

Human Capital and Catch Management Capability in Small-Scale Fisheries: Evidence from Coastal Fishing Communities in Manokwari, Indonesia

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Abstract

This study investigates the effects of fishermen's competence and catch management capability on income improvement among coastal fishing communities in East and West Manokwari, Indonesia. A quantitative survey was conducted with 100 active fishermen selected through purposive sampling. Data were analyzed using validity and reliability tests, multiple linear regression, t-tests, F-tests, and coefficient of determination analysis. The results reveal that both fishermen's competence and catch management capability have positive and significant effects on income improvement. Catch management capability is the more dominant predictor, highlighting the importance of post-harvest handling, storage, distribution, and marketing in generating higher economic value from fishery products. The model explains 74.1% of the variation in fishermen's income improvement, indicating strong explanatory power. These findings suggest that improving coastal livelihoods requires an integrated strategy that combines human capital development with operational capability strengthening across the fisheries value chain. The study contributes to small-scale fisheries and coastal development literature by showing that fishermen's welfare depends not only on catching capacity, but also on the ability to manage, process, and market catches more effectively.

Keywords: small-scale fisheries; fishermen's competence; catch management capability; coastal livelihoods; income improvement

1. Introduction

Small-scale fisheries play a vital role in sustaining coastal livelihoods, food security, employment, and local economic development, particularly in archipelagic and resource-dependent countries such as Indonesia. Globally, fisheries and aquaculture are increasingly recognized not only as food-production sectors, but also as strategic livelihood systems that support millions of households, strengthen local economies, and contribute to poverty reduction (FAO, 2024). In Indonesia, coastal communities remain highly dependent on marine resources for income and nutrition, while the fisheries sector continues to provide employment and economic opportunities for millions of people (World Bank, 2023). Despite this strategic importance, the welfare of small-scale fishers remains vulnerable because their income is often affected by seasonal uncertainty, limited technology, weak bargaining power, restricted market access, and insufficient capacity to manage fishery products beyond the point of capture.

The problem of fishermen's income is particularly important in Eastern Indonesia, where coastal communities are geographically close to abundant marine resources but do not always receive proportional economic benefits from those resources. Manokwari Regency in West Papua Province represents this condition. The region has considerable fisheries potential, with capture fisheries production reaching 16,992 tons and a production value of approximately IDR 930 billion in 2022, while aquaculture production also reached around 17,100 tons (Badan Pusat Statistik Provinsi Papua Barat, 2022). The presence of approximately 1,353 fishing households further indicates that fisheries are central to the local economy and household livelihood structure. However, this production potential has not been fully translated into stable and improved fishermen's income. Many fishermen continue to sell their catches in raw form, with limited post-harvest processing, storage, distribution, and market-oriented value addition. As a result, the economic value captured by fishermen remains relatively low, even when fishery production is substantial.

Existing discussions on fishermen's welfare often emphasize production volume, fishing equipment, market fluctuation, and access to capital. While these factors are important, they do not fully explain why some fishermen are better able to improve income than others within similar coastal environments. From a human capital perspective, fishermen's competence is a critical determinant of productivity and

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economic performance. Competence refers to the combination of knowledge, skills, experience, work attitudes, and adaptive capacity that enables individuals to perform economic activities effectively (Kasmir, 2022). In the fisheries context, competent fishermen are more likely to understand fishing techniques, manage operational risks, adopt appropriate technologies, make better business decisions, and respond more effectively to market and environmental changes. Prior studies have shown that strengthening the quality of fishermen's human resources through training, capacity development, and structured business management can improve productivity and welfare (Harsono et al., 2021; Purnomo & Tahir, 2023).

In addition to competence, catch management capability is increasingly important for improving fishermen's income. The Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries emphasize that all actors across the fisheries value chain, including those involved in pre-harvest and post-harvest activities, should be recognized and supported through infrastructure, organizational strengthening, and capacity development (FAO, 2015). Catch management capability includes post-harvest handling, processing, storage, distribution, and marketing. These capabilities allow fishermen to improve product quality, reduce losses, extend product shelf life, access better markets, and generate higher added value. Therefore, income improvement in small-scale fisheries should not be understood only as a matter of increasing catch volume, but also as a matter of strengthening the capacity to transform catches into higher-value fishery products.

