



Integration of Blue and Green Economy for Business Sustainability in Makassar City

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Abstract. This study aims to analyze the impacts and challenges of blue and green economy policies in supporting business sustainability in Makassar City, with a focus on marine resource management. The blue economy concept has brought significant changes in marine resource governance in Makassar City, especially in the fisheries, marine tourism, and marine conservation sectors. In addition, the blue economy which focuses on sustainable use of marine resources, plays an important role in improving the welfare of coastal communities. On the other hand, the green economy encourages environmentally friendly practices in the agriculture, energy and transportation sectors. In the context of Makassar, which has great potential in the fields of fisheries and tourism, synergy between these two economies can create new jobs, reduce pollution and preserve the ecosystem. Through in-depth interviews with stakeholders, this study explores the implementation of this concept in Makassar and its impacts and benefits for local communities. The findings show that despite progress, challenges such as overfishing and coral reef management still need to be addressed.

Keywords: Blue Economy, Green Economy, Makassar City

1 Introduction

Makassar City, as one of the largest coastal cities in Indonesia, has a wealth of marine natural resources with great potential. This city plays a vital role in the fisheries and marine tourism sectors in South Sulawesi. As a center for the fisheries industry that serves national and international needs, Makassar is also known for its beautiful underwater scenery, which is a magnet for tourists. However, like most rapidly developing coastal areas, Makassar faces significant environmental challenges. Overfishing practices, coral reef degradation, marine pollution, and lack of sustainable management pose serious threats to the city's marine ecosystem [1].

Along with the existing developments, increasing economic activities in coastal areas have also raised concerns about the sustainability of marine resources. In facing this problem, Makassar has begun to adopt two main concepts in an effort to maintain a balance between economic growth and environmental preservation, namely the blue economy and the green economy. The blue economy focuses on the management and

utilization of sustainable marine resources, such as the fisheries sector, marine conservation, and marine tourism, with the main goal of improving the welfare of coastal communities without damaging marine ecosystems. On the other hand, the green economy focuses on reducing the environmental impact of economic activities on land through environmentally friendly approaches, such as the use of renewable energy, better waste management, and protection of coastal ecosystems [2].

The implementation of the blue and green economy in Makassar City is expected to create a balance between economic utilization and environmental preservation. These two concepts not only offer sustainable economic growth for coastal cities, but also open up new opportunities for local communities to engage in more environmentally friendly economic activities. For example, coral reef conservation and marine ecotourism programs have begun as part of efforts to maintain the sustainability of marine natural resources. In addition, wiser fisheries management and coastal area development that minimizes ecosystem damage are one of the pillars in implementing the blue economy concept [3]. One relevant case is from Pari Island, Indonesia, where the blue economy concept has been applied through coral reef conservation and marine ecotourism. This approach integrates economic growth with environmental preservation by involving local communities in sustainable tourism activities, such as guiding tourists and managing coral ecosystems, this program focus on maintaining marine biodiversity while supporting livelihoods through ecotourism, which serves as a model for similar coastal cities like Makassar [4]. However, even though these initiatives have begun to be implemented, various challenges still remain. Sustainable marine resource management requires good coordination between the government, the community, and industry players. In addition, strict and consistent enforcement of regulations is also essential to ensure that the concept of the blue and green economy can run effectively. This study aims to explore the extent to which blue and green economy policies have been implemented in Makassar City, as well as to see the positive impacts that have been generated. In addition, this study will identify the challenges that are still faced in implementing these policies, both in terms of regulation, community participation, and coordination between stakeholders. Through a qualitative approach, this study is expected to provide a comprehensive picture of the implementation of the blue and green economy in Makassar, as well as provide recommendations that can support the sustainability of natural resources in this coastal city.

2 Literature Review

Literature Review I

1. Title : Case Study of the Application of the Blue Economy in Making Coral Reefs a Business Commodity on Pari Island, Indonesia
2. Authors : Iwan Fadli Pasaribu, Nur Aniza Aprillia, Trifena Priskila Br Purba, Nanda Teguh Junianto, Nandya Andriani, Suryanusaciptaning Akbar, and Wiranti, Nico Mulia Subekti.
3. Year : 2024

4. Journal : International Journal of Fisheries and Aquatic Studies
5. Methodology : The study employed qualitative research methods, which included interviews with key stakeholders involved in coral reef conservation on Pari Island to gain detailed insights into the challenges and successes of these efforts. Focus Group Discussions (FGDs) were conducted to gather broader community perspectives on coral reef conservation issues, while field observations were made directly at Pari Island to observe the conditions and dynamics of the coral reef ecosystem and related conservation activities [4].
6. Findings : The study found that coral reefs around Pari Island, particularly the Acropora coral species, play a vital ecological and economic role by enhancing biodiversity and attracting tourists, making them essential for both conservation and business efforts. The transplantation of Acropora corals has been effective in rehabilitating damaged reefs, promoting marine life, and supporting the local ecotourism industry. Sustainable ecotourism activities, such as diving and snorkeling, have positively impacted both environmental protection and the local economy by generating income for communities while promoting coral conservation. However, challenges such as insufficient government support and weak law enforcement hinder further progress. The study highlights the need for stronger collaboration between local communities, the government, and conservation organizations to ensure the long-term sustainability of these initiatives [4].

Literature Review II

1. Title : Definition and Evaluation Methodology of the Blue Economy: Focusing on the Difference from the Ocean/Marine Economy
2. Authors : Hajime Tanaka
3. Year : 2023
4. Journal : Ocean Policy Research Institute, Sasakawa Peace Foundation.
5. Methodology : The paper reviews existing definitions and evaluation methodologies for the blue economy and compares it to the ocean/marine economy. It utilizes an environmental economics model, specifically the Total Economic Value (TEV) framework, to differentiate between use values (marketable goods) and non-use values (goods that contribute to future generations). Various international reports, accounting methods such as the System of National Accounts (SNA), and Input-Output (I-O) tables are also employed to evaluate the size of marine economies in different countries [5].
6. Findings : The blue economy is defined as an ocean-based economy that simultaneously promotes economic growth, environmental sustainability, and social inclusion. It differs from the traditional ocean/marine economy by incorporating non-use values, such as the preservation of marine ecosystems for future generations. The study emphasizes the need for accounting methods that include natural capital in the evaluation process, as these resources provide long-term benefits not reflected in short-term economic measures. It also highlights the

importance of interdisciplinary research to integrate economic, environmental, and social aspects when assessing the blue economy [5].

