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Fisheries Production, Consumption, and Exports: Drivers of Indonesia's Blue Economy Performance

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ABSTRACT

Purpose: This research aims to analyze the contribution of the fisheries sector to the implementation of the 14th Sustainable Development Goal (SDG)—namely, the performance of the blue economy in Indonesia—through economic growth. It focuses on three key variables: fisheries production, the fish consumption rate, and fisheries exports.

Method: This study uses panel data regression, analyzing fisheries statistical data from 34 provinces in Indonesia with annual data spanning from 2018 to 2022. All data were processed using Eviews 10 software.

Result: Using the Fixed Effect Model (FEM) approach, we found that the volume of fisheries production has a positive but insignificant effect on the performance of the blue economy in Indonesia. Meanwhile, the fish consumption rate and fisheries exports have a significant positive effect on the blue economy's performance in the country.

Practical Implications for Economic Growth and Development: This research offers practical implications for the Indonesian government. Policymakers could implement measures to boost productivity in the fisheries sector, such as simplifying the investment process for investors and facilitating fisheries export activities.

Keywords: *fisheries sector, fisheries production, fish consumption rate, fisheries export, economic growth, blue economy*

INTRODUCTION

Economic development refers to a country's efforts to achieve its predetermined economic goals. It is crucial for improving the welfare of society. To create a nation with a prosperous society, economic development must be implemented in line with sustainable principles. Sustainable development, particularly in line with the 14th Sustainable Development Goal (SDG), emphasizes the concept of a "blue economy," which focuses on conserving and sustainably utilizing marine and ocean resources. According to the World Bank (2017), the blue economy can impact exchange rates, stimulate economic development, reduce poverty, and promote equality while advancing marine energy, fisheries, and marine technology.

The blue economy is closely tied to the sustainable use of marine resources, balancing ecosystem conservation with economic growth, societal welfare, and livelihoods. Additionally, it aims to educate the public about the importance of preserving marine ecosystems (Hendarto & Yuniwati, 2021). Despite its significant potential, Indonesia is more widely recognized as an agricultural country, even though it is also a maritime nation with a sea area of 5.8 million km² and the third-longest coastline in the world. Currently, only about 60% of Indonesia's total potential marine and fisheries resources are being utilized. The untapped potential—comprising both biological and non-biological resources—is vast and abundant.

Given this, Indonesia has an opportunity to adopt the blue economy concept, which would enable optimal utilization of its marine potential while ensuring the preservation of marine ecosystems. This approach could transform the country's dependence on extractive economic practices into a sustainable, marine-based industrial economy (BAPPENAS, 2021).

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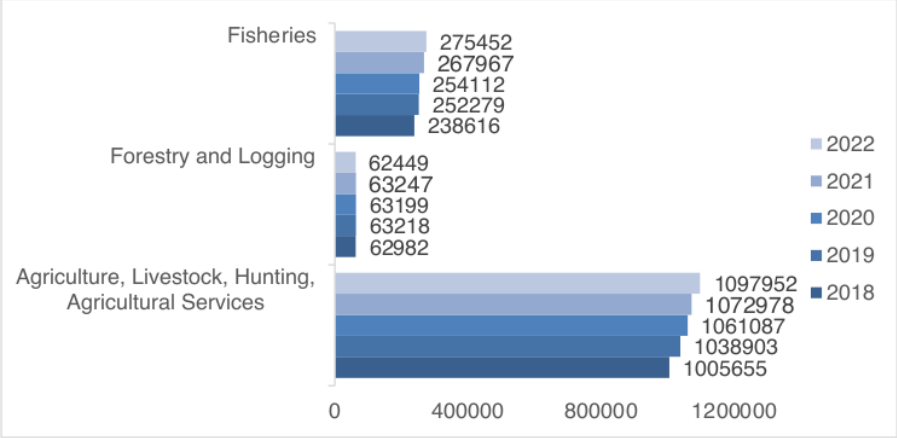
The theory of sustainable growth states that economic development can progress alongside the responsible use of natural resources, provided ecosystem sustainability is maintained. Economic performance in a country over a given period is often measured through Gross Domestic Product (GDP). GDP reflects national income and serves as an indicator of a government's success in mobilizing various economic sectors (Sukirno, 2015). Among the key contributors to GDP, the agriculture, forestry, and fisheries sector plays a significant role. For instance, Indonesia's fisheries sub-sector has shown a steady upward trend from 2018 to 2023, reaching IDR 290.575 billion in 2023, as illustrated in Figure 1.

