

The Blue Economy Approach and Development of Marine Fisheries Potential in the Coastal Region of Jayapura City

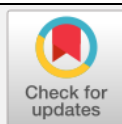
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ABSTRACT

This study investigates the application of the blue economy approach in enhancing the potential of marine fisheries in the coastal areas of Jayapura City, Papua Province, Indonesia. Drawing upon the city's abundant marine biodiversity and strategic geographical location, the research aims to examine the socio-economic dynamics of Indigenous coastal communities, evaluate the integration of blue economy principles, and propose strategic frameworks for sustainable fisheries management. Data were collected from 111 respondents across four key coastal regions in Jayapura using descriptive statistical methods, profitability analysis, and SWOT analysis. The findings reveal substantial untapped potential of marine fisheries hindered by challenges such as limited product diversification, inadequate market accessibility, and environmental constraints. The study emphasizes the critical need for comprehensive policy integration, community capacity-building, and ecological preservation to achieve sustainable development. This research contributes to local economic policy discourse and provides replicable insights for implementing blue economy initiatives in similar coastal contexts.

Keywords: Blue Economy; Coastal Region; Community Empowerment; Marine Fisheries; Sustainable Development

1. Introduction

Regional economic development involves the management of resources by local governments and communities, fostering partnerships between public and private sectors to create employment opportunities and stimulate regional economic growth (Arsyad, 2016; Tambunan, 2005). In Indonesia, sustainable development has been integrated to balance economic, environmental, and social aspects in managing natural resources (Wulandari et al., 2024). One approach that aligns with this vision is the blue economy, which emphasizes the sustainable utilization of ocean and marine resources to drive economic growth, enhance livelihoods, and preserve marine ecosystems (Silver et al., 2015; Smith-Godfrey, 2016).

Globally, the blue economy is a critical pillar in economic development. For example, South Korea emphasizes marine biotechnology and tourism (Choi et al., 2022). China integrates coastal regional development with marine resource-based entrepreneurship and environmental protection (Fu et al., 2024; Li et al., 2024). India focuses on ocean spatial planning and offshore energy, and Australia advocates for offshore decarbonization technologies and environmental regulations (Frohlich et al., 2023). These examples demonstrate how the blue economy contributes to economic growth while maintaining ecological integrity and social inclusivity.

Indonesia, the world's largest archipelagic country, comprises over 17,000 islands. The total area of Indonesia is approximately 5.8 million square kilometers, including land and sea territories (Oegroseno, 2009). Cenderawasih Bay in Papua's northern waters is renowned for its rich marine biodiversity and abundant fisheries resources. Studies have documented various fish species, including small pelagic fish, vital to the local fishing industry. For instance, hydroacoustic research has assessed the distribution of small pelagic fish in Cenderawasih Bay, highlighting its significant fishery potential (Hisyam et al., 2024).

Additionally, the bay's coral reef ecosystems support diverse fish assemblages. A study focusing on the influence of coral reef benthic conditions around Puruf Island in Cenderawasih Bay found a strong association between coral health and fish diversity, underscoring the ecological importance of these habitats (Mansoben et al., 2024). However, low product diversification, market access limitations, and environmental issues like marine pollution hinder optimal resource utilization and sustainable development.

Implementing blue economy principles in Indonesia is supported by initiatives such as the "Manokwari Declaration," which emphasizes biodiversity conservation and climate change mitigation (Cámara-Leret et al., 2019). The declaration reflects Papua and West Papua's commitment to sustainable development through responsible resource management, including marine ecosystems. However, achieving this vision requires addressing socio-economic challenges faced by coastal communities, such as limited access to markets and the dominance of intermediaries in the fisheries sector.

In Jayapura, local fishermen often sell their catch without adding value through processing or diversification. This practice limits their economic benefits and contributes to reliance on traditional fishing methods. Additionally, issues such as marine waste, particularly in coastal areas, harm marine habitats and reduce the productivity of fisheries. These problems highlight the need for innovative approaches integrating sustainable practices with economic development.

A notable opportunity for advancing the blue economy in Papua lies in leveraging community-based tourism that incorporates marine resource management. Programs like developing eco-marine tourism in Cenderawasih Bay have shown promise in providing alternative livelihoods to local communities and reducing dependence on overfishing while promoting biodiversity conservation (Aini et al., 2019; Anna & Saputra, 2017; Bawole et al.,

2015). Additionally, fostering partnerships between local governments and private sector actors can enhance the infrastructure needed for sustainable fisheries, such as cold storage and processing facilities.

Research highlights the role of capacity-building programs in enhancing the knowledge of coastal communities about sustainable practices (Cinner et al., 2018; Crawford et al., 1993; Franco & Tracey, 2019). Such initiatives focus on educating fishermen about post-harvest techniques, waste management, and marine conservation. Empowering these communities with technical skills and market information can significantly improve their competitiveness in national and international markets. This aligns with Indonesia's broader goal of promoting inclusive economic growth while preserving its rich marine biodiversity.

This study explores the potential of the blue economy approach in managing fisheries in Jayapura, focusing on the socio-economic characteristics of indigenous coastal communities, the current state of blue economy implementation, and strategies for fostering sustainable fisheries. By addressing these aspects, this research aims to provide insights that can inform policymakers and stakeholders on effective ways to harness marine resources for economic growth while preserving the environment.

Moreover, the study contributes to the broader discourse on sustainable development by demonstrating how localized blue economy initiatives can align with global objectives. For instance, integrating environmental conservation, community engagement, and economic goals supports Indonesia's commitments to international frameworks like the United Nations Sustainable Development Goals (SDGs). This alignment underscores the importance of localized actions in achieving broader sustainability targets.

Finally, the findings of this research aim to provide practical recommendations for enhancing the blue economy framework in Papua, particularly in Jayapura. It seeks to address challenges such as improving the value chain, increasing community awareness about sustainable practices, and expanding market access for local fishermen. By focusing on these areas, the research highlights growth opportunities that are both economically viable and environmentally responsible.

