Research Article

Effectiveness of Government Intervention in Regulating Tax and Incentives Towards Indonesia's Blue Economy Sustainability

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Abstract

Indonesia is now focusing on developing more inclusive and sustainable economic growth in the maritime sector. The potential of Indonesia's marine resources has become the focus of transformation in terms of implementing the blue economy framework. The tourism and maritime sectors are among the largest contributors to the Indonesian economy. However, the analysis and application of the blue economy to the socio-economy of coastal communities have still not received much attention. Previous research on this topic is still limited, particularly regarding the impact of related policies and regulations. Therefore, this paper aims to evaluate the effectiveness of government intervention in imposed tax and incentive provisions as leading factors for implementing a sustainable blue economy. This paper also aims to analyze further the potential and challenges in developing Indonesia's marine economy. This paper will use the methodology of secondary data analysis and case studies with the approach of public economics. The findings of this paper are recommendations for policy reform to support the blue economy transition in Indonesia, such as mobilizing incentives, developing better resource management systems, and strengthening institutional capacity.

Keywords: Environmental Tax; Indonesia Blue Economy; Institutional Capacity; Resources Management; Sustainable Incentives

Introduction

Indonesia is a country with two-thirds of its territory being oceans and is the largest archipelago in the world. Being an archipelagic state, Indonesia consisted of 17,508 large and small islands across its territory of approximately 1.92 million km² of land area, archipelagic waters, a 12-nautical mile territorial sea of area 3.1

million km², and a 200-nautical mile exclusive economic zone (EEZ) of area 2.7 million km² (Rochwulaningsih et al. 2019). With biodiversity and abundant resources within its vast marine territory, the maritime sector in Indonesia has become one of the major economic sectors and is overflowing with potential cultural and economic value. The potential of Indonesia's maritime industry has then started to become the focus of transformation to implement a more inclusive and sustainable blue economy framework. The marine and shore contribute a key resource to the tourism industry, providing all elements for tourism development and helping expand the diverse domain of nature-based tourism (Bari, 2017). According to the United Nations, the blue economy is an economy that determines whether the utilization of ocean resources is sustainable through economic sectors and related policies. Implementing the blue economy must guarantee social equity and environmental sustainability as core tenets of its attribution (Bennett et al., 2019).

Indonesia's blue economic development activity has gained more attention since Indonesia and the OECD formulated the Blue Economy Development Framework for Indonesia's Economic Transformation. Indonesia's arranged blue economy sectors cover fisheries, seafood processing, shipping and ports, shipbuilding and repair, shallow water offshore oil and gas, marine manufacturing and coastal tourism, marine business services, marine research, development, education, and dredging (BAPPENAS, 2021). To bring more sustainable blue economy practices into reality, the Indonesian government implements its regulations through laws and policies. The issues regarding Indonesia's marine condition vary from illegal, unreported, and unregulated fishing (IUUF) and exploitative fishing due to technological limitations to the lowest contributing sector to gross domestic product (GDP) and prevailing poverty among coastal communities, where fisheries are known to be the poorest sector in Indonesia. The investment rate of the marine and fisheries sector also remains low, even with a valuation of up to USD 9 billion generated annually from the industry.

The main purpose of this paper is to assess the least contributing sectors in Indonesia, fisheries, to maximize their potential with transformation in institutional arrangements and related policies to produce a more environmentally sustainable and equitable society and well-being. This article will later discuss the impact of implemented regulations on fisheries' production rate and coastal communities' poverty rate through Regulatory Impact Assessment (RIA). Furthermore, a cost-benefit analysis will be conducted to assess the effectiveness and necessity of technological transfer in coastal communities. In the last session, this article will also propose suitable regulations in addition to tax incentives and institutional systems to boost investment and create a win-win solution for companies while providing economic opportunities for local communities.

Literature Review

Conceptual Framework

Blue Economy Principle

The concept of Blue Economy, developed by Gunter Pauli in 2010, is founded on the principles of sustainability and local autonomy. In his book "Blue Economy-10 Years, 100 Innovations, 100 Million Jobs," Pauli outlines a departure from the previous red and green economies. The red economy, prioritizing resource exploitation without regard for the reciprocal relationship with nature, is considered the root cause of current global crises and environmental degradation. Conversely, the green economy, centered on producing environmentally friendly goods, necessitates significant investments from businesses and consumers, resulting in higher costs. However, implementing this concept can be challenging due to its associated expenses and exclusivity, particularly during crises.

Pauli (2010) argues that the blue economy concept surpasses the red and green economies in terms of advancement. The blue economy prioritizes environmental sustainability and seeks a comprehensive

transformation of the economic system. According to Pauli (2010), adopting the blue economy concept will generate new employment opportunities, enhance social and economic capital, and lead to sustainable community development. This concept underscores the responsible utilization of marine resources, the transition to clean and renewable energy sources, and the establishment of a fair and comprehensive alternative economy. The blue economy effectively harnesses natural resources within the natural ecosystem, employing regenerative strategies to ensure the preservation of resource abundance. Creating added value in the blue economy stems from the active engagement of interconnected natural resource cycles in a symbiotic manner. Ultimately, the blue economy aims to fortify local economic systems, improve community well-being, and mitigate adverse effects on the environment and natural resources.

Tragedy of the Commons

Garrett Hardin presents the concept of common resources, which are subject to limited supply despite their inherent communal nature. Consequently, common resources exhibit the combined attributes of public and private goods. Comparable to public goods, common resources are non-excludable, rendering them accessible to all individuals without the ability to exclude. Nevertheless, the consumption of common resources mirrors the competitive nature of private goods. In essence, once an individual appropriates a unit of the resource, it becomes inaccessible to other users. Considering the multitude of individuals who compete for resources, each consumption act diminishes the stock of available resources.