Figure 1. GDP of Agriculture, Forestry, and Fisheries Sector (in Billion Rupiahs)



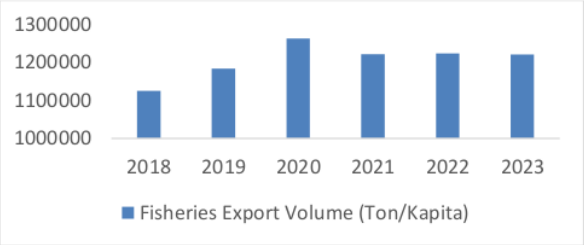
Source: Ministry of Maritime Affairs and Fisheries (2024)

The increase in GDP highlights the contribution of the fisheries sub-sector to Indonesia's economic growth. However, when compared to other sub-sectors, the fisheries sub-sector's contribution remains relatively small. In 2023, the composition of GDP within the agriculture, forestry, and fisheries sector was dominated by the agriculture, livestock, hunting, and agricultural services sub-sector, which accounted for 9.25% of the total GDP. The fisheries sub-sector was the second-largest contributor, accounting for 2.66% of the total GDP of 12.53%. This relatively modest contribution from the fisheries sub-sector can be attributed to suboptimal fisheries production in Indonesia (BPS, 2023).

The fisheries sector has the potential to strengthen the blue economy through increased fish consumption rates. Fish consumption in Indonesia has been rising steadily each year and serves as a key driver of economic growth. In 2018, the per capita fish consumption rate was 50.69 kg, while the highest rate was recorded in 2022 at 57.27 kg per capita. Increased household consumption of fishery products positively impacts economic output, thereby boosting the national economy (Tajerin, 2017).

The potential of the fisheries sector in Indonesia's national economy is also evident from its role in exports, which contribute to output formation, community income, and employment opportunities (Widyaningrum & Suhartini, 2021).

Figure 2. Fisheries Export Volume (Ton/Kapita)



Source: Ministry of Maritime Affairs and Fisheries (2024)

Previous studies have explored various aspects of the fisheries sector and its impact on economic growth in Indonesia. For instance, research by Febrisya et al. (2021) found that the fisheries sector in Bogor Regency is a leading sector capable of meeting local demand for fishery products while also capturing trade opportunities for fishery products in other regions. Similarly, Julianto et al. (2020) assessed the fisheries sector in Pangandaran Regency, which experienced fluctuations but showed an increasing growth rate in fisheries sector GRDP, largely driven by capture fisheries production.

Tarigan et al. (2021), through MRA analysis, revealed that the fisheries sector functions as a basic sector that impacts the non-basic sector by creating jobs and contributing labor to other economic areas. Research by Janis et al. (2022) highlighted that the fisheries sub-sector in Sangihe Islands Regency has an average annual contribution of 21.86%, far exceeding other sub-sectors in the agriculture, forestry, and fisheries sector GRDP. Additionally, Kaiso and Bhokaleba (2021) argued that the capture fisheries and aquaculture sectors significantly support the economy of Sikka District, with a contribution value of 30.13%.

Despite these studies, none have specifically examined the relationship between the fisheries sector and the performance of the blue economy as measured by Indonesia's economic growth. This research seeks to fill that gap in the literature. Unlike previous studies that primarily focused on the impact of the fisheries sector at the regional level, this study introduces a novel approach by analyzing the fisheries sector's contribution to the blue economy in Indonesia through three main variables: the volume of fisheries production, fish consumption rates, and fisheries exports.

The aim of this research is to analyze the contribution of the fisheries sector to the implementation of the 14th SDG, which pertains to the performance of the blue economy in Indonesia and its role in economic growth. This research is particularly important as it provides a foundation for policy development to enhance the performance of the blue economy. By utilizing fisheries and marine resources sustainably, it seeks to improve community welfare through the fisheries sector.

