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RESEARCH ARTICLE

Socio-Economic Study of Traditional Fishermen in Sayolo Village Papua as a Basis for Affirmative Welfare Programs

Kajian Sosial Ekonomi Nelayan Tradisional Kampung Sayolo Papua sebagai Dasar Program Afirmatif Peningkatan Kesejahteraan

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Abstract. Traditional fishers in coastal areas of Papua face limitations in fishing technology, access to capital, and market access, which contribute to the low welfare levels of fishing households. This study aimed to analyze the socioeconomic conditions of traditional fishers in Sayolo Village, Teminabuan District, South Sorong Regency, and to formulate the need for affirmative programs to improve their welfare. This study employed a descriptive qualitative and quantitative approach through field observations, in-depth interviews, questionnaires administered to 30 fisher household heads, and Focus Group Discussions (FGDs) involving relevant stakeholders. The results showed that 70% of respondents worked as full-time fishers, with educational attainment predominantly at the elementary school level (53%). Average fish catches ranged from 30–45 kg per week during the peak fishing season and declined to 15–20 kg per week during unfavorable seasons. Net income ranged from approximately IDR 200,000 to IDR 650,000 per week, which remained below the Provincial Minimum Wage. Operational cost structures were dominated by fuel expenses, accounting for 45–55% of total costs, thereby increasing income vulnerability among fishers. Existing affirmative programs included fishing gear assistance, fish processing training, and village financial support; however, their implementation remained uneven. The policy implications suggest the need to strengthen fishers' institutions, improve access to financial capital, provide post-harvest facilities, and promote the empowerment of coastal women based on local resource potential.

Keywords: small-scale fisheries, coastal communities, empowerment, affirmative policy.

Abstrak. *Nelayan tradisional di wilayah pesisir Papua menghadapi keterbatasan teknologi penangkapan, akses permodalan, dan pemasaran yang berdampak pada rendahnya tingkat kesejahteraan rumah tangga. Penelitian ini bertujuan menganalisis kondisi sosial ekonomi nelayan tradisional di Kampung Sayolo, Distrik Teminabuan, Kabupaten Sorong Selatan, serta merumuskan kebutuhan program afirmatif untuk peningkatan kesejahteraan. Penelitian menggunakan pendekatan deskriptif kualitatif dan kuantitatif melalui observasi lapangan, wawancara mendalam, kuesioner terhadap 30 kepala keluarga nelayan, serta Focus Group Discussion (FGD) dengan pemangku kepentingan. Hasil penelitian menunjukkan bahwa 70% responden bekerja sebagai nelayan penuh dengan tingkat pendidikan didominasi SD (53%). Rata-rata tangkapan berkisar 30–45 kg per minggu pada musim baik dan 15–20 kg pada musim buruk, dengan pendapatan bersih sekitar Rp200.000–Rp650.000 per minggu, masih di bawah Upah Minimum Provinsi. Struktur biaya operasional didominasi BBM sebesar 45–55% sehingga meningkatkan kerentanan pendapatan nelayan. Program afirmatif yang ada meliputi bantuan alat tangkap, pelatihan pengolahan hasil perikanan, dan dukungan dana kampung, namun implementasinya belum merata. Implikasi kebijakan menunjukkan perlunya penguatan kelembagaan nelayan, peningkatan akses permodalan, penyediaan fasilitas pascapanen, serta pemberdayaan perempuan pesisir berbasis potensi lokal.*

Kata Kunci: perikanan skala kecil, masyarakat pesisir, pemberdayaan, kebijakan afirmatif.

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INTRODUCTION

Traditional fishing communities in Papua are highly dependent on fisheries resources as their main source of livelihood. Fishing activities are generally carried out using simple fishing technology, with limited access to capital and under relatively isolated geographical conditions, which affect the productivity and welfare of fisher households (Dewi, 2018). These conditions make traditional fishers vulnerable to seasonal fluctuations, changes in aquatic environments, and instability in fish prices. Similar conditions have also been reported in various small-scale fisheries in developing countries, where limited productive assets, market access, and institutional support are identified as major factors contributing to fisher poverty (Allison & Ellis, 2001; Béné, 2009).

