

# ADAPTIVE STRATEGY FOR FISHER EMPOWERMENT TO THE IMPACT OF MEASURED FISHING POLICY IN NORTH ACEH REGENCY

*ESTRATÉGIA ADAPTATIVA PARA O EMPODERAMENTO DOS PESCADORES EM RELAÇÃO AO IMPACTO DA POLÍTICA DE PESCA MEDIDA NA REGÊNCIA DE ACEH DO NORTE*

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## Abstract

The Measured Fishing Policy (PIT) implemented by the Indonesian Ministry of Maritime Affairs and Fisheries aims to maintain the sustainability of marine resources by regulating the number and area of fishing. However, this policy has a significant impact on smallholder fishermen, especially in North Aceh Regency, who rely on fish catches for their daily livelihoods. Limited access to technology, appropriate fishing equipment, and limited knowledge of these policies make it difficult for smallholder fishers to adapt to the established regulations. This study aims to identify adaptive strategies used by

## Resumo

A Política de Pesca Medida (PIT) implementada pelo Ministério de Assuntos Marítimos e Pesca da Indonésia visa manter a sustentabilidade dos recursos marinhos, regulando o número e a área de pesca. No entanto, essa política tem um impacto significativo sobre os pequenos pescadores, especialmente na Regência de Aceh do Norte, que dependem da pesca para sua subsistência diária. O acesso limitado à tecnologia, aos equipamentos de pesca adequados e o conhecimento limitado dessas políticas dificultam a adaptação dos pequenos pescadores às regulamentações estabelecidas.



smallholder fishers in North Aceh Regency in dealing with the impact of PIT policies and design a local needs-based empowerment model that can increase their adaptation capacity. The method used in this study is a qualitative approach, with data collection through in-depth interviews, direct observation, and the use of related documents. The results of the study show that smallholder fishers develop adaptive strategies that are sustainable, such as household economic savings and social solidarity between fishermen. However, this strategy does not include larger structural changes in the face of PIT policy. Therefore, this study suggests community-based empowerment that includes social, economic, and institutional support that can strengthen fishermen's adaptability. Supportive policies are also needed that include stabilizing fish prices, securing fuel supply, and increasing access to technology to help smallholder fishers adapt to PIT policies without sacrificing their welfare.

**Keywords:** Measured Fishing. Adaptive Strategies. Empowerment. Small-Scale Fishers. Fisheries Policy.

*Este estudo visa identificar estratégias adaptativas utilizadas por pequenos pescadores na Regência de Aceh do Norte para lidar com o impacto das políticas de PIT e elaborar um modelo de empoderamento baseado nas necessidades locais que possa aumentar sua capacidade de adaptação. O método utilizado neste estudo é uma abordagem qualitativa, com coleta de dados por meio de entrevistas em profundidade, observação direta e uso de documentos relacionados. Os resultados do estudo mostram que os pequenos pescadores desenvolvem estratégias adaptativas sustentáveis, como economia familiar e solidariedade social entre os pescadores. No entanto, essa estratégia não inclui mudanças estruturais mais amplas diante da política de PIT. Portanto, este estudo sugere o empoderamento comunitário, que inclui apoio social, econômico e institucional, capaz de fortalecer a adaptabilidade dos pescadores. Políticas de apoio também são necessárias, incluindo a estabilização dos preços do pescado, a garantia do fornecimento de combustível e o aumento do acesso à tecnologia para ajudar os pequenos pescadores a se adaptarem às políticas do PIT sem sacrificar seu bem-estar.*

**Palavras-chave:** Pesca Mensurada. Estratégias Adaptativas. Empoderamento. Pescadores de Pequena Escala. Política Pesqueira.

## 1 INTRODUCTION

Indonesia, as an archipelagic country with more than 17,000 islands and a sea area covering more than two-thirds of its territory, has a fisheries sector that plays a very important role in the country's economy (Hidayat et al., 2022; Warren & Steenbergen, 2021) Most coastal residents, especially small-scale fishermen, depend on the sea as their main source of livelihood. However, with the increasingly limited fishery resources that can be harvested, the sustainability of this sector is a major challenge (Meliala, 2024). To overcome these challenges, the Government of Indonesia through the Ministry of Maritime Affairs and Fisheries (KKP) launched the Measured Fishing (PIT) policy. This policy aims to regulate the number of fish that can be caught by implementing quotas and restrictions on fishing areas in accordance with the carrying capacity of the marine ecosystem. The main goal is to maintain the sustainability of fish resources, prevent overexploitation, and ensure that fisheries are managed sustainably for the long-term benefit (Aprian et al., 2023; Jumentoro et al., 2025).