The relevance of catch management is especially strong in coastal areas where fishermen face weak market integration and limited post-harvest infrastructure. When catches are sold immediately in raw form, fishermen are often forced to accept low prices, particularly when supply is abundant or when middlemen control access to markets. Conversely, fishermen with stronger capacity in handling, preserving, processing, distributing, and marketing fish products may obtain greater economic returns from the same or even smaller catch volumes. This suggests that operational capability in managing catches may have a stronger influence on income than technical fishing competence alone. Studies on fishermen's livelihoods and coastal economic empowerment have similarly emphasized that business management, institutional support, marketing strategies, and value-chain strengthening are essential for improving the welfare of coastal communities (Falah & Aptasari, 2023; Pangemanan et al., 2025; Pulungan & Wahyuningsih, 2024).

Although previous studies have examined fishermen's welfare, human resource quality, and coastal economic empowerment, empirical research that integrates fishermen's competence and catch management capability as joint determinants of income improvement remains limited, particularly in the context of West Papua. This gap is important because coastal income improvement requires both human capital and operational capability. Fishermen need knowledge, skills, experience, and adaptive attitudes to conduct fishing activities productively, but they also need the capability to manage catches after landing in order to create added value. Without catch management capability, competence in fishing may only increase production without significantly improving household income. Likewise, without adequate competence, fishermen may be unable to manage technology, business decisions, and market opportunities effectively.

To address this gap, this study investigates the effects of fishermen's competence and catch management capability on income improvement among coastal fishing communities in East and West Manokwari, Indonesia. Specifically, the study examines whether fishermen's competence has a positive and significant effect on income improvement, whether catch management capability has a positive and significant effect on income improvement, and whether both variables simultaneously explain variations in fishermen's income. By using a quantitative survey of 100 active fishermen and multiple linear regression analysis, this study contributes to the literature on small-scale fisheries, coastal livelihood development, and human-capital-based economic empowerment. Practically, the findings are expected to inform local government and fisheries stakeholders in designing integrated empowerment strategies that combine technical training, post-harvest infrastructure, business management, distribution systems, and market access improvement for sustainable coastal economic development.

2. Methods

2.1 Research design

This study employed a quantitative research design using a cross-sectional survey approach. The design was considered appropriate because the study aimed to examine the statistical effects of fishermen's competence and catch management capability on income improvement among coastal fishing communities. A quantitative survey allows researchers to measure respondents' perceptions, capabilities, and economic outcomes in a structured manner and to test hypothesized relationships among variables through inferential statistical analysis.

The study focused on three main variables: fishermen's competence as the first independent variable, catch management capability as the second independent variable, and fishermen's income improvement as the dependent variable. The research model was designed to assess both the partial and simultaneous effects of the two independent variables on income improvement.

2.2 Study area

The research was conducted in the coastal areas of East Manokwari and West Manokwari, West Papua Province, Indonesia. These areas were selected because fisheries constitute one of the main sources of livelihood for local coastal communities. Manokwari has considerable capture fisheries potential, yet many fishermen continue to face income instability, limited post-harvest management capacity, and weak market access. The study area therefore provides a relevant empirical setting for examining how human capital and catch management capability contribute to fishermen's income improvement.

3.2 Population and sample

The population of this study consisted of active fishermen living and working in the coastal communities of East Manokwari and West Manokwari. The respondents were fishermen whose main source of income came from capture fisheries and who were directly involved in managing their catches after landing.

The sample was selected using purposive sampling. This technique was used because the study required respondents who had direct experience in fishing activities and catch management practices. The inclusion criteria were: (1) active fishermen in East or West Manokwari, (2) fishermen who relied on capture fisheries as a primary source of income, and (3) fishermen who were directly involved in post-harvest handling, storage, distribution, or marketing of their catches. A total of 100 respondents participated in the study. This sample size was considered adequate for multivariate analysis because it met the minimum recommendation of 5–10 respondents per research indicator (Hair et al., 2019).

