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FISHERIES MANAGEMENT STRATEGIES BASED ON MEASURED FISHING IN SUSTAINABLE FISHERIES RESOURCES DEVELOPMENT IN INDONESIA

Strategi Pengelolaan Perikanan Berbasis Penangkapan Ikan Terukur dalam Pembangunan Sumber Daya Perikanan Berkelanjutan di Indonesia

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ABSTRACT

The exploitation of fish resources exceeds regenerative capacity, with fish stock degradation due to overfishing and IUU fishing. Small-scale fishers face limitations in technology, infrastructure, and capital, which encourage unsustainable fishing practices. This study aims to analyze the Fisheries Management Strategy Based on Scalable Fishing in Sustainable Fisheries Resource Development in Indonesia. The method used is a descriptive Kualitatif Systematic Literature Review (SLR). The results show novelty. This research introduces several innovative elements that distinguish the PIT policy from previous fishery management approaches in Indonesia. First, the shift from input control (limiting vessel permits) to quota-based output control provides a more effective solution for preventing overfishing and the "race-to-fish" phenomenon. Secondly, the post-production revenue model, where levies are collected after the catch, alleviates financial burdens on small-scale fishers, promoting fairness in the industry. Another novel aspect is the integration of digital technologies, such as the Catch Documentation Scheme (CDS) and digital marketing platforms, enhancing transparency and market access. Additionally, the PIT policy's alignment with the Blue Economy emphasizes ecosystem conservation while ensuring economic sustainability principles. Lastly, adaptive management based on ecological zoning and stock recovery efforts ensures a balanced approach between exploitation and conservation, a strategic advancement in Indonesia's fishery management.

Keywords: Management Strategy, Measured Fishing, Sustainable Fisheries Resource Development

ABSTRAK

Pemanfaatan sumber daya ikan melebihi kapasitas regeneratif, dengan degradasi stok ikan akibat *overfishing* dan *IUU Fishing*. Nelayan kecil menghadapi keterbatasan teknologi, infrastruktur, dan modal, yang mendorong praktik penangkapan yang tidak berkelanjutan. Penelitian ini bertujuan untuk menganalisa Strategi Pengelolaan Perikanan Berbasis

Penangkapan Ikan Terukur Dalam Pembangunan Sumber Daya Perikanan Berkelanjutan Di Indonesia. Metode yang digunakan adalah deskriptif kualitatif *Systematic Literature Review* (SLR). Hasil penelitian menunjukkan *novelty* Penelitian ini memperkenalkan beberapa elemen inovatif yang membedakan kebijakan PIT dengan pendekatan pengelolaan perikanan sebelumnya di Indonesia. Pertama, pergeseran dari kontrol input (membatasi izin kapal) ke kontrol output berbasis kuota memberikan solusi yang lebih efektif untuk mencegah penangkapan ikan berlebihan dan fenomena "*race-to-fish*". Kedua, model pendapatan pasca produksi, di mana retribusi dikumpulkan setelah tangkapan, meringankan beban keuangan nelayan skala kecil, mempromosikan keadilan dalam industri. Aspek baru lainnya adalah integrasi teknologi digital, seperti Skema Dokumentasi Tangkapan (CDS) dan *platform* pemasaran digital, meningkatkan transparansi dan akses pasar. Selain itu, keselarasan kebijakan PIT dengan prinsip-prinsip Ekonomi Biru menekankan konservasi ekosistem sekaligus memastikan keberlanjutan ekonomi. Terakhir, pengelolaan adaptif berdasarkan zonasi ekologis dan upaya pemulihan stok memastikan pendekatan yang seimbang antara eksploitasi dan konservasi, kemajuan strategis dalam pengelolaan perikanan Indonesia.

Kata Kunci: Strategi Pengelolaan, Penangkapan Ikan Terukur, Pembangunan Sumber Daya Perikanan Berkelanjutan

INTRODUCTION

Indonesia, as the world's largest archipelagic nation, possesses abundant marine resource potential, with a total marine area of 5.9 million km². This potential includes an Exclusive Economic Zone (EEZ) of 2.7 million km² and a territorial sea area of 3.2 million km², as stipulated in the 1982 United Nations Convention on the Law of the Sea (UNCLOS). Unfortunately, the utilization of the marine sector, particularly fisheries, remains under-utilized despite its significant contribution to the economy. In the second semester of 2021, the fisheries sector contributed IDR 67.7 trillion, or 2.44%, to the total Gross Domestic Product (GDP). Furthermore, the sector's export value reached a six-year high of USD 5.2 billion in 2020 (Zaini *et al.,* 2023).

