

STRATEGIES OF IMPROVING INCOME FOR HANDLINE RED SNAPPER FISHER IN LAMONGAN REGENCY, EAST JAVA

Strategi Peningkatan Pendapatan Nelayan Pancing Ulur untuk Kakap Merah di Kabupaten Lamongan, Jawa Timur

Lina Indriani^{1*}, Sugeng Hari Wisudo², Am Azbas Taurasman², Mohammad Imron²

¹Fisheries Socio-Economics Study Program, Mulawarman University, East Kalimantan

²Marine Fisheries Technology Study Program, IPB University, West Java

Kuaro Street, Gn. Kelua, Samarinda Ulu District, Samarinda City, East Kalimantan 75117

*Corresponding author: linaindriani@fpik.unmul.ac.id

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ABSTRACT

The red snapper is one of the fishery commodities with high economic value in Indonesia. In Lamongan Regency, one of the fish landing areas where red snapper is a primary catch commodity is located in Kandangsemangkon Village, Paciran District. However, the income of crew members (ABK) working in the red snapper fishery remains relatively low, which may affect their level of welfare. The average income of red snapper fishermen in Kandangsemangkon Village is IDR 1.667.448/month, which is below the minimum wage in Lamongan Regency. The government needs to formulate strategies to increase the income of red snapper fishermen. This study aims to formulate strategies to increase the income of red snapper fishers in Lamongan Regency. The study used a purposive sampling method. The data were analyzed using descriptive analysis and SWOT analysis. The results indicate that four strategies were formulated. These four strategies are improving the quality of fish catches by replacing ice blocks with slurry ice, facilitating the creation of alternative livelihoods, controlling the quantity of fish marketed according to demand using a warehouse receipt system, and optimizing the number of workers every boat.

Keywords: fisher, income, wages, strategy, SWOT

ABSTRAK

Ikan kakap merah termasuk salah satu komoditas perikanan yang memiliki nilai ekonomi tinggi di Indonesia. Di Kabupaten Lamongan, salah satu lokasi pendaratan ikan yang menjadikan kakap merah sebagai komoditas utama hasil tangkapan berada di Desa Kandangsemangkon, Kecamatan Paciran. Namun, pendapatan nelayan anak buah kapal (ABK) yang bekerja pada perikanan kakap merah masih relatif rendah, sehingga kondisi tersebut berpotensi memengaruhi tingkat kesejahteraan mereka. Pendapatan rata-rata ABK perikanan kakap merah di Desa Kandangsemangkon Rp1.667.448/bulan, yakni di bawah upah minimum Kabupaten Lamongan. Pemerintah perlu merumuskan strategi untuk meningkatkan pendapatan nelayan

kakap merah. Penelitian ini bertujuan untuk merumuskan strategi peningkatan pendapatan nelayan kakap merah di Kabupaten Lamongan. Metode pengambilan sampel menggunakan *purposive sampling*. Analisis data dilakukan secara deskriptif dan SWOT. Hasil penelitian menunjukkan bahwa strategi yang dirumuskan ada empat. Keempat strategi tersebut adalah peningkatan mutu hasil tangkapan ikan dengan mengganti es balok dengan *slurry ice*, memfasilitasi penciptaan mata pencaharian alternatif, mengendalikan jumlah ikan yang dipasarkan sesuai kebutuhan dengan menggunakan sistem resi gudang, mengoptimalkan jumlah tenaga kerja (nelayan) perkapal.

Kata Kunci: Nelayan, Pendapatan, Upah, Strategi, SWOT

INTRODUCTION

East Java boasts the highest capture fishery production in Indonesia and plays a strategic role in supporting the national fisheries sector. This high level of production is facilitated by East Java's geography, characterized by an extensive coastline and access to waters with significant fishing potential. Furthermore, the presence of fishing ports, fishing fleets, and the economic activities of coastal communities reinforces East Java's position as a key hub for capture fishery production in Indonesia. Fisheries statistics from the Ministry of Marine Affairs and Fisheries (KKP) indicate that capture fishery production in East Java reached 633,718 tons, accounting for 8% of the national total. This achievement demonstrates East Java's significant contribution to national fishery output. The substantial production volume reflects intense fishing activity by both small-scale and industrial-scale fishermen across various coastal areas. The catch comprises a diverse range of commodities—spanning pelagic to demersal species—that hold high economic value and serve as regional specialties.