However, although this policy has the noble goal of conserving fishery resources, its impact on smallholder fishers, especially in coastal areas such as North Aceh Regency, is enormous. Smallholder fishermen in North Aceh, who largely depend on the sea for their livelihoods, often do not have sufficient access to meet the regulations set out in the PIT policy. These limitations include access to fishing gear that complies with policy standards, inability to meet the specified catch quota, and their lack of understanding of the new policy. As a result, PIT policies that are supposed to support marine conservation risk worsening the social and economic conditions of small fishermen. Smallholder fishers often do not have adequate resources to follow these policies. They are also limited in terms of knowledge and access to the latest technology required to comply with regulations such as catch quotas, fishing area restrictions, and recommended types of fishing gear. This makes it difficult for small fishermen in North Aceh to adapt to the changes brought by the PIT policy. This policy seems to worsen their situation, given that many smallholder fishermen are completely dependent on their catch to meet their daily needs (Damasio et al., 2022; Zhang et al., 2025).

As a result, small-scale fishers who are not ready for this policy tend to continue their activities in old ways that have been passed down from generation to generation without paying attention to the quota provisions or limitations of the fishing area set in the PIT policy (Pavoni & Piselli, 2016; Salas et al., 2018). In addition, high operational costs, such as soaring fuel prices and expensive equipment costs, further add to their burden. Meanwhile, the uncertainty of the fish market caused by fluctuating prices worsens the purchasing power of small fishermen, making them even more economically vulnerable. This study aims to explore how smallholder fishermen in North Aceh Regency respond to the PIT policy, as well as the adaptive strategies they develop to survive in the midst of policies that are less favorable to them. In addition, this study also aims to design an empowerment model based on the local needs of smallholder fishers, to help them address the impact of this policy. Community-based empowerment that prioritizes the active participation of smallholder fishers in the process of adaptation and resource management is very important in this context (Sultana & Thompson, 2007). Through proper empowerment, smallholder fishers are expected to increase their capacity to adapt to policy changes and reduce the negative impacts they cause.

The empowerment of smallholder fishermen based on local wisdom is very important considering that many of them rely on hereditary knowledge and traditions in

carrying out sea activities (Ahdan et al., 2021; Purnomo et al., 2021). Without contextual empowerment in accordance with local conditions, smallholder fishermen in North Aceh will be increasingly marginalized and find it difficult to adapt to existing policies. Therefore, this research has become very relevant to find solutions based on their needs, rather than just relying on a technocratic approach from the government (Purwanti et al., 2025) In this context, an empowerment strategy that not only relies on technical assistance and equipment, but also strengthens the social, economic, and institutional aspects of the fishing community, is urgent (Gomes et al., 2020) A more contextual and participatory approach is urgently needed to create more inclusive and values-based policies in coastal communities.

This research is very important because it can provide insight into how smallholder fishers in North Aceh can develop their adaptive strategies in the face of significant policy changes. A better understanding of the socio-economic dynamics of these smallholder fishers will allow for more effective and responsive policy formulation to their needs. The results of this study are expected to provide policy recommendations that can strengthen the adaptability of smallholder fishers, as well as improve their quality of life in the long term. Effective empowerment for smallholder fishers is not only limited to providing fishing gear or access to technology, but must also involve strengthening existing social solidarity and local networks. Therefore, community-based empowerment is an important element in supporting the sustainability of PIT policies without harming smallholder fishers.

As such, it is important to develop an empowerment model that does not rely solely on a top-down approach, but is also based on the active participation of fishermen. Community-based empowerment that involves fishers in every stage of policy planning and implementation will provide a sense of ownership of the policy, so that they will be more motivated to follow existing rules and adapt to the policy changes implemented.

## **2 RESEARCH METHODOLOGY**

This study uses a qualitative approach with data collection methods in the form of direct observation, in-depth interviews, and the use of related documents (Moleong, 2021; Sujarweni, 2014). This study uses a qualitative approach with data collection methods in the form of direct observation, in-depth interviews, and the use of related documents. The

research was conducted in North Aceh Regency, which has a large small fisher population and a high dependence on the fisheries sector. Interviews were conducted with small fishermen, community leaders, village officials, and other related parties. The data analysis method used is thematic analysis, which aims to identify patterns in the data to find adaptive strategies and effective forms of empowerment for smallholder fishers (Zainal et al., 2023). This approach allows researchers to understand the social and economic dynamics experienced by fishermen, as well as formulate appropriate solutions based on their local conditions.