Literature Review III

1. Title : The Blue Acceleration: The Trajectory of Human Expansion into the Ocean
2. Authors : Jean-Baptiste Jouffray, Robert Blasiak, Albert V. Norström, Henrik Österblom, Magnus Nyström, and Carl Folke.
3. Year : 2020
4. Journal : One Earth
5. Methodology : The study employs a quantitative analysis of global data related to human activities in ocean industries. It uses a comprehensive review of sectors like shipping, aquaculture, marine energy, and seabed mining, among others. The data sets are analyzed to map trends in human exploitation of ocean resources over time, emphasizing the acceleration in the last few decades [6].
6. Findings : The article identifies the rapid increase in human activities related to the ocean, termed "blue acceleration." It reveals that the ocean has become a focal point for numerous industries, including shipping, oil extraction, renewable energy, and aquaculture. This surge in ocean-related economic activity is driven by technological advances and growing global demand for resources. However, the study also highlights the environmental risks associated with this expansion, including degradation of marine ecosystems and the need for stronger governance and sustainable management practices to protect the ocean's long-term health and biodiversity [6].

Literature Review IV

1. Title : Blue Economy: Community Case Studies Addressing the Poverty-Environment Nexus in Ocean and Coastal Management
2. Authors : Sulan Chen, Charlotte De Bruyne, and Manasa Bollempalli.
3. Year : 2020
4. Journal : Sustainability
5. Methodology : The article uses a case study approach to explore the intersection of poverty and environmental challenges in coastal and ocean management within the framework of the blue economy. It includes qualitative data gathered through interviews, community workshops, and field observations, focusing on local communities that rely heavily on marine resources for their livelihoods. The study examines how these communities implement blue economy initiatives to balance economic development with environmental sustainability [7].
6. Findings : The article highlights that local communities play a crucial role in implementing blue economy principles to address the poverty-environment nexus. It finds that successful case studies involve community-led initiatives that promote sustainable fishing, ecotourism, and conservation practices. These initiatives not only improve the livelihoods of the communities by providing income but also contribute to the protection of marine ecosystems. However, challenges such as

limited resources, inadequate government support, and climate change impacts remain significant barriers. The study concludes that strengthening community participation and fostering partnerships between local and national stakeholders are essential for achieving long-term success in blue economy efforts [7].

Literature Review V

1. Title : Opportunities and Challenges in Development Community-Based Marine Ecotourism on Samalona Island, Makassar City
2. Authors : Yudha Prakasa, Michael Rudolfus Sawu, and Muhammad Farid Ulinnuha.
3. Year : 2023
4. Journal : Journal of Tourism Sustainability
5. Methodology : The article utilizes a qualitative research approach, combining case studies and field observations on Samalona Island to assess the potential for community-based marine ecotourism. Data collection includes interviews with local residents, stakeholders, and tourists, as well as analysis of existing ecotourism activities on the island. The study focuses on identifying opportunities for sustainable tourism growth while addressing environmental and socio-economic challenges that the community faces [8].
6. Findings : The study finds that Samalona Island has significant potential for developing community-based marine ecotourism, owing to its rich marine biodiversity and strategic location near Makassar City. Opportunities for ecotourism include snorkeling, diving, and environmental education programs, which can boost the local economy. However, the study also highlights challenges such as the lack of infrastructure, limited government support, and environmental degradation due to over-tourism and insufficient waste management. The authors suggest that involving the local community in ecotourism management, improving infrastructure, and promoting environmental conservation practices are crucial to achieving sustainable development in the blue economy sector on Samalona Island [8].

Literature Review VI

1. Title : Sustainable Fishing Harvest Rates for Fluctuating Fish and Invertebrate Stocks
2. Authors : Alicia Poot-Salazar, Iván Velázquez-Abunader, Otilio Avendaño, Polo Barajas-Girón, Ramon Isaac Rojas-González, Saúl Pensamiento-Villarauz, Jesús M. Soto-Vázquez, José F. Chávez-Villegas, and Rubén H. Roa-Ureta.
3. Year : 2024
4. Journal : PLOS ONE
5. Methodology : The study tested the theory of fluctuating stocks using two harvested octopus populations from the Yucatan Peninsula, Mexico. The methodology involved a two-stage stock assessment approach, which incorporated time-varying parameters over a 22-year time series. In the first stage, intra-annual generalized depletion (IAGD) models were used to estimate the octopus stock

dynamics within fishing seasons. The second stage used the Pella-Tomlinson surplus production models to analyze biomass and calculate sustainable harvest rates. These models were used to project the sustainability of different harvest strategies over a ten-year period [9].

6. Findings : The study demonstrated that traditional maximum sustainable yield (MSY) methods are unsuitable for stocks with fluctuating population dynamics. The authors found that using MSY would likely lead to the collapse of octopus stocks in the region. In contrast, a more sustainable approach was to use Total Latent Productivity (TLP), which accounts for both positive and negative population growth phases. Their results showed that management based on TLP would ensure the long-term sustainability of these octopus populations. They recommended the TLP approach for other fluctuating fish and invertebrate stocks as well, particularly for those with high intrinsic population growth rates [9].