In the context of this study, an affirmative program is defined as a form of policy intervention specifically designed to improve the capacity and welfare of traditional fisher groups through production equipment assistance, improved access to capital, institutional strengthening, and the development of post-harvest enterprises. Affirmative programs are necessary because traditional fishers are considered a vulnerable group with limited access to economic resources and market opportunities compared with large-scale fisheries actors (FAO, 2015). This approach is consistent with the sustainable livelihoods framework, which emphasizes the importance of access to economic, social, and institutional assets in improving the welfare of coastal communities (Allison & Horemans, 2006).

Sayolo Village, as one of the coastal areas in Teminabuan District, is characterized by traditional fishers operating at a small business scale, with limited technology and restricted market access. The problems faced include low fisher income due to limited productivity (Juliantono & Munandar, 2016), dependence on collectors that weakens bargaining power (Dara et al., 2023), limited storage facilities and post-harvest technology that reduce the added value of fishery products (Suyanto, 2011), and the suboptimal implementation of sustainable empowerment programs for coastal communities (Hermawan et al., 2024). These conditions indicate the need for a specific study on the socio-economic conditions of traditional fishers in Sayolo Village as a basis for formulating affirmative programs that are aligned with local characteristics.

Previous studies have generally discussed fisher empowerment in broad terms, without specifically examining the need for affirmative programs based on local socio-economic conditions, particularly in Papua, which remains relatively underrepresented in the scientific literature. Therefore, this study seeks to address this gap by presenting an analysis of the socio-economic conditions of traditional fishers and formulating relevant affirmative program needs to improve the welfare of coastal communities in Sayolo Village. Based on the above background, this study aims to identify the socio-economic characteristics of traditional fishers in Sayolo Village, analyze their livelihood conditions and the problems they face, and formulate relevant affirmative program needs to support the sustainable improvement of fisher welfare.

MATERIAL AND METHODS

This study was conducted from May to October 2025 in Sayolo Village, Teminabuan District, South Sorong Regency, Southwest Papua Province, Indonesia. The research site was selected purposively based on several considerations: Sayolo Village is a coastal area where the majority of residents work as traditional fishers, characterized by limited fishing technology, restricted market access, and inadequate institutional support. In addition, the village has received several fisheries assistance programs whose implementation has not yet been comprehensively evaluated. These conditions made Sayolo Village a relevant study site for examining the socio-economic conditions of traditional fishers and identifying the need for affirmative programs aimed at improving coastal community welfare.

This study employed a mixed-method approach, integrating qualitative and quantitative data to provide a more comprehensive understanding of the socio-economic conditions of traditional fishers (Creswell, 2014). The quantitative approach was used to generate numerical data on fisher household characteristics, income levels, operational

costs, fishing gear types, and fishing activity patterns. Meanwhile, the qualitative approach was used to explore socio-cultural contexts, livelihood patterns, and institutional dynamics within fishing communities that could not be adequately explained through quantitative data alone (Amanah et al., 2014).

The study population consisted of all traditional fisher households in Sayolo Village. Respondents were selected using purposive sampling, with the criteria that respondents had to be active fishers who regularly engaged in fishing activities and resided within the study area. A total of 30 fisher household heads were selected as respondents. This sample size was considered representative for describing socio-economic conditions at the village level because this study was designed as a case study aimed at obtaining contextual understanding rather than statistical generalization. Therefore, the findings of this study are limited to areas with similar socio-economic characteristics and fisheries systems.

Primary data were collected using several techniques, including in-depth interviews, Focus Group Discussions (FGDs), participatory observation, and structured questionnaires (Sugiyono, 2013). In-depth interviews were conducted with community leaders, village heads, fishers, and relevant stakeholders to obtain information regarding socio-economic conditions, fisheries activities, and previously implemented assistance programs. FGDs were conducted to explore, in a participatory manner, the need for affirmative programs and the challenges faced by fishing communities (Tirkantara, 2025). Participatory observation was carried out to directly observe fishing activities, fish marketing practices, and socio-economic interactions within coastal communities. Quantitative data were collected through closed-ended and open-ended questionnaires covering respondent characteristics, fishing gear ownership, production levels, income, operational costs, and access to assistance programs (Septianda, 2024).

In addition to primary data, this study also utilized secondary data obtained from village reports, data from Statistics Indonesia (BPS), reports from the Marine and Fisheries Office, and documents related to coastal community empowerment programs (Tamrin, 2017). These secondary data were used to complement and strengthen the analysis of the socio-economic conditions of fishers in the study area.