However, there are a few things to consider. First, in direct observation, researchers need to pay attention to potential biases due to interactions with subjects that could affect their behavior. The use of triangulation techniques can reduce this potential bias. Second, in in-depth interviews, it is important to manage the difference in perspectives between fishermen, community leaders, and village officials. The use of semi-structured interviews can help to get more in-depth and relevant information. In addition, the documents used must be checked for validity so that only the most relevant and up-to-date data is used. In thematic analysis, researchers must be careful not to get caught up in subjective interpretations. Re-verify the theme found using data from various sources to ensure its accuracy. Given the local context of North Aceh, the analysis should also take into account differences within small groups of fishermen to capture variations in how they adapt to empowerment. This approach will result in a more holistic understanding of the empowerment of smallholder fishers in North Aceh.

### **3 RESULTS AND DISCUSSION**

#### **3.1 North Aceh regency measured fishing policy**

The Measured Fishing Policy (PIT) launched by the government is actually intended to maintain the sustainability of marine resources while improving fisheries governance (Jumantoro et al., 2025). However, for small fishermen in North Aceh Regency, this policy has provoked a variety of responses, most of which are pessimistic. The results of the interviews show that the majority of fishermen, even important figures such as the commander of the laot and the handler, do not know clearly what the PIT policy is. The lack of socialization is the main cause so that fishermen continue to go to

sea in the old ways, without sorting out the size of the catch and without paying attention to the quota.

Rafinda, a fisherman in Northwest Hagu Village, admitted that he had never heard of this policy at all. The same thing was conveyed by Abdullah, Deputy Commander of Laot Ujong Blang who stated that there had been no official meeting or socialization involving fishermen leaders. As a result, the sea activity went on as usual: all the fish caught, both large and small, were immediately brought ashore to be sold to collectors. For small fishermen, this method does help meet daily economic needs. However, in terms of resource sustainability, this practice has the potential to accelerate the decline of fish populations (Praza et al., 2024).

Fishermen's concerns are increasing when they imagine a scenario if this policy is actually implemented. For small-scale fishermen, sorting fish in the middle of the ocean means reducing the number of catches that can be taken home, while operational costs such as fuel and equipment remain high. This condition will suppress their daily and monthly income. In fact, the risk of loss is even greater because the price of fish in the market is also very volatile. If the catch is abundant, the price plummets; On the other hand, when catches are minimal, operational costs soar due to fuel shortages. This situation is what makes fishermen consider that the PIT policy actually adds to the burden of living. In addition, there are also external factors that add to the complexity of the problem, namely the existence of anchovy trawlers with high-intensity lights at night. This activity is complained of killing fish seeds and threatening the regeneration of marine resources. Likewise, the operation of trawl trawls, although considered indirectly to kill fish seeds, still damages coral reefs and triggers conflicts between fishermen due to the breakage of the net. Weak law enforcement and policies are considered to be the main cause of sustainable damage in the ocean.

In general, fishermen argue that the PIT policy can only be accepted if it is accompanied by supporting policies, especially the stabilization of fish prices in the market. Without a fair price guarantee, the rules for sorting catches will worsen economic conditions (Baharudin et al., 2024). Moreover, small fishermen in North Aceh are very dependent on daily income, where the results of going to sea today are usually only enough for the capital to go to sea tomorrow. This means that they live in a very vulnerable economic cycle. The impact of the PIT policy on smallholder fishers in North Aceh is twofold: conceptually it aims to be good for sustainability, but practically has the

potential to reduce welfare because it has not been accompanied by socialization, price protection, and adequate fuel supply.

### **3.2 Knowledge and policy acceptance by fishermen**

Based on interviews with fishermen in North Aceh Regency, many fishermen who operate using small boats and sail near the coast admitted that they were not aware of the existence of a measurable fishing policy. They revealed that so far they have been fishing in a way that has been done for generations, without any sorting of fish sizes caught. Even some fishermen leaders who should know more about this policy also admitted that they had never received information about it. This shows that there is a significant gap in terms of policy socialization between the government and the fishing community, especially small-scale fishers who are often overlooked.