2. Literature Review

2.1. Blue Economy Theory

The concept of the blue economy emphasizes the sustainable utilization of marine resources to drive economic development, environmental conservation, and social welfare. Introduced during a 2009 U.S. Senate Committee discussion, the term gained prominence through Gunter Pauli's book "The Blue Economy: 10 Years, 100 Innovations, 100 Million Jobs". Pauli proposed a model focused on resource efficiency, zero waste, job creation, and innovation while remaining competitive and environmentally responsible (Pauli, 2010).

Pauli's vision emphasizes harmony between humanity and the natural environment, promoting social inclusion and equity. The blue economy seeks to enhance resource management by integrating principles like local employment, poverty alleviation, and economic multipliers, transitioning from green economy concepts to more ocean-centric approaches.

Globally, the blue economy has become a focus in forums like the Asia-Pacific Economic Cooperation (APEC), reflecting a growing recognition of its role in addressing sustainability challenges that earlier concepts like the Brundtland Commission's sustainable development framework left unresolved. The blue economy generates wealth from ocean-related activities while protecting marine ecosystems (Gamage, 2016; Satizábal et al., 2020). Organizations like

the World Bank and the United Nations emphasize cross-sectoral collaboration and sustainable policies to manage fisheries, preserve ecosystems, and reduce pollution (Bank, 2023; Lee et al., 2020). The blue economy integrates environmental and economic goals, promoting partnerships and innovative solutions to ensure long-term marine resource sustainability.

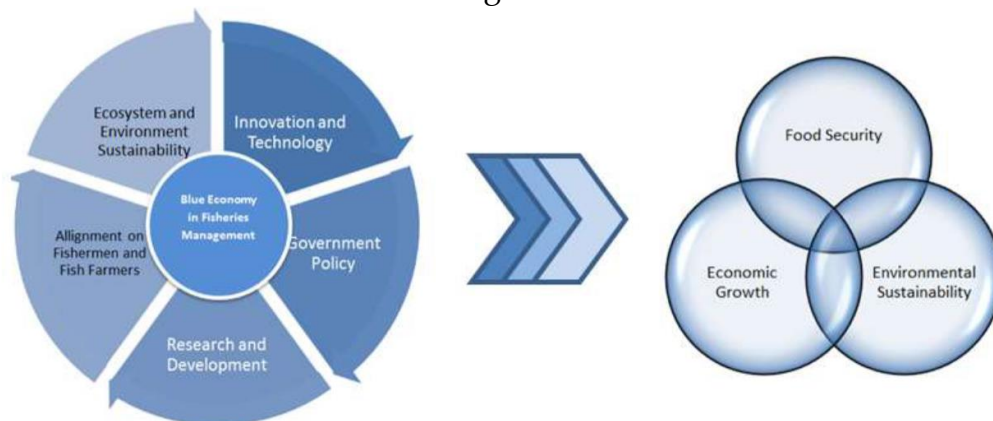


Figure 1. Integration of Blue Economy Model and Sustainable Fisheries Management

Source: (Sari & Muslimah, 2020)

Figure 1 shows that developing the economic concept requires the collaboration of several aspects to create sustainable fisheries development. The first aspect is related to strengthening the blue economy with technology and innovation, which will affect the efficiency of marine fisheries management. For example, fish seed regeneration, research, and development are needed to develop marine fisheries' potential. The next aspect is a policy that supports the blue economy program. Policy is important for formulating a more effective strategy in developing the blue economy. The government will, of course, make the policy with the legislative institution by listening to input from the community. Another important aspect of implementing the blue economy is empowering local communities. This is very important so that local communities are also involved in the blue economy program so that the program will be sustainable. Lastly, no less important is maintaining the ecosystem of the marine habitat. Balance in maintaining marine areas is the responsibility of all stakeholders (community, government, NGOs) not to damage marine biota, where there is no overexploitation in the extraction of fish catches.

According to the Organisation for Economic Co-operation and Development (OECD), the ocean economy's output was valued at approximately USD 1.5 trillion in 2010, with projections suggesting it could exceed USD 3 trillion by 2030 (OECD, 2016). Around 58.5 million people are employed worldwide in primary fish production, of which 21 percent are women. Up to 600 million livelihoods depend partly on fisheries and aquaculture, mainly in developing countries. Healthy oceans and coastal ecosystems are essential for economic growth and food production and contribute to global efforts to mitigate climate change (FAO, 2022).

Several countries have adopted or attempted to apply the concept of the blue economy in marine resource management and fisheries activities. This approach emphasizes sustainable utilization of marine resources to achieve economic growth, improve livelihoods, and ensure ecosystem health. The blue economy has gained traction as a strategy to address challenges such as overfishing, habitat degradation, and climate change while promoting innovation and inclusive development.

Bangladesh is a prominent example of a country striving to implement the blue economy concept. Since 2015, the country has held consultations and workshops to integrate blue

economy principles into its marine and fisheries policies (Bhuyan et al., 2022; Islam & Shamsuddoha, 2018; Sarker et al., 2018). These efforts focus on harnessing its vast maritime resources in the Bay of Bengal to enhance socio-economic development. Initiatives include improving sustainable fisheries practices, expanding aquaculture, and exploring opportunities in marine tourism and renewable energy.

Other South Asian countries have undertaken similar initiatives. Sri Lanka, for instance, has adopted a comprehensive approach to leverage its strategic location in the Indian Ocean. It emphasizes sustainable fisheries, maritime trade, and marine conservation (Bari, 2017; Cooray et al., 2022). With its extensive coastline, India has incorporated blue economy strategies into national policies, focusing on fisheries management, port modernization, and ocean-based renewable energy (Mukhopadhyay et al., 2020; Upadhyay & Mishra, 2020). These efforts aim to create a balance between economic development and environmental sustainability.

