to trade activities and growth of the fisheries sector. The Global Value Chain (GVC) is a revolutionary 21st-century production system, where the production and distribution of certain commodities take place simultaneously in several countries, which presents a new critical challenge to how to evaluate and improve a country's the trade and competitiveness (OECD et al., 2014; World Bank, 2017). A country that has integrated into the GVC must assess the risks that can threaten their survival in the value chain, such as being more vulnerable to external shocks (Taglioni &

Winkler, 2016; UNIDO, 2015). Indonesia's participation rate is lower than that of other countries in the region, as evidenced by several indicators used to assess a country's involvement in GVC. Furthermore, GVC considers the trade value of Indonesian machine tools. This case discusses the fishing sector, which is one of the five drivers of the Indonesian economy (Sulistijowati, 2021), but has not become a key sector even though it is a producer of landed fisheries.

Indonesia's participation in GVCs through forward and backward linkages decreased from 2000 to 2020 (Figure 2). GVC participation to forward decreased from 21.5% in 2000 to 12.9% in 2017, while participation in backward decreased from 16.9% to 10.1% in the same period. Indonesia's international trade is more bilateral than global (OECD-WTO, 2018). From a forward-linkages perspective, most of Indonesia's domestic value-added used by its direct importers to produce their final products for domestic consumption. Meanwhile, from backward, most of the added value attached to imports between Indonesia is used in final production for domestic consumption rather than for exports (Figure 2).

Figure 2: Foreign Value-added and Domestic Value-added Indonesia




Source: (ADB MRIO, 2022)

Labor costs, infrastructure, access to funding sources, availability, and skills are all economic factors that play a significant role in the GVC concept. Thus, the government's role in economic regulation such as setting taxes, providing incentives, energy policy and setting minimum wages is needed (Hernández & Pedersen, 2017; World Bank, 2017). Therefore, in order to combat potential risks, there is a need for an effective marine policy to lessen the environmental effects of the development of coastal resources and maintain the diversity of fish

production (OECD, 2019; UNCTAD, 2014). This is considering the constraints of international trade in the form of information or communication, technology and regulations.

## DATA AND METHODOLOGY

### Data

The type of data used is panel data for groups of provinces in Indonesia, consisting of Sumatra Island, Java Island, Bali-Nusa Tenggara Region, Sulawesi Island, Kalimantan Island, and Maluku-Papua Island in 2012-2021.

Table 1: Variables descriptions and data sources

| Variables | Definition | Data sources |
|---|---|---|
| GDPFISH | Value of gross domestic product from the marine and fisheries sector (in billion rupiah) | Central Bureau of Statistics |
| INV | value of investment the marine and fisheries sector (foreign direct investment and domestic investment) in US$ thousand | Investment Coordinating Board (BKPM) |
| TradeOpp | trade openness (% of GDP) | World Development Indicators |
| NETEXP | value of net-export from the marine and fisheries sector (in USD) | Ministry of Maritime Affairs and Fisheries Republic of Indonesia |
| GVC | GVC index (the average production length of GVC activities based on forward linkages (to the end of the chain), which is the ratio of GVC-related domestic value added and its induced gross output (PLV)_ Agriculture, Hunting, Forestry, and Fishing | ADB-MRIO |
| FishProd | Value of production from the marine and fisheries sector (billion rupiah) | Ministry of Maritime Affairs and Fisheries Republic of Indonesia |

### Estimation

The research data were analyzed using the panel vector autoregression (P-VAR) method. There are several pre-estimated analyses of VAR consisting of data stationarity test, optimum lag test, cointegration test, and model stability test. The VAR methodology is categorized as an extension of the autoregressive (AR) model based on its multi-variable characteristics. In addition, it also resembles the style estimation of the simultaneous equation model (SEM) (Greene, 2012; Gujarati, 2012). This study uses cross-sectional data so that the panel VAR method is used.

In general, the VAR model takes the form:

$$X_t=\beta_{(0)}+\beta_n X_{(t-n)}+u_t \quad (1)$$

Where

$X_t$is the element vector of the dependent variable, $\beta_0$is the vector constant n x 1. $\beta_n$is the coefficient of $X_t$while n is the length of the lag. $u_t$is a vector of shock for each variable.

