

Factors affecting the welfare of fishermen in Banten Province using SEM (structural equation modeling)

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Abstract. The fisheries sector is a strategic industry for both national and regional economic development in coastal regions that are rich in marine resources. Capture fishermen play a crucial role in supporting food security and regional economic growth in Serang Regency, which is predominantly coastal. Therefore, this research aimed to analyze the factors affecting the capacity and welfare of fishermen in Serang Regency. The analysis was conducted in eight subdistricts, namely, Pontang, Tanara, Tirtayasa, Kramatwatu, Bojonegara, Pulo Ampel, Anyer, and Cinangka, between November 2025 and January 2026. Purposive sampling was performed with the condition that the respondents were fishermen who had gone to sea for 1 year and who had used less than 5 GT of boats. The number of samples was 10 times the number of indicators (20), totaling 200 capture fishermen spread across the eight subdistricts in Serang Regency. Data analysis was performed using the structural equation modeling (SEM-LISREL) method. The results revealed that the factors affecting fishermen's capacity were both internal and external, with direct and positive effects. Factors affecting fishermen's welfare included external elements (X2), with significant direct and negative effects on welfare (Y2). Furthermore, fishermen's capacity (Y1) significantly and positively affects welfare (Y2). The internal factors of fishermen (X1) also have a significant indirect and positive effect on the welfare of fishermen (Y2) through capacity (Y1).

Keywords: fishermen, household welfare, operational capacity, SEM-LISREL.

Introduction. Serang Regency is in the western part of Banten Province, with a coastline facing the Sunda Strait, making the region possess significant potential for capture fisheries. This potential originates from the availability of several types of pelagic and demersal fish with high economic value, such as tuna, mackerel, and snapper. Capture fisheries in this region are the primary source of livelihood for most coastal communities (Saptanto et al., 2023), particularly in subdistricts such as Pontang, Tirtayasa, and Pulo Ampel.

The extensive potential of the Serang Regency has not significantly improved the welfare of capture fishermen. Various surveys and regional data show most fishermen are still categorized as low-income earners, with a substantial proportion remaining vulnerable to poverty (Saksono et al., 2023). This socioeconomic situation is marked by limited capital, low levels of formal education, and heavy dependence on daily catches (Sari, 2024). Under these conditions, fishermen often lack bargaining power within the fisheries value chain because they are primarily producers reliant on middlemen or collectors. Mulyadi (2017) reported that fishermen are people whose livelihoods depend on marine products through fishing. Moreover, Sastrawidjaya (2016) described fishermen as individuals whose livelihoods depend on marine products and who reside in coastal regions.

The issues faced by fishermen include not only economic but also human resources (HR) and institutional capacity (Abdullah et al., 2024). This limited capacity is reflected in the inability to manage fisheries effectively, a lack of knowledge in household financial management, and restricted access to environmentally friendly and sustainable fishing technologies. Additionally, the institutions of fishermen, such as cooperatives or joint

ventures, often operate sub optimally because of weak management, poor coordination, and low member participation.

Previous publications have indicated that poverty among fishermen is caused not only by natural factors and seasonal changes but also by fishermen's limited knowledge, skills, institutions, and ability to adapt to social, economic, and environmental shifts (Pretty et al., 2003; Kusnadi, 2009; Widodo, 2011). This limited capacity promotes unsustainable resource use practices, which ultimately lead to the degradation of coastal ecosystems and a decline in capture fisheries productivity.

Furthermore, changing global environmental and economic conditions increase the complexity of the challenges faced by fishermen. Climate change has caused shifts in fishing seasons and unpredictable extreme weather affecting catches (Rahim & Hastuti, 2023; Jabnabillah & Reza, 2024). Moreover, rising fuel prices and competition from large-scale fishing vessels worsen the economic conditions of small-scale fishermen. In this situation, fishermen's ability to adapt is crucial for survival and for increasing competitiveness in the sector (Mollmann et al., 2026).

