The Influence of Blue Economy on Economic Growth of Sumenep Regency

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Abstract: The urgency of conducting this study is that Sumenep Regency, located in the Madura archipelago, has a long coastline and access to abundant marine resources, but the challenges faced are overfishing, marine pollution, and coral reef damage are serious threats. In addition, sea level rise and changes in weather patterns can have a significant impact on the economy of coastal communities. The purpose of the research in this study is to test and analyze the influence of the blue economy on economic growth in Sumenep Regency. The method used is multiple regression for the period 2010 to 2023. The estimation results show that the variables of the fisheries sector, marine tourism, and environmental conservation have a positive impact on the economic growth of Sumenep Regency. This research is not only useful for optimizing regional potential, but also ensuring that the development carried out does not damage the ecosystem and continues to provide benefits for future generations.

Keywords: economic growth, multiple regression, the blue economy.

1. INTRODUCTION

Badur Beach, located in Sumenep Regency, Madura, is one of the coastal destinations that has great potential to be developed within the framework of the blue economy. The blue economy, which focuses on the sustainable use of marine resources, can be a strategy to improve community welfare while preserving the environment. With its stunning natural beauty, abundant marine resources, and rich coastal community culture, Badur Beach is a strategic area for the development of sectors such as marine tourism, sustainable fisheries, and renewable energy.

The marine tourism sector in Badur Beach has a strong appeal thanks to its white sandy beaches, clear sea water, and pristine natural environment. This potential can be maximized by developing tourism infrastructure such as environmentally friendly accommodation, local seafood-based restaurants, and tourism activities such as snorkeling, beach walks, and mangrove educational tours (Adger, et al., 2005). With a sustainable approach, tourism in this area will not only increase community income but also strengthen awareness of environmental conservation (Bennett, et al, 2014).

In addition, the potential of the fisheries sector in Badur Beach is also very promising. This area has a rich marine ecosystem, with various types of fish, shellfish, and other aquatic products that can support both capture and aquaculture. The blue economy approach can be implemented through modern fish and shrimp cultivation technology, diversification of processed seafood products, and digital marketing that reaches national and international markets (Farhan & Lim, 2020). This sector can become a significant economic pillar for coastal communities with good management. No less important, Badur Beach also has the potential

for the development of renewable energy such as wind and solar power. Its location in a coastal area with high sunlight intensity and stable wind potential makes it ideal for small to medium-scale renewable energy projects. This renewable energy not only supports local energy needs but can also attract investors to support the wider economic development of the region (Morgan & Pritchard, 2019).

The development of the blue economy in Badur Beach requires synergy between the local government, local communities, and the private sector. A collaborative approach based on the principle of curiosity will ensure that the potential of this area can be optimally utilized without damaging the existing ecosystem. With the right policies and support from various parties, Badur Beach can be an example of the success of blue economy-based marine resource management in Indonesia.

The urgency of implementing a blue economy in this area is not only based on the utilization of economic potential but also on efforts to overcome the challenges faced by coastal communities and coastal ecosystems. With a sustainable approach, the blue economy can be a solution in managing natural resources wisely, improving community welfare, and preserving the environment for future generations.

One of the main reasons for the importance of implementing a blue economy in Badur Beach is to encourage coastal ecosystems. Excessive exploitation of marine resources, such as uncontrolled fishing and human activities that damage the environment, can threaten biodiversity in this area. Through the blue economy, environmentally friendly practices such as sustainable fisheries, coral reef rehabilitation, and mangrove area protection can be implemented to maintain ecosystem balance.

In addition to environmental aspects, the urgency of the blue economy also lies in the need to improve the welfare of coastal communities in Badur Beach. Most of the local population depends on the marine and fisheries sector for their livelihoods. By implementing a blue economy approach, communities can be empowered through capacity-building programs, such as training in modern cultivation technology, diversification of marine products, and access to wider markets. This is expected to create new, more stable, and sustainable economic opportunities.

The blue economy is also important as an adaptation strategy to climate change, the impact of which is increasingly felt in coastal areas. Rising sea levels, coastal abrasion, and changing weather patterns can threaten economic activities and the lives of people on Badur Beach. The implementation of the blue economy can include mitigation initiatives such as the use of renewable energy, natural coastal protection from abrasion, and scientific data-based coastal area management to reduce disaster risks.