Furthermore, the regression model for panel data in general is as follows:

$$Y\_it=\beta\_0+\beta\_1 X\_1it+\beta\_2 X\_2it+\cdots+\beta\_p X\_pit+\mu\_it \quad (2)$$

The specifications for this research model refer to several empirical studies related to the research objectives, such as research from (Alshubiri et al., 2019), (Abe et al., 2017; Eegunjobi & Ngepah, 2022; Emam et al., 2021; Miar et al., 2020; Seung, 2022).

As a result, the following are the specifications of this research model:

$$LOGGDPFish\_(it-1)=\beta\_0+\beta\_1 LOGINV\_(it-1)+\beta\_2 NETEXP\_(it-1)+\beta\_3 LOGTRADEOPP\_(it-1)+\beta\_(4\ ) GVC\_(it-1)+\beta\_5 LOGFISHPROD\_(it-1)+u\_it \quad (3)$$

Variable explanations are as follows: variable explanations are as follows: the dependent variable is the gross domestic product of the marine and fisheries sector (LOGGDPFISH); and the independent variable consists of the value of investment the marine and fisheries sector/INV (foreign direct investment and domestic investment), the net-export value of marine and fisheries products (NETEXP), trade openness (TRADEOPP), the GVC index (GVC ), and the variables of production from the marine and fisheries sector (FishProd). $\beta_0$ is a constant; $\beta_{1,2,3,4,5,6}$is a parameter vector; *it* represents the region at a specific time; t-1 represents the lag relationship; and *u* represents error correction.

## RESULTS AND DISCUSSION

### Descriptive Statistics

The aim of descriptive statistics test results is to describe the fundamental characteristics of the data in a study. The general description of each variable used in the study can be explained individually by displaying the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera, and probability. Table 2 displays the results of descriptive statistical test.

Table 2: Results of Descriptive Statistical Tests

| | LOGGDPFISH | LOGINV | LOGNETEXP | LOGTRADEOPP | GVC | LOGFISHPROD |
|---|---|---|---|---|---|---|
| Mean | 4.588842 | 2.031458 | 9.619886 | 1.618747 | 4.135474 | 7.299814 |
| Median | 4.533362 | 1.902232 | 9.622549 | 1.614615 | 4.228464 | 7.331516 |
| Maximum | 5.084816 | 3.012542 | 9.719485 | 1.695332 | 4.286772 | 7.876007 |
| Minimum | 4.023787 | 1.148609 | 9.540430 | 1.518193 | 3.898802 | 6.277165 |
| Std. Dev. | 0.322050 | 0.573169 | 0.054718 | 0.054983 | 0.155352 | 0.330611 |

Source: Authors' Computation, 2022

Based on the descriptive statistical test, the maximum value of the GDPFish variable is 5.084816, which is the GDPFish value in the Sumatra region in 2021, while the minimum value is 4.023787, which is the GDPFish value in the Bali and Nusa Tenggara regions in 2012. INV has a maximum value of 3.012542, namely in the Sumatra region in 2021, and a minimum value of 1.148609 in the Bali and Nusa Tenggara regions in 2013. The maximum value of NETEXP is 9.719485 in 2021, while the minimum value is 9.540430 in 2012. TRADEOPP has a maximum value of 1.695332 in 2012 and a minimum value of 1.518193 in 2020. The maximum value of the GVC variable is 4.286772 in 2015, while the minimum value is 3.898802 in 2019. The maximum value of FISHPROD is 7.876007 in the Sumatra region in 2019, while the minimum value is 6.277165 in the Sulawesi region in 2012. The standard deviation value of all research variables is smaller than the mean, which means having good data distribution.

**Stationarity Test**

This study used the vector autoregression (VAR) or vector error correction model (VECM) method. VAR modeling will be used when the results of the data stationarity test or the results of the root test show that all research variables are stationary at the level. The study model used is VECM if the data stationarity test results indicate stationarity not at the level but rather at the first or second difference. However, the VAR model can still be used by differentiating the research data, and the cointegration test results show that is no cointegration between variables. The pre-estimated VAR/VECM test, which includes the data stationarity test, optimum lag test, cointegration test, and data stability test, is the test run prior to estimating the VAR/VECM. The appropriate research model for the estimation is explained using a pre-estimation test.