Data analysis was conducted by integrating qualitative and quantitative data through a triangulation approach. Quantitative data were analyzed using descriptive statistics to describe the socio-economic conditions of traditional fishers. Meanwhile, qualitative data derived from interviews, FGDs, and observations were used to provide in-depth explanations of the factors influencing these conditions and to identify relevant affirmative program needs. The integration of both types of data was intended to produce a more comprehensive interpretation of the socio-economic conditions of traditional fishers in Sayolo Village and to formulate welfare improvement recommendations based on local characteristics (Creswell, 2014).

Data Sources

The data sources in this study consisted of both primary and secondary data. Primary data were obtained through field surveys using structured questionnaires administered to 30 fisher household heads to collect information on respondent characteristics, income, operational costs, fishing gear types, number of fishing trips, fish marketing systems, and household welfare conditions. In addition, in-depth interviews were conducted with key fishers, community leaders, women involved in fish trading, fisher group leaders, and district government representatives to explore their experiences, perceptions, and constraints related to fisheries activities.

Primary data were further strengthened through Focus Group Discussions (FGDs) involving fishers, coastal youth, and women entrepreneurs to validate survey findings while identifying relevant affirmative program needs. Participatory observation was also conducted to directly examine fishing activities, post-harvest handling practices, and fish marketing systems, which were documented through field notes and visual documentation.

Secondary data were obtained from official government reports, including fisheries statistics from South Sorong Regency, demographic and socio-economic data from

Teminabuan District, and the profile of Sayolo Village. Additional secondary data were collected from publications by Statistics Indonesia (BPS), reports from the Ministry of Marine Affairs and Fisheries, books, and relevant previous studies to strengthen the analysis and provide contextual support for field findings.

Data Analysis

Data analysis in this study integrated qualitative and quantitative approaches using descriptive analysis and SWOT analysis to identify strategic factors influencing the socio-economic conditions of traditional fishers in Sayolo Village. Quantitative data obtained from questionnaires were analyzed descriptively to describe respondent characteristics, income levels, operational costs, fishing activities, and access to assistance programs.

Qualitative data from interviews, FGDs, and observations were then used to identify internal and external factors affecting fisher livelihoods. SWOT analysis was employed to formulate affirmative program strategies based on the socio-economic conditions of fishers. Internal factors consisted of strengths and weaknesses related to fisher characteristics, available resources, and fisheries business activities. External factors included opportunities and threats associated with market conditions, policy support, aquatic environmental conditions, and institutional dynamics. These factors were identified through triangulation of questionnaire results, interviews, FGDs, and field observations.

After identifying strategic factors, Internal Factor Analysis Summary (IFAS) and External Factor Analysis Summary (EFAS) matrices were developed. The weighting of each factor was determined based on its level of importance as identified through FGDs and interviews with key respondents. Weights ranged from 0.00 to 1.00, with a total weight of 1.00 assigned separately for internal and external factors. Each factor was then assigned a rating on a 1–4 scale, where 1 indicated a very low influence and 4 indicated a very strong influence on the socio-economic conditions of fishers.

The score for each factor was calculated by multiplying the assigned weight by its rating. These scores were then summed to obtain the total IFAS and EFAS values. These values were used to determine the strategic position of fishers within the SWOT matrix. Based on this position, development strategies were formulated through combinations of SO (Strength–Opportunities), WO (Weakness–Opportunities), ST (Strength–Threats), and WT (Weakness–Threats) strategies.

The results of this analysis were used to formulate affirmative program needs that are aligned with the socio-economic conditions of traditional fishers in Sayolo Village. This approach was selected to align with the study objectives of identifying the socio-economic conditions of fishers, analyzing internal and external factors affecting their welfare, and formulating affirmative program needs based on local characteristics.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Fishers in Sayolo Village

The results of the study involving 30 traditional fisher household heads in Sayolo Village showed that most respondents were of productive age and had a relatively low level of education. The distribution of respondent characteristics is presented in Table 1. Most fishers were in the productive age group of 25–45 years, accounting for 63%, while the remaining respondents were over 45 years old. Educational attainment was dominated by elementary school graduates, accounting for 53%, followed by junior high school graduates at 30% and senior high school graduates at 17%. In addition, 70% of respondents worked as full-time fishers, while the remaining 30% were part-time fishers with additional occupations outside fishing activities.