3.3 Research instrument

Data were collected using a structured questionnaire developed based on the study variables and indicators. The questionnaire consisted of three main sections. The first section measured fishermen's competence, which included knowledge, skills, experience, and work attitude. The second section measured catch management capability, which included post-harvest handling, storage, distribution, and marketing. The third section measured fishermen's income improvement, which included main income, income stability, and improvement in household economic conditions.

All questionnaire items were measured using a Likert scale. Respondents were asked to indicate their level of agreement with each statement. The Likert scale was used because it allows the measurement of attitudes, perceptions, and self-assessed capabilities in a structured and quantifiable form.

3.4 Variable measurement

Fishermen's competence refers to the extent to which fishermen possess the knowledge, technical skills, experience, and work attitudes needed to conduct fishing activities effectively. This variable reflects the human capital dimension of small-scale fisheries.

Catch management capability refers to fishermen's ability to manage catches after landing through handling, storage, distribution, and marketing. This variable reflects operational capability in transforming fishery products into higher economic value.

Fishermen's income improvement refers to perceived improvement in fishermen's economic conditions, including increased main income, more stable income, and better household economic capacity. This variable represents the livelihood outcome of fishermen's competence and catch management capability.

3.5 Data collection procedure

Primary data were collected through the distribution of structured questionnaires to selected fishermen in East and West Manokwari. Before data collection, respondents were informed about the purpose of the study and the voluntary nature of their participation. The questionnaire was administered directly to ensure that respondents understood the meaning of each item and to minimize incomplete responses.

The data collection process focused on obtaining information about fishermen's competence, catch management practices, and income improvement. Because the respondents were selected based on their direct involvement in fishing and catch management, the collected data were expected to reflect the actual conditions of small-scale fishing households in the study area.

3.6 Data analysis

The collected data were analyzed using several statistical procedures. First, a validity test was conducted to examine whether each questionnaire item accurately measured the intended variable. An item was considered valid when the calculated correlation coefficient was greater than the r-table value. Second, a reliability test was conducted using Cronbach's alpha to assess the internal consistency of each variable. A variable was considered reliable when the Cronbach's alpha value exceeded 0.60.

After the validity and reliability of the instrument were confirmed, multiple linear regression analysis was used to test the effects of fishermen's competence and catch management capability on fishermen's income improvement. The regression model used in this study was formulated as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

where Y represents fishermen's income improvement, α represents the constant, X_1 represents fishermen's competence, X_2 represents catch management capability, β_1 and β_2 represent regression coefficients, and ε represents the error term.

Partial effects were tested using the t-test to determine whether each independent variable had a significant effect on income improvement. The simultaneous effect was tested using the F-test to determine whether fishermen's competence and catch management capability jointly influenced income improvement. The coefficient of determination was also calculated to determine the proportion of variance in income improvement explained by the independent variables. A significance level of 0.05 was used for all hypothesis testing.

3.7 Ethical considerations

The study involved fishermen as human respondents; therefore, ethical considerations were applied during the research process. Respondents were informed about the purpose of the study, the voluntary nature of their participation, and the confidentiality of their responses. No personal identifying information was reported in the analysis. The data were used only for academic research purposes.

3. Results

3.1 Instrument validity and reliability

Before testing the hypotheses, the validity and reliability of the research instrument were examined. The validity test showed that all questionnaire items used to measure fishermen's competence, catch management capability, and income improvement were valid. The correlation coefficients of all items exceeded the r-table value of 0.196 for 100 respondents. The item-total correlation values ranged from 0.689 to 0.758 for fishermen's competence, from 0.698 to 0.774 for catch management capability, and from 0.731 to 0.794 for income improvement. These results indicate that all measurement items were appropriate for representing their respective constructs.