The data stationarity test, also known as the unit root test, was used to determine the level of stationarity in the research data. The stationarity test of the data in this study used the unit root test of the Levin, Lin, and Chu panel data and the PP-Fisher Chi-square. (Levin et al., 2002) used the panel data unit root test by considering the following basic ADF specifications:

$$\Delta y\_it=\delta\_i\ y\_(it-1)+\sum\_(L=1\ )\^(P\_1)\blacksquare\theta\_iL\ \Delta y\_(it-1)+\alpha\_mi\ d\_mt+\varepsilon\_it,\qquad m=1,2,3 \quad (4)$$

The order of the $p_i$ lags are allowed to vary between individuals. (Campbell & Perron, 1991) recommend the method proposed by Hall (1990) for selecting an appropriate lag sequence: for a given sample length T, select the maximum lag sequence $p_{max}$, and then use the

t statistic of *iL* to determine whether the smaller lag sequence is greater. (This t statistic has a standard normal distribution under the null hypothesis (iL = 0), both when $\delta_i$ = 0and when $\delta_i$ < 0. The results of the LLC and PP-Fisher unit root tests are presented in Table 3. The data in this study were transformed into the form logarithm with the aim of changing the data that was initially distributed deviated or not normally distributed into or close to a normal distribution.

Table 3: Result of Unit Root Test

| | Levin, Lin & Chu t* | PP - Fisher Chi-square |
|---|---|---|
| LOGGDPFISH | [0.0000]* | [0.0000]* |
| LOGINV | [0.0000]** | [0.0000]** |
| LOGNETEXP | [0.0000]** | [0.0443]** |
| LOGTRADEOPP | [0.0009]* | [0.3069] |
| GVC | [0.0001]** | [0.0000]** |
| LOGFISHPROD | [0.0121]** | [0.00100]** |

* Significant at level; ** significant at the 1st difference level; *** significant at the level of 2nd differences
Source: Authors' Computation, 2022

The results of the stationarity test in Table 3 show that the LOGGDPFish and LOGTRADEOPP variables are stationary at the levels in the LLC and PP-Fisher chi-square calculations. The data stationarity test showed that the LOGINV, LOGNETEXP, GVC, and LOGFISHPROD variables were stationary at the 1st difference level. Based on the data stationarity test, the next step is to perform data differentiation. It is a continuation of the unit root test and is only required if all of the data is not stationary at degree zero or one (0). The results of the first difference data stationarity test shown in Table 4 show that all variables (independent and dependent) are stationary at the level.

Table 4: Result of Unit Root Test on 1st Difference

| | Levin, Lin & Chu t* | PP - Fisher Chi-square |
|---|---|---|
| dLOGGDPFISH | [0.0033]* | [0.0000]** |
| dLOGINV | [0.0000]* | [0.0000]* |
| dLOGNETEXP | [0.0000]* | [0.0000]* |
| dLOGTRADEOPP | [0.0000]* | [0.7901] |
| dGVC | [0.0001]* | [0.0000]* |
| dLOGFISHPROD | [0.0121]* | [0.0000]* |

* Significant at level level; ** significant at the 1st difference level; *** significant at the level of 2nd differences
Source: Authors' Computation, 2022

**Optimum Lag**

The Optimum lag test is used to determine the length of the lag or the length of the period of influence between variables. The determination of the lag length in this study is based on the likelihood ratio (LR), final prediction error (FPE), akaike information criterion (AIC),

and Schwarz information (SC). According to the results of the optimum lag test presented in Table 5, the optimal lag length is at lag 1.