However, Indonesia still faces significant challenges, including Illegal, Unreported, and Unregulated (IUU) Fishing, overexploitation (overfishing), degradation of fish resources, and suboptimal fisheries infrastructure and facilities. Even with the establishment of Task Force 115 through Presidential Regulation No. 115 of 2015, which aims to eradicate IUU Fishing, the results achieved have been inadequate. As a result, damage to marine ecosystems and biodiversity, and low state revenue from the fisheries sector remain serious problems.

To address these challenges, the Indonesian government, through the Ministry of Maritime Affairs and Fisheries (KKP), has initiated the Measured Fishing Policy. This policy is a fisheries management approach based on zoning and catch quotas. The goal is to maintain the sustainability of fish resources, improve the welfare of fishermen, and support national economic growth. Based on Ministerial Decree No. 50/KEPMEN-KP/2017, the potential utilization of fish resources in Indonesia is estimated at 12.54 million tons per year.

Although the measured fishing policy is considered aligned with the principles of sustainability, its implementation on the ground faces significant challenges. Small-scale fishing groups that often operate more than 12 nautical miles from the coastline have expressed objections, fearing that catch quota restrictions will reduce their income. Farra's (2023) research found that small-scale fishers in Labuan were not yet prepared for this policy. Meanwhile, Econusa's (2023) study showed that communities in the Aru Islands had very little knowledge of the measured fishing plan (Ramdhani *et al.,* 2022).

Other criticisms have arisen regarding this regulation, which is considered to lack a mature legal framework. For example, explicit provisions regarding measured fishing are not

included in the Job Creation Law or Government Regulation Number 27 of 2021. Constitutional Court Decision Number 91/PUU-XVII/2020 also stated that the creation of the Job Creation Law contradicts the 1945 Constitution, thus deeming this regulation not fully ready for implementation.

The measured fishing system aims to regulate catch quotas based on zoning, involving traditional fishermen, industry, and tourism activities. This system is designed to maintain fairness between various parties and protect the environment. However, to achieve this goal, extensive outreach and the involvement of fishermen in the policy formulation process are necessary (Gerungan *et al.,* 2024).

As an archipelagic nation, Indonesia has a significant opportunity to optimize its maritime sector. With a vast ocean area dominating its territory, a maritime policy that balances ecology and economics can support the achievement of the Global Maritime Axis vision, as envisioned in Presidential Regulation Number 16 of 2017 concerning Indonesian Maritime Policy. In the long term, the success of this policy depends not only on strong regulations but also on public support, especially for fishermen. By combining scientific approaches, such as utilizing satellite data to determine potential fishing areas, with an inclusive economic strategy, Indonesia's fisheries sector can become a driving force for economic growth while preserving marine resources.

The Measured Fishing Policy is a strategic step to address the challenges of sustainable fisheries management in Indonesia. Das sein, current conditions indicate that the level of utilization of fish resources tends to exceed regenerative capacity, especially in waters already experiencing overfishing. Data shows the degradation of fish stocks due to uncontrolled fishing activities, such as Illegal, Unreported, and Unregulated (IUU) Fishing, as well as exploitation carried out without regard for ecosystem sustainability. On the other hand, small-scale fishers face limited technology, infrastructure, and capital to support environmentally friendly fishing practices, often driven by economic needs without regard for ecological impacts (Rossarie *et al.,* 2023).

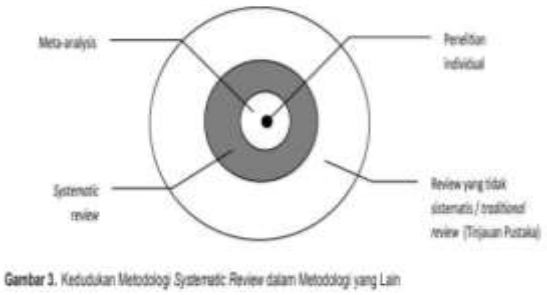
As an ideal solution (das sollen), the Measured Fishing policy aims to strike a balance between economic interests and environmental conservation. By implementing a clear zoning system and measurable fishing quotas, the government can limit pressure on fish populations in areas vulnerable to damage. Furthermore, the application of technology such as satellite-based monitoring to determine potential fishing zones is a relevant step to ensure fishing complies with sustainable principles. This policy also pays special attention to small-scale fishers, by providing training, access to capital, and infrastructure development to support them in transitioning to more efficient and responsible fishing practices.

However, the implementation of this policy requires strong regulatory support and consistent oversight. The desired outcome is the establishment of a legal system that provides regulatory certainty for all stakeholders, including small-scale fishers, fishing companies, and local governments. This includes extensive outreach to raise public awareness and acceptance of this policy, particularly among fishers. With integrated data-driven management and collaboration between various parties, Indonesia's vision as the Global Maritime Axis can be achieved, making the fisheries sector an economic force that maintains the sustainability of its natural resources.