The characteristics of common resources, derived from both public and private goods, render them susceptible to overexploitation. This interplay of conflicting interests engenders incentives for users to disregard the social costs associated with resource management, preservation, and maintenance. Consequently, individuals or groups endeavor to maximize their gains from the common resource, even if its sustainability is improbable (Hardin, G., 2013).

The tragedy of the commons manifests when individuals or groups endeavor to exploit common resources to attain maximum benefits and do so at a pace exceeding others. Subsequently, no incentive is offered by any party to another to encourage the reuse or replenishment of communal assets, as it cannot be controlled whether someone else will utilize them (Hardin, G., 2013). Hence, the greater the utilization of common resources, the scarcer they become, ultimately leading to their complete depletion.

Empirically, the occurrence of the tragedy of the commons, as observed before the 1960s, is evident (Hardin, G., 2013). Initially, the Newfoundland coast experienced a substantial production of codfish, sustaining the fish population in the sea. It was made possible by the fishing techniques employed during that era, which allowed the natural reproductive cycle of codfish to persist. However, advancements in fishing technology prompted fishermen to engage in substantial cold fish capture without consideration for the natural reproductive cycle. In the absence of ownership rights and institutional regulations, this industry underwent a collapse in the 1990s.

At the national level, local governments possess the ability to manage common resources effectively through the implementation of clear limitations. On an international scale, the enforcement of regulations on common resources poses a challenge due to the presence of ambiguous boundaries. Institutional factors and technology play a critical role in the competition and exclusivity of a resource, particularly concerning the relevant laws and regulations. Government regulations on common resources may involve the management of consumption quantities or the investment in resource renewal and conservation (Hardin, G., 2013). For example, government regulations may impose quotas on the fish that can be caught to manage marine resources effectively.

Negative Externality

Fishery management is a multidimensional process that necessitates the multidisciplinary integration of biological and ecological elements of resources with socio-economic and institutional factors that influence the conduct of fishermen and policymakers (Guggisberg, S., 2016). The primary objective of fishery management is to attain sustainability, thereby ensuring that future generations can also avail themselves of these resources. To achieve optimal allocation of natural resources, it is imperative to establish property rights. These rights ascertain ownership, impose restrictions, and establish penalties for infringements. The rights are exclusive, making the rights holder accountable for all resource utilization. Furthermore, the rights are transferable, thereby facilitating utility maximization, and are subject to effective monitoring (Yutaro Sakai, 2017).

In fisheries, the underlying assumptions of the neoclassical market model are frequently contravened. Overexploitation is a prevalent issue in numerous vital fisheries sectors across the globe. Externalities, which are costs or benefits not financially incurred or received by producers, play a significant role. These externalities can assume a positive or negative form and arise from producing or consuming goods and services (Ryan et al., 2014). The costs and benefits can have a private nature or impact on society. Fishing externalities typically exhibit a negative character. In the context of fisheries, these externalities arise from fishermen freely exploiting a resource, and in the absence of agreements, resource users do not consider the external impact on others (Ryan et al., 2014).

An illustrative example of fisheries ecosystem externalities is the detrimental effect of habitat damage on fishery productivity. It can lead to changes in responses to exogenous shocks. such as alterations in input costs, fish prices, or technology. Resource managers must address negative ecosystem externalities by incentivizing levels of fishing activity that generate relatively lower negative externalities (Ryan et al., 2014).

Case Study from Madagascar: Sustainably Managing Small-Scale Fisheries in Partnership with Communities (UNEP, 2015)

Initially, the blue economy in southern Madagascar was established based on sustainable management practices for small-scale fishermen belonging to traditional communities. A collaboration between seafood exporters, the government, and marine conservation institutions was formed over a decade ago to create locally managed marine areas. The Vezo village took the initiative in 2004 to pioneer a regional-scale green economy by closing a portion of the octopus fishing grounds. This decision resulted in a significant increase in their catch upon reopening, leading to the adoption of this approach by several neighboring villages. The concept of temporary closures along the coastline has since been widely implemented, with traditional fishermen successfully implementing over 250 closures along approximately 450 km.

Octopus fishing holds great economic significance in the southern region of Madagascar, particularly for traditional fishermen in arid and remote areas, where it serves as their primary livelihood. Temporarily closing specific fishing areas has proven to be a practical solution for a short period, as the economic benefits outweigh the costs incurred from income loss during the closure. For eight years, this method has demonstrated economic advantages that surpass the income loss experienced during the closures. The establishment of locally scaled conservation areas, with the support of non-governmental conservation organizations, included the management of prohibitions on destructive fishing methods and permanently protecting key habitat areas through fishing or extraction bans.

This collaborative network now encompasses approximately 85 fisherman-based villages along the southwestern coastline of Madagascar, involving a significant number of individuals totaling 60,000. Community-based management has focused on obtaining sustainable fisheries certification from marine councils. The success of this program has motivated the government to implement national temporary fishery closures annually. Furthermore, efforts to expand the program include creating new livelihood opportunities

through cultivating seaweed and sea cucumbers. The expansion also entails extending protected marine habitat areas and reinforcing traditional fishermen's management rights.