Table 5: Result of Optimum lag test

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | 221.0964 | NA | 1.40e-11 | -7.966532 | -7.745534 | -7.881302 |
| 1 | 609.0323 | 675.2959* | 3.08e-17* | -21.00120* | -19.45421* | -20.40458* |

Source: Authors' Computation, 2022

## Cointegration Test

The cointegration test is used to determine whether the data used in the study has the same stochastic trend and long-term movement. The Kao residual cointegration test was used in this study for panel data cointegration. Kao performed a cointegration test on panel data by developing the DF and ADF statistical tests (Kao, 1999). The results of the Kao residual cointegration test in Table 5 show that there is no cointegration as evidenced by the t-statistical probability value < alpha 0.10.

Table 6: Result of Kao Residual Cointegration Test

| | t-Statistic | Prob. |
|---|---|---|
| ADF | -1.444668 | 0.0743 |
| Residual variances | 0.000185 | |
| HAC variance | 0.000218 | |

Source: Authors' Computation, 2022

## Stability Test

The VAR stability test aims to determine the validity of the data. The stability test of the VAR estimation was carried out by checking the condition of the VAR stability in the form of roots of a characteristic polynomial. VAR model is stable if all its roots have a modulus smaller than one (Gujarati, 2012). Based on the results of the VAR stability test, which are shown in Table 7, the modulus value is less than 1, so the estimated VAR to be used is stable at its optimal lag.

Table 7: Result of Stability Test

| Root | Modulus |
|---|---|
| 0.921103 | 0.921103 |
| -0.102437 - 0.813151i | 0.819578 |
| -0.102437 + 0.813151i | 0.819578 |
| -0.593509 - 0.490251i | 0.769804 |
| -0.593509 + 0.490251i | 0.769804 |
| -0.401377 | 0.401377 |

No root lies outside the unit circle.
VAR satisfies the stability condition.
Source: Authors' Computation, 2022

**P-VAR Estimation**

This study used the vector autoregression method, which according to the results of the stationarity test, shows that not all research data is stationary at the level that requires the data to be differentiated. Furthermore, the cointegration test shows that there is no cointegration between research variables. Thus, the appropriate research model is the vector autoregression (VAR) method with the optimum lag at lag 1. The results of the panel VAR estimation are shown in Table 8.

Table 8: Result of P-VAR Estimation

| | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LOGGDPFISH | 0.651217 | 0.110611 | 5.887436 | 0.0000* |
| LOGINV | -0.01093 | 0.003797 | -2.87938 | 0.0043* |
| LOGNETEXP | 0.050086 | 0.066301 | 0.755429 | 0.4507 |
| LOGTRADEOPP | -0.05347 | 0.071916 | -0.74353 | 0.4579 |
| GVC | 0.047576 | 0.017193 | 2.767212 | 0.0061* |
| LOGFISHPROD | 0.0249 | 0.012943 | 1.923813 | 0.0555* |
| C | 0.009412 | 0.005972 | 1.576083 | 0.1163 |

Source: Authors' Computation, 2022

**DISCUSSION**

The VAR estimation results show that LOGGDPFISH has a positive and significant effect on the variable itself, as evidenced by a positive coefficient value of (0.651217) and a probability value of (0.0000) < alpha 0.05. INV has a negative coefficient value of ( -0.01093) and a probability t-statistic value of (0.0043) alpha 0.05, which means that the investment value of the cannabis sector has a negative and significant effect on the Indonesian marine and fisheries sector's GDP. This statement indicates that when the value of the investment in the fisheries sector increases, it will have an impact on decreasing the GDP of the Indonesian fisheries and marine sectors. (Forte & Moura, 2013) explain that foreign direct investment (FDI) influences the host country's economic growth through several channels. Empirically, various studies consider that FDI generates economic growth, but others conclude that FDI is a source of negative effects.

Research results from Forte & Moura (2013) concluded that the effect of FDI on economic growth depends on the domestic conditions of the host country (e.g., human capital, economic and technological conditions, and the degree of economic openness). This research differs from the results of previous empirical studies, which state that domestic investment has a long-term relationship and a significant positive relationship with economic growth, as research results Adams (2009) and Yusoff & Febrina (2014). This empirical gap can occur due to differences in the economic conditions of each country with different research focuses.