Literature Review VII

1. Title : Mapping the global value and distribution of coral reef tourism
2. Authors : Mark Spalding, Laretta Burke, Spencer A. Wood, Joscelyne Ashpole, James Hutchison, and Philine zu Ermgassen.
3. Year : 2017
4. Journal : Marine Policy
5. Methodology : The authors used a novel combination of national-level statistics, social media data, and crowd-sourced datasets to estimate the global economic value of coral reef-related tourism. The study focused on two distinct components of reef-related tourism: "on-reef" tourism, involving direct activities like diving and snorkeling, and "reef-adjacent" tourism, referring to indirect benefits from coral reefs such as sandy beaches and clear waters. The research included a spatial analysis, combining datasets from various sources including hotel locations and geotagged photographs from social media (Flickr). The authors employed GIS techniques to map the distribution of these tourism values at global and local scales [10].
6. Findings : Coral reefs support a significant proportion of global coastal tourism, with reef-related tourism valued at approximately \$35.8 billion annually. This represents about 9% of all coastal tourism expenditure in coral reef countries. The study also found that while only 30% of the world's coral reefs are used for tourism, the economic value varies greatly, with some reefs generating millions of dollars per square kilometer annually. The research highlighted the importance of sustainable tourism management, given the high economic dependence on coral reefs in many small island nations [10].

Literature Review VIII

1. Title : Shifting gears: Diversification, intensification, and effort increases in small-scale fisheries (1950-2010)
2. Authors : Jennifer C. Selgrath, Sarah E. Gergel, Amanda C. J. Vincent

3. Year : 2018
4. Journal : PLOS ONE
5. Methodology : The study conducted a long-term (1950-2010) assessment of fishing gear usage dynamics in small-scale fisheries in the Danajon Bank, Philippines, using fisher interviews and historical documentation. A total of 391 fishers from 23 villages were interviewed to reconstruct their fishing histories, and changes in fishing gear diversity and intensity were analyzed over four governance periods. These governance periods included local to national policy shifts influencing fisheries management. Data were analyzed using generalized least squares (GLS) models to examine trends in fishing effort and gear usage across governance eras [11].
6. Findings : The study revealed significant increases in both the diversification and intensification of fishing gears in small-scale fisheries over time. While individual fishing effort (days per year) remained steady, total fishing effort increased by 240%. The use of nets and diving increased the most, with nets showing a 2.9-fold rise in total effort. Additionally, there was a substantial rise in the use of non-selective, destructive, and active gears, which contribute more to ecological damage. The study found that policy changes emphasizing production over sustainability had long-lasting effects on fishing practices, with intensive fishing methods persisting decades after such policies were discontinued [11].

3 Research Methods

This study applies a qualitative approach using a case study method to explore the implementation of the blue economy in Makassar in depth. Data were collected through in-depth interviews with 20 respondents covering various stakeholders, including fishermen, tourism actors, government officials, and marine experts. These interviews aimed to gain direct insight and their experiences related to blue economy practices and their impacts on the environment and society. In addition, document analysis was also conducted to complement the data obtained from the interviews. The documents analyzed included policy reports, literature studies, and Makassar City government documents that were relevant to the research topic. This approach allowed researchers to gain a comprehensive picture of the challenges, successes, and needs in implementing the blue economy in Makassar, as well as to develop recommendations based on empirical data [5].

4 Research Results and Discussion

4.1 Implementation of Blue Economy in Makassar City: Efforts for Sustainability of Marine Resources and Improvement of Local Economy

Makassar City, as one of the largest coastal cities in Indonesia, has taken significant steps in implementing the concept of the blue economy, a development approach that prioritizes the sustainable use of marine resources. The blue economy is a term used to describe industries that are associated with the ocean. Although the color "blue" is frequently connected to the ocean, industries that depend on marine resources are also

referred to by words like ocean economy or marine economy [6]. The concept of the blue economy emphasizes the importance of maintaining a balance between economic growth and the preservation of marine ecosystems, so that it not only has an impact on environmental sustainability, but also provides economic benefits for coastal communities. As an important center in the fisheries and marine tourism sector in Eastern Indonesia, Makassar seeks to be a model for other coastal cities in terms of managing and utilizing marine natural resources. The implementation of the blue economy in Makassar is not only limited to the management of the fisheries sector, but also includes marine ecosystem conservation, marine tourism development, and coastal community empowerment [7]. In the fisheries sector, the local government has collaborated with various stakeholders, including non-governmental organizations and local fishing communities, to implement sustainable fishing practices. The use of environmentally friendly technology in fishing as well as training for fishermen on the importance of maintaining fish populations is one of the main focuses of this blue program, economy [8]. This is important because overfishing has become a significant problem, not only in Makassar but in many other coastal areas in Indonesia. By implementing wiser methods, it is hoped that the sustainability of fish stocks can be maintained for future generations. In addition to fisheries management, marine ecosystem conservation is also a major pillar in the implementation of the blue economy in Makassar [9]. Ecosystems such as coral reefs, mangroves, and seagrass beds are important components in maintaining the balance of marine ecosystems. Coral reefs, for example, are habitats for various species of fish and other marine biota, and function as natural protection against coastal erosion. In the waters around Samalona Island and Lae-Lae Island, a coral reef conservation program has been carried out through coral transplantation activities and routine seabed cleaning [10]. This is done by involving local communities, so that they can participate in maintaining the surrounding environment which is a source of their livelihood. The development of marine tourism is also one of the sectors that has received attention in the implementation of the blue economy in Makassar [3].

As the maritime industry experiences significant growth across various sectors, particularly in seafood and seaside tourism [11], the beauty of the underwater world around Makassar, especially on small islands such as Samalona and Lae-Lae, has great potential to attract tourists from both within and outside the country. Through the concept of ecotourism, the government is trying to develop marine tourism that is not only economically profitable, but also environmentally friendly [12]. Diving and snorkeling tourism are the main attractions offered, while still paying attention to the protection of coral reef ecosystems that are vulnerable to damage due to human activities. Not only focusing on economic and conservation aspects, the implementation of the blue economy in Makassar also involves empowering coastal communities. Through training programs and providing access to technology, fishermen and other coastal communities are encouraged to improve their skills in sustainable marine resource management [13]. Degradation of the natural environment, spanning from unsustainable coastal development, overfishing, and destructive fishing methods, to the loss of marine ecosystems and biodiversity are just a few examples of the significant impact that humans have had on the ocean [14]. In addition, the community is also given an understanding of the importance of preserving the environment as an effort to improve long-term welfare. Thus, the blue

economy not only has an impact on economic growth in coastal areas, but also provides social benefits by increasing public awareness and participation in maintaining marine ecosystems [15]. However, the implementation of the blue economy in Makassar still faces a number of challenges, such as the lack of consistent regulatory enforcement, limited resources, and resistance from several community groups who still rely on traditional methods in utilizing marine resources. However, with a strong commitment from the government and support from various parties, Makassar can be a good example in realizing a balance between economic growth and environmental preservation through the implementation of a sustainable blue economy [16].