One area where red snapper is a leading commodity is Lamongan Regency, East Java. Yusrizal *et al.* (2019) reported that red snapper has a Location Quotient (LQ) of 2.61, classifying it as a primary leading product in Lamongan Regency. This high LQ value reflects the significant contribution of red snapper to the local fisheries sector and highlights Lamongan Regency's comparative advantage in developing this commodity. This advantage is supported by the availability of fish resources, fishermen's experience, the presence of fisheries infrastructure and facilities, and well-developed marketing networks. Consequently, red snapper serves not only as a key capture fishery commodity but also as a primary driver of economic growth for coastal communities in Lamongan Regency.

One of the centers for red snapper capture fisheries in Lamongan Regency is Kandangsemangkon Village, Paciran District. Despite its status as a leading commodity, the income of small-scale red snapper fishermen remains low. The Ministry of Marine Affairs and Fisheries (KKP) issued Decree Number 123 of 2021 regarding the Snapper Fisheries Management Plan (RPP), which acknowledges the issue of low incomes among small-scale fishermen. Previous research by Indriani *et al.* (2022) indicated that the average net income of crew members in Paciran District—specifically in Kandangsemangkon Village—was Rp1,667,448 per month.

The income of red snapper fishermen (crew members) in Lamongan Regency remains below the 2023 Lamongan Regency minimum wage of IDR 2,501,977 and is classified as low. Low income levels among fishermen can affect their overall welfare (Fujiani and Prayogo, 2022). Improving welfare is one of the government's responsibilities. In Lamongan, the local government and the Lamongan Regency Fisheries and Marine Affairs Agency have undertaken efforts to improve the welfare of those involved in the fisheries sector. The Lamongan Regency Government supports raising the standard of living for small-scale fishermen to achieve greater welfare by enacting Lamongan Regency Regional Regulation Number 5 of 2021 concerning the empowerment of small-scale fishermen. Furthermore, the Lamongan Regency Fisheries

and Marine Affairs Agency formulated a 2021–2026 strategic plan that aims, in part, to improve the welfare of fisheries businesses by increasing fishermen's income. Other government initiatives to boost income include launching the "Lamongan Jaya" flagship program—which focuses on innovative, fish-based products—as well as providing assistance packages (basic necessities) and free medical treatment to fishermen's families.

However, the programs implemented by the government to date have not succeeded in raising fishermen's income. Persistently low income levels result in poor welfare and quality of life for fishermen, while also negatively impacting regional economic growth and sustainability (Prasetyaningtyas, 2017). Therefore, the government needs to formulate appropriate strategies to increase fishermen's income. Nainggolan *et al.* (2020) noted that developing business activities through sound strategic management leads to continuous improvements in business performance. Local governments bear the responsibility of improving the welfare of their communities, including fishermen. Both the local government and the Lamongan Regency Fisheries Agency have programs aimed, in part, at enhancing the welfare of fisheries businesses. Fishermen's income levels influence their well-being and impact the local economy. This study aims to formulate strategies to increase the income of red snapper fishermen in Kandangsemangkon Village, Lamongan Regency, East Java. The findings can serve as a basis for developing income-enhancement strategies to improve the welfare of red snapper fishermen and support sustainable capture fisheries development. The strategy formulation employs a SWOT analysis approach, incorporating in-depth interviews with relevant stakeholders. The study is expected to assist the government in addressing issues effectively and efficiently, while also improving fishermen's welfare and fostering a responsible, sustainable red snapper fishery.

RESEARCH METHODS

Data collection took place in Kandangsemangkon Village, Paciran District, Lamongan Regency—a key landing site for red snapper in the region. Data collection relied on observation and interviews. The study utilized both primary and secondary data regarding the socio-economic conditions of fishermen, the red snapper fishery business, and factors influencing fishermen's income in Kandangsemangkon Village. Primary data were obtained directly from respondents through structured interviews and field observations. Secondary data were sourced from the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia, Statistics Indonesia (BPS), the Lamongan Regency Fisheries Agency, fishermen group documents, and fishery statistical reports.