The Serang Regency Government has launched various programs to support the sector, such as providing fishing gear assistance, acquiring small boats, offering fishermen training programs, and forming joint venture groups. However, these programs are often suboptimal because top-down planning and implementation fail to address the real needs and local potential of fishermen. The lack of post program evaluation and ongoing mentorship has also led to unsustainable results. Therefore, this research aims to identify the factors that affect the capacity and well-being of fishermen in Serang Regency, Banten.

Material and Method. This research adopted a quantitative design using a survey method for data collection. The survey was conducted in eight subdistricts with fisheries potential in Serang Regency. According to Sugiyono (2018), quantitative design is a method based on the positive paradigm that involves the examination of a specific population or sample. The survey method involved a design in which information on the symptoms of existing problems was collected through interviews using Umar's (2003) questionnaire. The data sources included primary and secondary data collected in eight subdistricts, namely, Pontang, Tanara, Tirtayasa, Kramatwatu, Bojonegara, Pulo Ampel, Anyer, and Cinangka. These locations were selected because the subdistricts were centers of fishing activities in Serang Regency (Serang Regency Government, 2025). The research period ranged from November 2025 to January 2026. The population consisted of 1,914 fishermen who used boats with a GT of less than 5. Purposive sampling was applied to respondents who were fishermen who had gone to sea for 1 year, using boats with 5 GTs. The number of samples was 10 times the number of indicators (20), namely, 200 fishermen spread across eight subdistricts in Serang Regency, with 25 taken from each subdistrict. The variables used were internal factors of fishermen (X_1), with indicators including experience at sea ($X_{1.1}$), self-confidence ($X_{1.2}$), cosmopolitanism ($X_{1.3}$), courage to take risks ($X_{1.4}$), and motivation ($X_{1.5}$). The external factors of the fishermen (X_2) included market support ($X_{2.1}$), capital support ($X_{2.2}$), government policy support ($X_{2.3}$), infrastructure support ($X_{2.4}$), and extension support ($X_{2.5}$). Fishermen's capacity (Y_1) comprises indicators, namely, survival ability ($Y_{1.1}$), technical ability ($Y_{1.2}$), managerial ability ($Y_{1.3}$), marketing ability ($Y_{1.4}$), and value-added ability ($Y_{1.5}$). Fishermen's welfare (Y_2) consisted of indicators, namely, housing ($Y_{2.1}$), health ($Y_{2.2}$), consumption ($Y_{2.3}$), income ($Y_{2.4}$), and formal education ($Y_{2.5}$). The analysis tool in this research used structural equation modeling (SEM)–LISREL.

SEM is a multivariate analysis method used to examine complex causal relationships between latent (unobserved) variables and measured variables simultaneously. One of the software tools employed for processing and analyzing SEM models is LISREL (Linear Structural Relationship). This study utilized SEM-LISREL to analyze the causal relationships among internal factors, external factors, fishermen capacity, and the welfare of fishermen in Serang Regency. The SEM method was selected because it allows for the simultaneous examination of both direct and indirect relationships between variables. In the proposed research model, internal factors (X_1) and external factors (X_2) influence fishermen capacity (Y_1), while fishermen capacity in turn affects fishermen welfare (Y_2). Additionally, internal and external factors can also have a direct influence on fishermen welfare. The analysis

involved testing both the measurement model and the structural model. The significance of the relationships between the variables was determined based on a t-value greater than 1.96 at the 95% confidence level.

Results. The results of the SEM-LISREL analysis indicate that the capacity of fishermen is a crucial factor in enhancing the welfare of capture fishermen in Serang Regency, Banten. Both internal and external factors significantly influence fishermen's capacity, which in turn has a positive and significant effect on their welfare. Additionally, the analysis shows that fishermen's capacity serves as a mediating variable, linking the impact of internal and external factors on fishermen's welfare. Therefore, improving the welfare of fishermen requires more than just addressing internal and external factors; it also necessitates strengthening their capacity. This approach will ensure that the benefits lead to optimal and sustainable improvements in welfare.