Marine Conservation Program. One of the important steps taken by the Makassar City government in implementing the blue economy is the implementation of a marine conservation program. This program aims to protect the marine ecosystem from damage caused by human activities, such as overfishing, marine pollution, and coral reef destruction. Marine conservation in Makassar is focused on several marine tourism areas, including Samalona Island and Lae-Lae Island.

Coral Reef Conservation on Samalona Island and Lae-Lae Island. Samalona Island and Lae-Lae Island, located in the waters around Makassar, are very popular destinations among local and international tourists. Famous for their underwater beauty, these two islands are the main objects of a coral reef conservation program that aims to protect and preserve unique and important marine ecosystems, (Dear Sir, Coral reef conservation in the area is an integral part of the blue economy program designed to ensure sustainable use of marine resources. The coral reefs in Samalona Island and Lae-Lae Island serve as primary habitats for various species of fish and other marine biota. These reefs not only provide shelter and breeding grounds for small fish, but also contribute to the stability of the marine ecosystem as a whole. The balance of the marine ecosystem, which depends on the health of coral reefs, plays an important role in maintaining water quality and preventing coastal erosion. With coral reefs functioning as coastal protectors, the area also plays a role in reducing the impacts of climate change and natural disasters such as high waves and storms [13].

To achieve these conservation goals, the Makassar regional government has initiated various strategic steps. The conservation program involves collaboration between the government, non-governmental organizations, and local communities. One of the main efforts in this program is coral transplantation, which aims to regrow coral reefs that have been damaged by human activities or environmental changes. This activity is carried out by planting coral fragments taken from healthy areas to locations that require recovery. This process requires special techniques and regular monitoring to ensure optimal coral growth. In addition to transplantation, regular seabed cleaning is also part of the conservation program. This cleaning aims to remove garbage and pollutants that can damage coral reefs and disrupt the lives of marine biota. This activity is not only carried out by a team of experts, but also involves volunteers from local communities who care about the environment [17].

By involving the community in the clean-up efforts, awareness of the importance of coral reef conservation can be raised. The role of local fishermen is also crucial to

the success of this conservation program. As part of the conservation efforts, fishermen on Samalona Island and Lae-Lae Island are invited to play an active role in maintaining the marine ecosystem. They are trained to use environmentally friendly fishing methods and are expected to reduce negative impacts on coral reefs [18]. In addition, fishermen are also involved in monitoring the health of coral reefs and providing important information on changes in marine conditions that can affect the sustainability of the ecosystem. Through this coral reef conservation program, it is hoped that not only the sustainability of coral reefs on Samalona Island and Lae-Lae Island will be maintained, but also the wider marine ecosystem. This effort is a concrete example of the application of the blue economy principle, which prioritizes the balance between the use of marine resources and environmental protection. With solid collaboration between various parties and active community involvement, Samalona Island and Lae-Lae Island are expected to continue to be centers of marine biodiversity and enchanting and sustainable tourist destinations [19].

Impact on Marine Tourism. Marine conservation carried out on Samalona Island and Lae-Lae Island not only provides significant benefits for the marine ecosystem, but also plays an important role in the development of the marine tourism sector in Makassar. Well-maintained coral reefs are a major attraction for tourists, especially for those interested in snorkeling and diving activities. Conservation efforts carried out in this area have a widespread positive impact, not only on the environment but also on the economic aspects of tourism. Samalona Island and Lae-Lae Island have long been known as attractive marine tourism destinations [20]. However, in recent years, the increase in tourist visits to this area has experienced a significant spike. This is in line with the success of the conservation program which has improved the quality and health of coral reefs. Tourists from all over come to enjoy the underwater beauty which is rich in biodiversity, thanks to the conservation efforts that have been implemented. The well-maintained health of coral reefs ensures that the snorkeling and diving experience is more satisfying, because tourists can see vibrant and colorful coral reefs and various charming fish species. The increase in the number of tourists has a direct impact on the income of the tourism sector in Makassar [21].

With the influx of visitors, local businesses, from tour operators to accommodation providers and restaurants, experience significant economic benefits. This increased income not only supports the local economy, but also creates new jobs, which in turn improves the well-being of local communities. Sustainable tourism activities contribute to the development of better infrastructure and services, strengthening the attractiveness of the area as a major tourist destination. However, the sustainable development of marine tourism is key to ensuring that the economic benefits of the sector do not come at the expense of environmental sustainability. Therefore, conservation programs also include education and understanding of environmentally friendly tourism practices [16]. Tourists are given clear instructions on the rules to be followed during their visit. They are reminded not to touch the coral reefs, as touching them with your hands can damage the coral structure and disrupt the life of marine life. In addition, tourists are also instructed not to litter in the sea, in order to avoid pollution that can damage the coral reef ecosystem. This initiative not only involves monitoring and educating tourists but also ensuring that all tourism activities are

carried out with due regard to the principles of sustainability. Programs such as training for tour guides and outreach on the environmental impacts of tourism activities are held regularly. This aims to build greater awareness among tourists and tour operators about the importance of preserving the marine ecosystem. Overall, coral reef conservation in Samalona Island and Lae-Lae Island provides dual benefits. On the one hand, it protects important marine biodiversity and ensures the sustainability of the ecosystem. On the other hand, it supports the growth of a sustainable marine tourism sector, providing positive economic impacts for the local community. With a balanced approach between environmental conservation and economic development, the area can continue to be an attractive and sustainable tourist destination in the future [22]. Local engagement is crucial when it comes to management, because the positive effects and negative effects will be felt right away by the local population. Local involvement is demonstrated by the establishment of community organizations with unique goals and interests. Participation is defined as the active involvement of the community in ongoing tourism projects within a developing tourist region. Its goal is to protect the health and welfare of the local community [23].