The reliability test further confirmed that the research instrument had strong internal consistency. The Cronbach's alpha value for fishermen's competence was 0.912, while catch management capability obtained a value of 0.925. The income improvement variable also showed a reliable result, with a Cronbach's alpha value of 0.894. Since all values were above the minimum threshold of 0.60, the instrument was considered reliable and suitable for further statistical analysis.

Table 1. Validity and reliability summary

Variable	Number of Items	Validity Range	Cronbach's Alpha	Interpretation
Fishermen's competence	8	0.689–0.758	0.912	Valid and reliable
Catch management capability	8	0.698–0.774	0.925	Valid and reliable
Income improvement	6	0.731–0.794	0.894	Valid and reliable

3.2 Multiple linear regression analysis

Multiple linear regression analysis was conducted to examine the effects of fishermen's competence and catch management capability on income improvement. The results showed that both independent variables had positive regression coefficients, indicating that higher levels of competence and stronger catch management capability were associated with higher income improvement among fishermen.

The regression equation is presented as follows:

$$Y = 1.285 + 0.312X_1 + 0.428X_2$$

In this equation, Y represents fishermen's income improvement, X₁ represents fishermen's competence, and X₂ represents catch management capability. The coefficient for fishermen's competence was 0.312, suggesting that improvement in competence contributed positively to income improvement. Meanwhile, the coefficient for catch management capability was 0.428, indicating a stronger contribution to income improvement compared with fishermen's competence.

Table 2. Multiple linear regression results

Variable	B	Std. Error	Beta	t	Sig.
Constant	1.285	1.147	—	1.120	0.266
Fishermen's competence	0.312	0.058	0.384	5.379	0.000
Catch management capability	0.428	0.061	0.471	7.016	0.000

The standardized beta coefficients show that catch management capability had a stronger effect on income improvement than fishermen's competence. This finding suggests that, although human capital remains important, the ability to manage catches after landing plays a more decisive role in increasing fishermen's income.

3.4 Partial hypothesis testing

The partial test results confirmed that fishermen's competence had a positive and significant effect on income improvement. The t-value for fishermen's competence was 5.379, with a significance value of 0.000. Since the significance value was lower than 0.05, the first hypothesis was supported. This result indicates that fishermen with better knowledge, skills, experience, and work attitudes are more likely to experience income improvement.

Catch management capability also had a positive and significant effect on income improvement. The t-value for this variable was 7.016, with a significance value of 0.000. This result supports the second hypothesis and indicates that fishermen who are better able to handle, store, distribute, and market their catches tend to achieve higher income improvement. The larger t-value and standardized beta coefficient indicate that catch management capability was the more dominant predictor in the model.

3.5 Simultaneous hypothesis testing

The simultaneous test was conducted to determine whether fishermen's competence and catch management capability jointly influenced income improvement. The F-test result showed an F-value of 138.547 with a significance value of 0.000. Since the significance value was below 0.05, the third hypothesis was supported. This finding demonstrates that the combination of fishermen's competence and catch management capability significantly explains income improvement among coastal fishermen in East and West Manokwari.

Table 3. Simultaneous test results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	462.384	2	231.192	138.547	0.000
Residual	161.876	97	1.669	—	—
Total	624.260	99	—	—	—

The result indicates that income improvement in small-scale fisheries is not explained by a single factor alone. Instead, it is shaped by the interaction between human capital and operational capability. Fishermen need competence to conduct fishing activities effectively, but they also need catch management capability to transform fishery products into higher economic value.

3.6 Coefficient of determination

The coefficient of determination was used to assess the explanatory power of the regression model. The R value was 0.861, indicating a strong relationship between the independent variables and income improvement. The R Square value was 0.741, meaning that 74.1% of the variation in fishermen's income improvement could be explained by fishermen's competence and catch management capability. The Adjusted R Square value was 0.736, indicating that the model remained stable after adjustment for the number of predictors.

Table 4. Coefficient of determination

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.861	0.741	0.736	1.291

These results show that the model has strong explanatory power. The remaining 25.9% of variation in fishermen's income improvement may be influenced by other factors not examined in this study, such as access to capital, fishing technology, market price fluctuation, weather conditions, government support, and institutional arrangements.