RESEARCH METHODS

This study uses the Systematic Literature Review (SLR) method to identify, evaluate, and integrate previous studies relevant to fisheries management strategies based on measured fishing in the development of sustainable fisheries resources in Indonesia. The SLR method is carried out through several systematic stages: formulating research questions, developing a review protocol, searching for literature, selecting relevant studies, extracting data, and

synthesizing data. This method aims to gain a comprehensive understanding of key issues related to fisheries sustainability in Indonesia and how measured fishing can support fisheries resource conservation.



Gambar 3. Kedudukan Metodologi Systematic Review dalam Metodologi yang Lain

Figure 1 SLR Systematic
Journal Source: (Siswanto, 2010)

A systematic literature review is a research method for identifying, evaluating, and integrating all previous research relevant to the discussion of this research. This systematic literature review is used to answer research questions through the analysis of research results collected from Google Scholar, Mendeley, Publish, or Perish indexed nationally and internationally. Data analysis is carried out systematically to collect data. There are steps in determining a qualitative literature review systematically, broken down, and comprehensive with the following steps taken: formulating research questions, conducting literature searches, selecting articles, conducting qualitative analysis of findings, implementing quality control, and compiling a final report. Literature reviews will be very useful for synthesizing highly relevant previous research, so that the facts presented to policymakers are more comprehensive and balanced. (Siswanto, 2010).

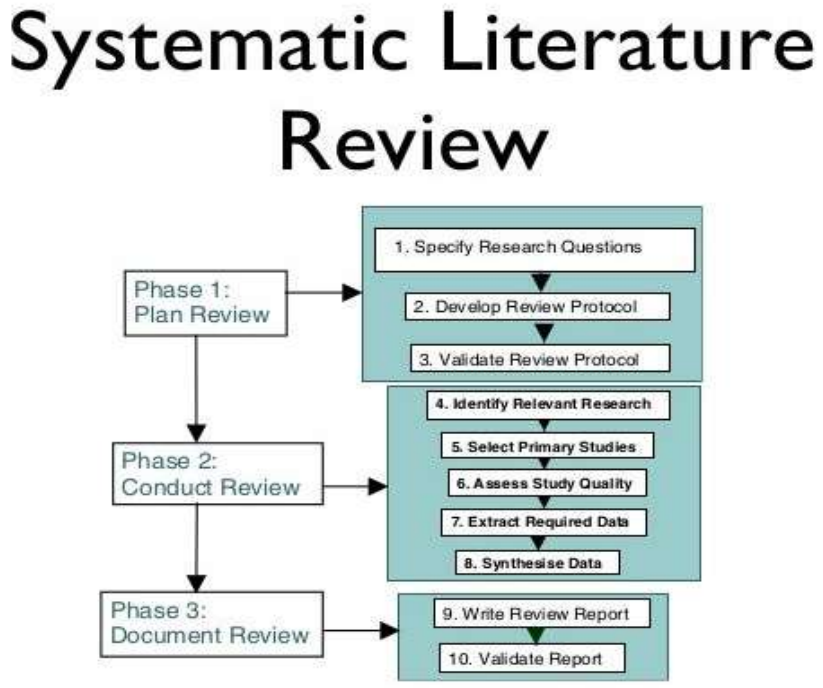


Fig. 1. Systematic literature review process.

Figure 1 SLR Process
Journal Source: (Siswanto, 2010)

Data Collection Stages in SLR

This research was designed to address strategic issues related to measured fishing policies, focusing on two main questions: How can measured fishing strategies support sustainable fisheries development in Indonesia? and What are the challenges and opportunities in implementing measured fishing policies in Indonesia? To ensure the research is focused and consistent, a research protocol was developed to establish literature inclusion and exclusion criteria and a data search strategy. Inclusion criteria included studies addressing fisheries sustainability, fishing policies, and their social, economic, and environmental impacts.

The first step in data collection was a systematic literature search through reputable sources such as Google Scholar, Mendeley, and Publish or Perish. Keywords used in the search included "measured fishing," "sustainable fisheries resources," and "fisheries management in Indonesia." Journal articles indexed nationally and internationally were prioritized to ensure the quality and validity of the collected data.

After the literature was collected, selection and screening were conducted based on relevance to the research questions and the quality of the methodology used. The primary focus was on studies presenting empirical data and in-depth analysis of sustainable fisheries policies. From the selected articles, data was extracted to obtain information on the methodology, research results, and relevant conclusions. The data collected covered how measured fishing policies are implemented, the challenges faced, and their impacts on ecological, social, and economic aspects.