4.2 Sustainable Fisheries Management

In addition to marine conservation programs, the fisheries sector in Makassar has also experienced positive changes through the implementation of sustainable fisheries management. The fisheries sector is one of the main sectors in the Makassar economy, with many coastal residents depending on fish catches for their livelihoods. However, the problem of overfishing and the use of environmentally unfriendly fishing gear has damaged the marine ecosystem and reduced fish catches [24].

Fishermen Education and Use of Environmentally Friendly Fishing Gear. The impact of overfishing on marine ecosystems is substantial. Sustainable management strategies, such as concentrating on total permissible captures based on shifting stock dynamics, are crucial for sustaining fish populations and guaranteeing long-term economic advantages for coastal communities, according to a comprehensive assessment [25]. Sustainable fisheries management in Makassar is very important in maintaining the balance of the marine ecosystem and the welfare of coastal communities. One of the main steps taken to achieve this goal is through educating fishermen about sustainable fishing practices and the use of environmentally friendly fishing gear. This education is expected to help fishermen understand the importance of maintaining the marine ecosystem and implementing fishing methods that do not damage the environment, while increasing their catch. The Makassar local government, in collaboration with various environmental organizations, has developed and implemented a comprehensive training program for local fishermen to provide the knowledge and skills needed in sustainable fishing [2].

One of the main components of the training is an understanding of the use of nets with the right mesh size. The use of nets with larger meshes allows fishermen to only catch adult fish, while young fish can remain in the sea to grow and reproduce. This is important in maintaining the balance of fish populations in the sea and preventing

overfishing. By maintaining a healthy fish population, the sustainability of the catch can be guaranteed, which ultimately benefits fishermen in the long term [26]. In addition to the use of appropriate nets, the training also emphasized the importance of fishing methods that do not damage coral reef habitats. Coral reefs are very important ecosystems, because they not only provide shelter for various species of fish and other marine biota, but also play a role in maintaining the balance of the marine ecosystem as a whole. While many benefits may still be felt in local communities, coral reefs and other ecosystems increase tourism and tax revenue in different governments. In particular, reef tourism is particularly international, and its benefits are distributed to distant receivers through international hotel chains, airlines, tour operators, and even manufacturers of diving equipment and souvenirs [27]. Healthy coral reefs attract many tourists, thus contributing to the marine tourism sector, which is an important source of income for coastal communities. Therefore, fishermen are trained to avoid destructive fishing techniques, such as the use of explosives or poisons, which not only kill fish indiscriminately but also damage coral reef structures, which take years to recover [28].

One of the significant changes resulting from this education program is the shift from using explosives and poisons to more environmentally friendly fishing methods. Previously, fishermen in several areas still used these hazardous materials because the catch was obtained faster, even though the negative effects on the marine ecosystem were very large. However, with continuous education, fishermen began to realize that although traditional methods such as explosives and poisons may provide instant results, their long-term impacts are actually detrimental. This shift not only protects coral reefs and other marine biota, but also helps maintain the quality and sustainability of marine resources for future generations [29]. The use of environmentally friendly fishing gear has also been shown to improve the quality of fishermen's catches. More selective fishing gear allows fishermen to catch better quality fish, which are more valued in the market. Thus, fishermen can increase their income without having to increase the number of fish they catch. In addition, this method helps reduce pressure on fish stocks in the ocean, allowing fish populations to recover and thrive [26].

With this effort, it is hoped that sustainable fisheries management in Makassar can continue to develop and provide long-term benefits, not only for the marine ecosystem, but also for the welfare of fishing communities and future generations. Selective fishing methods that do not damage marine habitats ensure that the fish caught are in good condition, with higher quality. Fish that grow to adult size before being caught tend to have higher economic value, which can increase fishermen's income. This training not only provides direct benefits to fishermen, but also builds broader awareness of the importance of environmental conservation among coastal communities. By understanding the relationship between marine ecosystem health and catches, fishermen are expected to be more motivated to implement environmentally friendly practices in their daily activities. Overall, educating fishermen and using environmentally friendly fishing gear is an important part of sustainable fisheries management efforts in Makassar. Through proper training and the application of more sustainable fishing techniques, it is hoped that marine ecosystems can be well maintained and the fisheries sector can develop sustainably, providing long-term economic benefits for fishermen and coastal communities [20].

Improving Fishermen's Welfare. The sustainable fisheries management program in Makassar has become one of the important initiatives in preserving the marine ecosystem and improving the welfare of coastal communities, especially fishermen. This initiative aims to create a balance between the needs of a protected environment and the economic needs of fishermen who depend on their catch. This effort is carried out with a comprehensive approach, so that the impact is expected to be felt not only in the marine ecosystem, but also in the welfare of fishermen involved in daily fishing activities. One of the main pillars of this program is training and education for local fishermen, which aims to provide them with knowledge about more efficient and environmentally friendly fishing practices. Dewi explains that this training covers various important aspects, including the introduction of more selective fishing techniques and fishing methods that minimize damage to the marine environment [30]. Through this education, fishermen are introduced to concepts and techniques that not only aim to increase catches but also to maintain fish populations in the sea. One of the techniques taught is the use of nets with the right mesh size. The use of appropriate mesh allows fishermen to only catch adult fish, while younger fish are allowed to breed, so that fish populations can be maintained in the long term. In addition, the training also involves the introduction of other techniques such as the use of environmentally friendly fishing gear that has minimal impact on marine habitats, especially coral reefs. Coral reefs are important ecosystems that support the lives of various species of fish and other marine life. Therefore, destructive fishing practices such as the use of explosives and poisons are prohibited. Instead, fishermen are taught to use fishing methods that do not damage coral reefs and other marine life, such as fishing with more selective techniques.