3.7 Summary of Hypothesis Testing

The overall hypothesis testing results show that all proposed hypotheses were supported. Fishermen's competence had a positive and significant effect on income improvement. Catch management capability also had a positive and significant effect, with a stronger influence than fishermen's competence. Simultaneously, both variables significantly explained income improvement among coastal fishing communities in East and West Manokwari.

Table 5. Summary of hypothesis testing

Hypothesis	Relationship	Result
H1	Fishermen's competence → Income improvement	Supported
H2	Catch management capability → Income improvement	Supported
H3	Fishermen's competence and catch management capability → Income improvement	Supported

Overall, the findings indicate that improving fishermen's income requires more than increasing fishing productivity. Human capital development remains important, but stronger attention should be given to post-harvest handling, storage, distribution, and marketing because these capabilities directly influence the value that fishermen obtain from their catches.

4. Discussion

This study examined the effects of fishermen's competence and catch management capability on income improvement among coastal fishing communities in East and West Manokwari, Indonesia. The findings demonstrate that both fishermen's competence and catch management capability have positive and significant effects on income improvement. However, catch management capability emerged as the stronger predictor, indicating that fishermen's income is shaped not only by their ability to conduct fishing activities, but also by their capacity to handle, store, distribute, and market catches after landing.

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This finding provides important empirical evidence that income improvement in small-scale fisheries depends on the integration of human capital and post-harvest operational capability.

4.1 Fishermen's competence and income improvement

The positive and significant effect of fishermen's competence on income improvement confirms the importance of human capital in small-scale fisheries. Fishermen with higher levels of knowledge, technical skills, experience, and work attitudes are more likely to manage fishing activities efficiently and make better economic decisions. This result is consistent with Human Capital Theory, which argues that individual knowledge, skills, and experience function as productive assets that improve economic performance (Becker, 1993). In the fisheries context, competence enables fishermen to improve operational efficiency, reduce avoidable losses, use fishing equipment more effectively, and adapt to changing environmental and market conditions.

This finding is also in line with previous studies showing that strengthening the quality of human resources among fishermen can improve productivity and welfare. Harsono et al. (2021) found that improving fishermen's human resource capacity through structured management, coordination, and training contributes to better productivity and livelihood outcomes. Similarly, Purnomo and Tahir (2023) emphasized that fishermen's empowerment should be built on capacity development, local knowledge, and practical skills that allow fishing communities to become more economically independent. The present study supports these arguments by showing that fishermen's competence is not merely an individual attribute, but an economic resource that contributes directly to income improvement.

In Manokwari, this finding is particularly relevant because coastal fishermen operate in a context where income is often affected by weather uncertainty, market fluctuation, and limited access to technology. Competent fishermen are more likely to respond effectively to such challenges because they have better technical understanding, stronger experience, and greater ability to adjust their work strategies. However, the results also show that competence alone is not sufficient to maximize income. Although fishermen's competence significantly improves income, its effect is weaker than catch management capability. This suggests that the economic value of fishing activity is not determined only at sea, but also after the catch reaches land.

4.2 Catch management capability as the dominant predictor

The study found that catch management capability has a stronger effect on income improvement than fishermen's competence. This result indicates that post-harvest capability is a decisive factor in determining the economic value received by fishermen. Catch management capability includes handling, storage, distribution, and marketing. These activities influence product quality, shelf life, market reach, bargaining position, and selling price. When fishermen lack these capabilities, they are often forced to sell their catches immediately in raw form, usually at lower prices. By contrast, fishermen with stronger post-harvest and marketing capabilities are better positioned to create added value and obtain higher income from the same fishery resources.

This finding supports the value-chain perspective, which argues that economic gains are not produced only through primary production, but also through activities that add value, improve quality, connect producers to markets, and strengthen bargaining power (Kaplinsky & Morris, 2001). In small-scale fisheries, post-harvest handling and market integration are especially important because fishery products are perishable and price-sensitive. Without adequate storage, processing, and distribution systems, fishermen may lose income due to product deterioration, dependence on middlemen, and limited market choices. The Food and Agriculture Organization of the United Nations (2015) similarly emphasizes that sustainable small-scale fisheries require support not only for fishing activities, but also for post-harvest actors, value-chain participation, infrastructure, and market access.