Furthermore, the development of the blue economy on Badur Beach is in line with the national and global development agenda, including the sustainable development goals (SDGs). This policy can attract investment in the fields of environmentally friendly tourism, renewable energy, and marine conservation. With synergy between the local government, private sector, and community, Badur Beach has the opportunity to become a model for blue economy management that is not only economically profitable but also provides real social and environmental benefits.

2. LITERATURE REVIEW

Blue economy is an approach to economic development that focuses on the sustainable use of marine resources. According to Pauli (2010), the concept of blue economy involves innovation that utilizes marine resources by integrating environmental sustainability, economic efficiency, and social welfare. The goal is to create added value without damaging marine ecosystems, supporting a balance between economic growth and environmental conservation.

Smith-Godfrey (2016) highlighted the importance of a blue economy strategy to increase the added value of the marine sector, especially in island countries. The blue economy can have an impact on economic growth through diversification of income sources. Patil et al. (2018) stated that the blue economy sector contributes more than 3% to world GDP and provides more than 150 million jobs. This study shows the importance of investing in marine infrastructure and technology to maximize economic benefits. Haryanto et al. (2020) explained that in Indonesia, effective management of marine resources through a blue economy approach increases the contribution of the marine sector to GDP, especially in coastal areas such as Sulawesi and East Java.

Research by Österblom et al. (2017) highlights how an integrated blue economy-based approach can support economic growth while maintaining the sustainability of marine ecosystems. Sumaila et al. (2016) revealed that good fisheries management through a blue economy approach can increase fisheries productivity and have a positive impact on global economic growth. Voyer et al. (2018) revealed that the blue economy has great potential to support sustainable development and economic growth in various countries, including coastal areas and small islands.

Fauzi & Anna (2020) found that the potential of the blue economy in Indonesia has not been optimally utilized. However, the implementation of blue economy-based strategies in the fisheries, tourism, and renewable energy sectors can significantly increase economic growth. Lee et al. (2019) highlighted the importance of marine spatial planning in encouraging the

development of the blue economy, which has a direct impact on increasing regional GDP by optimizing the use of marine resources.

Teh & Sumaila (2016) showed that most developing countries that rely on the fisheries sector face obstacles in adopting a blue economy approach. Poorly targeted subsidies and weak management result in insignificant economic benefits. Bennett et al. (2019) found that despite the great potential of blue economy sectors such as marine tourism and aquaculture, the benefits are not felt evenly, especially in remote areas. This results in its overall economic impact being limited. Farhan & Lim (2020) conducted a study in Southeast Asia and found that efforts to develop a blue economy are often hampered by conflicts of interest between environmental conservation and exploitation of marine resources. This causes the contribution of the blue economy to economic growth to be less than optimal.

3. METHODS

The approach used in this study is quantitative. The quantitative approach focuses on proving the hypothesis. To determine the relationship between the dependent variable and the independent variable, multiple regression is used using time series data. This approach is used to determine the effect of the contribution of the fisheries sector, marine tourism income, and investment in environmental conservation on economic growth in Sumenep Regency. This study uses annual secondary data for the observation period from 2010 to 2023 in Sumenep Regency. Data sources come from institutions such as the Central Statistics Agency of Sumenep Regency, the Sumenep Regency Tourism Office, the Sumenep Regency Investment Board, and Bappeda. The data collection procedure is carried out documentary. All required data is quoted from the sources mentioned above. Furthermore, all data is documented based on supporting literature.

The analysis method used to process the data in this study is the Ordinary Least Square (OLS) method using the STATA 17 program. According to Gujarati (2003), there are several assumptions used in the OLS method, namely:

1. The conditional mean value of ui, depending on a particular Xi is zero.
2. The conditional variance of μi is constant (homoscedasticity).
3. There is no sequential correlation (autocorrelation).
4. The explanatory variables are nonstochastic, that is, they remain in repeated sampling.
5. There is no perfect linearity between the independent variables (multicollinearity).
6. μ is normally distributed with the mean and variance given by assumptions 1 and 2.