METHOD

This research is a quantitative study that utilizes secondary data obtained from the Ministry of Marine Affairs and Fisheries (KKP) and the Central Statistics Agency (BPS). The study uses fisheries statistical data from 34 provinces in Indonesia, covering the years 2018 to 2022. Data collection was conducted through documentation and an extensive literature review.

The analytical approach employed in this research is panel data analysis, which combines cross-sectional and time-series data, and the estimations were performed using EViews 10 software. The estimation models include the Common Effects Model (CEM), Fixed Effects Model (FEM), and Random Effects Model (REM). To determine the most appropriate model, two diagnostic tests were conducted: the Chow test and the Hausman test.

This study focuses on three key independent variables: the volume of fisheries production, fish consumption rates, and fisheries exports. The performance of the blue economy is proxied by the Gross Regional Domestic Product (GRDP) of the fisheries sector, which serves as the dependent variable. The econometric model used for the estimation is formulated as follows:

$$EG_{i\,t} = \beta_0 + \beta_1 FP_{i\,t} + \beta_2 FCR_{i\,t} + \beta_3 FE_{i\,t} + \varepsilon_{i\,t}$$

Where:
EG = GRDP Value of Fisheries Sector (billion rupiah)
FP = Fisheries Production Volume (tons)
FCR = Fish Consumption Rate (kg/capita)
FE = Fisheries Export Volume (tons)
β_0 = Constant
β_1 - β_3 = Regression Coefficient
i = 34 Provinces
t = 2018-2022
$\varepsilon_{i\,t}$ = Error Term

Hypotheses Development

Fisheries Production and Blue Economy Performance

According to the theory of sustainable economic growth, well-managed fisheries production that balances the utilization of natural resources with environmental sustainability can significantly contribute to sustainable economic growth (Pearce et al., 2006). High fisheries production serves as an indicator of strong blue economy performance if it leads to increased fisheries income and job creation, both of which support economic growth. In the context of the blue economy, fisheries production also adds value through the processing of catches and the marketing of fisheries products to international markets (World Bank, 2017).

H1: Fisheries production has a positive contribution to blue economy performance

Fish Consumption Rate and Blue Economy Performance

According to supply and demand theory, an increase in demand for goods or services is driven by a rise in consumption activities within the community (Mankiw, 2014). When fish consumption increases, it reflects a stronger domestic market for fisheries, which helps stabilize prices and enhances the welfare of fishermen's businesses in a country (FAO, 2020). Sustainable fisheries consumption can further drive the fisheries and marine industry to produce high-value fishery products.

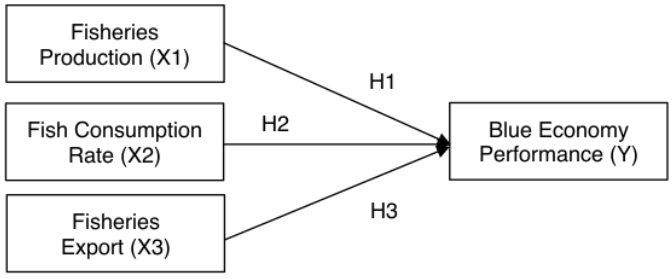
H2: Fish consumption rate has a positive contribution to blue economy performance

Fisheries Exports and Blue Economy Performance

International trade theory suggests that exports can increase national income and encourage investment in productive sectors (Krugman et al., 2015). Increased fisheries exports can contribute to the country's foreign exchange earnings and expand access to international markets (OECD, 2024). It also provides investment opportunities in the fisheries sector, helping businesses boost economic growth.

H3: Fisheries exports positively contribute to blue economy performance

Figure 3. Research Framework



Source: Developed by the authors (2024)

RESULT AND DISCUSSION

Chow and Hausman Test

To obtain the best model in panel data regression, it is necessary to test the model. The first test performed is the Chow test, which determines whether the Fixed Effect Model (FEM) is better than the Common Effect Model (CEM) (Widarjono, 2013). The results show that the Cross-section Chi-square probability value is 0.0000, which is less than α (0.05), indicating that the Fixed Effect Model (FEM) is the preferred model. The selection of the Fixed Effect Model is then followed by the Hausman test to determine whether the Random Effect Model (REM) is more appropriate than the Fixed Effect Model (FEM) (Gujarati, 2012). The results show that the cross-section random probability value is 0.0013, which is also less than α (0.05), further supporting the choice of the Fixed Effect Model. In conclusion, based on the two tests, the Fixed Effect Model (FEM) is selected as the appropriate model.