The final stage involved data analysis and synthesis to identify key themes related to measured fishing-based fisheries management. This data was then summarized to develop strategic recommendations that support sustainable fisheries management in Indonesia. The resulting recommendations aim to provide balanced, evidence-based input to policymakers, ensuring that implemented policies deliver ecological, social, and economic benefits. The journal search process to select the final journals involved the following steps:

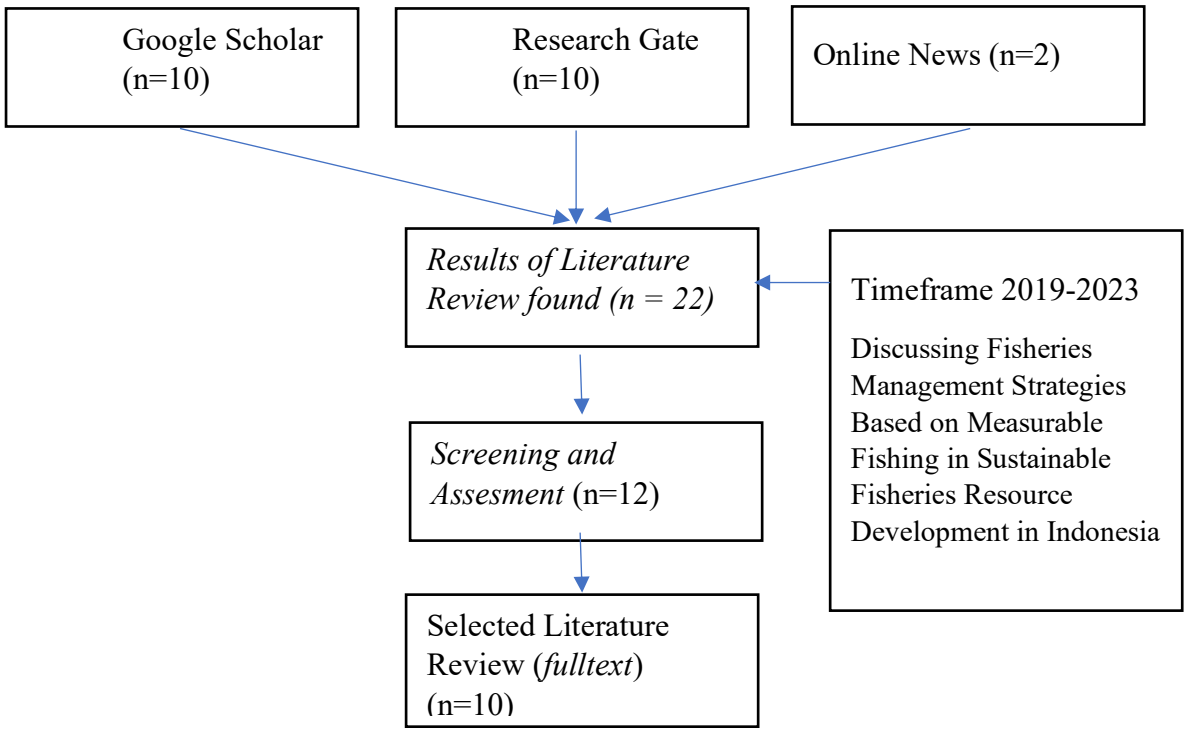


Figure 3 Steps of Literature Review
Source: Data Processed by Researchers, 2024

Based on journal searches conducted in Google Scholar, ResearchGate, and online news sources using the keywords "measured fishing," "fisheries management," "sustainable fishing," and "Indonesia," the researchers identified 22 relevant literature published between 2019 and 2023. Google Scholar contributed 10 articles, while ResearchGate added another 10 articles, and 2 relevant reports were collected from online news sources. These 22 sources were then further screened and assessed, narrowing the selection to 12 studies based on specific criteria. The primary focus was on literature discussing fisheries management strategies through measured fishing techniques, with an emphasis on sustainable fisheries resource development in Indonesia. After a detailed evaluation, 10 studies were finally selected for the literature review, all of which were available in full text and deemed highly relevant for an in-depth analysis of the topic.