The study employed two groups of respondents for distinct analytical purposes. The first group—comprising handline fishermen in Kandangsemangkon Village (totaling 38 fishing units)—was used to analyze socio-economic conditions and income-influencing factors. Based on the FAO **Handbook for Fisheries Socio-Economic Sample Survey** (2017), which recommends a 50% sampling rate for strata with fewer than 50 units, a sample of 19 fishermen was selected using purposive sampling. Respondent criteria included operating a handline fishing unit targeting red snapper, residing in Kandangsemangkon, and possessing extensive knowledge of the red snapper fishery business. The second group—used for IFAS and EFAS assessments within the SWOT analysis—was selected via purposive sampling, comprising one representative from the Lamongan Regency Fisheries Agency and one fisheries extension officer. Criteria for the Fisheries Agency respondent included a minimum tenure of three years and familiarity with the formulation and development of the 2021–2026 Fisheries Strategic Plan. The selection of two respondents for the IFAS and EFAS assessments—comprising an official from the Lamongan Regency Fisheries Agency and a fisheries extension officer—was based on a key informant approach rather than a population sampling method requiring statistical generalization. These individuals were chosen because they are directly

involved in and hold authority over the formulation and implementation of the Lamongan Regency Fisheries Strategic Plan (2021–2026); consequently, they are considered to possess the best understanding of the existing conditions, policy direction, and the internal and external factors influencing strategies to increase the income of handline fishermen in Kandangsemangkon Village.

Data analysis was conducted using the SWOT (Strengths, Weaknesses, Opportunities, Threats) framework. The first stage involved identifying external factors (opportunities and threats) and internal factors (strengths and weaknesses). The second stage entailed weighting these factors using the EFAS (External Factors Analysis Strategy) and IFAS (Internal Factors Analysis Strategy) matrices. Weighting and rating were performed by the Lamongan Regency Fisheries and Marine Affairs Agency and fisheries extension officers in the Kandangsemangkon Village area. The EFAS and IFAS matrices were constructed by listing the relevant factors and assigning a weight to each, ranging from 1.0 (highly important) to 0.0 (unimportant). Subsequently, ratings were calculated for the IFAS and EFAS matrices; for opportunities and strengths, higher values corresponded to greater significance (i.e., a major opportunity or strength received a higher value, while a minor one received a lower value). Conversely, ratings for threats and weaknesses were assigned in reverse: a significant threat or weakness received a rating of 1, whereas a minor one received a rating of 4.

The final stage involved strategy formulation using the SWOT matrix, comprising four specific strategies: 1) SO Strategy (Strengths (S) and Opportunities (O)): a strategy derived from combining these elements to leverage strengths in capitalizing on identified opportunities; 2) WO Strategy (Weaknesses (W) and Opportunities (O)): a strategy formulated to maximize identified opportunities while minimizing weaknesses; 3) ST Strategy (Strengths (S) and Threats (T)): a strategy that maximizes existing strengths to minimize prevailing threats; 4) The WT strategy (Weaknesses (W) and Threats (T)) is employed when facing both threats and weaknesses; the strategy formulated aims to escape this precarious situation by shifting focus to a better alternative venture.

RESULT

Analysis of Internal and External Factors

a) Internal Factors

Internal environmental factors are factors present within the environment that nonetheless influence the viability of fishing operations. These internal factors relate to the strengths and weaknesses of the Lamongan Regency Government—specifically the Department of Fisheries and Marine Affairs—regarding efforts to increase the income of crew members (ABK), as outlined in the IFAS matrix (Table 1).

Table 1. IFAS Matrix

Internal Strategic Factors	Quality	Rating	Score
Strength			
A good relationship between the district-level and provincial-level Fisheries and Marine Affairs Agencies.	0,175	3	0,525
Supervision and guidance for fishermen are already being provided by the Lamongan Regency Fisheries and Marine Affairs Agency.	0,125	3	0,375
Facilities for accessing training and marketing for processed fishery products are already available through the Lamongan Regency Fisheries and Marine Affairs Agency.	0,100	2,5	0,250

Internal Strategic Factors	Quality	Rating	Score
Ease of access for submitting proposals to the East Java Provincial Marine Affairs and Fisheries Agency.	0,225	4	0,900
Total Strength			2,050
Weakness			
The Lamongan Regency Fisheries and Marine Affairs Agency does not have the authority to formulate policies.	0,100	2	0,200
Limitations in the guidance of fishermen groups by the Lamongan Regency Fisheries and Marine Affairs Agency.	0,050	3,5	0,175
Limitations regarding the provision of business capital assistance by the Lamongan Regency Fisheries and Marine Affairs Agency.	0,125	4	0,500
Limited market access faced by the Lamongan Regency Fisheries and Marine Affairs Agency.	0,100	2,5	0,250
Total Weakness			1,125
Difference Between Total Strengths and Total Weaknesses			0,925
Total IFAS			3,175

b) External Factors

External environmental factors are those situated outside the immediate operational environment yet capable of influencing the viability of fishing operations. These external factors—which relate to opportunities and threats beyond the control of the Lamongan Regency Marine and Fisheries Agency—can impact the growth of fishermen's incomes and are outlined in the EFAS matrix (Table 2).