Table 1. FEM and REM Regression Result

Variable	Regression Coefficient	
	FEM	REM
C	5.42E+12	4.40E+12
FP	20086320	1244336.4
FCR	-8.07E+10	2.39E+10
FE	42353276	23974158
R^2	0.514363	0.995418
Prob F-statistic	0.000000	0.000000

1. Chow Test

Cross-section F (33,133) = 529.175; Prob F = 0.0000

2. Hausman Test

Cross-section random X^2 (3) = 15.705; Prob X^2 = 0.0013

Source: Processed data (2024)

Multicollinearity Test

The multicollinearity test aims to determine whether there is a correlation between the independent variables used in the model. The results of the tests conducted are as follows:

Table 2. Multicollinearity Test Result

	X1	X2	X3
X1	1.000000	0.272461	0.387442
X2	0.272461	1.000000	-0.184596
X3	0.387442	-0.184596	1.000000

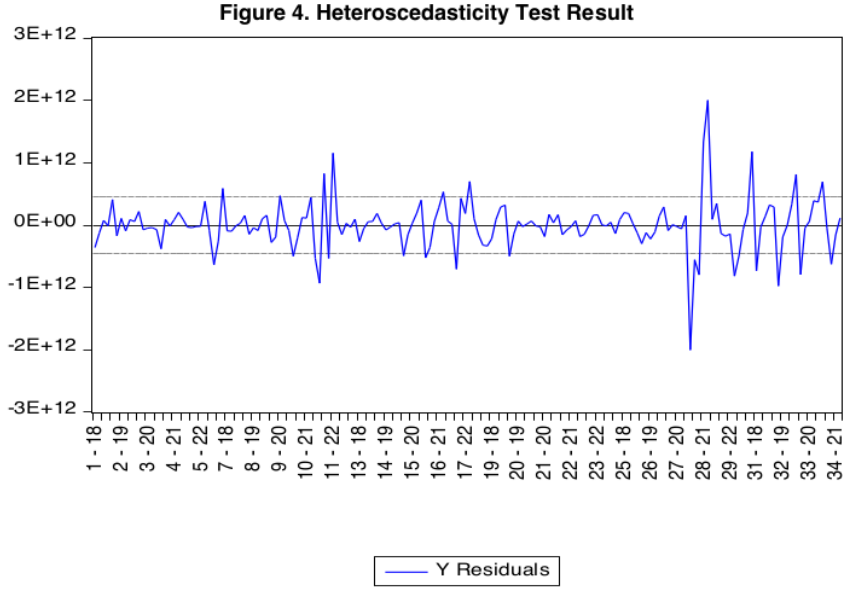
Source: Processed data (2024)

The correlation coefficient between X1 and X2 is 0.272461 (< 0.8), the correlation coefficient between X1 and X3 is 0.387442 (< 0.8), and the correlation coefficient between X2 and X3 is -0.184596 (< 0.8). Based on these results, it can be concluded that the data used is free from multicollinearity, meaning it passes the multicollinearity test.

Heteroscedasticity Test

The heteroscedasticity test is used to determine whether there is unequal variance in the residuals across different observations.

Figure 4. Heteroscedasticity Test Result



Source: Processed data (2024)

From the residual graph (in blue), it can be observed that the residuals do not cross the boundaries of 500 and -500, indicating that the residual variance is constant. Therefore, it can be concluded that the data does not exhibit symptoms of heteroscedasticity and passes the heteroscedasticity test. Based on the estimation results from the EViews 10 program, the estimation model is as follows:

Table 2. Panel Data Regression Result

Variable	Coefficient	t-statistic	Prob	Conclusion
FP	$\beta_1 = 1244336.38171$	1.139	0.2567	FP has a positive effect but not significant at α = 0.05
FCR	$\beta_2 = 23886893524.3$	2.775	0.0063	FCR has a positive effect at α = 0.05
FE	$\beta_3 = 23974157.692$	5.459	0.0000	FE has a positive effect at α = 0.05
F-statistic = 1020.950			R^2 = 0.995418	
F-table = 2.92			T-table = 2.04227	