RESULT

Based on the analysis and searches of journals and online news, the researchers conducted a mapping to facilitate the literature review process, which is presented in the following table:

Table 1: Selected Online Journals and News

No	Researcher Name	Heading	Method	Result
1	(Rossarie *et al.,* 2024)	Suitability of Fishing Vessel Locations with Potential Fishing Areas in Raja Ampat Regency Waters Based on Satellite Imagery Data	Qualitative	Fishing zone analysis using sea surface temperature and chlorophyll-a distribution data from Aqua MODIS imagery, as well as VIIRS Boat Detection data, found an average chlorophyll concentration of 0.63 mg/m³ and a night temperature of 28.83°C. Throughout 2021, 859 vessels were detected operating in North Misool, Southeast Misool, the waters around Sorong City, and west of Waigeo. No spatial violations were identified, with vessels avoiding the Core Zone of the Conservation Area. This research highlights appropriate fisheries management based on scientific data, supporting the sustainability of marine resources and optimizing fishing activities.
2	(Halu Oleo *et al.,* 2024)	Fishermen's perceptions of fishing are measured from social, economic and environmental aspects.	Qualitative	Research shows that most fishers have a positive view of this policy, recognizing its benefits in preserving fish resources and reducing the risk of conflict among fishers. However, there are concerns regarding the immediate economic impacts, as well as the need for more effective outreach and mentoring. Furthermore, fishers understand the importance of protecting marine ecosystems and support the use of more environmentally friendly fishing gear.

3	(Pratiwi *et al.,* 2022)	Legal Policy for Determining Fisheries Management Areas and Measured Fishing in Sustainable Fisheries Resource Development	Qualitative	The Draft Government Regulation on Measured Fishing is considered to be in line with the principles of sustainability and economic democracy as stipulated in Article 33 paragraph (4) of the 1945 Constitution of the Republic of Indonesia. However, in the context of ecological sustainability, a review of the duration of fisheries resource management contracts is needed, especially in the Fisheries Management Area of the Republic of Indonesia (WPPNRI) which is experiencing overfishing.
4	(Purnomo *et al.,* 2023)	Assistance in the Implementation of Measured Fisheries Policies, Fish Feed Production, and Utilization of Digital Marketing	Qualitative	Bycatch waste, such as shellfish, has not been optimally utilized, while marketing of the catch still relies on middlemen. Universitas 17 Agustus 1945 Cirebon offers solutions in the form of socialization of the Measured Fishing Policy, fish feed production training, and digital marketing through WhatsApp Business, supported by lectures, practice, and evaluation methods.
5	(Mardhiyah Ramdhani *et al.,* 2022)	Strategy for Developing a Catch Quota Monitoring System in Indonesian Fisheries	Qualitative	The Catch Documentation Scheme (CDS) was developed by the CCSBT to monitor tuna fisheries quotas through recording, reporting, and monitoring. In Indonesia, its ten-year implementation has faced various challenges but has improved industry compliance. Advocating for fisheries crisis awareness and providing baseline data are priorities in establishing an effective monitoring program.
6	(Gerungan *et al.,* 2024)	Communication Strategy of the Ministry of Maritime Affairs and Fisheries in Socializing the Measured Fishing Policy (Case Study of Tegal City Fishermen)	Qualitative	Research has found that the Ministry of Maritime Affairs and Fisheries (KKP) uses communication strategies such as word of mouth, public consultation, and media to promote the Measured Fishing (PIT) policy. However, this strategy is ineffective due to differing perceptions from fishermen in the northern coast of Java, who feel the policy is detrimental. Therefore, a fisherman-based approach is needed.
7	(Masyithah, 2023)	Challenges of Implementing Measured Fishing Policies	Qualitative	The Measured Fishing (PIT) policy in Government Regulation No. 11 of 2023 has faced controversy, including a lack of implementing regulations and threats to local fishermen from the influx of foreign

				investors. The government needs to evaluate this policy, while the Indonesian House of Representatives (DPR RI) is expected to oversee its implementation and ensure budget allocation for supporting infrastructure.
8	(Sajjadia, 2023)	Examining National Fisheries Governance Through Government Regulation No. 11 of 2023 Concerning Measured Fishing to Achieve a Blue Economy	Qualitative	While most articles in the regulations support Blue Economy principles, legal loopholes exist, such as unclear definitions of small-scale fishers, exploitation within the Indonesian National Fisheries Authority (WPPPNRI), and disparities in port facilities. With sustainable policies, Indonesia can optimize its fisheries potential for long-term social, economic, and environmental benefits.
9	(Trenggono, 2023)	Quota-Based Measured Fishing for Sustainable Fishery Resources in Indonesia	Qualitative	Measured Fishing (PIT) uses catch quotas to maintain the sustainability of fish resources while improving fisherman welfare and state revenues. This model replaces ineffective vessel permit restrictions, reduces overexploitation, prevents manipulation of vessel size, and supports the principles of fairness and sustainability in the fisheries sector.
10	(Simposium Nasional Kelautan dan Perikanan, 2023.)	Clustering of Demersal Fishing Areas in the North Java Waters, Lamongan	Qualitative	Quota-based Measured Fishing (PIT) supports the sustainability of fish resources, improves fisherman welfare, and prevents overexploitation. This system replaces vessel permit restrictions, ensures fairness through post-production fees, reduces vessel size manipulation, and maintains cross-regional economic balance and ocean health.