The relatively low level of education affected fishers' ability to access fishing technology, market information, and government empowerment programs. This condition is consistent with previous studies stating that low educational attainment is one of the factors limiting fishers' adaptive capacity to economic and environmental changes (Juliantono & Munandar, 2016). In addition, the dominance of full-time fishers indicates the high dependence of households on fisheries as their main source of income;

therefore, fluctuations in fish catches strongly affect the welfare conditions of fisher households. These characteristics indicate that improving fisher welfare does not depend solely on increasing production, but also requires interventions in the form of human resource capacity building, access to information, and business diversification. Therefore, the formulation of affirmative programs should consider the educational conditions, employment structure, and economic dependence of fishing communities in Sayolo Village.

Table 1. Socio-Economic Characteristics of Fisher Respondents in Sayolo Village

Characteristic	Category	Number	Percentage (%)
Age	25–35 years	10	33
	36–45 years	9	30
	>45 years	11	37
Education	SD	16	53
	SMP	9	30
	SMA	5	17
Employment status	Full-time fisher	21	70
	Part-time fisher	9	30

Fishing Activities and Fisheries Business Patterns

Fishing activities in Sayolo Village were still dominated by small-scale fisheries using simple fishing gear, such as handlines, small gillnets, and fish traps. Fishing operations were generally conducted 3–4 times per week, with each fishing trip lasting approximately 4–6 hours. This condition indicates that fishing activities remain traditional, with limited fishing grounds and relatively low business productivity. Such characteristics of small-scale fisheries using simple technology are commonly found in coastal communities in developing regions and affect production volume and fisher income (Béné, 2009; Allison & Ellis, 2001).

The results showed that fish production fluctuated substantially between favorable and unfavorable fishing seasons. As presented in Table 2, the average catch ranged from 30–45 kg per week during favorable seasons, while it decreased to 15–20 kg per week during unfavorable seasons. This production fluctuation directly affected fisher income, with net income ranging from IDR 400,000 to IDR 650,000 per week during favorable seasons and decreasing to IDR 200,000–300,000 per week during unfavorable seasons. This income variation indicates the high dependence of fishers on seasonal and weather conditions in fishing activities.

Unstable income is one of the main characteristics of traditional fisher households. Dependence on natural conditions exposes fishers to relatively high economic risks, particularly during high-wave seasons that limit fishing activities. Previous studies have shown that fluctuations in production and income are major factors contributing to the economic vulnerability of small-scale fishers, especially in areas with limited access to technology and markets (Allison & Horemans, 2006; Béné, 2009). This condition makes it difficult for fisher households to maintain stable economic planning.

Based on the income range obtained, most fisher households were categorized as low-income when compared with household needs and operational costs. In addition, dependence on a single income source from fishing activities increases household economic risk when production declines. Therefore, improving fisher welfare requires not only increased fish catches but also business diversification, stronger market access, and affirmative program support that can increase the added value of fishery products.

Table 2. Weekly Production and Income of Fishers

Parameter	Favorable Season	Unfavorable Season
Average catch (kg/week)	30–45	15–20
Gross income (IDR/week)	850.000–1.200.000	400.000–650.000
Net income (IDR/week)	400.000–650.000	200.000–300.000

Cost Structure and Business Feasibility

The operational cost structure of fishing businesses in Sayolo Village was dominated by fuel costs. Based on the results presented in Table 3, fuel accounted for 45–55% of total operational costs, followed by bait at 10–15%, ice blocks at 8–12%, gear maintenance at 10–12%, and other costs at 5–10%. This cost composition indicates that fishing businesses are highly dependent on fuel availability and prices. Such dependence makes fishing activities vulnerable to fuel price increases and weather conditions that affect fishing frequency.

The dominance of fuel costs is a common characteristic of small-scale fisheries using motorized boats with limited fishing ranges. Previous studies have shown that a high proportion of fuel costs can reduce fishing business efficiency and increase the risk of losses when catches decline (Juliantono & Munandar, 2016; Béné, 2009). This condition also contributes to low profit margins, particularly during unfavorable seasons when production decreases while operational costs remain relatively fixed.

Based on the range of net income and operational cost structure, fishing businesses in Sayolo Village remain economically feasible during favorable seasons but are highly vulnerable during unfavorable seasons. A decline in catch production significantly reduces fishers' net income, thereby limiting the ability of households to meet basic needs. In addition, the absence of business diversification makes fishers highly dependent on fish catches as their primary source of income.