Investment in many countries of the world is an important economic factor, which is one of the determinants of ensuring the participation of national enterprises in international production processes and maximizing the benefits of investment and commodity exchange between countries. The impact of investment on economic growth is still being debated. However, many empirical studies do not answer questions about the relationship between investment and economic growth.

NETEXP has a positive but not significant effect on the GDP growth of Indonesia's fisheries and marine sectors. This statement is supported by the value of the netexport coefficient, which is 0.050086, and the probability value of the t-statistic, which is 0.4507 > alpha 0.05. These results indicate that when the net exports of the Indonesian fisheries and marine sector increase, it will have an impact on increasing the GDP of the Indonesian fisheries and marine sector, but not significantly. Emam et al. (2021)also found analytical evidence that fish exports have a significant positive effect on the growth of the agricultural sector in the long term.

TradeOpp has a negative coefficient value of ( -0.05347) and a probability t-statistic value of (0.4579) > alpha 0.05, which means that trade openness has negative effect and no significant on the GDP of the Indonesian fisheries and marine sector. This statement indicates that when the value of trade openness increases, it will have an impact on reducing the GDP of the Indonesian fisheries and marine sector, but not significantly. The results of this study contradict research by Eegunjobi & Ngepah (2022)that explains that trade openness has a positive effect on economic growth.

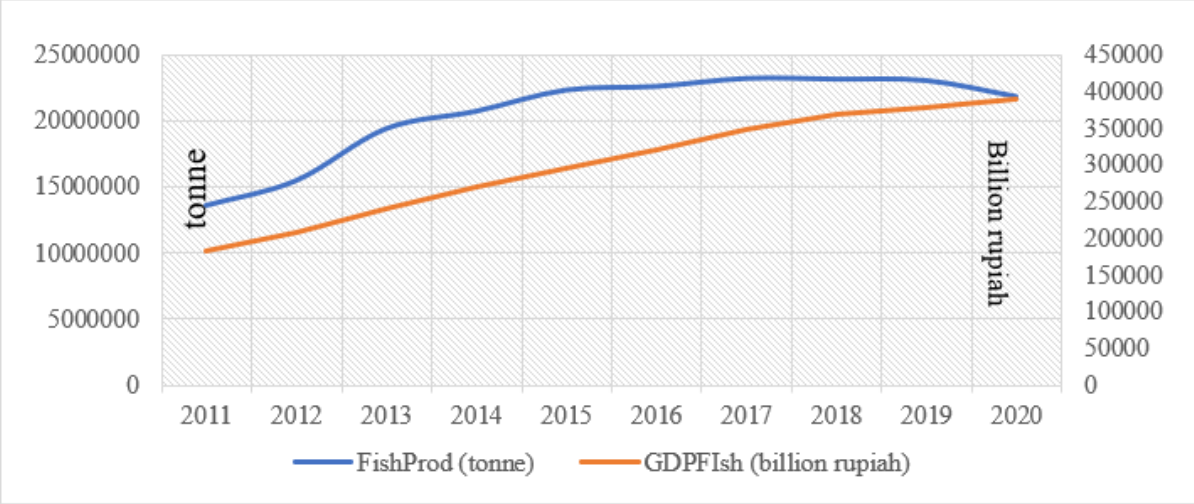
GVC has a positive and significant influence on the GDP growth of Indonesia's fisheries and marine sectors because the value of the GVC coefficient, which is 0.047576, and the probability value of the t-statistic, which is 0.0061* <alpha 0.05. These results indicate that when the GVC participation of the Indonesian fisheries and marine sector increases, it will positif impact and significant increase in the GDP of the Indonesian fisheries and marine sector. Furthermore, Eegunjobi & Ngepah (2022)explain that the quality of domestic institutional governance is important for GVC participation in developing seafood exporting countries.

FishProd has a positive coefficient value of 0.0249 and a probability t-statistic value (0.0555) alpha 0.10, indicating that it significantly and favorably affects Indonesia's GDP. The income or GDP of Indonesia's fisheries and marine sector will therefore be significantly affected by changes in fish production, and vice versa. As fish production declines, the GDP of Indonesia's fisheries and marine sector will be affected. The findings of this research are

consistent with a prior empirical study by Alshubiri et al. (2019), which indicates that marine fish output has a favorable and considerable impact on the sea trade balance.