According to Khumayah, these methods aim to protect marine ecosystems while still providing adequate catches for fishermen [31]. In addition to providing training, this program is also equipped with government assistance in the form of more efficient modern fishing gear. This assistance aims to increase the productivity of fishermen while reducing pressure on marine ecosystems. The fishing gear provided is designed to increase fishing efficiency, so that fishermen can catch fish more selectively and reduce the number of fish that are not the right size or species that are wasted. In addition, this modern fishing gear is also designed to minimize environmental damage, such as not damaging the seabed or damaging coral reef habitats [32]. This more modern technology not only provides advantages in terms of efficiency, but also in terms of the time and energy required to catch fish. With more sophisticated fishing gear, fishermen can catch more fish in less time. This is certainly very beneficial, considering that traditional fishermen often spend quite a long time at sea only to get catches that are not commensurate with the efforts they put in. With the assistance of modern fishing gear, fishermen can be more productive and reduce the risk of overfishing that occurs due to inefficient fishing practices. In the long term, this assistance is expected to not only improve the welfare of fishermen by increasing catches, but also maintain the balance of fish populations in the sea. As part of efforts to maintain the sustainability of marine resources, this program also includes stricter supervision of fishing activities. The local government, in collaboration with related parties, is trying to reduce overfishing activities by implementing stricter regulations and imposing sanctions on fishermen who violate the rules. This is done to ensure that

environmentally unfriendly practices, such as the use of explosives or poisons, are no longer carried out by fishermen [33].

However, even though the program has been running well, challenges remain. One of them is resistance from some fishermen who are accustomed to traditional fishing methods. Many fishermen are reluctant to switch to more modern or environmentally friendly fishing methods because they are worried that new fishing gear will not be as effective as the fishing gear they have been using for years. To overcome this, the government and related organizations must continue to provide support, both in the form of additional training and incentives, so that fishermen feel more motivated to participate in this program. In addition, the success of this program also depends heavily on good cooperation between various parties, including the government, fishermen, and environmental organizations. Bolkiah emphasized the importance of a collaborative approach in implementing a sustainable fisheries program. Without support from all stakeholders, it is difficult to achieve the desired long-term goals, namely protecting marine ecosystems and improving the welfare of fishermen. Overall, the sustainable fisheries management program in Makassar offers a holistic solution to the problems faced by fishermen and marine ecosystems. By combining training, assistance with modern fishing gear, and strict regulations, this program is expected to provide significant benefits for both fishermen and the marine environment. This program also provides an example of how the welfare of coastal communities can be improved through a more environmentally friendly approach. However, challenges in implementing this program must continue to be overcome through ongoing education and close cooperation between all parties involved.

The implementation of sustainable fishing methods and the use of modern fishing gear not only focuses on environmental protection but also contributes to increasing the productivity of fishermen. For example, the use of contemporary fishing equipment, such as improved hooks and echo-sounder buoys, reduces bycatch and permits more selective fishing. This increases production by helping fishermen find larger fish schools more quickly, which cuts down on search time and fuel expenses, while also improving compliance with conservation initiatives [34]. Previously, many fishermen experienced a decline in catches due to overfishing and damage to marine habitats. With the implementation of more environmentally friendly fishing practices, previously declining fish populations have begun to recover. This has had a positive impact on the catches of fishermen, who can now enjoy increased catches as the fish population recovers. This increase in catches has a domino effect on the economic welfare of fishermen [2]. With increased catches, fishermen can earn better incomes, which in turn improves their standard of living. Better economic well-being allows fishermen to better meet their basic needs, such as education and health, and improves their overall quality of life [30]. The program also contributes to the economic stability of coastal communities, which often depend on fishing activities as their main source of livelihood. Overall, the sustainable fisheries management program in Makassar that focuses on improving the welfare of fishermen is a very important initiative. By prioritizing education, modern technology, and environmentally friendly practices, this program not only protects the marine ecosystem but also provides real benefits to the lives of fishermen. With the success of this program, it is hoped that a harmonious balance will be created between environmental protection and improving the quality

of life of coastal communities, which ultimately supports the sustainability of the fisheries sector and marine ecosystems in Makassar [19].

4.3 Challenges in Implementing the Blue Economy in Makassar

The implementation of the blue economy in Makassar, which aims to promote the sustainability of marine resources and improve the welfare of coastal communities, has shown positive results. However, the journey towards optimal sustainability is still marked by several significant challenges. To achieve the overall goals of the blue economy, these challenges need to be identified and addressed effectively. Some of the main challenges in the implementation of the blue economy in Makassar include overfishing, marine environmental degradation, and limited infrastructure [35].

Overfishing. Overfishing has become a serious problem that threatens the sustainability of marine resources, especially in Makassar waters. This phenomenon not only damages the marine ecosystem but also has an impact on the welfare of fishermen in the long term, given the drastic decline in fish populations due to overexploitation. Although the government has set regulations governing fishing limits, the implementation of these regulations often encounters obstacles in the field, so that overfishing remains a real threat. In the context of Makassar waters, this problem is also exacerbated by environmentally unfriendly fishing practices, which are still widely carried out by local fishermen. According to Juanda, most of the local fishing communities in Makassar consist of small-scale fishermen who have limited access to modern technology and fishing gear [33]. As a result, many of them still use traditional fishing methods that are not in accordance with existing regulations. These methods, such as the use of explosives and poisons, not only damage marine habitats such as coral reefs and seaweed, but also cause non-selective fish deaths. The use of these hazardous chemicals results in overfishing, where not only adult fish are caught, but also young fish that should still be able to reproduce to maintain population balance. One factor that worsens this situation is the weak supervision and law enforcement in the field.