If the above assumptions are maintained, then the least squares estimator is the best unbiased linear estimator (BLUE). After specifying the variables in a model, the next thing to do is to estimate the equation model to get the most accurate results possible. Therefore, several testing criteria were carried out on the equation model, namely statistical and econometric testing.

The assumption of no multicollinearity indicates that the independent variables in the model do not have a perfect or nearly perfect linear relationship with each other. If multicollinearity occurs, the regression coefficient becomes unstable, and difficult to interpret, and its variance increases. This symptom can be detected through the Variance Inflation Factor (VIF) value or high correlation between independent variables. The homoscedasticity assumption requires that the variance of the error term (disturbance) must be constant for each observation. If the variance of the error term is not constant (heteroscedasticity), then the estimation results become inefficient and no longer have minimum variance. Heteroscedasticity can be tested using methods such as the Breusch-Pagan Test.

The assumption of no autocorrelation requires that the error terms between observations are not correlated with each other. Autocorrelation often occurs in time series data, where the error term in one period is correlated with the error term in the previous period. This condition causes the regression estimation results to no longer be efficient. The normality assumption states that the error term should be normally distributed. This assumption is important for hypothesis testing and the interpretation of regression coefficients. Normality can be tested using methods such as the Jarque-Bera Test.

$$Y_t = \alpha + \beta 1 X1_t + \beta 2 X2_t + \beta 3 X3_t + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

where Y is the economic growth of Sumenep district (percent), X1 is the contribution of the fisheries sector (billion rupiahs), X2 is marine tourism revenue (billion rupiahs), and X3 is an investment in environmental conservation (billion rupiahs). t is the time series subscript data and e is the error term.

4. RESULTS

The blue economy has a close relationship with economic growth, especially for areas with abundant marine and coastal resource potential. The blue economy is a concept of sustainable marine resource management to encourage economic growth while maintaining environmental balance and social welfare (Lee & Khim, 2019). Activities in the blue economy, such as sustainable fisheries, marine tourism development, marine cultivation, and marine product processing, can create new jobs, increase the income of coastal communities, and

increase contributions to the Gross Regional Domestic Product (GRDP). By utilizing marine resources wisely, the blue economy can be a major driver of inclusive and sustainable economic growth.

In addition, the blue economy plays a role in economic diversification, especially in coastal areas that are vulnerable to economic pressures due to dependence on certain sectors. The marine and fisheries sector, if managed with the principle of sustainability, can generate significant added value through the development of environmentally friendly technology and innovation of marine resource-based products. The resulting economic growth is not only quantitative but also qualitative, because it considers social and environmental impacts, such as marine ecosystem protection, climate change mitigation, and increasing the capacity of local communities. Thus, the implementation of the blue economy can create a more resilient and competitive economy at the global level.

Furthermore, the blue economy also triggers investment in infrastructure that supports the marine sector, such as the construction of environmentally friendly ports, marine processing facilities, and the development of marine-based renewable energy. This investment directly contributes to increasing economic activity in coastal areas, thus providing a multiplier effect for other sectors, such as trade, industry, and services. In addition, marine tourism managed with the principle of sustainability not only attracts tourists but also drives local economic growth through increased consumption, small business income, and regional revenue.

In the long term, the blue economy has a positive impact on the quality of life of coastal communities and encourages economic inclusion. Through community empowerment programs, skills training, and better access to productive resources, the blue economy can reduce poverty levels and improve community welfare. This creates a strong foundation for stable, equitable, and sustainable economic growth. Therefore, the blue economy is not just an economic strategy, but a holistic solution to realize a balance between economic development, environmental sustainability, and improving social welfare.

Table 1
Multiple Regression Result

Variable	Coef	Prob.	Note
C	0,223	0,000***	-
X1	0,456	0,000***	Significant
X2	0,672	0,001***	Signifiant
X3	0,198	0,026**	Significant
R-Square	0,745		

Where Y is the economic growth of Sumenep district (percent), X1 is the contribution of the fisheries sector, X2 is marine tourism revenue, and X3 is an investment in environmental conservation (billion rupiahs).***, **, * is significant on 1 percent, 5 percent, and 10 percent.