Government policies are of the utmost importance, particularly in legalizing local traditional laws and securing support from the national judiciary. Establishing an institution by the government ensures formal fishing management rights for traditional fishermen. Other institutions provide technical and material support, facilitating village collaboration and knowledge transfer. These institutions also serve as intermediaries between the private sector and fishing communities. Additionally, seafood export companies (Copefrito and Murex) have supported the temporary closure program since its inception. They also offer higher prices for octopuses obtained through the program, contributing to establishing a sustainable value chain for marine management.

Previous Studies

The Role of Subsidies and Governance in Fisheries Sustainability

The growing attention to sustainable fisheries and the blue economy reflects increasing global concern over marine resource depletion, climate change, and governance failures. The Blue Economy framework, introduced by Pauli (2010), promotes a development model that aligns economic growth with ecological sustainability through the regenerative use of marine resources and inclusive local participation. Nevertheless, translating these principles into effective governance, particularly through fiscal instruments such as subsidies and taxation, remains a complex challenge, as outcomes vary significantly across policy environments.

A recurring issue in the literature is the persistence of negative externalities, especially within open-access fisheries. Sakai (2017) underscores that when property rights are unclear or unenforced, fisheries become highly susceptible to overexploitation, as users focus on short-term gains while disregarding long-term ecological and economic costs. His study, which analyzes 23 OECD countries between 1996 and 2011, finds that the impact of subsidies on fish stock sustainability depends heavily on the management regime. Cost-reducing subsidies under traditional input/output control systems are associated with stock depletion, whereas subsidies aimed at infrastructure and services tend to yield more positive results. Notably, in systems utilizing individual transferable quotas (ITQs), subsidies show no significant link to resource degradation, indicating the potential of property rights regimes to internalize externalities.

While Sakai's contribution provides valuable insights into the interaction between subsidy types and governance structures, it remains largely situated within the context of high-income countries and employs aggregate ecological indicators such as the Modified Fish Stock Overexploited or Collapsed (MFSOC) index. As such, there is limited exploration of how other fiscal tools such as taxation and targeted incentives might operate as instruments for behavioral change and sustainability, particularly within developing economies. This gap is especially relevant for countries like Indonesia, where diverse institutional settings and ecological pressures call for a more nuanced understanding of how fiscal policy can support effective marine resource management.

The Political Economy of Fisheries Subsidies and Their Distributional Consequences

Fisheries subsidies have emerged as a critical concern in global marine governance, largely due to their potential to distort fishing behavior and accelerate resource depletion. Schuhbauer et al. (2020) reveal that the distribution of subsidies is structurally skewed in favor of large-scale fisheries (LSF), which receive over 80% of total financial support mostly in the form of capacity-enhancing subsidies such as fuel, vessel construction, and infrastructure. These subsidies, while politically expedient, often incentivize overcapacity and

unsustainable practices. In contrast, small-scale fisheries (SSF), which employ the majority of the world's marine fishers, receive only 19% of global subsidies, yet the bulk of their support still falls within the same problematic subsidy category. This disparity not only undermines ecological sustainability but also raises concerns around equity and long-term economic viability.

While Schuhbauer et al. (2020) provide a robust analysis of subsidy distribution, their work leaves several critical areas unexplored. The study primarily focuses on global and regional dynamics, offering limited insight into how these imbalances manifest in national contexts, especially within emerging economies in Southeast Asia. Additionally, the emphasis on subsidy allocation patterns overlooks the potential role of alternative fiscal tools such as environmental taxes or performance-based incentives in promoting sustainable fishing behavior. Finally, the reliance on modeled and secondary data limits the assessment of real-time governance effectiveness and the tangible outcomes of policy interventions at the community level. These gaps underscore the need for further empirical research that examines how different fiscal instruments operate within specific institutional and socio-economic settings.

Structural Drivers of Overfishing and Governance Failures in Marine Resource Management

The global fisheries sector is under increasing ecological pressure, with many marine fish stocks facing severe depletion, collapse, or even extinction. Guggisberg (2016) provides a comprehensive assessment of this crisis, identifying overfishing, habitat degradation, climate variability, and governance failures as interconnected drivers of unsustainable resource exploitation. While marine capture fisheries once held potential as a renewable resource base, current industrial and commercial pressures have exceeded the regulatory capacities of both national and international governance systems.

A central argument in Guggisberg (2016) is the underestimated role of legal overfishing in stock depletion. Fisheries management regimes often permit total allowable catches (TACs) beyond scientific recommendations, thereby institutionalizing unsustainable practices. This highlights a critical misalignment between regulatory intent and ecological outcomes where legality does not equate to sustainability. However, her analysis places greater emphasis on legal and biological factors, with limited discussion on how economic and fiscal tools such as taxes or incentives could support more sustainable behavior within the sector.

Furthermore, Guggisberg's global and legal comparative lens provides little insight into how these governance issues unfold in specific developing country contexts. In Indonesia, for example, the fisheries sector is governed through overlapping institutional layers, national, regional, and community-based that often generate conflict or inefficiency. There is a pressing need for country-specific studies to assess how governance frameworks perform under actual political and ecological conditions. In addition, although aquaculture is presented as a partial solution to the crisis in capture fisheries, Guggisberg also warns of its environmental trade-offs. The current literature offers limited examination of how fiscal instruments might mitigate these externalities or incentivize more sustainable aquaculture practices, signaling a clear opportunity for further empirical inquiry.