As explained by Hatta, many coastal areas in Makassar face limitations in terms of supervision of fishing activities [36]. Fishermen who violate regulations often escape sanctions due to the lack of patrols and strict supervision. In addition, law enforcement against violators is also not optimal, both in terms of human resource capacity and the infrastructure available to effectively monitor activities at sea. Budget limitations and coordination between institutions are also challenges in efforts to overcome overfishing in the area. To overcome this problem, improvements in supervision and law enforcement are needed. Authorities must be more active in monitoring fishing activities in Makassar waters. Monitoring technology, such as the use of vessel monitoring systems (VMS) and drones, can be applied to increase the effectiveness of supervision. This technology will make it easier for authorities to detect illegal activities at sea and provide a quick response to violations that occur. In addition, the government must also increase cooperation with local communities and fishing groups to report fishing activities that are not in accordance with the rules. In

addition to stricter supervision, socialization and education for fishermen are also important steps to reduce overfishing practices.

Tangke stated that many fishermen in Makassar still do not understand the long-term impacts of overfishing on marine ecosystems and their livelihoods [36]. Therefore, education on the importance of maintaining the balance of fish populations and the negative impacts of destructive fishing methods needs to be strengthened. More comprehensive training programs should be introduced to help fishermen switch to more environmentally friendly fishing methods, such as using nets with appropriate mesh sizes or fishing techniques that do not damage marine habitats. Education should also include an understanding of the fish reproductive cycle and how to maintain healthy fish populations by avoiding catching juveniles. This is important so that fishermen can see the long-term benefits of sustainable fishing practices. Local governments, together with environmental organizations and research institutions, can work together to develop educational programs based on scientific data on the condition of marine ecosystems and fish populations in Makassar waters.

In addition, providing incentives to fishermen who implement sustainable fishing practices can also be an effective strategy to reduce overfishing. The government can provide financial support or assistance with more environmentally friendly fishing gear to fishermen who demonstrate a commitment to following fishing regulations. Programs such as sustainable fishing certification can be implemented, where fishermen who comply with regulations and use environmentally friendly fishing gear will receive a certificate that can increase the selling value of their catch in the market. In addition, stricter law enforcement is also needed to provide a deterrent effect to violators. The sanctions applied must be in accordance with the level of violation, ranging from warnings, fines, to revocation of fishing licenses for fishermen who are proven to have repeatedly carried out overfishing activities. Consistent and fair law enforcement is essential to create compliance among fishermen with existing regulations. On the other hand, coastal communities, including fishermen, need to be involved in the planning and management process of marine resources. By involving them in decision-making, fishermen will feel they have a responsibility to maintain the sustainability of the marine resources they rely on. This will also help build awareness of the importance of maintaining marine ecosystems so that they remain sustainable for future generations. Joint management programs between the government and local communities can be one solution to increase fishermen's participation in marine conservation efforts. Overall, overfishing in Makassar waters is a complex problem that requires a holistic approach to overcome. In addition to stricter regulatory enforcement, efforts are needed to socialize, educate, and actively participate local fishermen. The government must also continue to develop monitoring technology and improve surveillance infrastructure to ensure that fishing activities in Makassar waters are carried out sustainably. With good cooperation between the government, fishermen, and the community, as well as support from various environmental organizations, it is hoped that overfishing can be reduced significantly, so that marine resources in Makassar can remain sustainable and provide long-term benefits for the welfare of coastal communities.

Degradation of the Marine Environment. Marine environmental degradation is one of the major challenges currently faced by Makassar, especially in the context of coral reef ecosystem damage. Coral reefs play an important role in maintaining the balance of marine ecosystems, not only as a habitat for various species of fish and marine biota, but also as a natural protector of the coast from erosion. However, irresponsible human activities and global climate change have threatened the existence of coral reefs in this area. Damage to coral reefs due to activities such as coral mining and marine pollution has caused significant environmental degradation, affecting the sustainability of marine ecosystems and reducing marine biodiversity. According to Reswita, human activities such as coral mining for building materials, dumping industrial and domestic waste into the sea, and fishing with destructive methods, such as the use of explosives and poisons, are the main causes of coral reef damage in Makassar [37]. Coral mining damages the physical structure of reefs that serve as habitats for many marine species. Meanwhile, marine pollution from hazardous waste, such as plastic, chemicals, and heavy metals, pollutes seawater and disrupts ecosystem processes that support marine life. The impact of these human activities is very detrimental and threatens the sustainability of marine natural resources that are the mainstay of coastal communities, including fishermen. Coral reef damage has a very broad impact on marine ecosystems. Coral reefs provide shelter, feeding, and breeding grounds for various species of fish and other marine biota. In addition, coral reefs also help protect coastlines from erosion caused by ocean waves. When coral reefs are damaged, fish lose their habitat, which ultimately reduces fish populations and impacts the livelihoods of fishermen who depend on marine catches. In addition, coral reef degradation also makes beaches more vulnerable to damage from storms and large waves, which can cause flooding and more severe coastal erosion.

In addition to human activities, global climate change also plays a significant role in accelerating the destruction of coral reefs. Global warming causes an increase in sea water temperatures, which is one of the main causes of the coral bleaching phenomenon. This phenomenon occurs when coral reefs experience stress due to significant increases in water temperatures, which causes corals to release zooxanthellae algae that live in their tissues. These algae are very important for the health of coral reefs, because they provide nutrients and color to corals through the process of photosynthesis. Without these algae, corals lose their nutritional sources, turn white (bleaching occurs), and are more susceptible to disease and death. Febrianto highlighted that prolonged coral bleaching can cause permanent damage to coral reef ecosystems. Corals that experience bleaching and do not recover within a certain period of time will die, resulting in the loss of important ecosystem functions that they have [17]. This not only impacts marine biodiversity, but also the welfare of people who depend on marine ecosystems for their livelihoods. Fishermen who depend on fish living around coral reefs will face major challenges in meeting their needs, as the decline in fish populations will have a direct impact on their catches. Facing this major challenge requires close collaboration between various parties, including the government, local communities, and the private sector.