Pakistan has also made strides in embracing the blue economy framework. Efforts include enhancing the capacity of its fishing industry, promoting coastal tourism, and addressing marine pollution (Gill & Iqbal, 2021; Khan et al., 2024). The country's participation in initiatives such as the China-Pakistan Economic Corridor (CPEC) has opened up opportunities to expand its maritime infrastructure, including developing ports and shipbuilding. However, implementing blue economy strategies in Pakistan faces challenges, including limited institutional capacity and insufficient policy coherence (Ali, 2020; Gao, 2023).

While the blue economy concept holds great promise, its success depends on effective governance, stakeholder collaboration, and international cooperation. These South Asian nations are beginning to recognize the economic potential of their marine resources, but achieving sustainable outcomes requires addressing structural barriers, fostering innovation, and ensuring community participation. Regional dialogues and partnerships can help share best practices and align efforts to promote a shared vision for a sustainable blue economy.

2.2. Coastal Areas

Coastal areas play a crucial role in the environment and economy of many countries, including Indonesia. These regions provide a wealth of natural resources, support biodiversity, and serve as hubs for economic activities such as fisheries, tourism, and shipping. However, they are also vulnerable to various threats, such as over-exploitation of resources, pollution, habitat degradation, and climate change. Therefore, effective management of coastal areas is essential to ensure sustainable development while protecting their ecological functions. One widely recognized approach to managing coastal areas is Integrated Coastal Zone Management (ICZM), which seeks to balance environmental protection with socio-economic development. According to Cicin-Sain and Knecht, ICZM is a comprehensive and coordinated process involving various stakeholders in decision-making, making it an effective tool for addressing the challenges coastal areas face (Cicin-Sain & Knecht, 2013).

Sustainable development is a key theme in coastal zone management, particularly due to urbanization, industrialization, and tourism pressures. Sustainable management practices help to preserve coastal ecosystems while supporting human activities (Moore & Kumble, 2024). In Indonesia, integrating sustainability into coastal management policies can help protect vital ecosystems, such as coral reefs and mangrove forests, which are essential for the livelihood of local communities. Sustainable practices, such as ecotourism, sustainable fisheries management, and habitat restoration, are effective strategies for mitigating the environmental degradation caused by rapid development (Aspiany et al., 2019; Gorospe, 2024).

The role of local communities in managing coastal areas has garnered significant attention, particularly through community-based approaches that involve local stakeholders in decision-making and stewardship of coastal resources. These methods are especially effective in regions where traditional knowledge and local practices are crucial in resource conservation. Community-based coastal resource management (CBCRM) empowers local communities to become stewards of their coastal resources. By involving residents in the management process, CBCRM fosters a sense of ownership and ensures that strategies are culturally appropriate and tailored to local contexts. Studies have shown that when communities are trained and empowered, they can effectively manage coastal resources, leading to sustainable outcomes (Sarinas, 2016).

In regions like Misool, Raja Ampat, Indonesia, indigenous knowledge and practices have been integrated into marine ecotourism development. The traditional practice of “sasi laut,” a form of marine resource management, has been incorporated into tourism activities, showcasing the destination’s uniqueness and contributing to conservation efforts. This integration preserves local ecosystems and enhances the tourism experience by highlighting cultural heritage (Prasetyo et al., 2020).

Empowering local communities through participatory conservation and restoration efforts in coastal wetlands has led to positive social and ecological outcomes. Engaging communities in managing their natural resources ensures more effective and sustainable conservation strategies. Such community-led initiatives have been successful in various parts of the world, including Southeast Asia, where local involvement has been key to recovering mangrove habitats (Moore & Kumble, 2024).

Despite the positive outcomes of sustainable and community-based management, coastal areas face significant challenges, including pollution, overfishing, and habitat destruction. Marine plastic pollution has been a growing concern for decades, with single-use plastics being a significant source of this pollution. International policies have been implemented to reduce plastic marine pollution from single-use plastics, such as plastic bags and microbeads. However, challenges remain in effectively managing and enforcing these policies to mitigate the impact on coastal and marine ecosystems (Xanthos & Walker, 2017).

Overfishing and destructive industrial practices are major drivers of biodiversity loss in the ocean. The establishment of Marine Protected Areas (MPAs) has been recognized as an effective solution to protect marine life and habitats, making them more resilient to the pressures of extractive and destructive practices and climate change impacts (Asokan, 2024). MPAs serve as tools for ocean sustainability by conserving marine ecosystems and resources. They exemplify the evolution of science and policy in marine conservation, highlighting the importance of protected areas in maintaining ecological balance and supporting biodiversity (Gonçalves, 2023).

The impact of climate change on coastal areas is another critical issue that needs to be addressed in coastal management strategies. Sea-level rise, increased storm frequency, and changes in marine ecosystems pose serious risks to coastal zones, particularly in low-lying regions like Indonesia (Nurhidayah et al., 2022). Climate change adaptation strategies, including developing early warning systems, infrastructure resilience, and ecosystem-based adaptation, are vital for mitigating these risks. Integrating climate resilience into coastal management plans is necessary to ensure that coastal areas remain habitable and productive for future generations. In conclusion, effective coastal area management requires a combination of integrated approaches, sustainable practices, community involvement, and climate adaptation strategies to safeguard the environment and the livelihoods of coastal populations.

Coastal areas are considered unique regions. In the context of landscapes, coasts are identified as meeting points between land and sea. In other words, coastal areas are considered zones where terrestrial and marine ecosystems intersect, creating unique geographical characteristics. This approach emphasizes the importance of understanding land-sea interactions within the context of coastal area management.