Maritime Integration, Governance, and the Challenges of Implementing Blue Economy in Indonesia

The ambition for Indonesia to become a leading maritime nation has been a recurring theme in national policy discourse. However, as noted by Rochwulaningsih et al. (2019), the realization of this vision has been hampered by institutional, technological, and economic limitations. Although Indonesia is legally recognized as an archipelagic state with immense marine potential, it has struggled to convert this status into a cohesive maritime economic strategy. Despite initiatives such as the Tol Laut program and the Global Maritime Fulcrum declaration, development remains predominantly land-based, with insufficient integration of maritime priorities into national economic planning.

Rochwulaningsih et al. (2019) emphasize that the core issue lies in the absence of a comprehensive and integrated maritime policy. They argue that successful maritime development requires not only physical connectivity but also political and institutional coherence. The fragmented development of port infrastructure, inconsistent inter-island linkages, and weak fiscal coordination have contributed to persistent regional disparities and limited Indonesia's ability to absorb external shocks. This analysis provides an important conceptual foundation for evaluating the kinds of fiscal mechanisms needed to foster economic resilience and ecological sustainability in the marine sector.

Nevertheless, several critical gaps remain in the literature. While the study acknowledges the lack of legal and political support for implementing blue economy principles, it does not investigate the role of specific fiscal instruments such as taxation, subsidies, or targeted incentives in aligning economic behavior with sustainability objectives. Moreover, although the authors highlight the need for institutional reform, they stop short of assessing the effectiveness of government interventions through measurable outcomes, particularly in the fisheries sector. This opens space for further research that links fiscal policy design with practical resource governance at the national level.

Research Gap and Study Contribution

Building on previous theoretical and empirical insights, it becomes clear that the sustainability of marine resources is influenced not only by ecological and economic considerations but also by the presence of equitable incentive mechanisms, well-defined property rights, and robust institutional governance. Accordingly, a blue economy approach that integrates principles of sustainability and social justice requires closer examination, particularly through the lens of policy tools such as environmental taxation and targeted fiscal incentives. This conceptual grounding provides the rationale for this study's focus on evaluating the role of government intervention in advancing the sustainability of Indonesia's blue economy, specifically in tax and incentive policies .

A review of previous studies reveals that while there has been significant scholarly attention to issues such as sustainable fisheries management, fiscal policy, and institutional arrangements within the blue economy discourse, much of this literature is framed within international contexts or leans heavily toward ecological dimensions.Research that directly investigates how fiscal and tax-related interventions by national governments influence the development of a sustainable blue economy, especially in the Indonesian setting, remains limited. This study seeks to fill that gap by examining how fiscal and institutional policies can enhance both the resilience of the fisheries sector and the socio-economic well-being of coastal communities, thereby contributing to a more inclusive and enduring blue economy model in Indonesia.

Methods

The research method employed in this study is the integrative review method. This method was chosen for its suitability in addressing the research question, which seeks an in-depth understanding of how government intervention through incentives and taxes can enhance the implementation of a sustainable blue economy. The integrative review is particularly relevant as it allows for a comprehensive synthesis of findings from various sources, providing a cohesive understanding of the complex relationships between governmental policies and sustainable economic practices.

As Cronin and George (2023) describe, the integrative review method synthesizes diverse topics into a unified analysis, offering new perspectives and insights. In the context of this study, the integrative review facilitates the combination and comparison of findings from multiple sources, such as academic articles, government reports, and institutional frameworks. By summarizing these sources, the methodology enables the research

to present a broader view of how incentives and taxation policies can support the blue economy, bridging gaps in existing literature and revealing innovative solutions.

This approach allows the study to integrate findings from both theoretical and empirical research, presenting a comprehensive and balanced perspective on the role of government interventions in fostering sustainable economic practices. Through this method, the research contributes to the broader discourse on sustainable development and provides actionable insights for policymakers.

Result and Analysis

Regulatory Impact Assessment

Illegal fishing, in the context of public economics, is considered a form of theft because the act harms the state and society instead of a natural resource that can be enjoyed together (common resources). Non-exclusive resources can lead to a repeat of the Tragedy of the Commons in the form of declining fish stocks and environmental degradation.

The United Nations has recognized illegal, unreported, and unregulated fishing (IUUF) by foreign countries as one of the seven main threats to global maritime security. IUU fishing is defined by the Food and Agriculture Organization of the United Nations (FAO) as a fishery activity that involves three categories of lawlessness, namely, "1. Illegal fishing, which refers to fisheries activities conducted without a license by foreign vessels in the underwater waters of another country's jurisdiction, or in other ways that violate the laws and regulations of that fishery; 2. Unreported fishing refers to fishing that is not officially recorded; 3. Unregulated fishing refers to fisheries activities conducted in areas where no management measures are in place."

Other countries' theft of Indonesia's fish resources violates international fisheries law. Although, in theory, fish resources are considered a shared resource that all countries can access, IUU fishing actions, such as illegal, unreported, and unregulated fishing, are still considered violations based on violations of international law. Although, in theory, fish resources are considered a shared resource that all countries can access, IUU fishing still violates existing regulations and laws. In this context, Indonesia, with a *Zona Ekonomi Eksklusif* (ZEE) of approximately 7.9 million km², has vast marine waters. Despite having a high potential for commercial fish resources, weak maritime control supervision in the ZEE makes Indonesia one of the highest-levels of IUU fishing activities globally. Data from Indonesia's Ministry of Maritime Affairs and Fisheries in 2021 showed that 88 Indonesian fishing vessels violated regulations, while 47 illegal foreign fishing vessels were arrested. Countries such as Malaysia, the Philippines, and Vietnam are frequently involved in IUU fishing in Indonesian waters. The Ministry of Marine Affairs and Fisheries (KKP) reported the arrest of 100 fishing vessels involved in IUU fishing, with an economic loss of around IDR 30 trillion.