The lack of understanding of measurable fishing policies has a major impact on fishers' ability to adapt to the new rules that are in place. They do not have enough knowledge to prepare themselves, so they cannot adjust their way of going to sea according to existing regulations. This of course hinders the acceptance of the policy at the level of the fishing community. For example, many fishermen are unaware of the existence of quota restrictions or fishing zones that are part of the measurable fishing policy. They also feel unprepared to abide by rules that require sorting fish by size, as doing so will affect their already limited income.

In addition, the lack of adequate information makes fishermen feel that this policy is not in their favor, making it difficult for them to feel the benefits. Therefore, it is important for the government or related parties to increase socialization regarding this policy in a more comprehensive way and directly touch the fishing community. Effective socialization will help fishers understand the goals and benefits of the policy, so that they can be better prepared and willing to follow existing rules for the sustainability of marine resources and their own welfare.

### 3.3 Influence on marine activities and income

Most fishermen in North Aceh Regency consider that the Measured Fishing (PIT) policy has the potential to reduce income because the obligation to sort fish will reduce the catch volume while increasing operational costs. A handler in Pusong said,

*"If you have to choose and sort the catch, it is very influential because it is not proportional between the operational costs and the results obtained. In fact, fishermen can lose money because of the lack of results that can be brought."*

Even now, fishermen's income is relatively minimal. High fuel prices and declining fish populations are the main obstacles. The former commander of the Navy said,

*"The income of fishermen is currently very minimal, while the costs incurred to go to sea are very large. This is influenced by the high price of fuel and the difficulty of obtaining fish due to the reduction of populations in the ocean."*

According to Abdullah, to cover daily needs, crew members often take advantage of rest time by fishing additionally.

*"The crew takes advantage of their free time on the sidelines of breaks from boat activities to fish and hopes to get the catch to then sell to collectors,"*

Conditions are getting tougher with dependence on subsidized fuels which are often scarce. Many fishermen complain about the difficulty of obtaining diesel, sometimes even forced to buy at a higher price through a third party. When fuel is hard to come by, seagoing activities are disrupted and operational costs swell. These findings indicate the economic vulnerability of small fishers in the midst of the plan to implement the PIT policy. From a fisheries economics perspective, setting quotas and catch sizes aims to maintain the sustainability of fish stocks, but without a buffer mechanism such as fuel subsidies, fish price stabilization, or income compensation, the policy can become a unilateral burden for fishermen. In the theory of *livelihood security*, the sustainability of livelihoods is influenced by access to natural, financial, human, and social assets. The results of the study show that fishermen's financial assets are very fragile: daily income is depleted for the next sea needs, and capital reserves are almost non-existent. If the PIT policy is implemented without a guarantee of price and fuel supply, the risk of loss will be even greater.

In addition, the adaptive strategy carried out is still survival, not transformation. Efforts such as additional fishing or borrowing capital to *toke* only patch short-term needs, without strengthening economic resilience. Dependence on loans has the potential to trigger a debt cycle that is difficult to break. Within the framework of public policy, this situation confirms the need for *compensatory measures*. The government needs to prepare incentives, such as guaranteed fuel subsidies, minimum pricing schemes for catches, and easily accessible capital facilities. Without this support, the implementation of the PIT policy can actually hinder the goal of fishermen's welfare while reducing compliance with conservation rules. Overall, the influence of the PIT policy on fishing activities and the income of fishermen in North Aceh is projected to be negative if it is not balanced with supporting policies that protect the economy of fishermen's households. Fuel supply stability, price certainty, and access to capital are key for sustainable fisheries policies to run without causing heavy socio-economic burdens.

### 3.4 Fishermen's adaptive strategy

Adaptive strategies are efforts made by small fishermen in dealing with changes in policies and changing environmental conditions. However, the results of interviews with fishermen in North Aceh show that until now there has been no significant change in social adaptation related to the Measured Fishing (PIT) policy. The reason is simple: this policy has not really touched fishermen directly because there is minimal socialization and its implementation has not been effective in the field. As a result, seagoing activities are still carried out in the old ways, namely armed with hereditary knowledge without paying attention to quotas or fishing zones. All the fish obtained are still taken home and sold to collectors, without any selection process.