The Ministry of Marine Affairs and Fisheries divides Indonesia's waters into several National Fisheries Management Areas (Wilayah Pengelolaan Perikanan Negara Republik Indonesia or WPPNRI). This classification is based on the habitat characteristics and biodiversity of each region. The WPPNRI, as regulated by Ministerial Regulation No. 18 of 2014, encompasses inland waters, territorial seas, additional zones, and the Indonesian Exclusive Economic Zone (EEZ) ([Menteri Kelautan dan Perikanan Republik Indonesia, 2014](#)). Indonesia's WPPNRI is divided into 11 fisheries management areas, as follows:

- 1) WPPNRI 571: Covers the waters of the Malacca Strait and the Andaman Sea.
- 2) WPPNRI 572: Covers the waters of the Indian Ocean west of Sumatra and the Sunda Strait.
- 3) WPPNRI 573: Includes the waters of the Indian Ocean south of Java, south of Nusa Tenggara, the Sawu Sea, and the western part of the Timor Sea.
- 4) WPPNRI 711: Covers the waters of the Karimata Strait, Natuna Sea, and the South China Sea.
- 5) WPPNRI 712: Covers the waters of the Java Sea.
- 6) WPPNRI 713: Covers the waters of the Makassar Strait, Bone Gulf, Flores Sea, and Bali Sea.
- 7) WPPNRI 714: Covers the waters of the Tolo Gulf and the Banda Sea.
- 8) WPPNRI 715: Covers the waters of the Tomini Gulf, Maluku Sea, Halmahera Sea, Seram Sea, and Berau Gulf.
- 9) WPPNRI 716: Covers the waters of the Sulawesi Sea and the northern part of Halmahera Island.
- 10) WPPNRI 717: Covers the waters of Cenderawasih Gulf and the Pacific Ocean.
- 11) WPPNRI 718: Covers the waters of the Aru Sea, Arafura Sea, and the eastern part of the Timor Sea.

Pauli stated that the development of coastal areas follows four principles under the Blue Economy Framework, aiming to improve the efficiency of natural resource management ([Pauli, 2010](#)). First, the Minimize Waste principle emphasizes clean production with zero waste. Second, social inclusion in production processes aims to distribute social welfare by enhancing the economy and creating job opportunities for underprivileged communities. Third, innovation and adaptation are applied in all activities by considering the principles of physics and the adaptive nature of ecosystems. Fourth, economic activities are expected to create a multiplier effect, delivering widespread impacts across various sectors while resilient to market price fluctuations.

3. Research Methodology

3.1. Research Locations Characteristics

This study focuses on the coastal areas of Jayapura City, specifically Skouw Yambe (Muara Tami Subdistrict), Enggros Village (Abepura Subdistrict), Tobati Village (Jayapura Selatan Subdistrict), Argapura Urban Administrative Village (Jayapura Selatan Subdistrict), and Bayangkara Urban Administrative Village (Jayapura Utara Subdistrict).

Skouw Yambe, located in Muara Tami Subdistrict, spans an area of 30 square kilometers and borders Papua New Guinea to the east and the Pacific Ocean to the north. The village has

an estimated population of 60,000 residents, primarily fishermen and farmers who depend on marine resources such as tuna, skipjack (*cakalang*), and shrimp (BPS, 2023).

Enggros Village and Tobati Village, situated within Youtefa Bay, belong to the Abepura Subdistrict and Jayapura Selatan Subdistrict, respectively. Combined, they cover an area of 23 square kilometers. Enggros Village is inhabited by approximately 6,000 residents, most of whom engage in fishing activities. These areas are also well-known tourist destinations, featuring landmarks such as the Youtefa Bridge and extensive mangrove forests.

Argapura Urban Administrative Village, known as Kampung Vietnam, is in Jayapura Selatan Subdistrict. It is home to around 200 residents across 315 households. Strategically positioned near Jayapura's business district, this area is renowned for its fisheries and tourism potential, supplying fresh fish to local markets.

Bayangkara Urban Administrative Village, commonly referred to as Dok IX Base G, is part of Jayapura Utara Subdistrict. This densely populated area hosts a mix of indigenous Papuan fishermen and the Butonese community. The local fish markets here are vibrant, offering freshly caught seafood and attracting numerous buyers.

3.2. Data Types and Sources

This study utilizes both primary and secondary data to ensure comprehensive analysis. The primary data were collected through questionnaires distributed to 111 respondents, all fishermen residing in the four study areas. The distribution of respondents is detailed in **Table 1** below. These primary data provide firsthand insights into the targeted coastal areas' socio-economic conditions and fisheries activities. Additionally, secondary data were obtained from reliable sources, including the BPS-Statistics Indonesia Jayapura Municipality and Jayapura City Fisheries Agency.

Table 1. Distribution of Respondents Across Study Areas

Area	Number of Respondents
Skouw Yambe	25
Enggros Tobati	31
Kampung Vietnam	23
Dok IX Base G	32
Total	111

3.3. Data Analysis

Data analysis in this study employs qualitative descriptive methods with the following steps:

1) Demographic and Social Characteristics

The demographic and social characteristics of fishermen were analyzed using descriptive statistics, focusing on age, family size, ethnicity, and fishing patterns.

2) Income Analysis

Income is calculated as net income by subtracting total costs (TC) from total revenue (TR). Revenue is determined by multiplying the price per unit (p) by the quantity of fish sold (q). Net profit is calculated using the following formula:

$$\pi = TR - TC$$

Where:

$$TR = p \cdot q \text{ and } TC = TFC + TVC$$

Explanation of Symbols:

π : Profit (IDR)
 TR: Total Revenue (IDR)
 TC: Total Cost (IDR)
 p: Price per unit (IDR /unit)
 q: Quantity produced (units)
 TFC: Total Fixed Costs (IDR)
 TVC: Total Variable Costs (IDR)

3) Strategic Analysis

A SWOT framework is used for strategic analysis to develop strategies for implementing the blue economy model among Jayapura's coastal communities. This approach combines existing government policies with community needs to create actionable strategies.

Table 2. SWOT Analysis

External \ Internal	Internal	Strengths (S)	Weaknesses (W)
	External		
	Opportunity (O)	Strategies (SO)	Strategies (WO)
	Threats (T)	Strategies (ST)	Strategies (WT)

4. Results and Discussion

The data obtained from the survey in Skouw Yambe Village, Enggors Tobati, Kampung Vietnam, and Dok IX Base G Village were analyzed using cross-tabulation. There were 111 fishermen as respondents in this study. The following is the respondents' distribution from the survey results in the four villages in Jayapura City.