The phenomenon that occurs supports the results of the analysis. It can be seen in **Figure** 3 that the increase in the number of captured and cultured fish production (in tons) during 2011-2020 tends to increase in tandem with the increase in Indonesia's GDPFish. However, when the COVID-19 pandemic occurred, the number of fishery and marine sector products decreased, one of which was due to weakening economic activity due to the impact of the pandemic that affected the productivity of fishermen or fish farming entrepreneurs (Ministry of Maritime Affairs and Fisheries, 2020; Wiradana et al., 2021).

Figure 3: Development of Fishery Production Volume and Gross Domestic Product of Fisheries Sector in Indonesia 2011-2020




Source: (Central Bureau of Statistics, 2022)

The decline in the amount of fishery and marine products in 2020, as seen in Figure 1, is a decrease in the volume of aquaculture with an average annual decline of 0.83 percent (Ministry of Maritime Affairs and Fisheries, 2020). Despite the fact that total production in the fishing and marine sectors has decreased in 2020, the sector's total GDP has increased, albeit not significantly. This can occur when commodity prices on the international market rise in the midst of difficult economic conditions and are not yet stable due to the pandemic.

Investment in many countries of the world is an important economic factor that is one of the determinants in ensuring the participation of national enterprises in international production processes, and maximizing the benefits of investment and commodity exchange between countries. The impact of investment on economic growth is still a matter of debate.

However, many empirical studies do not answer the question of the relationship between investment and economic growth (Humbatova et al, 2020).

UNCTAD (2013) explained that GVC relations in developing countries can play an important role in economic growth. The domestic value added from trading in GVCs can be very significant compared to the size of the local economy. Del Prete et al. (2017) have found in our analysis that increasing GVC participation in North African countries has the potential to have major benefits for local industries, countries, and even entire areas. However, the ability to sustain these benefits depends on certain local conditions, such as a favorable environment for foreign investment, and lower trade barriers, leaving room for policy intervention.

Indonesia, the tenth largest economy in the world, is one of the ASEAN members that has struggled to rise above the middle-income status. One factor that requires consideration from the standpoint of structural change is the slow expansion of the percentage of manufacturing value added to GDP. Due to the concentration of Indonesia's manufacturing activities at lower production levels, which only require a small number of imported inputs and foreign technology, the high share of domestic value added in the country is concerning (Korwatanasakul & Purbantina, 2021). In other words, despite being an active participant, Indonesia appears to be falling short of maximizing GVC's growth. The only basic inputs that Indonesia contributes are raw materials and low-tech semi-finished goods. As a result, in order for human resources to support productive development, it is necessary to improve their quality along with the development of their knowledge and technical skills (Klimovskikh et al., 2023; Selvalakshmi et al., 2023).