Table 2. EFAS Matrix

External Strategic Factors	Quality	Rating	Score
Opportunities			
There is an independent fishermen's group (Kandangsemangkon Village Fishermen's Association).	0,175	3	0,525
High market demand from consumers	0,175	3,5	0,613
Sustainable fish landing site in Kandangsemangkon Village	0,100	2	0,200
Obtaining government support	0,175	3,5	0,613
Total Probability			1,951
Threats			
The existence of a bond between fishermen and agents.	0,038	3	0,114
High operational costs for going to sea	0,125	1	0,125
Adverse weather conditions and fluctuations in the red snapper fishing season	0,088	2,5	0,220
The absence of sustainable business financial management in Kandangsemangkon Village.	0,050	2,5	0,125
Fluctuating market prices and production of red snapper	0,075	2	0,150
Total Threat			0,734
Difference between Total Chances and Total Threats			1,217
Total EFAS			2,685

The strategy formulation stage employs a SWOT matrix based on internal and external factors—specifically SO (strengths-opportunities), WO (weaknesses-opportunities), ST (strengths-threats), and WT (weaknesses-threats) strategies—as presented in Table 3.

Table 3. SWOT Matrix

IFAS EFAS	STRENGTHS (S) 1. A good relationship between the regency-level and provincial-level marine and fisheries agencies; 2. The Lamongan Regency Marine and Fisheries Agency is already conducting supervision and providing guidance to fishermen; 3. Facilities for accessing training and marketing for processed fishery products are already available through the Lamongan Regency Marine and Fisheries Agency; 4. Ease of access for submitting proposals to the East Java Provincial Marine Affairs and Fisheries Agency.	WEAKNESSES (W) 1. The Lamongan Regency Marine and Fisheries Agency does not have the authority to formulate policies in the marine and fisheries sector; 2. Limitations in the guidance of fishermen groups by the Lamongan Regency Marine and Fisheries Agency; 3. Limitations in providing business capital assistance from the Lamongan Regency Marine and Fisheries Agency; 4. Limited market access faced by the Lamongan Regency Marine and Fisheries Agency.
OPPORTUNITIES (O) 1. There is an independent fishermen's group known as the Kandangsemangkon Village Fishermen's Association (Rukun Nelayan); 2. High market demand from consumers; 3. Sustainable fish landing site in Kandangsemangkon Village; 4. Obtaining government support.	SO STRATEGY 1. Improving the quality of fish catches (S1, S2, S3, S4; O1, O2, O3, O4)	WO STRATEGY 1. Facilitating the creation of alternative livelihoods for fishermen and crew members (W1, W2, W3, W4; O1, O2, O3, O4)

THREATS (T)	ST STRATEGY	WT STRATEGY
1. The existence of a bond between fishermen and agents; 2. High operational costs for going to sea; 3. Adverse weather conditions and the fluctuating red snapper fishing season; 4. Absence of financial management for sustainable business activities in Kandangsemangkon Village; 5. Fluctuating market prices and production of red snapper.	1. Controlling the volume of fish marketed according to demand (S1, S2, S3, S4; T1, T2, T3, T4, T5, T6)	1. Optimizing the number of crew members (fishermen) per vessel (W3; T3, T5, T6).