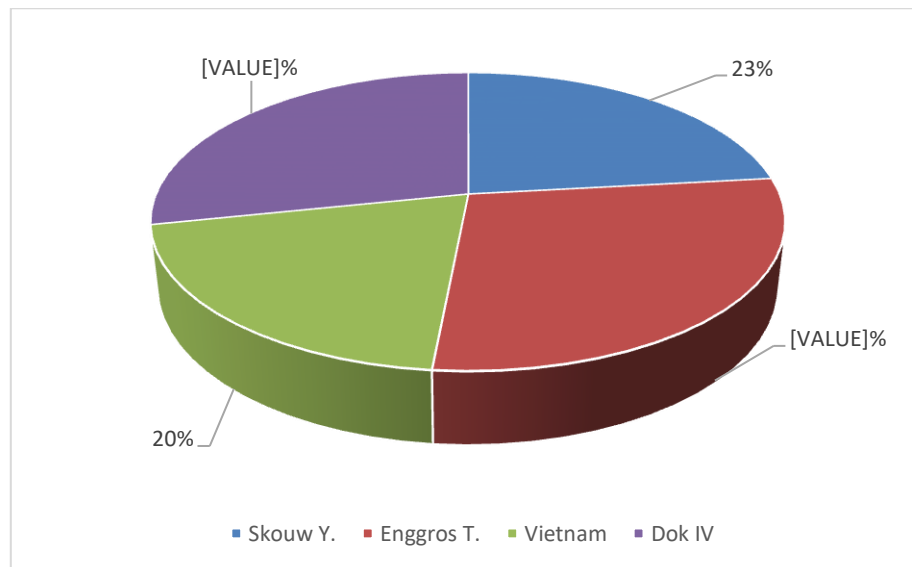


Figure 2. Distribution of Fishermen in Four Villages (N=111)

Figure 2 illustrates the distribution of respondents in the four villages in Jayapura City. Of the 111 fishermen sampled in this study, 23 percent came from Skouw Yambe Village, 28 percent from Enggros Tobati Village, 20 percent from Vietnam Village, and 28 percent from Dok IX Base G Village. Table 3 illustrates the distribution of respondents based on age. Of the 25 respondents in Skow Yambe Village, 28 percent were aged 31-40, and around 24 percent were aged 41-50. Meanwhile, 12 percent of fishermen were aged 21-30 years. The interesting thing about the table is that around 20 percent of fishermen over 60 years old can still carry out fishing activities. The interview results showed that the family's economic factors were influential, forcing them to catch fish at sea.

Table 3. Percentage of Fishermen in Four Villages Based on Age (%)

No	Age	Skouw Yambe	Enggros Tobati	Kampung Vietnam	Dok IX Base G
1	21-30 years old	12	26	30	25
2	31-40 years old	28	29	35	28
3	41-50 years old	24	29	22	25
4	51-60 years old	16	10	9	13
5	> 60 years old	20	6	4	9
Total		100	100	100	100
N		25	31	23	32

Source: Processed Data, 2024

Meanwhile, in Enggros Enggros Tobati Village, a productive age dominates the fishing community, where 29 percent of fishermen aged between 31-40 and 41-50 still do fishing activities. Furthermore, only a small number (6 percent) of residents aged 60 years and over are still working as fishermen. For Vietnam Village, fishermen aged 31-30 years are 35 percent, followed by residents aged 21-30 years. Meanwhile, only 4 percent of the population in Vietnam Village is still actively fishing. For Dok IX Base G Village, the average age of fishermen is

productive, where each reaches 15 percent, 28 percent, and 25 percent, with ages between 21-30 years, 31-40 years, and 41-50 years.

The educational background of fishermen in the four villages of Jayapura City is predominantly composed of those with high and junior high school education. Interestingly, there are also fishermen with a tertiary education. Interviews with respondents reveal that fishermen with a higher education background often take up fishing temporarily while seeking employment in the formal sector, particularly as civil servants. Additionally, fishermen with only an elementary school education represent a smaller portion of the population, as seen in **Table 4**.

In Skouw Yambe Village, out of 25 respondents, 40 percent of fishermen have completed upper secondary education, while 36 percent have completed lower secondary education. A smaller proportion, 16 percent, have only completed primary education, and 8 percent have pursued tertiary education.

In Enggros Tobati Village, of the 31 respondents, 35 percent have completed upper secondary education, and 32 percent have completed lower secondary education. An equal percentage of fishermen (16 percent) have a primary or tertiary education.

In Vietnam Village, nearly half of the 23 respondents (52 percent) have completed upper secondary education, followed by 30 percent who have completed lower secondary education. Fishermen with tertiary education represent 13 percent, while only 4 percent have completed primary education.

In Kampung Dok IX Base G, out of 32 respondents, 41 percent have completed upper secondary education, followed by 31 percent who have completed lower secondary education. Fishermen with tertiary education account for 19 percent, while 9 percent have completed only primary education.

Table 4. Education Level of Fishermen in Four Villages (%)

No	Education Level	Skouw Yambe	Enggros Tobati	Vietnam Village	Dok IX Base G
1	Tertiary Education	8	16	13	19
2	Upper Secondary Education	40	35	52	41
3	Lower Secondary Education	36	32	30	31
4	Primary Education	16	16	4	9
Total		100	100	100	100
N		25	31	23	32

Source: Processed Data, 2024

The educational background of fishermen shows considerable variation across the four villages. Most fishermen have completed upper secondary education. However, interviews and data from the Jayapura City Central Statistics Agency highlight that economic constraints often prevent fishermen's households from pursuing higher levels of education. Extreme poverty remains a significant factor limiting access to education for children in these communities.

The condition of household family members is a critical indicator of the welfare level of the fishing community in Jayapura City. A larger family size typically requires higher income to support all members. Limited income, as observed among the respondents in this study, significantly affects household expenses.