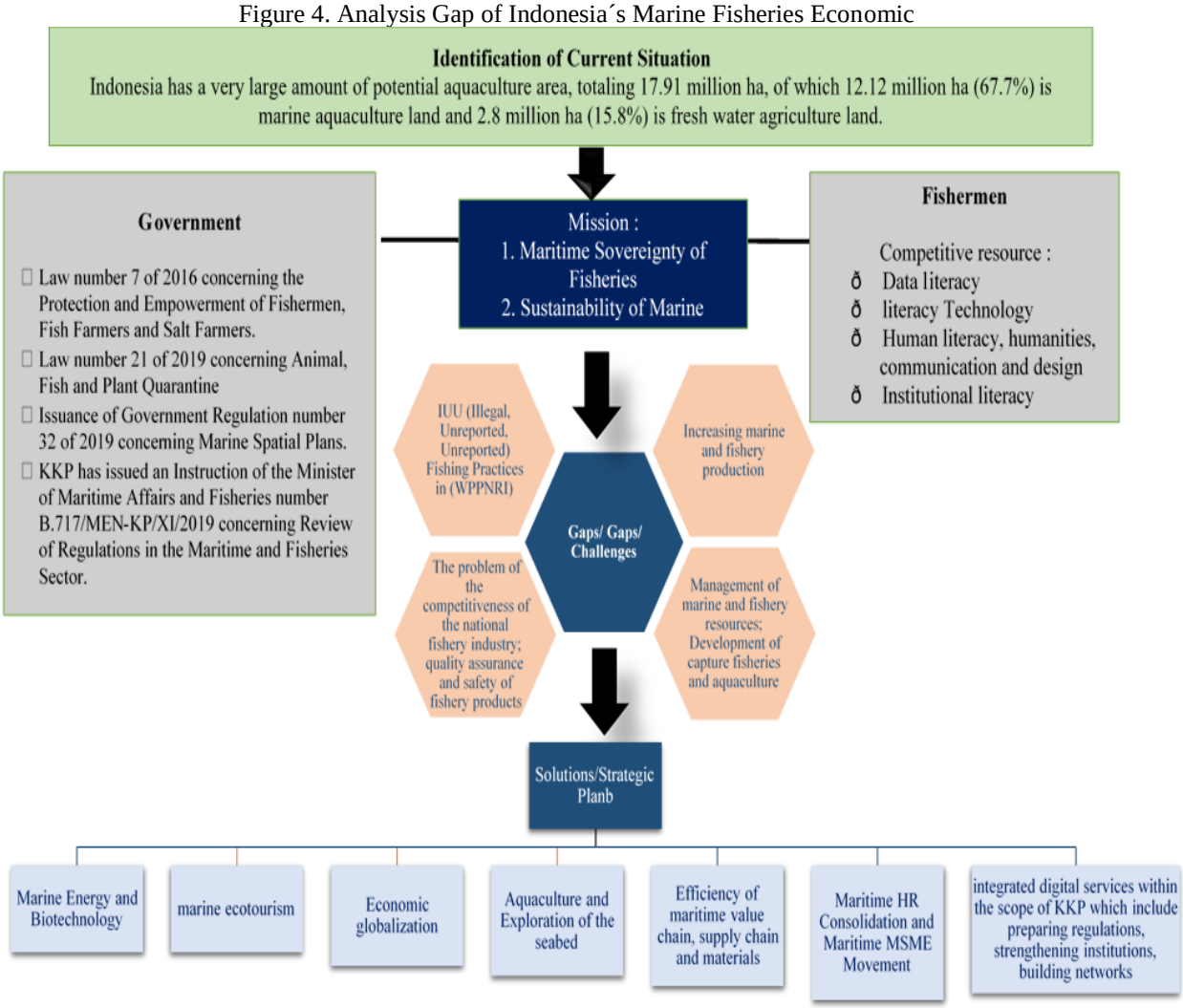
Human intervention in the Indonesian oceans has had a negative impact on marine plant species and diversity. Overfishing and neglect have decimated sea creature populations. FAO (Food and Agriculture Organization) continues to support the formation of cooperatives and related organizations that aim to improve fishing practices to establish responsible fisheries policies. FAO also continues to highlight ways to increase production by reducing post-harvest losses in small-scale fisheries (FAO, 2018). Thus, integration among various parties must be improved in the production process, marketing, improving the quality and quantity of marine and aquaculture products, and implementing appropriate trade policies to sustain marine economic growth.

The researchers conducted a gap analysis of the dynamics of the Indonesian marine and fisheries sector concerning the issues and outcomes of the data analysis, as shown in Figure 4. The IPA (importance-performance analysis) method includes gap analysis. In this study, gap

analysis entails identifying the present condition, future scenarios, gaps and difficulties, and potential remedies.

This study's gap analysis highlights the existing situation, showing that Indonesia has abundant natural potential, particularly in the marine and fishing sectors, which can have a favorable effect on the sustainability of the national economy. This potential is one way to realize Indonesia's mission of creating food sovereignty, sustainability of the marine and fisheries economy, and the welfare of fishermen. The government creates laws through regulations that can serve as the cornerstone for the sustainability of activities in the marine and fisheries sectors in order to accomplish this purpose. In addition to protecting and empowering fishermen, and fish farmers, and regulating the quarantine of animals, fish, and plants, these laws and regulations also address how to respond to rapid changes in the strategic environment as well as advancements in science, technology, and information.