These conditions indicate that improving fisher welfare depends not only on increasing production but also on improving operational cost efficiency and increasing the added value of catches. Therefore, the required affirmative programs include the provision of more efficient fishing technology, fuel-efficient boat engines, and the development of fish processing enterprises to sustainably increase fisher household income.

Table 3. Operational Cost Structure of Fishers per Trip

Cost Component	Percentage (%)
BBM	45–55
Umpan	10–15
Es Balok	8–12
Perawatan alat	10–12
Lain-lain	5–10

Role of Women in Strengthening the Economy of Fisher Households

Women in Sayolo Village play an important role in the economic activities of fisher households, particularly in the post-harvest and marketing stages of fishery products. Based on the results presented in Table 4, 87% of women were involved in cleaning and sorting catches, 72% in local sales, 60% in simple processing, and 90% in household financial management. The high level of women's involvement indicates that fisheries-related economic activities do not rely solely on fishing activities carried out by men, but are also supported by women's contributions to the fisheries value chain.

Women's involvement in post-harvest and marketing activities indirectly contributes to increasing fisher household income. Women play a role in maintaining catch quality, accelerating the sales process, and processing part of the catch into value-added products. Previous studies have shown that women's participation in the fisheries value chain can improve the economic stability of fisher households, particularly when catch production declines (Arfyanto et al., 2020; Qiyami, 2021). In addition, women also contribute to household financial management, which affects the allocation of expenditures for food, education, and health needs.

Although women's contribution is relatively high, their involvement remains limited to household-scale activities with relatively low added value. Most women do not yet have access to fish processing training, business capital, or broader marketing networks. This condition indicates that the economic potential of coastal women has not been optimally utilized. Therefore, efforts to improve fisher welfare should be

accompanied by women's empowerment through fish processing training, strengthening of micro-enterprises, and the development of group-based marketing.

The role of women in fisher household economies also serves as an adaptation strategy to income fluctuations in the fishing sector. When catches decline, processing and sales activities carried out by women help maintain household income stability. Therefore, the empowerment of coastal women is an important component of affirmative programs aimed at strengthening the economic resilience and welfare of traditional fishers in Sayolo Village. Women's roles in post-harvest and marketing activities also contribute to household income through direct sales and simple processing of fish catches. These contributions help maintain family economic stability, particularly when fishers' catches decline.

Table 4. Women's Roles in Fisheries Activities

Aktivitas	Persentase (%)
Cleaning and sorting	87
Local sales	72
Simple processing	60
Financial management	90

Market Access and Institutional Problems among Fishers

The results showed that the marketing of fishers' catches in Sayolo Village was still dominated by local collectors. Most fishers sold their catches immediately after returning from fishing due to limited cold storage facilities and post-harvest infrastructure. This condition left fishers with no alternative marketing channels, resulting in a relatively weak bargaining position in price determination. Fish prices were generally determined by collectors based on market demand and catch quality, while fishers acted as price takers.

This marketing structure indicates an oligopsonistic market pattern, in which the number of buyers is relatively limited and fishers depend on collectors as the main marketing channel. Previous studies have shown that oligopsonistic market structures in small-scale fisheries result in weak bargaining power among fishers, while a larger share of profit margins is captured by intermediaries (Dharmawan, 2007; Aidore et al., 2023). Dependence on collectors is also reinforced by limited access to transportation and price information, making it difficult for fishers to reach broader markets. In addition, the payment system used in sales transactions is generally direct and lacks a clear price contract. In some cases, fishers also receive capital assistance or loans from collectors before fishing trips, which are later repaid through deductions from catch sales. This system further strengthens fishers' dependence on collectors and limits their marketing flexibility. As a result, fishers face difficulties in obtaining more competitive prices and increasing the added value of fishery products.

Fisher institutions in Sayolo Village have also not functioned optimally as a means of strengthening bargaining power. Existing fisher groups do not yet have collective marketing systems or partnerships with broader markets. Weak institutional capacity prevents fishers from engaging in joint sales, catch storage, or collective product processing. Therefore, strengthening fisher institutions through the establishment of joint business groups or cooperatives is essential to improve market access and enhance the marketing structure of fishery products.

These limited marketing conditions directly affected fisher welfare. Low selling prices and dependence on collectors prevented fishers from optimizing their income, even when catch production increased. Therefore, the affirmative programs required include the development of collective marketing systems, the provision of cold storage facilities, and improved access to price information to strengthen the bargaining position of fishers in Sayolo Village.