Table 5. Number of Family Members in Four Villages in Jayapura City (%)

No	Number of Family Members	Skouw Yambe	Enggros Tobati	Vietnam Village	Dok IX Base G
1	1-3	44	48	43	50
2	4-6	40	39	35	38
3	>7	16	13	22	13
Total		100	100	100	100
N		25	31	23	32

Source: Processed Data, 2024

Table 5 illustrates the distribution of family members in fishermen's households across four villages in Jayapura City. In Skouw Yambe Village, 44 percent of the 25 respondents have 1-3 family members, while 40 percent have 4-6 members. Only 16 percent of households have more than seven family members. Similarly, in Enggros Tobati Village, 48 percent of the 31 respondents have 1-3 family members, and 39 percent have 4-6 members. Only 13 percent of households have more than seven members.

In Vietnam Village, 43 percent of the 23 respondents have 1-3 family members, while 35 percent have 4-6 members. A notable 22 percent of households have more than seven family members, the highest among the villages. In Dok IX Base G Village, 50 percent of the 32 respondents have 1-3 family members, while 38 percent have 4-6 members. Only 13 percent of respondents reported having more than seven family members.

Experience plays a vital role in determining a fisherman's ability to operate and employ methods to catch fish. In Jayapura City, traditional fishermen often rely on their experience rather than modern tools, such as satellite-connected fish detectors, to locate fish.

Table 6. Fishermen's Experience in Four Villages in Jayapura City (%)

No	Experience (Years)	Skouw Yambe	Enggros Tobati	Vietnam Village	Dok IX Base G
1	1-5	20	19	17	22
2	6-10	44	48	43	41
3	>10	36	32	39	38
Total		100	100	100	100
N		25	31	23	32

Source: Processed Data, 2024

Table 6 presents the experience levels of fishermen in the four villages. In Skouw Yambe Village, 44 percent of the 25 respondents have 6-10 years of experience, while 36 percent have more than 10 years of experience. In Enggros Tobati Village, 48 percent of the 31 respondents have 6-10 years of experience, and 32 percent have more than 10 years of experience.

In Vietnam Village, 43 percent of the 23 respondents have 6-10 years of experience, while 39 percent have over 10 years of experience, the highest among the villages. In Dok IX Base G Village, 41 percent of the 32 respondents have 6-10 years of experience, while 38 percent have more than 10 years of experience.

The time spent at sea is crucial in determining the success of fishing activities. Longer fishing trips often result in higher fish production, which subsequently increases the income levels of fishermen.

Table 7. Fishing Time in Four Villages in Jayapura City (%)

No	Fishing Time (Days)	Skouw Yambe	Enggros Tobati	Vietnam Village	Dok IX Base G
1	< 2 Days	20	29	43	16
2	3-5 Days	28	32	17	19
3	6-8 Days	32	19	26	31
4	9-13 Days	12	13	9	25
5	> 13 Days	8	6	4	9
Total		100	100	100	100
N		25	31	23	32

Source: Processed Data, 2024

In Skouw Yambe Village, 32 percent of the 25 respondents reported spending 6-8 days at sea, while 28 percent typically spent 3-5 days. Only a small proportion, 8 percent, go to sea for more than 13 days. In Enggros Tobati Village, of the 31 respondents, 32 percent spent 3-5 days at sea, followed by 29 percent who spent less than 2 days. A minority, around 6 percent, extend their fishing trips to over 13 days. In Vietnam Village, most respondents (43 percent) spend less than 2 days at sea, while 26 percent spend 6-8 days, and only 4 percent reported fishing trips lasting more than 13 days. Meanwhile, 31 percent of the 32 respondents typically spend 6-8 days at sea in Dok IX Base G Village, while 25 percent venture out for 9-13 days. A smaller percentage, 9 percent, reported spending over 13 days fishing.

Interviews with respondents revealed that fishermen often choose to fish farther from the coast, employing traps typically used for catching skipjack and tuna. This shift in fishing practices is largely driven by the declining abundance of fish near the shore, prompting fishermen to spend extended periods at sea. While these longer trips demand greater effort, they provide opportunities for higher catches, thereby improving the fishermen's income.

Table 8. Fishermen's Income in Four Villages in Jayapura City (%)

No	Average Income (IDR)	Skouw Yambe	Enggros Tobati	Vietnam Village	Dok IX Base G
1	< 749,999	8	10	13	9
2	750,000 – 1,999,999	32	19	22	31
3	2,000,000 – 3,999,999	40	45	30	38
4	4,000,000 – 5,999,999	16	16	22	13
5	> 6,000,000	4	10	13	9
Total		100	100	100	100
N		25	31	23	32

Source: Processed Data, 2024

Table 8 presents the average monthly income of fishermen in four villages in Jayapura City. The income is calculated after deducting variable costs such as fuel, labor wages, food, fishing equipment, and bait. Fishermen also provided data on the average fish catch per trip, aggregated into monthly estimates.

In Skouw Yambe Village, 40 percent of the 25 respondents earn an average monthly income of IDR 2 million to IDR 3.9 million, while 32 percent earn between IDR 750 thousand and IDR 1.9 million. A smaller proportion, 8 percent, earn less than IDR 749 thousand. Only 4 percent of fishermen report incomes exceeding IDR 6 million.

In Enggros Tobati Village, 45 percent of the 31 respondents earn IDR 2 million to IDR 3.9 million per month, while 19 percent earn between IDR 750 thousand and IDR 1.9 million. Around 10 percent of respondents earn more than IDR 6 million, while another 10 percent earn less than IDR 749 thousand.

Of the 23 respondents in Vietnam Village, 30 percent earn IDR 2 million to IDR 3.9 million, while 22 percent earn between IDR 4 million and IDR 5.9 million. The lowest income group (< IDR 749 thousand) comprises 13 percent of respondents, and 13 percent report incomes exceeding IDR 6 million.