Figure 4. Analysis Gap of Indonesia´s Marine Fisheries Economic




Source: Strategic Plan (RENSTRA) o the Ministry of Maritime Affairs and Fisheries for 2020-2024 and various empirical studies (processed)

Furthermore, fishermen who are important actors in the marine and fisheries sector also strive to become competitive human resources (HR). Competitive HR development can be done through data literacy, technology literacy, humanities literacy, communication and design literacy, institutional literacy, and supply chain literacy (Abdulkadir et al., 2022; Klimovskikh et al., 2023). Even though the government and society have made efforts to maximize the productivity and competitiveness of the marine and fisheries sector in both domestic and global markets, there are still many gaps and challenges faced that could hinder the sustainability of the sector.

In this study, the researchers summarized several important things to be used as additional references regarding efforts to develop a sovereign, sustainable, and prosperous marine sector. The solution in question is as follows:

a. Development of Marine Energy and Biotechnology as a sustainable effort, especially Indonesia's participation in the global value chain.

b. Marine ecotourism is an effort to build and maintain a symbiotic relationship between tourism and the marine natural environment.

c. Economic globalization involves the expansion of marine commodity market share

d. Aquaculture and seabed exploration as productivity and innovation development efforts

e. The efficiency of the value chain, supply chain, and maritime materials as an effort to increase the efficiency of the marketing system.

f. Consolidation of maritime human resources and the maritime MSME movement as an effort to increase the insight and quality of human resources in managing marine resources. In addition, the UMKP movement is an effort to drive the economy and one way to develop innovation and investment.

g. Preparation of integrated digital services within the scope of KKP which includes preparing regulations, strengthening institutions, building networks, infrastructure facilities, and increasing HR capacity with digital expertise

## CONCLUSION

International trade barriers consist of information or communication, technology and regulations. In this case, countries must strengthen their commitment to ensure that marine resources are managed in a sustainable and fair manner and are able to compete internationally.

The formulation of the research problem is how the influence of macroeconomic and trade variables on the economic growth (GDP) of the Indonesian marine and fisheries sector and how to plan the right strategy to improve the performance of the Indonesian marine and fisheries sector in international market networks or global value chains. Thus the purpose of this study is to analyze the indicators that play a role in the growth of the fisheries sector in its development towards GVC and formulate a strategic plan in pushing the Indonesian marine sector towards a sustainable economy and competing in GVC. The results of the estimated PVAR show that the investment of the fisheries sector has a negative and significant impact on the GDP of the fisheries sector, and GVC and fish production has a positive and significant impact on fisheries GDP. Whereas, Net-export and Trade openness have an insignificant impact on the GDP of fisheries. However, there is a need for supervision, particularly during the fishing process, to ensure that the applicable procedures are followed without harming the marine ecosystem. This also applies to the fish farming process, which both maintains fish quality and is environmentally friendly. Furthermore, Indonesia's GVC participation, particularly on the basis of Agriculture, Hunting, Forestry, and Fishing, has a significant positive impact on the Indonesian fisheries sector's GDP. As a result, in order to encourage increased Indonesian participation, Indonesia must improve its production, marketing, technology, and institutional systems. Investment is also an important driver of economic growth. As a result, the government's role in attracting more investors into the country is required.

The fishing and marine sectors' performance achievements are being challenged both internally and externally. The internal challenge is related to institutional governance in production and marketing activities, which includes fishermen's welfare. Meanwhile, external challenges include global uncertainty caused by the volume of product requests, natural disasters or pandemics, and international trade policies. Thus, integration among various parties must be strengthened to achieve community welfare as well as the stability and sustainability of Indonesia's fisheries and marine economy.

The limitation of this study is that it only identifies the impact of independent variables on the GDP growth of the fisheries sector. Consequently, it is necessary to identify a sustainability strategy for the fisheries sector. Thus the recommendation for further research is to modify the research model by adding crisis factors, both environmental crises and global economic uncertainty. In addition, an in-depth study is needed regarding policy recommendations by conducting qualitative research involving responses and suggestions from fishermen, industry, government and policy actors.

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