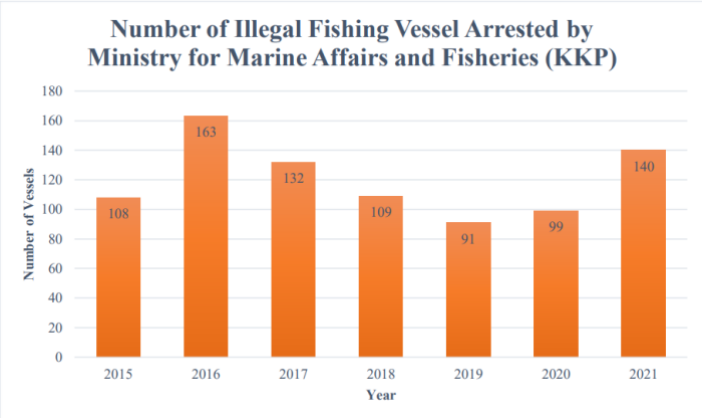

Figure 1. Number of Illegal Fishing Vessels Arrested by KKP from 2015 to 2021
Source: Iopscience, 2022

The graph above shows the trend of the number of illegal fishers arrested by KKP from 2015 to 2021, showing a peak point in 2016 with 163 ships, then continuing to decline with the lowest point in 2019, which amounted to 91 ships. The decline in the number of illegal ships is in line with the issuance of the KKP regulations for the 2014-2019 period regarding encouragement to engage in illegal ship sinking operations in Indonesian seas.

In the People's Representative Council of Indonesia (DPR RI) leadership meeting, the chairman of Commission IV DPR RI, Sudin, emphasized that we need to preserve the marine ecosystem by fishing with environmentally friendly technology. According to him, environmentally friendly fishing gear meets several criteria: high selectivity, safety for fishermen and consumers, and quality production. Meanwhile, according to the Food and Agriculture Organization (FAO) in the Code of Conduct for Responsible Fisheries (CCRF), the criteria for good fishing gear are having high selectivity, not damaging the habitat of fish, and not endangering fishermen.

The debate over fishing gear in Indonesia started during the era of President Soeharto. Presidential Decree No. 39/1980 on eliminating trawl nets applicable to the islands of Java and Sumatra was legalized after protests and requests from small fishermen to stop the operation of trawlers because it would harm them. Thirty-five years later, the polemic over fishing gear reappeared during President Jokowi's administration. "Do not continue to invite our fishermen to work with the old pattern; it is a shame that for years, we have been trapped in the debate over fishing gear in the form of trawls, while foreign countries are busy conducting research and innovation in the maritime sector." According to him, the way of thinking and acting of fishermen is still monotonous and linear, so they cannot keep up with the rapid changes in the world. Indonesia's maritime economic potential of USD 1.33 trillion becomes difficult to manage.

A cantrang or trawls is a fishing tool whose operation touches the bottom of the water. Using fishing gear such as *cantrang* causes a very wide sweep of the *tali selambar* (wrap rope) trajectory, which causes a stirring of the water bottom and causes damage to the underwater bottom ecosystem. Based on the research results in Tegal (Undip, 2008), trawls can only catch 46% of the target fish, while the other 54% are non-target, dominated by low fish (PPID, 2017).

In response, the government issued Minister of Marine Affairs Regulation No. 2/2015 on prohibiting trawls and seine nets. However, the response from the community was not as expected, as shown by the many waves of fishermen rallies that continued to occur so that the rules regarding restrictions on the use of *cantrang* fishing gear continued to be extended or relaxed until June 2017 through the Circular Letter of the Director General of Capture Fisheries No. B.743/DJPT/PI.220/VI/2017 concerning assistance in transitioning fishing gear for trawls and seine nets. The reason for the extension is that the replacement fishing gear promised by the government to fishermen has not been completed. Therefore, this further increased the trawl population from 5,781 in 2015 to 14,357 units in early 2017.

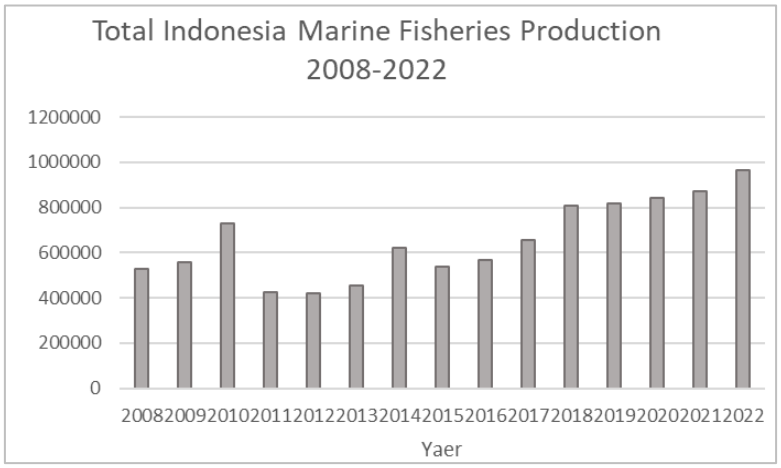

Figure 2. Total Indonesia Marine Fisheries Production 2008-2022
Source: KKP, 2023

Figure 2 shows that the production of marine fisheries has been increasing yearly and faced a significant spike from 2017 to 2022. The growth of capture fisheries creates many new jobs and better welfare for fishers. Banning fishing gear such as *cantrang* and providing replacement fishing gear directly increased the economic growth of Indonesia's marine sector. However, the Indonesian people still experience inequality in the progress of the fisheries production process compared to other countries. The policies provided by the government do not fully encourage blue economic development in the long term; there is still a need for other supporting policies, especially policies that have an impact on innovation in the production process of marine resources, such as improving institutions and improving the quality of human resources by increasing access to adequate health and education.