DISCUSSION

The strategy formulation process employs SWOT analysis. SWOT analysis is a systematic method for identifying internal and external factors—specifically strengths, weaknesses, opportunities, and threats—to formulate strategies. It encompasses efforts to recognize the internal and external factors that determine the performance of the company or organizational group under analysis (Mashuri & Nurjannah, 2020). The subject of the SWOT analysis in this study is the red snapper fishery in Kandangsemangkon Village, Paciran District, Lamongan Regency, East Java. The study focuses on fishermen based in Kandangsemangkon Village who use handline fishing gear to target red snapper as their primary commodity. The issue addressed is that while fishermen in Kandangsemangkon Village rely on fishing activities to meet their household needs, the income generated solely from fishing remains insufficient. If this situation persists, the fishermen will continue to experience low levels of welfare. Consequently, strategies implemented by the Lamongan Regency Government—specifically the Fisheries and Marine Affairs Agency—to improve fishermen's welfare must be optimized by increasing the income of those engaged in handline fishing for red snapper. The analysis of internal and external factors is detailed below:

a) Internal Factors

1) Strength

Internal strength factors influencing the increase in income for crew-member fishermen comprise four key aspects. The Lamongan Regency Fisheries and Marine Affairs Agency maintains a strong relationship with East Java Province—including plans for research assistance regarding alternative livelihoods for fishermen—with a weight of 0.175, a rating of 3, and a score of 0.525. Additionally, fisherman supervision and guidance—conducted through patrols and field monitoring—have been effectively implemented, earning a weight of 0.125, a rating of 3, and a score of 0.375. Facilities for training and the marketing of processed fishery products are also available; however, with a weight of 0.10, a rating of 2.5, and a score of 0.25, this represents the lowest-valued strength among the identified aspects.

The most significant strength lies in the ease of access for submitting proposals to the East Java Provincial Marine Affairs and Fisheries Agency; this factor holds the highest weight (0.225), a rating of 4, and a total score of 0.9. This accessibility creates a strategic opportunity

to propose periodic education and training programs, thereby enhancing fishermen's skills and improving the quality of fishing operations, particularly in Kandangsemangkon Village. Given its dominant total strength score, this aspect serves as a primary asset in formulating strategies to increase the income of crew-member fishermen.

2) Weaknesses

Meanwhile, the identified weaknesses also encompass four aspects. The most significant weakness is the Lamongan Regency Fisheries and Marine Affairs Agency's lack of authority to formulate policy—as all policies are established by the East Java Provincial Marine Affairs and Fisheries Agency—which carries a weight of 0.1, a rating of 2, and the lowest score of 0.2. Limited reach in providing guidance to fishermen groups—unevenly distributed due to budget constraints—also constitutes a weakness, with a weight of 0.05, a rating of 3.5, and a score of 0.175. Furthermore, limited market access regarding fish pricing received a weight of 0.1, a rating of 2.5, and a score of 0.25, given that price determination relies entirely on agreements between buyers and sellers in the field.

Another weakness is the Lamongan Regency Fisheries and Marine Affairs Agency's limited capacity to provide business capital assistance, including for the planned establishment of a fishermen's cooperative in Kandangsemangkon Village, which requires substantial capital. Although establishing a cooperative is a hope held by the local fishing community, budget constraints mean that business operations are still managed individually. This weakness received a rating of 4, a weight of 0.125, and a score of 0.5, making it the weakness with the greatest impact compared to the others; consequently, it requires serious attention in future policy planning.

Based on the IFAS (Internal Factor Analysis Summary) table analysis, the total score for internal factors was derived by summing the scores of all strengths and weaknesses. The total strength score reached 2.05—the sum of the scores from the four strength indicators—while the total weakness score was 1.125, derived from the four weakness indicators. The difference between the total strength and weakness scores indicates that strengths are more dominant than weaknesses; thus, the Lamongan Regency Fisheries and Marine Affairs Agency holds a sufficiently strong internal position to develop strategies for increasing the income of crew-member fishermen in Kandangsemangkon Village. This situation indicates that the opportunity to increase fishermen's income can be optimized if existing strengths are fully leveraged to address remaining weaknesses.

b) External Factors

1) Opportunities

The opportunities influencing the increase in income for crew-member fishermen in Kandangsemangkon Village encompass four key aspects. First, the existence of an independent fishermen's group—the **Rukun Nelayan Kandangsemangkon** (RnK)—presents a strategic opportunity for the government to develop the red snapper capture fishery, with a weight of 0.175, a rating of 3, and a score of 0.525. This group facilitates more organized guidance and extension activities for the fishermen. Second, the continuously developing fish landing site, equipped with adequate infrastructure, supports smooth fishing production operations, with a weight of 0.1, a rating of 2, and a score of 0.2.