The dominance of catch management capability is consistent with Falah and Aptasari (2023), who argued that fishermen's welfare depends strongly on economic institutions, business management, and value-chain strengthening. It also aligns with Pulungan and Wahyuningsih (2024), who showed that fisheries livelihoods are shaped by socio-economic conditions and management challenges, including market access and operational capacity. In the Manokwari context, this finding highlights a key development issue: abundant fisheries production does not automatically lead to higher fishermen's income when post-harvest management remains weak. Many fishermen still sell catches in raw form,

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with limited processing, storage, distribution, and marketing capacity. Therefore, the main income barrier is not only the quantity of fish caught, but also the limited capability to convert catches into higher-value products.

4.3 Integrating human capital and operational capability

The simultaneous test showed that fishermen's competence and catch management capability jointly have a significant effect on income improvement. The model explains 74.1% of the variation in fishermen's income improvement, indicating strong explanatory power. This result suggests that income improvement in small-scale fisheries requires an integrated development approach. Fishermen need technical competence to conduct fishing activities productively, but they also need operational capability to manage catches after landing and access better economic opportunities.

This finding strengthens the argument that coastal livelihood improvement should be understood as a multidimensional process. Human capital enables fishermen to work more effectively, while operational capability enables them to create and capture greater economic value. If fishermen have technical competence but weak post-harvest capability, they may increase catch volume without significantly increasing income. Conversely, if catch management facilities and market systems are available but fishermen lack the competence to use them effectively, the economic impact may remain limited. Therefore, both dimensions must be developed simultaneously.

The findings are also consistent with Pangemanan et al. (2025), who emphasized that the sustainability of fishermen's livelihoods depends on the integration of livelihood structure, resource management, and adaptive capacity. Small-scale fisheries are not only production systems but also livelihood systems that involve household strategies, social networks, market relations, and institutional support. In this sense, income improvement requires more than individual effort. It requires an enabling environment that supports fishermen through training, infrastructure, cooperatives, market information, financial access, and post-harvest innovation.

4.4 Theoretical implications

This study contributes to the literature on small-scale fisheries and coastal economic development in three ways. First, it extends the application of Human Capital Theory to coastal fisheries by showing that fishermen's competence has a direct and significant effect on income improvement. Competence should therefore be treated as a strategic livelihood asset rather than only as a technical characteristic of fishermen.

Second, the study highlights the importance of catch management capability as an operational capability that mediates the transformation of natural resources into economic value. The finding that catch management capability is more dominant than fishermen's competence suggests that post-harvest activities deserve stronger theoretical attention in fisheries livelihood studies. Small-scale fisheries research often focuses on production, resource access, and fishing technology, but this study shows that value creation after landing is equally, and perhaps more, important for income improvement.

Third, the study integrates human capital and operational capability into one empirical model. This integrated approach helps explain why fisheries production potential does not always translate into improved welfare. In resource-rich coastal regions such as Manokwari, income improvement depends not only on access to marine resources, but also on the capability of fishermen to manage, preserve, distribute, and market fishery products effectively.

4.5 Practical implications

The findings have several practical implications for coastal development policy in Manokwari and similar regions. First, local government and fisheries agencies should strengthen fishermen's competence through continuous training in fishing techniques, financial literacy, business management, occupational safety, technology use, and market adaptation. Training programs should not be generic, but should be based on the actual needs of small-scale fishermen in coastal communities.

Second, policy interventions should prioritize post-harvest infrastructure and catch management systems. Facilities such as cold storage, ice production, hygienic landing sites, small-scale processing units, and transportation networks can help fishermen maintain product quality and reduce post-harvest losses. These facilities are essential for improving fishermen's bargaining position and increasing product value.