In addition to the previously discussed, it is imperative to carefully consider the limitations and potential improvements in regulating ship cargo capacity. The capacity limits of our fishing vessels in Indonesia differ significantly from those of other nations. Conversely, there are geographic disparities: over the past few decades, Asia's fishing fleet has experienced substantial growth, resulting in a decline in fish catch for the same level of effort, whereas fishing fleet sizes in North America and Western Europe have slightly decreased, accompanied by an increase in catch per unit effort (Rousseau et al., 2019). Rousseau (2019) posited that if countries do not reduce the number of vessels, the oceans may not be able to sustain more efficient vessels. Therefore, Indonesia's relatively stagnant decreasing trend could impact catch results and market prices. Furthermore, it raises concerns about the potential displacement of local fishermen by foreign counterparts.

Hence, addressing any loopholes or deficiencies in the regulations governing cargo capacity is crucial. One possible solution could involve the implementation of stricter regulations or the introduction of incentives to encourage compliance. It could include revising penalties for violations or introducing alternative regulations to ensure vessels adhere to established load limits. Additionally, it is important to incorporate information regarding the trend of vessels into the analysis. Ideally obtained through registries, data on vessels is paramount to the regulatory body. It allows for assessing fleet size, facilitates fisheries management, and serves as a crucial initial step in recognizing and formalizing activities and participants in small-scale fisheries.

On the other hand, the fluctuations in the number of illegal fishing activities are correlated with regulatory changes between 2014 and 2019. Despite increased marine fisheries production since 2017, the persistence of illegal activities suggests that relying solely on licensing is inadequate. Strengthening law enforcement and exploring alternative models could provide a more effective deterrent against illegal fishing. Given the limitations of the current licensing system, it is crucial to explore alternative approaches that may offer more effective solutions.

While the government endeavors to provide technology to fishermen, it is vital to evaluate the effectiveness of this approach. Instances of incomplete technology adoption or misuse among coastal communities highlight the need for a more nuanced strategy. Addressing the gap in knowledge transfer is essential for the sustainable adoption of new technologies. Policies should be culturally sensitive and economically viable to ensure acceptance and long-term sustainability. Integrating local wisdom into implementing regulations and technology transfer programs can enhance their acceptance and effectiveness.

Subsequently, the absence of proper education, training, and continuous support when implementing technology can lead to substantial gaps in knowledge within the targeted communities. It coincides with the analysis conducted by the Food and Agriculture Organization (FAO) on the techno-economic performance of the primary global marine sector. Advances in fishing technologies persist, primarily focused on minimizing fuel expenses and conserving energy, which is crucial in advancing semi-industrial fishing operations, vessels, and equipment. Furthermore, notable progress has been made in improving fishing efficiency, mitigating the environmental impact of fishing activities, refining handling techniques, enhancing product quality, and ensuring safety at sea and the working conditions of fishermen aboard vessels. These advancements, in conjunction with an overall increase in aquatic product prices, effective fisheries management in specific

regions, and improved fleet capacity management in Europe and North America, collectively contribute to the favorable financial and economic performance of the primary global fishing industry (Anrooy et al., 2021). To ensure these technologies succeed in Indonesia, the government must prioritize facilitating effective knowledge transfer, ensuring long-term success and sustainability of technological interventions.

Cost-Benefit Analysis on Sustainable Technology

A comprehensive strategy must be implemented to enhance the adoption of sustainable fishing technologies in Indonesia. This strategy aims to address the immediate needs while simultaneously promoting long-term environmental and economic sustainability, thus contributing to the overall well-being of coastal communities. The starting point is to understand the requirements of coastal fishermen, including small and medium enterprises (SMEs). In the short term, interventions should primarily focus on modifying the behavior of fishermen by providing them with assurances that using these technologies will result in higher income, such as capturing larger fish and refraining from selling undersized and low-value fish.

To determine the economic feasibility of adopting these technologies, a rigorous cost-benefit analysis can be conducted. This analysis would involve comparing government data on the prices of both hazardous and sustainable fishing gear to ascertain whether the long-term costs associated with adopting sustainable equipment can be justified. It is worth noting that the affordability of sustainable alternatives, particularly in comparison to other options such as the ring net, significantly encourages their widespread utilization. The ongoing debate regarding the ban on trawls and seine nets since 2017 underscores the importance of embracing environmentally friendly technology. The WWF-Indonesia study's findings indicate that 18-40% of trawls and seine nets catches possess economic value and are fit for consumption, while a substantial 60-82% constitutes bycatch.

The Indonesian Traditional Fishermen's Union (KNTI) maintains that the trawls debate persists due to the incomplete process of transitioning fishermen from trawls to alternative fishing gear. Policies on this shift in fishing gear should not hinder the fishermen's right to pursue their livelihoods. It is essential to recognize that transitioning from trawls to alternative fishing gear is time-consuming, as it necessitates changes in the methods and practices fishermen use in their pursuit of fish. Consequently, providing training and guidance by the government and other stakeholders becomes imperative to enable fishermen to effectively utilize fishing gear that aligns with the government's objectives.