1. Effects of internal factors (X1) on fishermen's capacity (Y1), with a t value of 7.60. This finding indicated that the Internal Fishermen Factors variable had a positive and significant direct effect on fishermen's capacity. The results suggested that improving the quality of the internal factors of the fishermen directly enhances their capacity.
2. Effects of external factors (X2) on fishermen's capacity (Y1), with a t value of 2.15. The results revealed that the external factor variable had a positive and significant effect on fishermen's capacity. This implies that changes in external factors directly affect the capacity of the model.
3. Effect of fishermen's capacity (Y1) on welfare (Y2), with a t value of 3.32. These findings revealed that fishermen's capacity had a positive and significant effect on welfare. The greater the fishermen's capacity is, the higher the welfare.
4. The effect of external factors (X2) on fishermen's welfare (Y2) had a t value of -3.02. This implies that the external factor variable has a negative and significant direct effect on welfare. In other words, an increase in the external factors directly leads to a significant decrease in welfare.
5. The fishermen's capacity variable (Y1) fully mediated the relationship between internal factors (X1) and fishermen's welfare (Y2). This implies that internal factors did not directly affect fishermen's welfare but did influence fishermen's capacity (Y1). Therefore, policies aimed at improving internal factors would be effective at enhancing fishermen's welfare only when capacity is increased.
6. The same applied to the relationship between external factors (X2) and fishermen's welfare (Y2), which was indirectly affected through capacity (Y1). Policies designed to improve external factors would be effective at increasing fishermen's welfare when the capacity is also extended.
 - a. $R^2 = 0.66$. This implied that variables X1 and X2 together explained 66% of the variance in Y1, indicating a very strong model;
 - b. $R^2 = 0.18$. This suggested that variables Y1 and X2 explained only 18% of the variance in Y2. The remaining percentage was affected by factors outside the model.

Factors affecting fishermen's welfare through capacity were examined using SEM with LISREL 8.70. This process started with estimating or testing the parameters of the Thinking Framework. The model's fit test for the factors affecting usage levels is indicated in Figure 1. This showed that the model could estimate the covariance matrix of indicator variables, like the sample data. In other words, the model could be used to generalize the phenomenon examined. The results of the SEM-LISREL analysis are clearly shown in the goodness-of-fit model test table (Table 1). Kusnendi (2008) stated that the outcome of a structural model provided an answer to the research question, specifically predicting causal relationships or effects between variables.