Source: Data processed by researchers from various sources, 2024

Table 2. Research Grouping

No	Analysis Results	Having Correlation	No Correlation
1	Strategy	9 Research	1 Research
2	Challenge	5 Research	5 Research

Source: Data processed by researchers from various sources, 2024

DISCUSSION

Sustainable fishing is a priority in the management of Indonesia's marine resources. As an archipelagic nation with a significant ocean area, Indonesia faces significant challenges in maintaining a balance between the utilization and conservation of fishery resources (Pratiwi *et al.,* 2023). The Measured Fishing System (PIT), regulated by Government Regulation Number 11 of 2023, is one of the government's primary approaches to managing these resources. This policy offers a strategic solution to ensure ecological, social, and economic sustainability in the fisheries sector (Mardhiyah *et al.,* 2022).

On the other hand, the quota-based PIT is an effort to address the weaknesses of input-control management policies, such as vessel permit restrictions, which have been prone to manipulation of vessel size. As explained by Trenggono (2023), the quota-based system is designed to control catch limits in accordance with the capacity of the marine ecosystem. This is expected to suppress overexploitation and prevent the "race to fish" phenomenon, where businesses compete to exploit resources without regard for sustainability (Wahyudi, 2023).

The main advantage of the PIT lies in its implementation of the principle of fairness. State contributions through Non-Tax State Revenue (PNBP) are paid after the catch is obtained, providing business certainty for small-scale fishers and fisheries entrepreneurs. With this approach, fishermen are no longer burdened with initial costs, which often pose a financial barrier, especially for small-scale fishers (Wijaya *et al.,* 2024). The PIT provides strict boundaries for fishing zones and catch quotas, preventing excessive pressure on fish stocks. Research by Aulia *et al.,* (2016) shows that analysis of sea surface temperature and chlorophyll-a distribution can be used to efficiently identify potential fishing areas. This research also emphasizes the importance of marine spatial management, where fishing activities do not encroach on the core zones of conservation areas, thus preserving marine biodiversity. Furthermore, quota-based management allows for closer monitoring of specific fish stocks, such as Priacanthus tayenus and Nemipterus nemathoporus species found in the waters north of Java. By understanding the growth and recovery rates of fish populations, PIT policies can be adjusted to maintain the balance of marine ecosystems (Halim & Noviyanti, 2023). From a social perspective, the PIT policy provides benefits in reducing conflict between fishermen. (Halu Oleo *et al.,* 2024) showed that the majority of fishermen have a positive view of this policy, primarily due to its impact on marine resource conservation. With catch quotas, available resources can be managed more equitably, reducing the potential for conflict due to unequal resource distribution (Setyawan & Fauzi, 2023).

However, short-term economic challenges remain a concern. As noted by (Halu Oleo et al. 2024), these concerns can be addressed with more intensive mentoring. Digital marketing training, such as that implemented by the University of 17 August 1945 Cirebon, is one step to increase fishermen's capacity in navigating the digital era. Marketing their catch through platforms like WhatsApp Business allows fishermen to obtain a better selling price, reducing reliance on middlemen.

Novelty in Scalable Fishing Strategies to Support Sustainable Fisheries in Indonesia

In the context of sustainable fisheries development in Indonesia, the Measured Fishing (PIT) policy presents several novel elements that differentiate it from previous management approaches. Here are some of the novel aspects of the PIT strategy:

1. Quota-Based Approach as Output Control

The quota-based PIT approach is an innovation compared to traditional input control approaches such as vessel permit restrictions (Suryani *et al.,* 2023). This quota system eliminates the race-to-fish pattern, where businesses previously competed to exploit resources without control. By limiting the allowable catch to the capacity of a specific zone, PIT creates

a balance between economic utilization and ecological sustainability, a practice that has not been widely implemented systematically in Indonesia. (Ardani, 2024).

2. Strengthening the Principle of Justice through the Post-Production PNBP System

The PIT policy shifts the paradigm of state revenue from a pre-production to a post-production system. This provides business certainty for fishermen, especially small-scale fishermen, by only collecting levies after the catch is captured. This approach reflects greater fairness, reduces the financial burden on small-scale fishermen, and incentivizes business actors to comply with regulations without resorting to excessive exploitation (Sutrisno, 2023).