Introducing new technologies gives rise to concerns regarding potential gaps in knowledge dissemination within the fishing communities, thereby delaying the adoption of these technologies. As one potentially effective solution, implementing a new subsidy strategy is warranted, particularly to enhance the welfare of local communities in Indonesia. Current estimates from Schuhbaeur et al. (2020) reveal that out of the total global fisheries subsidies amounting to USD 35.4 billion in 2018, approximately 19% were allocated to the small-scale fishing sub-sector (SSF), which encompasses artisanal and subsistence fisheries. In contrast, over 80% of the subsidies were directed towards the large-scale (industrial) fishing sub-sector (LSF). Therefore, it is imperative to devise a new subsidy strategy to offset any potential cost increase associated with sustainable technology, thereby ensuring its affordability, particularly for small-scale fishermen.

Subsidies directed towards variable expenditures decrease operational costs, while subsidies allocated to capital expenditures alleviate the financial burden associated with the procurement and enhancement of sustainable fishery technology. In addition, subsidies aimed at augmenting fishers' incomes, in the form of price support, will augment revenues. These subsidies' collective impact is poised to enhance profits, fostering an increased commitment to the fishery through heightened efforts from existing fishers or the entry of new participants into the fishery. Furthermore, a necessity exists to enhance transparency in reporting fisheries subsidies. It is crucial to comprehend the distribution of these funds and their impact on each sub-sector. Moreover, the subsidies should be tailored to address the following needs: further empirical evaluation of the effects of subsidies, identification of subsidies that have a particularly detrimental effect on deep-sea fisheries, improved management of deep-sea resources, and effective enforcement of management

measures. Thus, using sustainable technology and applying principles from the blue economy will ensure the long-term preservation of fish stocks in the sea.

Additionally, regulators can implement the maximization of society's utility through initiatives that involve remuneration for work, including income guarantees during periods of transition or crisis. The government can establish a minimum income guarantee, considering various factors such as the needs of workers and their families, prevailing wage levels, the standard cost of living based on the region, social security benefits, the comparative living standards among different social groups, and economic indicators such as productivity levels. It extends beyond simple cash transfer programs to encompass comprehensive measures for social protection. The government can adopt labor inspection as an effective mechanism to reduce informal employment and enhance worker protection (Gallo & Thinyane, 2021). This approach will assist informal employees and businesses in improving their conditions, productivity, and compliance with relevant labor laws and standards. Inspectorates can achieve operational improvements through investments in digital technology to enhance efficiency and strategic prioritization.

Looking ahead, implementing subsidies for sustainable fishery technology should also be accompanied by regulating fish catch quotas. Catch quotas must be allocated equitably and proportionally among industries, local fishermen, and non-commercial activities. In the absence of transparency and close monitoring, there is a concern that it may result in the privatization of fisheries with an unequal distribution of quotas between large and small fishing industries. When quota regulations are fairly and accurately enforced, these subsidies for fishery technology will not impact total catches and fish prices. It aligns with the findings of Sakai (2017), who indicated that when a country enforces fair fish quota policies, subsidies have a minimal effect on fish stock.

Regulators can combine the Maximum Sustainable Yield (MSY) and Maximum Economic Yield (MEY) schemes as the primary instruments for the management of capture fisheries (Anna, 2019). The MSY scheme signifies the level of fish capture that can be sustained without depleting long-term fish stocks. On the other hand, the MEY scheme represents the level of fish capture that generates the highest income for fishermen. Additionally, subsidies can be directed towards supporting the modernization of subsistence and artisanal fisheries, providing funds for research and development to enhance understanding and innovation in the sustainability of marine resources.

Moreover, this indicates that government budgets allocated for sustainable technology subsidies contribute to the well-being of the local community as they are manifested in the development of well-managed institutions. This concept can be derived from the case study in Madagascar, where government policies legalized local traditional laws and gained support from the national judiciary. Consequently, the government should establish an institution to formalize fishing management rights for traditional fishermen, providing technical and material support, facilitating collaboration between villages, and promoting knowledge transfer. In this way, the valuation of maritime resources can also align with investments in the maritime sector.

The strategy to empower fishermen during the transformative period can be implemented and enhanced through the Smart Fisheries Village Program. As described by the fisheries ministry, this concept emphasizes the optimization of local and high-value fishery commodities throughout the entire supply chain, from upstream to downstream. Concurrently, there is a strategic expansion into other potentially marine-based sectors, particularly tourism. According to the ministry's head of fisheries research and development, the program envisions designated areas for tourism and micro-small-medium enterprises (SMEs) to cultivate sustainable fisheries villages that significantly contribute to the local economy.

When analyzing the prospects for optimizing Indonesia's marine resources, a crucial consideration lies in elevating the fisheries processing industry. This sector holds the highest value primarily due to demand in international export markets. Implementing the smart fisheries village program aligns with the broader objectives of advancing the fisheries sector in terms of sustainability and economic development. By strategically targeting high-value commodities and diversifying into related sectors such as tourism and SMEs, the program aims to create a modern fisheries ecosystem. The emphasis on the fisheries processing industry

also highlights the government's recognition of its pivotal role in capitalizing on international market opportunities.

The essence of the matter lies in the government or regulators addressing the needs and well-being of fishermen as a top priority. If these aspects can be accommodated, education and training programs can be introduced to enhance awareness and bridge the gap between short-term needs and long-term sustainability. Therefore, the Smart Fisheries Village Program concept envisions that the fisheries industry not only flourishes economically but also plays a critical role in advancing the overall well-being of local communities.