The greatest opportunities stem from two aspects that achieved the highest scores of 0.613 each. The first aspect is the high market demand for red snapper—for both domestic and export markets—with a weight of 0.175 and a rating of 3.5. The second aspect is the full support from the local government for fishing operations in Kandangsemangkon Village, given that the fishing gear used is environmentally friendly and the catch is a prime commodity in Lamongan Regency; this aspect carries a weight of 0.175 and a rating of 3.5. These two opportunities provide a solid foundation for the sustainability of fishing operations in the area.

2) Threats

There are five external factors posing threats to increasing fishermen's income. One such threat is the dependency relationship between fishermen and agents; fishermen borrow funds for operational costs from agents, necessitating the sale of their catch through these intermediaries (weight: 0.038; rating: 3; score: 0.114). This situation undermines the fishermen's bargaining power in the market. Furthermore, high operational costs for fishing trips constitute the most significant threat (weight: 0.125; rating: 1; score: 0.125), as higher operational expenses directly reduce the fishermen's net income. Adverse weather conditions and the unpredictable red snapper fishing season also threaten the stability of fishermen's income (weight: 0.088; rating: 2.5; score: 0.220).

Another threat affecting fishermen's income is the lack of sustainable business financial management. The absence of consistent and responsible personnel to manage business finances presents a serious obstacle (weight: 0.05; rating: 2.5; score: 0.025). Additionally, fluctuations in red snapper prices—determined by market agreements rather than government regulation—lead to income instability (weight: 0.075; rating: 2; score: 0.15). Collectively, these threats highlight the need for a comprehensive strategy from the Lamongan Regency Fisheries and Marine Affairs Agency to minimize the impact of negative external factors on the income of crew-member fishermen in Kandangsemangkon Village.

How to Implement the Strategy

1. SO Strategy

1) Improving the quality of fish catches

The selling price is influenced by the quality of the catch. Fishermen sell their catch in fresh form. Quality criteria for red snapper are categorized into two grades: Grade A (high-quality fish) and Grade B (fish of lower freshness). This difference in quality affects market prices; Grade A fish command a higher price than Grade B fish. For Grade A red snapper, the highest average price is IDR 88,000/kg, while the lowest is IDR 69,000/kg. For Grade B red snapper, the highest average price is IDR 55,000/kg, and the lowest is IDR 30,000/kg. Higher fish quality leads to higher prices, thereby increasing the fishermen's income.



Figure 2. Grade A red snapper quality sold by fishermen

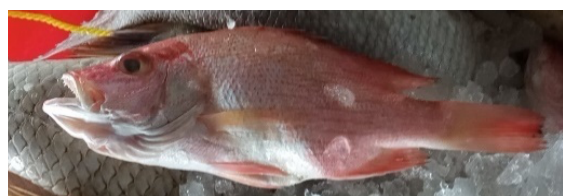


Figure 3. Grade B red snapper quality sold by fishermen

Field research indicates that red snapper fishermen use block ice for cooling during fishing operations. However, block ice has several drawbacks: it melts quickly and is bulky—occupying significant storage space that could otherwise hold more catch—and it offers a limited storage duration (Tiku *et al.*, 2023). Furthermore, manually crushed block ice often retains sharp, hard fragments that can damage the fish, thereby reducing both the

quality and market value of the catch. Consequently, storing fish with softer or finer ice is preferable. Given these conditions, slurry ice could replace block ice as the cooling medium. Cooling fish with slurry ice maintains the temperature of fresh fish for up to 12 days, preserving good sensory and microbiological quality (Nasirin *et al.*, 2016).

This strategy could be implemented through a collaborative effort involving the Lamongan Regency Fisheries Agency and various stakeholders—such as vessel owners, the Kandangsemangkon fishermen's group, port operators, and the East Java Provincial Marine and Fisheries Agency—to innovate and improve fish handling and quality. Fishermen face obstacles in adopting slurry ice due to the high cost of purchasing ice-crushing machinery. Therefore, the local government could assist by providing ice-crushing machines to the fishermen in Kandangsemangkon Village. The Lamongan Regency Marine and Fisheries Agency is well-positioned to facilitate this, thanks to its strong relationship with the provincial agency and its ability to submit proposals. A proposal for ice-crushing machines could be advanced by leveraging existing opportunities, specifically the presence of the Kandangsemangkon fishermen's group and the availability of government support. Proposals for implementing these innovations can be presented during discussion forums to facilitate decisions on effective and efficient policy strategy execution. Furthermore, outreach and guidance can be provided to local fishermen regarding proper fish handling practices; such efforts can be supported through collaboration with the East Java Provincial Marine Affairs and Fisheries Agency. Additionally, the Lamongan Regency Marine Affairs and Fisheries Agency and officials from the Brondong National Fishing Port (PPN) can collaborate to monitor and evaluate the quality of the fish catch.