3. Integration of Digital Technology in Monitoring and Marketing

The implementation of PIT utilizes advanced technologies such as the Catch Documentation Scheme (CDS) supported by CCSBT. This system enables upstream to downstream catch monitoring, creating transparency and accountability in the fisheries supply chain. Furthermore, the inclusion of digital marketing through platforms like WhatsApp Business introduces a new dimension to environmentally friendly catch marketing, supporting digitalization in the fisheries sector (Pramono, 2023).

4. Adaptation to the Blue Economy Concept

The PIT policy explicitly supports the Blue Economy principle, which integrates economic, ecological, and social benefits. This includes efforts to reduce bycatch waste, maximize the use of fisheries products, and optimize the use of marine resources through a sustainable approach. This element is a strategic novelty because it makes PIT a tool for achieving multidimensional development goals (Fadillah, 2023).

5. Implementation of Adaptive Management Areas Based on Ecological Zones

The PIT introduces zoning based on ecological capacity and fish stock status in each fisheries management area (WPPNRI). This approach allows for more adaptive management, prioritizing stock recovery in overfished areas. This zoning strategy is a step forward in ensuring the sustainability of marine ecosystems while ensuring equitable distribution of economic benefits (Wijayanti, 2023).

6. Synergy with Marine Ecosystem Conservation

PIT focuses not only on fish stock management but also encompasses the protection of conservation areas. Research shows that implementing PIT can ensure that fishing activities do not encroach on core conservation zones. This strategy is a significant innovation because it integrates fisheries management with broader marine ecosystem conservation (Murtini, 2023).

7. Empowering Small Fishermen Through Business Diversification

The PIT policy supports the diversification of fishing businesses, including the utilization of bycatch into value-added products such as fish feed. This not only reduces fisheries waste but also creates new economic opportunities. Community-based empowerment programs integrated into this policy serve as a new element that strengthens the social dimension of PIT (Rosyid *et al.,* 2023).

8. Increasing the Efficiency of Resource Utilization Through Satellite Data and Technology

The use of sea surface temperature and chlorophyll-a distribution data from satellite imagery (such as Aqua MODIS) and vessel detection with VIIRS has been a breakthrough in

identifying potential fishing zones. This approach improves resource utilization efficiency and minimizes the risk of overexploitation (Irawan *et al.,* 2024).

9. Transforming Management Systems through a Collaborative Approach

PIT encourages a collaborative approach between government, academics, and fishing communities. By involving various parties, this policy serves not only as a regulatory instrument but also as an empowerment tool, encouraging more inclusive collaboration to ensure sustainability (Adi *et al.,* 2023).

Challenges and Opportunities in Implementing Measured Fishing Policies

The implementation of the Measured Fishing (PIT) policy in Indonesia faces several challenges that must be overcome to achieve success. One major challenge is the lack of clarity in the implementing regulations needed to support its implementation. According to Masyithah Aulia Adhiem, although this policy is stipulated in Government Regulation No. 11 of 2023, there are still gaps in technical guidance, such as the mechanism for distributing catch quotas and field supervision. This slows down policy implementation and potentially creates inconsistencies between central and regional regulations. Furthermore, resistance from local fishermen is also a barrier. Kirsten Kimberly Injily Gerungan found that fishermen on the North Coast of Java (Pantura) viewed this policy as a burden because it was perceived as detrimental to small-scale fishermen. Differences in perception between the government and fishing communities hamper the policy's effectiveness, and without an appropriate communication strategy, this resistance could spread (Suherman *et al.,* 2024).

Another challenge is the lack of supporting infrastructure, such as ports, cold storage facilities, and catch tracking technology, which are unevenly distributed across the Indonesian Fisheries Management Area (WPPNRI). Sahira Sajjadia Luthfia highlighted that this lack of infrastructure could hamper the implementation of the PIT at the local level. Furthermore, the policy's opening of opportunities for foreign investors raises concerns about the sustainability of small-scale fishing businesses. Masyithah Aulia Adhiem noted that without adequate protection, foreign investors could dominate the fisheries sector, threatening the livelihoods of local fishermen. Another significant challenge is the lack of accurate and integrated data on fish stocks, fishing zone distribution, and vessel catch capacity. As noted by Nida Mardhiyah Ramdhani, the collection and integration of this data is hampered by weak coordination between relevant institutions. Furthermore, the issue of fisheries waste is a concern. Bycatch, such as shellfish, is often underutilized. Erna explained that this waste creates potential economic losses and environmental problems due to the lack of initiatives to process it into value-added products (Amira *et al.,* 2023).