The coefficient of 0.456 indicates that every 1 billion rupiah increase in the contribution of the fisheries sector can increase economic growth by 0.456%. This variable is significant at the 99% confidence level (P-value <0.01). The coefficient of 0.672 indicates that an increase in income from the marine tourism sector of 1 billion rupiah contributes to an increase in economic growth of 0.672%. This variable has the largest influence among all variables and is significant at the 99% confidence level. The coefficient of 0.198 indicates that an investment in environmental conservation of 1 billion rupiah increases economic growth by 0.198%. Although its contribution is smaller than other variables, its influence is still significant at the 95% confidence level (P-value <0.05). The R-squared of 0.745 indicates that 74.5% of the variation in economic growth of Sumenep Regency can be explained by the variables of the contribution of the fisheries sector, marine tourism income, and investment in environmental conservation. The rest is influenced by other factors outside the model.

Table 2
The Result of Classical Assumption

Test	Value	Result
VIF	2,35	No Multicolinearity
BPG	0,345	No Heteroskedasticity
LM	0,211	No Autocorrelation
Normality	0,976	Normality

The multicollinearity test shows that there is no strong linear relationship between independent variables, with a VIF (Variance Inflation Factor) value below 10. The VIF value in Table 2 confirms that there is no multicollinearity problem in the model so that the blue economic variables can be used to predict economic growth. The heteroscedasticity test also shows good results, where the distribution pattern on the scatterplot graph between the residuals and the predicted values does not form a certain pattern and appears to be randomly distributed. The BPG test confirms this with a value of 0.345 more than 0.05, which means that there is no heteroscedasticity. The autocorrelation test through the LM Test produces a value of 0.211 more than 0.05, indicating that there is no autocorrelation between the residuals. The JB normality test shows that the residuals are normally distributed, as evidenced by the p-value (0.976) > 0.05. This indicates that the normality assumption is met.

5. DISCUSSION

The fisheries sector, marine tourism, and investment in environmental conservation have contributed significantly to economic growth in Sumenep Regency. Sumenep Regency, located in a coastal and island area, has abundant blue economy potential. The fisheries sector is one of the main pillars of the regional economy. Capture fisheries and marine cultivation activities provide jobs for the community, increase fishermen's income, and become a source

of regional income through taxes and levies (Allison & Ellis, 2001). With sustainable management, the fisheries sector is able to provide a significant positive contribution to economic growth through increased production, marine exports, and added value from processing fishery products. In addition, income from marine tourism also has a significant influence on economic growth in Sumenep Regency. Beautiful beaches, such as Badur Beach, and underwater wealth that attracts domestic and foreign tourists are valuable assets in driving regional income. Marine tourism activities, such as snorkeling, diving, and ecotourism, open up business opportunities for local communities, such as boat rentals, accommodation, culinary, and handicrafts. Thus, marine tourism provides a broad multiplier effect on other sectors, such as trade and services, which ultimately supports economic growth significantly.

Furthermore, investment in environmental conservation plays an important role in supporting the sustainability of the fisheries and marine tourism sectors. Conservation programs, such as the rehabilitation of mangrove and coral reef ecosystems, help maintain the quality of the coastal and marine environment. Mangrove ecosystems function as natural protection from abrasion and as a breeding ground for fish, while coral reefs are an attraction for marine tourism while supporting fisheries productivity. Investment in environmental conservation not only ensures the sustainability of natural resources but also provides long-term economic benefits for the people of Sumenep. With a protected environment, the productivity of the fisheries sector increases, and the appeal of marine tourism is maintained.

The contribution of the fisheries sector to economic growth can also be seen from the increase in the export value of marine products from Sumenep Regency. Fishery products, such as fresh fish, seaweed, and processed products based on marine products, have a potential market both domestically and abroad. With the support of good processing technology and logistics, the added value of fishery products can increase significantly. This is an opportunity for Sumenep to expand its market share and increase regional income from the fisheries sector. In addition, empowering fishermen through training programs and assistance with modern equipment also encourages the productivity and efficiency of this sector.