2. WO Strategy

1) Facilitating the creation of alternative livelihoods for fishermen and crew members

Fishermen's income from fishing activities has not been optimally sufficient to meet their living needs, especially for crew members. Fishermen's income during the off-season and when there is no fishing activity is low due to the influence of the fishing season. Fishing businesses can be affected by the season, resulting in uncertainty for fishermen's livelihoods (Lukum *et al.*, 2023), which can lead to fishermen lacking a steady income and facing economic vulnerability (Yuniarti & Sukarniati, 2021). The Provincial Fisheries and Maritime Affairs Office, together with the Lamongan Regency Fisheries Office, are collaborating on research into alternative livelihoods for fishermen. This presents an opportunity to identify new alternative livelihoods and increase new sources of income. Therefore, the Regency and Provincial Fisheries and Maritime Affairs Offices can assist in facilitating the creation of alternative livelihoods for crew members in Kandangsemangkon Village. The following are several stages of implementing alternative livelihoods (Arief *et al.*, 2021):

- a) Considering the technical aspects of developing alternative business ventures based on interests and aptitudes, the availability of resources or raw materials and labor, and market opportunities;
- b) Conducting a financial feasibility analysis for each alternative business option;
- c) Raising awareness among fishermen about alternative livelihoods;
- d) Providing guidance and support to fishermen in the implementation of the strategy.

3. ST Strategy

1) Controlling the volume of fish marketed according to demand

Fluctuating market prices, production levels, and fishing seasons pose challenges to increasing fishermen's incomes. Red snapper is a suitable candidate for the Warehouse Receipt System (SRG) because it falls under the category of fish commodities eligible for storage within the system, provided that requirements regarding shelf life, quality, minimum quantity, and the availability and suitability of cold storage facilities and supporting

institutions are met. Law Number 9 of 2011 concerning the Warehouse Receipt System (SRG) outlines that the system aims to improve public welfare. The warehouse receipt system encompasses activities related to the issuance, transfer, pledging, and settlement of warehouse receipt transactions. This system allows for the management of fish supplies during peak production seasons—when market prices are typically low—by enabling the fish to be stored in cold storage facilities under the warehouse receipt scheme. Fishermen can then sell the stored fish when market prices rise, thereby increasing their income. This initiative can be further bolstered by the Lamongan Regency Fisheries and Marine Affairs Agency submitting program proposals to the East Java Provincial Marine Affairs and Fisheries Agency.

Red snapper has the potential to meet the commodity requirements of the Warehouse Receipt System (SRG), particularly when stored in a frozen state. Assessing the feasibility of implementing the SRG for red snapper requires consideration of commodity specifications. According to the Minister of Trade Regulation Number 14 of 2026 concerning Goods and Goods Requirements Eligible for Storage in the Warehouse Receipt System, fish are among the eligible commodities, provided they have a shelf life of at least three months, meet specific quality standards, and satisfy minimum storage quantity requirements. Frozen red snapper has been shown not to undergo significant nutritional degradation during 180 days of storage. When stored at -18°C for 180 days, red snapper retains its chemical and microbiological characteristics within acceptable limits, ensuring its nutritional value does not significantly decline from the initial standard (Foruzani *et al.*, 2018). Regarding quality, any fish intended for storage in the SRG must undergo quality testing in accordance with established standards. These standards align with the Regulation of the Commodity Futures Trading Regulatory Agency (Bappebti) Number 2 of 2026 concerning Warehouse Requirements for Goods Stored in the Warehouse Receipt System—specifically SNI 8661:2023—and mandate the use of cold storage facilities compliant with regulations for frozen fish commodities. Therefore, the suitability of red snapper as an SRG commodity at the research site must be verified through quality testing and an assessment of storage facility compliance. Meanwhile, the minimum quantity requirement cannot yet be confirmed as met until calculations are performed regarding the volume of red snapper production that can be consolidated from fishermen in Kandangsemangkon Village.