Incentives, Protection, and Investment Rate

Investment and trading activities are major elements in keeping the balance of the marine economy, which becomes inseparable from achieving an environmentally friendly process of sustainability of the fisheries and marine sector (Sulistijowati et al., 2023). Investment is becoming one of the crucial factors to support and improve the development of the marine industry. According to the Ministry of Marine Affairs and Fisheries data, Indonesia's estimated fish stocks are valued at 12 million metric tons, and 53% of the country's 11 fisheries management zones are currently 'fully exploited.' The average production of wild capture fisheries from the past five years has a valuation of up to 140 trillion rupiah annually (Gokkon, 2023). With a potential valuation of 140 trillion rupiah, the domestic and foreign investment in the fisheries sector serves a comparatively low number. According to data from the Indonesia Investment Coordinating Board, in 2022, domestic investment for the fisheries sector was only valued at 140.1 billion rupiahs, along with foreign investment valued at USD 1.2 million, taking the last position for investment across all sectors in Indonesia (Grahadyarini, 2022).

To stimulate investment in the marine and fisheries sector, the Indonesian government offers tax incentives under the Minister of Maritime Affairs and Fisheries Regulation No. 35/2022. These regulations are specifically arranged for criteria and requirements for providing income tax facilities for capital investment in certain business fields and/or certain business fields and regions, particularly in the marine and fisheries sectors. According to the regulation, to obtain the incentives, investors are required to fulfill some criteria, such as (a) having a high investment value or for export, (b) having large employment absorption, and (c) having high local content. In addition, the tax incentives come in a few forms as regulated in Government Regulation No. 78/2019, which are a deduction in net income of 30% of the total investment value, accelerated depreciation of tangible fixed assets, and accelerated amortization of intangible assets; imposition of income tax on dividends paid to overseas taxpayers other than permanent establishments in Indonesia is 10% or a lower rate under a double taxation avoidance agreement applicable; and compensation for losses longer than five years but not more than ten years with other derivative provisions.

Despite the potential value of marine and fisheries and the tax incentives imposed by the Indonesian government, the investment valuation remains very low. Thus, there might be a possibility that other reasons exist due to the low investment rate. After reevaluating the applied regulations on investment, a few criteria need to be fulfilled to claim the incentives, as explained previously. However, looking at the actual conditions in Indonesia, some of it might be hard to accomplish. One is the absorption of local Indonesian workers with a minimum involvement of 50 to 90 percent. Considering that marine and fisheries have a high poverty rate and are the least contributing sectors in Indonesia, the quality of human resources from the coastal communities might be questionable under their educational background. Therefore, human resources transformation and quality improvement, starting from basic education, are needed to build trust and engrave higher investment interest in the marine and fisheries sector.

Additionally, efforts to reduce poverty within coastal communities must go hand in hand with educational reforms to create a more skilled workforce. Institutional reforms are needed to build a more profitable and transparent managerial system, which would empower local enterprises and fishermen. One potential

solution is the establishment of a comprehensive "one-roof" investment flow system, which would streamline processes and provide a more effective mechanism for attracting investment into the sector.

Conclusion

Indonesia's vast maritime resources offer immense potential for economic growth, especially through the adoption of a sustainable blue economy framework. Transforming the maritime sector is crucial to achieving inclusive, eco-friendly, and sustainable development. However, this potential is constrained by several challenges, including illegal, unreported, and unregulated (IUUF) fishing, technological limitations, and investment gaps. This research explores the underperforming fisheries sector, aiming to unlock its potential through institutional reforms and policy innovations that prioritize environmental sustainability and social equity.

The analysis suggests key policy actions to address these challenges. Firstly, a stricter regulatory framework and enhanced enforcement mechanisms are essential to combat IUUF, particularly by addressing legal loopholes and considering alternative governance models. The ban on environmentally harmful fishing gear, such as trawls, has proven effective in supporting marine ecosystems and economic growth, but further support is necessary to facilitate the transition for affected fishermen. Attracting investment to the fisheries sector requires a holistic approach, incorporating tax incentives, social insurance, and risk mitigation strategies to enhance investor confidence. Additionally, improving the quality of labor and streamlining investment processes is critical to creating an environment conducive to both local and foreign investments.

The adoption of sustainable fishing technologies is pivotal for long-term success. A thorough cost-benefit analysis is essential to determine the economic feasibility of sustainable alternatives, with particular attention to their affordability for small-scale fishermen. Targeted subsidies, aimed at reducing variable and capital costs and providing income support, can facilitate the transition to sustainable practices without negatively impacting fish stocks or market prices.

A combination of the "Maximum Sustainable Yield" (MSY) and "Maximum Economic Yield" (MEY) systems has been put forth as a means of effective fisheries management. Moreover, governments should establish institutions that formally acknowledge fisheries management rights, foster cooperation, and facilitate knowledge transfer. Smart fishing village programs can implement and strengthen strategies to empower fishermen undergoing transition. This concept has proven to be a promising strategy for empowering fishermen, optimizing local raw materials, and diversifying into related sectors such as tourism. The program aligns with broader goals of sustainability and economic expansion and underscores the pivotal role played by the seafood processing industry in capitalizing on international market opportunities.

In conclusion, realizing the full potential of Indonesia's maritime sector requires a multidimensional strategy. This includes strengthening regulations, implementing targeted subsidies, facilitating investment, and empowering local communities. By adopting this integrated approach, Indonesia can pave the way for a prosperous and sustainable blue economy that benefits both the environment and society.

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