Source: Processed data (2024)

Discussion

Fisheries Production on Blue Economy Performance

In this test, was found that the volume of capture fisheries production is not significant in influencing the performance of the blue economy as measured by economic growth. Although the positive coefficient suggests that an increase in the volume of capture fisheries production could contribute to economic growth, the high probability value indicates that these results may be influenced by other unmeasured factors.

The panel data regression analysis reveals that the coefficient for capture fisheries production volume (X1) is 1,244,336.3, meaning that a 1% increase in the volume of capture fisheries production tends to increase economic growth by IDR 1,244,336 million. However, the probability value of 0.2567 indicates that this result is not significant at the 5% significance level (0.05), suggesting that the volume of capture fisheries production does not significantly contribute to economic growth during the studied period.

Several similar studies indicate that fisheries production does affect economic growth. For instance, Widyastuti & Nugraha (2021) found that fisheries production has a positive and significant impact on economic growth in Java Island, with a 1% increase in fisheries production corresponding to a 2.32% rise in economic growth. Research by Mardyani & Yulianti (2020) showed that districts and cities in Bangka Belitung Islands Province experienced significant economic growth from 2011 to 2019, due to higher production and sales value of fisheries on Belitung Island compared to Bangka Island. Research by Hilwa (2017) explains that increasing global demand for fish drives the volume of fisheries production, thereby fostering economic growth. Saputra et al. (2024) pointed out that the fisheries sector in Gorontalo Province plays a significant role in increasing regional income and job creation, contributing to economic growth. Similarly, Siregar et al. (2020) found that the fisheries sector, focusing on production activities, has a positive influence on economic growth in Batam City, making it a key sector that could generate employment in related non-basic sectors.

The relationship between the volume of capture fisheries production and economic growth can be analyzed through a blue economy perspective, which focuses on the optimal and sustainable use of marine natural resources to enhance economic welfare while ensuring environmental sustainability. The blue economy theory emphasizes that effective management of natural resources, such as fisheries, can lead to increased productivity and sustainable economic growth. Research by Bethel et al. (2021) explains that to promote economic growth and ensure marine resource sustainability, the Bahamas has adopted a small-scale fisheries (SSF) mapping approach. By mapping and sustainably managing small-scale fisheries, the Bahamian government not only protects marine ecosystems but also strengthens the livelihoods of local fishers. This approach demonstrates that the Bahamas

has developed a sustainable fisheries production model involving local communities in managing natural resources, thereby fostering inclusive and sustainable economic growth.

Fish Consumption Rate on Blue Economy Performance

It was found that the fish consumption rate has a positive and significant contribution to the performance of the blue economy, as measured by economic growth. The regression coefficient for the fish consumption rate variable is 23,886,893,524.3, meaning that every 1% increase in the fish consumption rate will raise economic growth by IDR 23,886,893,524.3 billion. This indicates that variations in fish consumption rates can impact economic growth in each province.

Additionally, based on the theory of a two-sector economy, where national income determines economic growth through consumption, the consumption component plays a key role. To support this analysis, previous studies are also relevant. For example, Marjusni & Idris (2023) found a positive and significant relationship between Indonesia's high fish consumption rates and increased demand for fish production, which subsequently impacts economic growth. Research by Palilah (2021) revealed that fish consumption rates positively and significantly affect GRDP in six provinces on Sulawesi Island. This was explained by the Almost Ideal Demand System (AIDS) model, which shows the habitual consumption of fish, driving up demand and benefiting both production and GRDP in the fisheries sector. According to Arthatian et al. (2018), fish consumption positively and significantly affects fish demand and contributes to economic growth. Similarly, Tajerin (2017) found that increased consumption of fishery products positively impacts national economic growth, with an 11.54% rise in fish consumption leading to an increase in economic output by IDR 10,018,185,000 billion.