Even so, small-scale fishers actually have traditional adaptive strategies that have been formed from the difficult conditions they face on a daily basis. One of them is saving and managing family finances. When catches decline, fishermen try to reduce household spending. Fishermen who work as crew members usually bring personal hooks to fish in between break times. The fish from this fishing is then sold to collectors as additional income. If this method is still not enough, they usually rely on loans from *toke* or capital owners. This loan is generally paid by deducting the wages of crew members or the next catch, so that fishermen can still go to sea even in deficit conditions.

In addition to economic management, fishermen also develop adaptive strategies through job flexibility. When bored or the income from the big sea is not enough, some fishermen choose to become crew members on small boats that operate near the coast, usually 1-5 miles from the seashore. This pattern of job mobility allows them to stay in the fishing profession without completely abandoning their identity as fishermen. This shows that despite the limitations in job options, fishermen try to find opportunities to continue earning income (Salam & Aarsal, 2024).

The next adaptive strategy is cooperation and mutual cooperation between fishermen. In coastal communities, the value of solidarity is still well maintained. For example, if a ship breaks down in the middle of the sea, another ship will help by pulling it home. If one ship runs out of fuel, another ship is willing to lend. Likewise, when the catch of fish is abundant, there is a practice of "meujengek" or sharing of the results, where small boats help to bring the catch and are given shares. This kind of solidarity serves as a social safety net that helps smallholder fishers survive the uncertainties of the sea and government policies. In terms of conveying aspirations, fishermen rely on community leaders such as the commander of the laot. This figure is considered to have the capacity to submit complaints to the village government, fisheries office, and related institutions. This process is usually carried out through open deliberation. Thus, fishermen's adaptation is not only individual, but also collective through entrenched social mechanisms (Babu et al., 2025).

If viewed more broadly, the adaptive strategy of North Aceh fishermen is still basically defensive and pragmatic. They try to survive difficult conditions by maximizing existing resources, not by major innovations or significant changes. This is understandable given the limited access to capital, information, and technology. However, the existence of social solidarity, work flexibility, and the ability to manage the household economy show that fishing communities have strong resilience. The challenge is how these traditional adaptive strategies can be strengthened with more responsive government policies and empowerment programs that favor smallholder fishers. Until now, there has been no significant change in social adaptation among small fishermen in North Aceh Regency. Most of the respondents admitted that they still go to sea in traditional ways that have been passed down from generation to generation, without quotas or sorting of fishing zones. A fisherman in Pusong Rafinda stated,

*"So far, fishermen have gone to sea as usual, meaning that all catches are taken and brought home to be sold to collectors"*

They also emphasized that there has been no socialization of the Measured Fishing (PIT) policy, so there is no encouragement to change the pattern of going to sea. The adaptation strategy that emerges is more defensive than transformational. Many fishermen are suppressing household expenses so that their living needs are met. If their income as crew members (ABK) decreases, they take the initiative to bring their own hooks to fish extra on the sidelines of break time. A shipwright Zainauddin revealed,

*"Boaters to increase their income take advantage of their free time by fishing and hope to get their catch to then sell to collectors"*

In addition, capital loans to *toke* are still an important mechanism when the catch is insufficient. Fishermen with small boats usually pay the loan in installments through a deduction of the catch. When sea conditions or fish prices are not supportive, some are forced to stop going to sea for a few days because they do not have bailout funds. Although economic adaptation tends to be minimal, the power of social solidarity is very prominent. The culture of *sharing* is still strong. For example, when one ship gets an abundance of fish, other small vessels are often asked to help transport the catch and get a share of the wages. If a ship runs out of fuel in the middle of the sea, other ships will lend fuel so that their counterparts can return to land. If the ship is damaged, the local fishermen voluntarily pull it home. These practices show that the value of mutual cooperation remains an inseparable part of the fisherman's life.

These findings show that small-scale fishermen in North Aceh rely on social capital as a buffer for the crisis. According to *the theory of community resilience*, social networks and mutual cooperation play an important role in maintaining the economic and psychological sustainability of people who face policy pressures or natural shocks. The practice of *stealing*, borrowing fuel, and pulling damaged ships is a tangible form of *collective coping mechanism* that provides community resilience. However, the heavy reliance on these traditional mechanisms also signals the limitations of adaptive innovation. There is no real effort to diversify work or improve technology. A fisherman Muhammad asserted,

*"We are still loyal to the work of fishermen, only sometimes when we get bored of being crew members of big boats we move to small boats that hunt fish by the coast"*

This attitude reflects a preference to remain within the fisheries sector, although offshore income opportunities may be available. The lack of socialization of PIT policies further hinders the adaptation process. According to Abdullah, the Deputy Commander of Laot from Ujong Blang admitted that