Income from marine tourism not only increases regional economic income but also encourages economic diversification in Sumenep Regency. Dependence on the fisheries sector can be balanced by the development of the tourism sector, which is more environmentally friendly and sustainable if managed properly. Tourism infrastructure, such as roads, docks, and accommodation facilities, are important catalysts in increasing the number of tourist visits (Heck et al., 2016). With increasing income from the tourism sector, employment opportunities in the service and tourism sectors are increasingly open, reducing unemployment and poverty rates in coastal areas.

Investment in environmental conservation also supports efforts to mitigate the impacts of climate change in Sumenep Regency. Increasing sea temperatures and damage to coastal ecosystems can hurt the productivity of the fisheries and tourism sectors. With conservation programs, such as coral reef restoration and mangrove planting, marine ecosystems can be restored so that fishermen's catches are stable and the natural beauty of the coast is maintained. This positive impact contributes directly to improving the welfare of local communities and sustainable regional economic growth (Ghosh & Maity, 2020).

Overall, the combination of contributions from the fisheries sector, marine tourism revenues, and investment in environmental conservation creates a synergy that supports the economic growth of Sumenep Regency. The three sectors are interrelated and support each other in optimizing the potential of the blue economy (Béné et al., 2010). For example, a protected environment through conservation will increase fisheries yields and strengthen the appeal of marine tourism. With coordination between the government, community, and private sector, the potential of the blue economy in Sumenep Regency can be optimized to achieve inclusive and sustainable economic growth.

However, to ensure this significant positive contribution, policies are needed that support sustainable management of natural resources. Local governments need to pay attention to regulations governing environmentally friendly fisheries practices, sustainable marine tourism management, and budget allocations for environmental conservation. In addition, education and empowerment of coastal communities are the keys to success in maximizing the potential of the blue economy. By involving local communities in conservation efforts and economic development, the sustainability of these programs can be maintained in the long term.

From a macroeconomic perspective, the contribution of the fisheries sector, marine tourism, and environmental conservation investment has the potential to increase the Gross Regional Domestic Product (GRDP) of Sumenep Regency. Income from these sectors can be used for infrastructure development, public services, and improving community welfare (Blue & Medlock, 2014). Investment in environmental conservation also creates long-term positive impacts, where healthy ecosystems become economic assets that support the productivity of key sectors.

Thus, the fisheries sector, marine tourism income, and investment in environmental conservation not only have a significant positive influence on the economic growth of Sumenep Regency but also create an inclusive and sustainable economic foundation. The synergy between the utilization of blue economy potential and environmental conservation efforts will ensure that Sumenep Regency grows into an advanced, prosperous, and environmentally friendly coastal area in the future.

6. CONCLUSION

Influence of the contribution of the fisheries sector, marine tourism revenue, and investment in environmental conservation positive significant on the economic growth of Sumenep district. Based on the significant positive influence of the contribution of the fisheries sector, marine tourism revenue, and investment in environmental conservation on the economic growth of Sumenep Regency, the local government needs to formulate policies that focus on the sustainability of the blue economy.

First, strengthening the supporting infrastructure of the fisheries sector, such as ports, cooling facilities, and marine product processing technology, must be prioritized to increase productivity and added value of fishery products. Second, the development of sustainable marine tourism through promotion, accessibility development, and involvement of local communities in tourism management needs to be increased to maximize regional income. Third, investment allocation for environmental conservation programs, such as the rehabilitation of mangrove and coral reef ecosystems, needs to be expanded to maintain the balance of coastal ecosystems. In addition, education and empowerment of coastal communities in environmentally friendly practices will ensure the sustainability of natural resources. With this policy, Sumenep Regency can optimize the potential of the blue economy to achieve inclusive and sustainable economic growth.

LIMITATION

The limitations in the study on the influence of the blue economy on economic growth in Sumenep Regency can be explained as follows. First, the limited data available is the main obstacle in this study. Second, this study only focuses on certain variables in the blue economy, such as the fisheries sector, marine tourism income, and environmental conservation investment, so it does not cover all other blue economy potentials. Third, this study uses a quantitative approach, which although it can identify the influence between variables, is less able to explore qualitative factors, such as the role of government policies, community culture, and resource management practices that affect the blue economy. Fourth, the scope of this study is limited to Sumenep Regency, so the results of the study may not be fully generalizable to other coastal areas with different economic, social, and environmental characteristics.

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