Despite these challenges, the PIT policy also offers significant opportunities to support sustainable fisheries development in Indonesia. One key opportunity is strengthening national fisheries governance. By implementing data-driven catch quotas, this policy can reduce overexploitation in overfished areas. Yulita Dwi Pratiwi noted that the draft Catch Documentation Scheme (PIT) policy aligns with the principles of sustainability and economic democracy as mandated by Article 33 of the 1945 Constitution of the Republic of Indonesia. Furthermore, the implementation of the Catch Documentation Scheme (CDS), as explained by Nida Mardhiyah Ramdhani, can improve compliance among fisheries businesses through better oversight of the catch process, from recording to reporting. This system has demonstrated success in the tuna fisheries sector, increasing transparency and accountability in the supply chain (Yulianto *et al.,* 2023).

Diversifying fisheries businesses also presents a promising opportunity. By utilizing bycatch into value-added products, this policy can create new sources of income for fishermen. For example, the 17 August 1945 University of Cirebon's empowerment program, which trains

fishermen to make fish feed from catch waste, demonstrates how local innovation can support the implementation of Catch Documentation Scheme (CDS). This policy also aligns with the principles of the Blue Economy, which integrates economic, social, and ecological benefits. Sahira Sajjadia Luthfia noted that by maximizing fisheries potential, PIT can be a catalyst for sustainable economic development in Indonesia (Kusuma *et al.,* 2023).

The use of technology also presents a significant opportunity in implementing this policy. Research by Aulia et al. shows that sea surface temperature and chlorophyll-a distribution data from satellite imagery can help identify potential fishing zones, increasing fishing efficiency while preventing overexploitation. Furthermore, the fairness approach promoted by the post-production PNBP system provides opportunities for small-scale fishers to remain actively involved in the fisheries sector. As explained by Sakti Wahyu Trenggono, levies are only collected after the catch is secured, thereby reducing the financial burden on small-scale fishers and increasing business certainty (Winata *et al.,* 2024).

To address the challenges and capitalize on opportunities in implementing the PIT policy, an integrated and comprehensive strategy is essential. First, strengthening derivative regulations is a priority. The government must immediately formulate clear and detailed regulations, covering quota distribution mechanisms, monitoring procedures, and sanctions for violations. Furthermore, an inclusive communication approach is crucial to bridge the gap in perceptions between the government and fishers. As proposed by Gerungan, the communication strategy should involve public consultation, direct dialogue, and intensive media outreach to build fishers' trust in the policy. Furthermore, developing fisheries infrastructure is key to supporting the smooth implementation of the Fisheries Information System (PIT). The government needs to ensure investment in facilities such as ports, storage facilities, and fish catch monitoring technology. This infrastructure will strengthen the implementation of PIT throughout the Indonesian Fisheries and Fisheries Management Authority (WPPNRI). Equally important, the PIT policy must prioritize local fishermen in the allocation of catch quotas, while ensuring that foreign investors do not dominate the market and threaten the sustainability of small-scale fisherman's businesses. The use of technology must also be an integral part of this policy; the use of satellite imagery and digital documentation systems can help manage fish stocks and conduct surveillance more effectively. Finally, empowering fishermen through training and mentoring to diversify their businesses should be a crucial component of this policy. This way, fishermen will not only rely on primary catches but can also increase their income by utilizing bycatch (Kurniawan & Sudarmanto, 2023).

By addressing these challenges and capitalizing on opportunities, the PIT policy can become a crucial foundation for supporting sustainable fisheries development, improving fisher welfare, and preserving marine resources in Indonesia.

CONCLUSION

The conclusion of the implementation of the Measured Fishing (PIT) policy in Indonesia reflects a new approach to sustainable fisheries management. This policy, based on catch quotas, offers a strategic solution to address overexploitation and ensure a balance between economic resource utilization and ecological sustainability. This approach is regulated by Government Regulation No. 11 of 2023 and emphasizes the importance of preserving fishery resources while supporting the economy of small-scale fishers. PIT provides fairness through the implementation of post-production Non-Tax State Revenue (PNBP), which reduces the initial financial burden on fishers. Furthermore, the use of digital technologies, such as the Catch Documentation Scheme (CDS) and digital marketing, strengthens catch monitoring and the marketing of fisheries products.

However, challenges remain, including resistance from local fishers who feel burdened, unclear derivative regulations, and limited supporting infrastructure such as cold storage facilities. However, the PIT policy also opens up significant opportunities, including strengthening fisheries governance and diversifying businesses that support sustainability. Through the utilization of bycatch and the development of value-added products, this policy can become a key pillar in realizing sustainable fisheries in Indonesia, ensuring the economic well-being of fishers while maintaining the balance of the marine ecosystem.

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