SWOT Analysis

SWOT analysis was used to identify the internal and external factors affecting the socio-economic conditions of traditional fishers in Sayolo Village and to formulate

appropriate affirmative program strategies. Internal factors included strengths and weaknesses related to fisher characteristics, resources, and fisheries business activities. External factors consisted of opportunities and threats associated with market conditions, policy support, and the fisheries business environment.

The identified internal and external strategic factors were arranged in the IFAS and EFAS matrices, as presented in Table 5. The total IFAS score of 3.50 indicated that the internal conditions of fishers were characterized by relatively stronger strengths than weaknesses, particularly in terms of local knowledge, social solidarity, and the potential of productive aquatic resources. Nevertheless, fishers still faced structural weaknesses, such as limited fishing gear, restricted access to capital, and suboptimal fisher institutions. These weaknesses represented major constraints to improving the productivity and welfare of fisher households. Meanwhile, the EFAS analysis showed a total score of 3.60, indicating that external opportunities were relatively greater than the threats faced. These opportunities included government affirmative program support, increasing market demand for fishery products, and opportunities for developing fish processing enterprises. However, fishers also faced threats such as weather uncertainty, competition with fishers from outside the area, and limited marketing infrastructure. These conditions suggest that the development of traditional fisheries enterprises in Sayolo Village has considerable potential, but requires adaptive strategies to reduce external risks.

Based on the IFAS and EFAS scores, the strategic position of fishers in Sayolo Village was located in the aggressive quadrant (SO), a condition in which internal strengths can be utilized to capture external opportunities. This position indicates that fisheries business development can be pursued through the optimization of local resources and the use of available affirmative program support. The SO strategy focused on utilizing fishers' local knowledge and social solidarity to improve productivity, as well as developing fish processing enterprises based on local potential to increase added value.

In addition to the SO strategy, the WO strategy was directed toward utilizing external opportunities to overcome internal weaknesses, such as modernizing fishing gear through government assistance and strengthening fisher institutions. The ST strategy focused on using internal strengths to anticipate external threats, for example through cooperation among fisher groups in dealing with weather fluctuations and market competition. Meanwhile, the WT strategy aimed to minimize weaknesses and avoid threats by improving fishers' capacity and developing collective marketing systems.

The results of the SWOT analysis indicated that the required affirmative programs include strengthening fisher institutions, improving access to capital, modernizing fishing gear, and developing post-harvest enterprises. These strategies are expected to increase business productivity, improve market access, and strengthen the economic resilience of traditional fisher households in Sayolo Village.

Internal and External Factors

The results of the analysis of internal and external factors affecting traditional fishers in Sayolo Village are presented in Table 5. Internal factors consisted of strengths and weaknesses derived from fishers' resource characteristics, business activities, and local institutions. Meanwhile, external factors included opportunities and threats arising from market conditions, government policies, and the fisheries business environment. Based on the IFAS matrix calculation, the total internal factor score was 3.50. This value indicated that fishers' internal strengths were relatively more dominant than their existing weaknesses. The main strengths of fishers in Sayolo Village included local knowledge of fishing grounds, strong social solidarity, and the potential of productive aquatic resources. Local knowledge helped fishers determine efficient fishing locations and fishing times, while social solidarity facilitated cooperation in fishing activities and information sharing. In addition, the availability of productive aquatic resources represented an important asset for the development of small-scale fisheries. Nevertheless, fishers still faced several significant internal weaknesses, particularly limited fishing gear, low access to capital, and suboptimal fisher institutions. The use of

simple fishing gear resulted in relatively low fishing productivity, while limited capital restricted fishers' ability to increase their business capacity. Furthermore, fisher institutions that had not yet functioned effectively limited fishers' bargaining position in the market and their access to assistance programs.

The analysis of external factors using the EFAS matrix showed a total score of 3.60. This value indicated that external opportunities were relatively greater than the threats faced by fishers. The main opportunities included government program support, increasing market demand for fishery products, and opportunities to develop fish processing enterprises. Government program support has the potential to improve production capacity and access to capital, while increasing market demand creates opportunities to enhance fisher income. On the other hand, fishers also faced external threats that could affect the sustainability of fisheries businesses. These threats included weather uncertainty, competition with fishers from outside the area, and limited marketing infrastructure. Unpredictable weather conditions can limit fishing frequency and reduce catch production. Competition with fishers using more modern fishing gear also has the potential to reduce the catches of traditional fishers. In addition, limited marketing infrastructure makes it difficult for fishers to reach broader markets.