In Dok IX Base G Village, 38 percent of the 32 respondents earn an average income of IDR 2 million to IDR 3.9 million, followed by 31 percent earning IDR 750 thousand to IDR 1.9 million. A smaller proportion, 9 percent, earn more than IDR 6 million, while 13 percent earn between IDR 4 million and IDR 5.9 million.

The data indicate that most fishermen across the four villages earn between IDR 2 million and IDR 3.9 million per month, with variations based on the village's fishing practices and proximity to resources. Despite some fishermen earning higher incomes (> IDR 6 million), a notable percentage of households in all villages remain in the lower income brackets, highlighting the economic challenges faced by the fishing community.

4.1. Blue Economy Development Strategy in Jayapura City

This study employs qualitative and quantitative descriptive analyses to examine the development of a blue economy in Jayapura City. A SWOT analysis framework evaluates the blue economy development strategy by exploring four key dimensions: strengths, weaknesses, opportunities, and threats. The primary goal of this analysis is to formulate relevant, effective, and optimal strategies to address the factors contributing to the decline in fishermen's income levels in the coastal areas of Jayapura City.

The strength of the SWOT analysis lies in its ability to compile and integrate multiple strategies by aligning internal factors with external conditions. The results are summarized in the IFAS Matrix (**Table 9**) and EFAS Matrix (**Table 10**). These matrices provide a systematic foundation for identifying and prioritizing strategies that align with the specific needs of the local fisheries and marine sectors.

The strategies generated through this analysis are designed to be actionable by incorporating measurable achievement indicators to ensure that outputs align with planned objectives. These strategies should be implemented to maximize their effectiveness as part of a prioritization framework informed by stakeholder input, including community members and relevant organizations in the fisheries and marine sectors. This collaborative approach ensures that the proposed programs and activities address economic challenges and contribute to improving the overall standard of living and welfare of the local community in Jayapura City.

Table 9. Internal Factors Analysis Summary (IFAS Matrix)

No	Internal Factors	Weight	Rating	Score
Strengths (S)				
1	Marketing network close to consumers	0.05	4	0.20
2	Having a fairly decent livelihood	0.10	4	0.40
3	Strong family ties within the local community	0.15	4	0.60
4	Strong support from fishermen, fishermen organizations, and the Jayapura City government to develop fisheries and marine businesses	0.15	3	0.45
5	Potential for growth in the number of fishermen	0.05	3	0.15
6	Hardworking fishermen	0.05	3	0.15
7	Continuing extension services from related agencies	0.10	3	0.30
Weaknesses (W)				
1	Lack of docking facilities	0.05	1	0.05
2	Limited human resources with skills and technology in capture fisheries and other expertise	0.05	2	0.10
3	Unavailability of infrastructure and facilities for capture fisheries	0.05	2	0.10
4	Frequent occupational changes among fishermen	0.05	2	0.10
5	Limited fishing gear coverage	0.05	2	0.10
6	Lack of adequate refrigeration or preservation facilities	0.02	2	0.04
7	Minimal participation of local fishermen in advancing their region	0.02	1	0.02
8	Limited infrastructure and facilities owned by the community and local government to support the capture fisheries sector	0.02	2	0.04
9	Poor coordination between local fishermen's needs and assistance provided by the local government	0.01	2	0.02
10	Low welfare level of fishermen, who still rely on external assistance	0.03	1	0.03
Total		1.00		2.85

Table 10. External Factors Analysis Summary (EFAS Matrix)

No	External Factors	Weight	Rating	Score
Opportunities (O)				
1	Geographical location of sheltered coastal areas	0.10	4	0.40
2	Excellent coastal area conditions	0.05	4	0.20
3	Government attention through various assistance programs for fishermen	0.05	4	0.20
4	High demand for fish in Jayapura City and surrounding areas	0.15	3	0.45
5	Increased fishing fleet equipped with more modern	0.15	3	0.45

No	External Factors	Weight	Rating	Score
	machinery			
6	Collaboration with private sector or local investors	0.10	3	0.30
7	Opportunities to receive assistance through membership of impoverished fishermen	0.05	3	0.15
Threats (T)				
1	Rising fuel prices	0.10	2	0.20
2	Monopoly control of fuel supply	0.10	2	0.20
3	Threat of environmental degradation due to global climate change affecting fish production and food security	0.05	2	0.10
4	Conflicts between large-scale and small-scale fishermen	0.03	1	0.03
5	Fish migration to different locations	0.01	2	0.02
6	Rising production costs	0.02	2	0.04
7	Competition in the global market requires high standards	0.02	1	0.02
8	Unpredictable weather patterns and seasons	0.02	1	0.02
Total		1.00		2.78

Table 11. Strengths (S) and Weaknesses (W)

Strengths (S)	Weaknesses (W)
1) Marketing network close to consumers, with sufficient demand.	1) Lack of docking facilities.
2) Strong family ties within the local community.	2) Limited human resources in skills and technology mastery in capturing fisheries and other expertise.
3) Strong support from fishermen.	3) Lack of infrastructure and facilities for capturing fisheries.
4) Support from fishermen's organizations and the Jayapura City government is needed to develop fisheries and marine industries.	4) Frequent occupational changes among fishermen.
5) Potential for growth in the number of fishermen, hardworking fishermen, and ongoing extension services from related agencies.	5) The limited reach of fishing gear.
	6) Lack of adequate refrigeration/preservation facilities.
	7) Minimal participation of local fishermen in advancing their region.
	8) Limited infrastructure and facilities owned by the community and local government to support the capture fisheries sector.
	9) Poor coordination between local fishermen's needs and the assistance the

Strengths (S)	Weaknesses (W)
	local government provides.
	10) There are low welfare levels among fishermen, who rely heavily on assistance from various parties.