The readiness of cold chain facilities is a crucial aspect in evaluating the feasibility of implementing the SRG for red snapper. According to the 2024 Annual Report of PPN Brondong, the facility possesses cold storage infrastructure with a recorded capacity of 400 tons—including an 8-ton Air Blast Freezer (ABF)—as well as two 50-ton units and two 3-ton Air Blast Freezers (ABF). While these facilities have the potential to support the handling and storage of frozen fish, their utilization for storing red snapper within the Warehouse Receipt System (SRG) framework requires further verification. Key aspects to be assessed include effective capacity, operational conditions, access for fishermen, storage costs, and the facility's compliance with SRG warehouse requirements.

However, the mere existence of a cold storage facility does not automatically imply that it is ready for use in supporting the Red Snapper Warehouse Receipt System (SRG). Field observations indicate that the utilization of the cold storage facility for red snapper caught by local fishermen has not yet been optimal. Therefore, key areas requiring attention include optimizing the existing facility by managing access and usage, consolidating catches, managing storage costs, and establishing institutional arrangements that link fishermen with the cold storage facility's management.

The presence of an active *Rukun Nelayan* (Fishermen's Association) in Kandangsemangkon Village (RNK) serves as a valuable institutional asset for supporting the implementation of the SRG. Strengthening the role of the Fishermen's Association could

focus on organizing red snapper catches, coordinating among fishermen, recording fish volume and quality, and liaising with cold storage management and SRG support institutions. Through collaborative management, catches from multiple fishermen can be consolidated to meet storage volume requirements and enhance the efficiency of the cold storage facility's utilization.

4. WT Strategy

1) Optimizing the number of crew members (fishermen) per vessel

Labor is a crucial input in fishing operations. The workforce on a fishing vessel comprises the captain, fishermen, and other crew members—including cooks, engine operators, and those directly involved in catching fish. Efficient fishing operations can be achieved by optimizing the vessel's workforce size. The number of crew members influences the value of the catch share and the resulting earnings. Research by Pusung *et al.* (2022) indicates that labor has a positive and significant impact on fishermen's income, thereby contributing to increased earnings. Consequently, a strategy is being planned to optimize the number of workers (fishermen) per vessel.

This study reveals a trend of rising costs as the number of workers on the vessel increases. For a vessel with six workers, the total cost—comprising crew wages, the boat owner's share, and operational expenses—amounts to IDR 24,156,862 per trip. This figure rises to IDR 28,914,706 per trip with seven workers, IDR 35,975,553 per trip with eight workers, and IDR 48,013,292 per trip with nine workers. Thus, increasing the workforce from six to seven people raises the total cost by IDR 4,757,844 (19.7%); increasing it from seven to eight people raises the cost by IDR 7,060,847 (24.4%); and increasing it from eight to nine people raises the cost by IDR 12,037,739 (33.5%). This pattern demonstrates that the incremental cost grows larger at higher staffing levels. Given these conditions, the strategy for optimizing crew size in the red snapper fishery focuses on determining a workforce number that aligns with technical requirements and vessel productivity. When considering the addition of a crew member, one must weigh the potential increase in catch or revenue against the associated additional costs.

Strategies to optimize crew size must take into account minimum manning requirements, task allocation, workload, and crew safety—referencing, for instance, Regulation of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia Number 4 of 2026 concerning fishing vessel manning governance (including quality standards and minimum manning levels), which aims, among other things, to ensure navigational safety. The Lamongan Regency Marine and Fisheries Agency can take action by providing guidance and facilitating the optimization of the workforce (fishermen) per vessel. The workforce size should be aligned with the vessel's capacity to ensure cost efficiency and, consequently, increased income (Pusung *et al.*, 2022). The mechanism for optimizing the workforce (fishermen) can be implemented as follows:

1. Establishing workforce planning objectives;
2. Conducting a survey of the workforce (fishermen) size, adjusted according to vessel size and fishing gear;
3. Conducting human resource mapping based on technical requirements;
4. Calculating the size of the workforce;
5. Developing a workforce plan;
6. Monitoring and evaluation of employment.

CONCLUSION

Based on the strategic analysis formulated to increase the income of crew-member fishermen using the SWOT matrix, four strategies have been identified: improving the quality of the catch, facilitating the creation of alternative livelihoods for crew-member fishermen,

controlling the volume of fish marketed in line with demand, and optimizing the workforce (number of fishermen) per vessel.

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