*"has not received information regarding the existence of a measurable fishing policy".* Without a clear understanding of policy, fishermen tend to stick to the old ways, even if they have the potential to affect their welfare. This situation is in line with the concept of *the policy implementation gap*, where the lack of communication between policymakers and the target community leads to failure to adapt. From an economic perspective, dependence on *toke* loans and daily catches shows income vulnerability. When catches decline, fishermen have to look for bailouts which are often burdensome. Moreover, the unstable price of fish adds to the uncertainty. A handler emphasized,

*"If you have to choose and sort the catch, it is very influential because it is not proportional between the operational costs and the results obtained. In fact, fishermen can lose money because of the lack of results that can be brought."*

This statement confirms that without support such as price stabilization and fuel guarantees, PIT policies will be difficult to adopt. In the framework of sustainable development, this condition demands interventions that not only rely on the strength of social capital, but also encourage *capacity building* and economic innovation. Governments and supporting agencies can facilitate equitable access to finance, alternative skills training, and the use of technologies such as weather apps or fish detection that have been proven to increase catches. This is in accordance with the views of fishermen who stated,

*"Technology is very helpful for fishermen, the catch is more abundant than boats that do not use technology"*

Overall, the adaptive strategy of the North Aceh fishing community is currently still focused on survival through community solidarity and austerity, not yet touching the structural transformation needed to face measurable fishing policies. In the future, strengthening social capital needs to be complemented by economic empowerment and increasing adaptation capacity so that fishermen are not only surviving, but also able to develop in the midst of changes in fisheries policies.

### 3.5 Empowerment and support needed

Based on interviews, it shows that government or NGO assistance has not directly touched small fishermen. Assistance is more often received by boat owners or trawlers, not fishermen who go to sea every day with small boats. A fisherman asserted,

"The assistance provided is never in direct contact with the fishermen personally, but is more aimed at boat owners or trawlers. So that only people with money enjoy assistance"

Fishermen consider the bailout fund as an urgent solution to anticipate the uncertainty of catches.

"The money I get today is only enough for the next day's sea needs. If there are no results the next day, fishermen will look for debt loans which are sometimes very difficult," said one of the informants. The bailout scheme is expected to prevent dependence on high-interest loans or deductions of catches"

In addition, fishermen proposed cooperatives that are managed in a transparent manner as a way to strengthen bargaining positions and reduce dependence on middlemen or toke. However, previous experience made them doubtful. A fisherman said,

"Cooperatives or fishermen's business groups are very good to implement, but they must be really managed and supervised properly. So far, cooperatives are often managed and controlled by various interests, so that fishermen are neglected".

The use of technology is also considered important. Some boats that install fish detection devices have proven to get better catches. Weather apps help improve safety at sea, and social media expands marketing.

"Technology is very helpful for fishermen... The catch is more abundant than ships that do not use technology. Weather applications are also very necessary to make it more comfortable to go to sea," explained a fisherman.

Fishermen also hope that the government will stabilize fish prices and guarantee fuel supply, so that their income will not be depressed when catches are abundant and prices fall. They added the importance of attention to the education of fishermen's children so that future generations have a chance to get out of the poverty cycle. These findings suggest that the empowerment of smallholder fishers requires financial, institutional, and technological support simultaneously. The bailout fund can function as

a safety net according to the concept of livelihood security, maintaining the sustainability of livelihoods when catches are reduced.

Healthy fishermen's cooperatives are highly relevant to the blue economy approach, enabling the collective purchase and distribution of catches and improving bargaining positions. However, the bad experiences expressed by fishermen demand accountable governance, for example through regular audits and member participation. The use of technology such as fish detection tools, weather applications, and online marketing is in line with technological empowerment, which increases efficiency, reduces weather risks, and expands markets. Meanwhile, fish price stabilization policies and fuel supply guarantees are needed so that measurable fishing policies do not add to the economic burden. Overall, the empowerment of smallholder fishers in North Aceh requires an integrative approach: fair bailouts, transparent cooperatives, the use of technology, and supportive market and fuel policies. Without this combination, sustainable fisheries policies will be difficult to adopt effectively by smallholder fishers.

### **3.6 Fishermen's efforts in adjusting**

Based on interviews conducted, many fishermen have not felt the direct impact of the measured fishing policy. As a result, they continue the traditional seagoing practices that have been passed down from generation to generation, without feeling the need to make significant changes in the way they work. One of the main features of this traditional practice is the reliance on the overall catch, without sorting the fish by size or type.