Table 12. Opportunities (O), SO Strategies, and WO Strategies

Opportunities (O)	SO Strategies (Strength-Opportunity)	WO Strategies (Weakness-Opportunity)
1) Geographical location of Jayapura City along the Pacific Ocean.	1) Increase production.	1) Invite the private sector to help provide fishing facilities.
2) Excellent coastal area conditions.	2) Use extension services to optimize fishing efforts.	2) Propose to the government to assist with programs to improve fishermen's welfare through bottom-up proposals.
3) Central government attention through various assistance programs for fishermen.	3) Invite private investors to invest.	
4) High demand for fish, particularly in Jayapura City and surrounding areas.	4) Propose to the government to increase the frequency of extension services and training programs.	
5) Increase in the number of fishing fleets equipped with more modern machinery.		
6) Collaboration with private sectors or local investors.		
7) Opportunities to receive assistance through membership of impoverished fishermen.		

Table 13. Threats (T), ST Strategies, and WT Strategies

Threats (T)	ST Strategies (Strength-Threat)	WT Strategies (Weakness-Threat)
1) Rising fuel prices.	1) Request government support to monitor fuel supply.	1) Expand the fishing fleet to reach broader fishing grounds.

Threats (T)	ST Strategies (Strength-Threat)	WT Strategies (Weakness-Threat)
2) Monopoly control over fuel supply.	2) Enhance community involvement, particularly in marketing efforts.	2) Improve fish preservation facilities and supply chains.
3) Threats of environmental degradation due to global climate change affecting fish production and food security.	3) Identify fishermen who can be effectively assisted.	3) Implement supervision over fuel price increases and encourage community involvement to address the issues.
4) Conflicts between large-scale and small-scale fishermen.	4) Provide facilities to improve fishing outcomes.	
5) Fish migration to different locations.		
6) Rising production costs.		
7) Competition in the global market demands high standards.		
8) Unpredictable weather patterns and seasons.		

The analysis results in the tables above indicate several alternative solutions for managing marine fisheries more efficiently in Jayapura City. These solutions aim to enhance fishermen's productivity and income levels in Skow Yambe Village, Enggros Tobati, Vietnam Village, and Dok IX Base.

A factor scoring analysis was employed to determine the optimal strategy, placing the total scores for internal and external factors within a strategic matrix. The calculations revealed that the total score for internal factors is 2.85, while the score for external factors is 2.78. Based on these results, the S-O (Strength-Opportunity) quadrant was identified as the most suitable strategy.

4.2. SO Strategy

The SO strategy focuses on leveraging strengths to capitalize on opportunities, aiming to enhance the livelihoods and welfare of fishermen in Jayapura City. One of the key strategies involves increasing production to boost fishermen's income, provided that market prices remain stable or even increase. Higher income levels will enable fishermen to meet their basic needs better, improving their families' welfare and fostering economic stability.

Additionally, sustainable fisheries management counseling with a blue economy approach is essential. Such counseling supports optimizing sustainable fishing practices while addressing critical post-harvest handling techniques. This form of training is particularly needed by fishermen in Jayapura City, as it enhances their ability to manage their businesses effectively and contributes to long-term resource sustainability.

Another important initiative involves engaging the private sector to invest in the fisheries industry. The private sector can significantly improve operational efficiency by providing

essential facilities such as boat moorings and reliable fuel supplies in areas where government services have been insufficient.

Furthermore, obtaining government support is vital for increasing the added value of marine fisheries. This can be achieved through targeted training programs that equip fishermen with skills to improve the quality and marketability of their catch. Proposals to the government should also emphasize increasing the frequency of training and extension services. Enhanced access to these services offers greater opportunities for fishermen to improve their fishing practices, ultimately leading to better livelihoods and achieving fisheries development goals in Jayapura City.

4.3. WO Strategy

The WO strategy aims to address existing weaknesses by leveraging available opportunities to improve the welfare and productivity of fishermen in Jayapura City. A key initiative involves inviting the private sector to support the development of essential fishing facilities. The private sector is crucial in optimizing opportunities for fishermen by providing access to resources and infrastructure that are otherwise limited.

Another important strategy is to propose government assistance programs tailored to the fishing community's needs. Whether long-term or short-term, these programs should focus on addressing the specific challenges fishermen face. By integrating fishermen's interests into government policies and initiatives, these programs can help gradually reduce their vulnerabilities and enhance their operational capacity.

Additionally, improving the welfare of fishing communities through bottom-up proposals is vital. This approach ensures that the programs and interventions align closely with the needs and aspirations of the fishermen. By prioritizing community-driven initiatives, the strategy fosters greater participation and ownership among the fishermen, ultimately contributing to their long-term economic and social well-being.

5. Conclusion

The analysis highlights the socio-economic characteristics of fishermen and their contributions to implementing the blue economy in the coastal areas of Jayapura City. Fishermen in this region display diverse socio-economic profiles, including variations in age, family size, fishing experience, and time spent at sea. Monthly incomes primarily range between IDR 2-3.9 million, with a smaller proportion earning IDR 4-5.9 million or exceeding IDR 6 million. These characteristics reflect fishermen's varying capacities and challenges in sustaining their livelihoods.

Fishermen in Skouw Yambe, Enggros Tobati, Kampung Vietnam, and Dok IX Base G have shown a commitment to sustainable fishing practices. They avoid destructive methods such as bombing or poisoning, which are known to harm coral reefs and marine ecosystems. This adherence to sustainable practices is further supported by the government, which enforces regulations and promotes the blue economy approach through education and law enforcement. Such efforts underscore the importance of sustainable resource management in preserving marine biodiversity while ensuring long-term economic benefits.

The SWOT analysis conducted in this study identified several strategies for developing the blue economy in Jayapura City. Key strategies include increasing production, providing training on sustainable fisheries management, involving the private sector in investment initiatives, securing government support, offering financial assistance, and diversifying fish

products. These strategies aim to address fishermen's socio-economic and environmental challenges while leveraging the region's strengths and opportunities.

Increased fish production, assuming stable market prices, is projected to enhance the incomes and livelihoods of fishermen. By addressing existing weaknesses and capitalizing on opportunities, the proposed strategies can significantly improve the economic welfare of fishing communities in Jayapura City and contribute to the overall development of the blue economy in the region.

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