High fish consumption rates can be seen as an indicator of community welfare and a driver of economic growth from a blue economy perspective. Increased demand for fishery products stimulates growth in the fisheries sector and the fishery processing industry, creating jobs and raising incomes. Aggregate demand theory supports this idea, suggesting that increased demand for a product can boost production and economic growth. Countries like Japan and South Korea, which have high per capita fish consumption, experience continuous demand for fish production, correlating with improved human resource quality through better nutrition and rapid economic growth driven by increased demand for fisheries production.

However, it is important that rising fish consumption rates are balanced with sustainable management of marine resources to prevent overfishing, which could harm marine ecosystems and reduce fish supply in the future.

Fisheries Exports on Blue Economy Performance

The findings revealed that fisheries exports contribute to the performance of the blue economy, as measured by economic growth. The regression coefficient for the fisheries export variable is 23,974,157.69, meaning that every 1% increase in fisheries exports will raise economic growth by IDR 23,974,157.69 million. Increased fisheries exports positively impact the fishing industry's economy.

This is consistent with the Heckscher-Ohlin theory, which posits that fisheries exports can significantly affect a country's economic growth. According to the theory, countries engaged in export activities typically possess cheap and abundant production factors, which accelerate economic growth and boost national income. Exports are driven by the profitable exchange of resources, with countries selling resources they have in abundance to those that lack them (Jhingan, 2000). As a result, exports benefit a country by increasing national income, production, and overall economic growth.

The results of this study align with those of Marjusni & Idris (2023), who found that every 1% increase in fisheries exports positively and significantly impacts economic growth in Indonesia's fisheries sector, increasing it by 0.011538%. Septyola (2022) found that fisheries

exports have a positive effect on economic growth in 12 provinces in eastern Indonesia, where a 1% increase in fisheries exports leads to a 0.205528% increase in economic growth. Additionally, research by Budiyanto et al. (2023) shows that fisheries exports significantly contribute to increasing the GRDP of Makassar City. These findings are also consistent with those of Fatema & Islam (2020), whose research on Bangladesh found that sustainable development through fisheries production and exports increased income, improved food security for fishermen's households, and contributed to economic growth.

In the context of the blue economy, fisheries exports are not just seen as a source of revenue but also as part of efforts to achieve sustainable development. By increasing fisheries exports, countries can earn significant foreign exchange, create jobs, and stimulate growth in other sectors such as processing, transportation, and logistics. According to the theory of comparative advantage, countries are more likely to export products they can produce at a lower cost compared to others. In archipelagic countries such as Indonesia and the Philippines, which are rich in marine resources, both nations have a comparative advantage in fisheries exports that can be leveraged to increase state revenues and improve the welfare of fishermen.

The application of the blue economy in fisheries exports seeks to balance export activities with the preservation of marine ecosystems. This includes setting catch quotas to prevent overfishing, using environmentally friendly fishing technologies, and promoting sustainable aquaculture practices.

CONCLUSION

The blue economy is a sustainable concept that utilizes the potential of fisheries and marine resources, particularly through the fisheries sector, to drive economic growth, especially in maritime countries like Indonesia. This research aims to analyze the contribution of the fisheries sector to the implementation of the 14th Sustainable Development Goal (SDG), focusing on the performance of the blue economy in Indonesia as measured by economic growth. Using the Fixed Effect Model (FEM), the study found that while the volume of capture fisheries production does not significantly contribute to the blue economy, it has a positive influence on blue economy performance through economic growth. On the other hand, both the number of fish consumption and fisheries exports have a significant positive impact on the performance of the blue economy in Indonesia.

The findings of this study suggest that each province in Indonesia should optimize its fisheries potential by utilizing natural resources effectively while ensuring environmental sustainability, in line with the principles of SDG 14. Additionally, it is recommended that the government implement policies that encourage the growth of the fisheries sector, such as facilitating investment and promoting fisheries export activities.

However, this research has some limitations. The results, particularly regarding the volume of fisheries production, do not fully align with economic growth theory. Despite the significant potential of the blue economy in Indonesia, the contribution of the fisheries sector has not been fully realized. Therefore, further in-depth studies are suggested to explore the influence of the fisheries sector—especially in terms of fisheries production volume—on the performance of the blue economy in more countries.

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