For many fishermen, this is considered more economically profitable. By not sorting the catch, they can take home all the fish that are successfully caught, which in turn increases the volume of the catch sold. In often volatile market conditions, where fish prices can fall drastically when supply is plentiful, separating fish by size can risk harming them. Therefore, they tend to avoid sorting fish, fearing that it will reduce their income.

However, some fishermen are starting to try to adapt to the existing policies, although they are still in the stage of limited understanding. They hope for more in-depth supportive policies, such as market price stability and ease of access to fuel, that will allow them to adapt to measurable fishing policies without incurring significant financial

losses. Thus, although they still use the same methods, there is hope for more gradual changes as more effective policy socialization from the government goes.

The results of the interviews show that small fishermen in North Aceh Regency have clear expectations for the government so that the Measured Fishing (PIT) policy does not increase their economic burden. First, they emphasized the importance of stabilizing fish prices in the market. According to fishermen, when catches are abundant, prices often plummet, so that income is not proportional to the cost of going to sea. A fisherman said,

"Even if the policy is enforced, the government must also have a policy to control the price of fish in the market. This means that prices are always stable, whether the catch is abundant or not."

Second, fishermen expect to ensure adequate and equitable fuel availability. The often scarce supply of diesel makes operational costs increase and complicates the seagoing schedule.

"The government must oversee the availability of fuel for fishermen so that it is sufficient," said one of the respondents

In addition to the economic aspect, fishermen also highlight the education of their children. They assessed that uncertain economic conditions had a direct impact on children's opportunities to continue their education. Many fishing families can only afford to send their children to school up to the level considered

"enough," because we have to prioritize the sustainability of the sea business. In the interview, it was revealed, "Most coastal communities only build equal educational continuity. The rest prioritize the generation to pursue the profession that their parents have been engaged in for generations, namely as fishermen."

Finally, fishermen emphasized the importance of policy socialization before implementation. They admitted that they had never been invited to discuss or given adequate information. Deputy Commander of Laot Ujong Blang said,

"Usually every time there is a policy regarding fishermen, the commander of the fishermen is always involved, but this time there has never been a meeting on the realization of the policy"

These expectations affirm the need for inclusive and responsive policies to the socio-economic realities of fishermen. In the framework of participatory policy making, the involvement of the target community from the planning stage is the key so that PIT

policies are not only oriented towards the conservation of marine resources, but also on coastal welfare.

Stabilization of fish prices is important to prevent *price shocks* that are detrimental to fishermen. A minimum pricing scheme or a stock buffer mechanism can be a solution. Fuel supply guarantees are also crucial so that fishermen do not get caught up in black market practices that trigger additional costs. In the field of education, government support, for example through special scholarships for fishermen's children and skill enhancement programs, can help break the chain of structural poverty in coastal communities. This attention to education is not only a long-term social investment, but also a strategy to build human resources that can strengthen the fisheries sector in the future.

In addition, transparent and sustainable socialization will increase trust building between the government and fishermen. Open policy communication will strengthen compliance, minimize resistance, and create a sense of *ownership* over PIT policies. Thus, fishermen's hopes and suggestions are not just aspirations, but indicators of basic needs that the government must consider. Involving fishers in every policy process, ensuring the stability of fish prices and fuel availability, and paying attention to the education of fishers' children will be an important foundation for the successful implementation of a fair and sustainable Measured Fishing policy.

#### 4 CONCLUSION

This study shows that the PIT policy has the potential to have a negative impact on smallholder fishers in North Aceh if it is not balanced with adequate supporting policies. The lack of policy socialization and limited access to resources and technology make it difficult for small fishermen to adapt to this policy. Therefore, an empowerment approach based on the local needs of fishermen is needed, such as strengthening cooperatives, financial support, and the use of technology. The empowerment of smallholder fishers should include social, economic, and institutional support that can strengthen their adaptability to PIT policies. In addition, stabilizing fish prices and ensuring fuel supply are important to ensure the sustainability of fishermen's livelihoods. Thus, PIT policies can be implemented more effectively and sustainably, and provide fair benefits for smallholder fishers.

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**Authors' Contribution**

Both authors contributed equally to the development of this article.

**Data availability**

All datasets relevant to this study's findings are fully available within the article.

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