Coral reef conservation programs need to be strengthened with a more holistic approach, involving various stakeholders and implementing ecosystem-based management strategies. One approach that can be taken is to expand legally protected marine conservation areas, where destructive human activities, such as mining and

unsustainable fishing, are prohibited. These conservation areas will serve as recovery areas for damaged coral reefs, allowing the ecosystem to recover and function optimally again. More environmentally friendly technologies also need to be implemented to help restore coral reef ecosystems. Coral reef health monitoring systems using satellite and drone technology can help authorities monitor coral reef conditions more efficiently. Data obtained from this technology can be used to detect damage early and take quick action to prevent further damage. In addition, coral transplantation techniques can be used to speed up the recovery process of damaged coral reefs. Coral transplantation involves taking healthy coral fragments from one location and planting them in the damaged location, where the coral can grow and form a new ecosystem. Education and increasing public awareness are also very important in supporting coral reef conservation efforts. Suharsono emphasized that local communities, especially fishermen, need to be given a deeper understanding of the importance of preserving coral reefs and the negative impacts of human activities that damage marine ecosystems [38]. Environmental awareness campaigns through mass media, schools, and community programs can help increase public understanding of the importance of preserving coral reefs. In addition, training programs for fishermen that teach more sustainable fishing methods can also help reduce pressure on coral reef ecosystems. In the long term, the government needs to adopt more assertive and sustainable policies in managing marine resources, including coral reefs. Regulations governing human activities at sea, such as fishing, tourism, and waste disposal, must be enforced more consistently. In addition, incentives can be given to companies operating around marine areas to implement environmentally friendly business practices and support conservation efforts. With good cooperation between the government, community, and private sector, coral reef degradation in Makassar can be overcome gradually. Through an approach based on ecosystem conservation, environmentally friendly technology, and increasing public awareness, it is hoped that damaged coral reefs can recover and return to function as important habitats for marine biodiversity. Ultimately, coral reef conservation will not only protect the marine environment, but will also provide long-term benefits for the welfare of coastal communities that depend on marine natural resources.

Infrastructure Limitations. Infrastructure limitations are one of the significant challenges in implementing the blue economy in Makassar, an issue that is very important for the sustainability of fisheries and marine tourism activities in the area. Adequate infrastructure is key to supporting the development of the blue economy, which involves the sustainable use of marine resources and the integration of economic activities and environmental conservation. Unfortunately, many coastal areas in Makassar still lack essential supporting facilities, such as fish processing facilities, fishing ports, and standard storage facilities [29]. First of all, a modern fish processing facility is one of the most important infrastructure aspects for fisheries activities. Efficient and hygienic processing ensures that the fish catch can be processed properly so that its quality is maintained and meets market standards. Without adequate processing facilities, fish catches are often not processed optimally, which has a negative impact on product quality and the potential economic value that can be obtained. This not only harms fishermen but can also lead to the waste of

valuable marine resources. In addition, adequate fishing ports are a key element in the fish catch distribution chain. Inadequate ports can hinder fishermen's access to markets and reduce the efficiency of catch distribution. A good port should be equipped with facilities for loading and unloading fish quickly and safely, as well as other facilities such as boat parking and repair services. Limitations in this regard can cause delays in the distribution of the catch, leading to a decrease in the quality of the fish and its economic value. Storage facilities also play an important role in maintaining the quality of the catch. Without appropriate storage facilities, the catch is susceptible to damage and deterioration, which can reduce its attractiveness in the market. Poor storage can also increase the risk of economic losses for fishermen and fisheries business actors. Therefore, the provision of adequate and standard storage facilities is essential to ensure that the quality of the catch can be maintained until it reaches consumers. To overcome these infrastructure limitations, significant investment is needed in the development of facilities that support fisheries and marine tourism activities [39].

Local governments should play an active role in planning and implementing necessary infrastructure projects, by working closely with the private sector and donor agencies. This collaboration can help raise funds and resources needed for the construction of fishing ports, processing facilities, and storage facilities. Infrastructure development must also pay attention to sustainability principles to avoid negative impacts on the environment. In the context of the blue economy, it is important to ensure that infrastructure projects do not damage marine ecosystems or reduce biodiversity. Infrastructure planning and management must be carried out by considering environmental impacts and seeking environmentally friendly solutions [40]. For example, the construction of fish processing facilities can be carried out with technology that reduces waste and pollution, and pays attention to protecting marine habitats. Overall, although the implementation of the blue economy in Makassar has shown some progress, challenges related to infrastructure limitations need to be seriously addressed to achieve more optimal sustainability [41]. Addressing the problems of overfishing, marine environmental degradation, and infrastructure limitations are important steps to ensure that the blue economy can provide greater benefits to coastal communities and marine ecosystems in the future. With proper attention to infrastructure investment and sustainable management, Makassar can maximize the potential of the blue economy, creating jobs, improving the welfare of coastal communities, and protecting the marine environment. Collaboration between government, the private sector, and communities will be key to overcoming these challenges and realizing the vision of a sustainable and inclusive blue economy.

5 Conclusion

The implementation of the blue economy in Makassar City has brought positive changes in the management of marine and coastal resources. Conservation programs, better fisheries management, and the development of marine tourism have succeeded in improving the welfare of local communities and supporting sustainable economic growth. However, there are still challenges that need to be addressed, including overfishing, lack of supporting infrastructure, and the need for increased supervision

of fishing practices. and donor agencies to finance the necessary infrastructure projects. The development of fishing ports, catch processing facilities, and storage facilities must be a priority to ensure that catches can be managed properly and markets can be reached more efficiently. In addition, infrastructure planning and management must be carried out with attention to sustainability principles to avoid negative impacts on the environment. Overall, although the implementation of the blue economy in Makassar has shown progress, these challenges need to be addressed seriously to achieve more optimal sustainability. By addressing the problems of overfishing, marine environmental degradation, and limited infrastructure, it is hoped that Makassar can achieve the goal of a more sustainable blue economy and provide greater benefits to coastal communities and marine ecosystems in the future

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