Based on the IFAS and EFAS scores, the condition of fishers in Sayolo Village indicated that internal strengths and external opportunities were relatively substantial. This suggests that the appropriate development strategy is to utilize local strengths to capture external opportunities through targeted affirmative programs (Table 6). These strategies should be directed toward improving fishers' capacity, strengthening institutions, and developing value-added enterprises to enhance the welfare of traditional fishers in Sayolo Village.

Table 5. Analysis of Internal and External Factors

Internal Strategic Factors	Weight	Rating	Score
Strengths			
1. Fishers' local knowledge of fishing grounds	0,15	4	0,60
2. Social solidarity and mutual cooperation	0,10	3	0,30
3. Potential of productive aquatic resources	0,10	3	0,30
Subtotal of Strengths			1,20
Weaknesses			
1. Fishing gear remains very simple	0,20	4	0,80
2. Limited access to capital and financing	0,15	3	0,45
3. Absence of post-harvest facilities	0,15	4	0,60
4. Fisher institutions are not yet optimal	0,15	3	0,45
Subtotal of Weaknesses			2,30
Total			3,50
External Strategic Factors	**Weight**	**Rating**	**Score**
Opportunities			
1. Government affirmative program support	0,20	4	0,80
2. Increasing market demand for fishery products	0,15	3	0,45
3. Opportunities for fishery product processing enterprises	0,10	3	0,30
Subtotal of Opportunities			1,55
Threats			
1. Climate change and extreme weather	0,20	4	0,80
2. Competition with fishers from outside the area	0,15	3	0,45
3. Limited infrastructure and market access	0,20	4	0,80
4. Fluctuations in fishery product prices	0,15	3	0,45
Subtotal of Threats			2,05
Total			3,60

The determination of weights and ratings in the IFAS and EFAS matrices was based on the results of Focus Group Discussions (FGDs), interviews with key respondents, and questionnaire data analysis. The weights were assigned according to

the level of importance of each factor in relation to the socio-economic conditions of fishers, whereas the ratings indicated the degree of influence of each factor on welfare improvement. This approach was used to reduce subjectivity in the assessment of strategic factors.

Table 6. SWOT Analysis Matrix

Internal / External	Opportunities	Threats
	1. Government affirmative program support 2. Increasing market demand for fishery products 3. Opportunities for household-scale fishery product processing	1. Climate change and extreme weather 2. Competition with fishers from outside the area3. Limited infrastructure and market access
Strengths	**SO Strategies**	**ST Strategies**
1. Fishers' local knowledge of fishing grounds 2. Strong social solidarity and mutual cooperation 3. Productive aquatic resources remain available	• Optimize fishers' local knowledge and solidarity to improve productivity through affirmative programs. • Develop fishery product processing enterprises based on local resources to increase added value.	• Utilize fishers' local knowledge to anticipate the risks of extreme weather. • Strengthen cooperation among fisher groups to address competition from fishers outside the area.
Weaknesses	**WO Strategies**	**WT Strategies**
1. Fishing gear remains simple 2. Limited access to capital and financing 3. Absence of post-harvest facilities4. Fisher institutions are not yet optimal	• Utilize government assistance to modernize fishing gear and strengthen fisher institutions. • Improve fishers' capacity through business management and marketing training.	• Reduce dependence on collectors through the establishment of cooperatives or joint business groups. • Improve fishers' technical skills to enhance their ability to cope with external challenges.

Fisher Household Welfare Indicators

The welfare of fisher households in Sayolo Village was determined not only by income level, but also by ownership of productive assets, access to basic services, and diversification of income sources. Fisher income fluctuated according to the fishing season; therefore, household economic conditions tended to be unstable. Dependence on fish catches as the main source of income increased economic vulnerability, particularly during unfavorable fishing seasons. In terms of productive assets, most fishers used small boats with simple fishing gear, which limited their fishing capacity. These asset limitations resulted in low productivity and restricted opportunities for income improvement. Previous studies have shown that ownership of productive assets is an important factor in determining the welfare level of fisher households because it is directly related to their business capacity (Allison & Ellis, 2001; Béné, 2009).