Third, fishermen should be supported in improving distribution and marketing capacity. This can be

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done through cooperative strengthening, digital marketing assistance, market information systems, partnerships with buyers, and product diversification. Stronger marketing capacity can reduce dependence on middlemen and enable fishermen to access higher-value markets.

Fourth, empowerment programs should integrate human capital development with value-chain strengthening. Training fishermen without improving post-harvest infrastructure may produce limited results. Likewise, providing infrastructure without strengthening fishermen's competence may reduce the effectiveness of development programs. Therefore, integrated policy design is needed to improve coastal income sustainably.

4.6 Limitations and future research

Despite its contributions, this study has several limitations. First, the study used a cross-sectional survey design, which captures the relationship among variables at one point in time. Future studies could use longitudinal designs to examine how fishermen's competence, catch management capability, and income change over time. Second, the sample was limited to 100 fishermen in East and West Manokwari. Although the sample was adequate for the statistical analysis used in this study, future research could expand the sample size and include other coastal areas in West Papua or Eastern Indonesia.

Third, this study focused on two main predictors: fishermen's competence and catch management capability. The coefficient of determination shows that 25.9% of income improvement is explained by other factors outside the model. Future studies should consider additional variables such as access to credit, fishing technology, cooperative membership, market price volatility, government support, climate risk, and social capital. Finally, future research may use mixed methods to complement survey results with qualitative insights into fishermen's lived experiences, local knowledge, market relations, and institutional constraints.

Overall, this study confirms that fishermen's income improvement in coastal Manokwari is strongly influenced by both human capital and catch management capability. However, the stronger effect of catch management capability indicates that post-harvest handling, storage, distribution, and marketing are central to increasing the economic value of fishery products. Therefore, improving fishermen's welfare requires a shift from production-oriented policy toward an integrated livelihood strategy that combines competence development, post-harvest infrastructure, value-chain strengthening, and market access improvement.

5. Conclusion

This study examined the effects of fishermen's competence and catch management capability on income improvement among coastal fishing communities in East and West Manokwari, Indonesia. The findings show that both fishermen's competence and catch management capability have positive and significant effects on income improvement. These results confirm that fishermen's income is not determined only by the availability of fishery resources, but also by the capacity of fishermen to use their knowledge, skills, experience, and operational abilities to manage fishing activities and post-harvest processes more effectively.

The study also found that catch management capability is the more dominant predictor of income improvement. This indicates that post-harvest handling, storage, distribution, and marketing play a crucial role in increasing the economic value of fishery products. Fishermen who are able to manage catches more effectively are more likely to improve product quality, reduce losses, access better markets, and obtain higher income. Therefore, income improvement in small-scale fisheries should not rely solely on increasing catch volume, but should also focus on strengthening value-added activities after the catch is landed.

The simultaneous effect of fishermen's competence and catch management capability further demonstrates that coastal livelihood improvement requires an integrated approach. Human capital development and operational capability strengthening must be treated as complementary strategies. Competence enables fishermen to conduct fishing activities productively, while catch management capability allows them to transform fishery products into higher economic value. The strong explanatory power of the model suggests that these two factors are central determinants of income improvement among coastal fishermen in Manokwari.

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The findings have important policy implications. Local governments, fisheries agencies, and development stakeholders should prioritize integrated empowerment programs that combine technical training, business management education, post-harvest infrastructure, market access support, and cooperative strengthening. Such programs can improve fishermen's productivity, bargaining position, and household economic resilience. In coastal regions with high fisheries potential, such as Manokwari, sustainable welfare improvement depends not only on resource extraction, but also on the ability of fishing communities to manage, process, distribute, and market their catches more effectively. Although this study provides empirical evidence on the role of human capital and catch management capability in improving fishermen's income, it has several limitations. The study used a cross-sectional survey and focused only on fishermen in East and West Manokwari. Future research should include broader coastal regions, larger samples, and additional variables such as access to credit, fishing technology, cooperative participation, market price fluctuation, government support, and climate-related risks. Further studies may also apply mixed-method approaches to gain deeper insight into the social, institutional, and market dynamics that shape fishermen's livelihoods.

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