In addition, welfare was also influenced by access to business support and marketing facilities. Limited storage facilities, transportation, and market access forced fishers to sell their catches immediately after fishing trips at relatively low prices. This condition narrowed opportunities to increase the added value of fishery products. Income diversification is an important strategy for maintaining the economic stability of fisher households. Some fishers engaged in additional occupations, such as gardening and small-scale trading, particularly during low-catch seasons. This strategy reflects the efforts of fisher households to reduce their dependence on the capture fisheries sector.

Income diversification is known to strengthen the economic resilience of coastal communities against fluctuations in production and income (Allison & Horemans, 2006).

Based on the indicators of income, productive assets, business access, and income diversification, the welfare level of fishers in Sayolo Village remains relatively low and vulnerable to seasonal changes. Therefore, affirmative programs are needed that focus on strengthening productive assets, improving market access, and developing alternative livelihoods to enhance fisher welfare sustainably.

Adaptation Strategies of Fisher Households

Fluctuations in fish catches encouraged fisher households in Sayolo Village to adopt various adaptation strategies to maintain income. When production declined, fishers reduced the frequency of fishing trips to minimize operational costs and engaged in alternative occupations, such as gardening, small-scale trading, and other informal work. This income diversification represents a common strategy among small-scale fisher households to reduce economic risks caused by uncertainty in fish catches (Cinner et al., 2012; Daw et al., 2012). In addition, the involvement of household members also formed part of the adaptation strategy. Women played roles in selling catches, conducting simple processing, and managing household finances. These contributions helped maintain family economic stability when income from fishing activities decreased. The involvement of household members in economic activities is known to strengthen the economic resilience of coastal communities against production fluctuations (Weeratunge et al., 2010; Harper et al., 2013).

Some fishers also adjusted household expenditures and utilized social networks, such as family assistance or informal loans, to meet their needs. These strategies indicate that the adaptations undertaken were still short-term in nature. Therefore, affirmative programs are needed to support business diversification, improve household economic skills, and develop value-added enterprises in order to strengthen fishers' economic resilience sustainably.

Identification of Affirmative Programs for Improving Fisher Welfare

The results showed that improving fisher welfare in Sayolo Village requires affirmative programs designed based on socio-economic conditions, business structures, and the constraints faced by fishers. In this study, affirmative programs are defined as interventions specifically aimed at improving production capacity, strengthening market access, and enhancing the economic resilience of fisher households. Based on the analysis of socio-economic conditions and the SWOT analysis, the required affirmative programs include production facility assistance, institutional strengthening, development of post-harvest enterprises, and improvement of marketing access. Production facility assistance should be directed toward the provision of more efficient fishing gear and fuel-efficient boat engines to increase fishing productivity. This program is important because most fishers still use simple fishing gear, which limits production volume and income. In addition, strengthening fisher institutions is needed through the establishment of joint business groups or fisher cooperatives. Strong institutions can improve fishers' bargaining position in marketing their catches and facilitate access to government assistance programs. Previous studies have shown that institutional strengthening is an important factor in improving fisher welfare through collective marketing and joint business management (Satria et al., 2019).

Affirmative programs should also be directed toward the development of post-harvest enterprises through fishery product processing training and the provision of village-scale cold storage facilities. Fishery product processing can increase added value and reduce losses caused by price declines during periods of abundant production. In addition, the provision of storage facilities enables fishers to postpone sales until better prices are obtained. Improving marketing access is another important affirmative program, which can be implemented through the development of marketing networks, provision of price information, and cooperation with fisheries business actors. This program aims to reduce fishers' dependence on collectors and strengthen their bargaining power in price determination. Thus, the formulated affirmative programs

should not only focus on increasing production, but also on strengthening business and marketing systems to improve fisher welfare sustainably.

CONCLUSION

The socio-economic conditions of traditional fishers in Sayolo Village were characterized by small-scale fishing operations, limited productive assets, and dependence on collector-based marketing systems, all of which affected household income stability. Fishers adopted adaptation strategies through occupational diversification and the involvement of household members; however, these efforts remained limited. This study contributes by mapping affirmative programs based on local conditions, including institutional strengthening, improvement of production facilities, development of post-harvest enterprises, and enhancement of marketing systems to improve fisher welfare.

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AUTHOR CONTRIBUTIONS STATEMENT

The authors declare that the contribution of each author to this manuscript was as follows: AD served as the main contributor and was responsible for designing the study, conceptualizing the research, collecting and analyzing the data, and writing the main manuscript. HJYA served as the second author, and LOMA served as the third author. The authors have submitted a signed Author Declaration Statement.

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest with any party regarding the publication of this article.

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