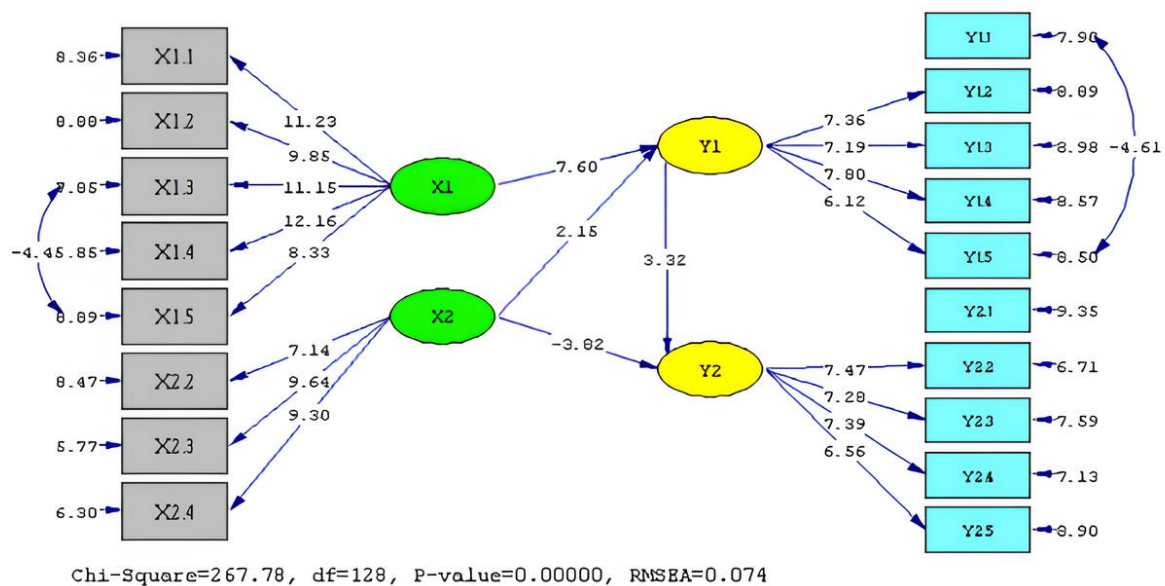


Figure 1. Structural model.

Table 1

LISREL model

No	Size*	Value	Standard value	Description
1	RMSEA	0.074	< 0.08	Good fit
2	NFI	0.89	< 0.90	Good fit
3	CFI	0.94	> 0.90	Good fit
4	IFI	0.94	> 0.90	Good fit
5	RMR	0.018	< 0.08	Good fit
6	GFI	0.91	> 0.90	Good fit
7	AGFI	0.91	> 0.90	Good fit
8	NNFI	0.92	> 0.90	Good fit
9	Chi-Square	267.78/df 128	< 3.00	Good fit

Source: Processed primary data, 2026. *Note: RMSEA = Root Mean Square Error of Approximation; NFI = Normed Fit Index; CFI = Comparative Fit Index; IFI = Incremental Fit Index; RMR = Root Mean Square Residual; GFI = Goodness of Fit Index; AGFI = Adjusted Goodness of Fit Index; NNFI = Non-Normed Fit Index.

Table 1 is utilized to assess the feasibility of the SEM-LISREL model. Since most of the Goodness of Fit indicators meet the necessary criteria, the research model is considered appropriate for analyzing the relationships between internal factors, external factors, fishermen capacity, and fishermen welfare.

Overall, a decomposition of the effect was performed to understand the direct and indirect effects among the research variables. Decomposition separated the total effect into direct and indirect effects, where the direct effect occurred when an independent variable affected a dependent variable without passing through others. An indirect effect occurred when an independent variable affected a dependent variable through one or more intermediate elements. Based on the parameter estimation image of the structural model, the direct and indirect effects among the tested research variables were explained. Table 2 provides a summary of the causal relationships between the research's latent variables and the t value as a statistical test.

Table 2

Direct effect between variables

The effect of variables	t value	R ²	Conclusion
Effect of X1 on Y1	7.60	0.66	Significantly positive
Effect of X2 on Y1	2.15		Significantly positive
Effect of Y1 on Y2	3.32	0.18	Significantly positive
Effect of X2 on Y2	-3.82		Significantly negative

Discussion

Factors affecting fishermen's capacity. Based on the results of data processing using SEM-LISREL, internal factors such as fishermen's experience, confidence, cosmopolitanism, courage to bear risks, and motivation to go to sea have a significant direct and positive effect on capacity because the t value is > 1.96 . External factors affecting fishing, including capital support, government policy support, and support for fishing infrastructure, also have a significant direct and positive effect on fishermen's capacity, as the t value is > 1.96 . The t -value is derived from the SEM-LISREL output found in the t -values section. This value is calculated by dividing the path coefficient by the standard error. A relationship between variables is considered significant if the t -value is greater than 1.96 or less than -1.96 at the 5% significance level. Therefore, internal (X1) and external (X2) factors directly and positively affect the capacity of fishermen in Serang Regency.

Effect of internal factors on fishermen's capacity. The effect of internal factors on fishermen's abilities shows that those with extensive experience tend to have a greater effect on personal skills. Fishing experience is crucial for fishermen because catches are not guaranteed because of unpredictable sea conditions, economic challenges, and environmental factors. Experienced fishermen generally have better knowledge of fish gathering locations, although challenges such as bad weather and traditional fishing gear still pose problems. Sea experience helps understand the characteristics of the ocean, including where and when fish can be found, which is essential for increasing catches and enhancing technical skills.

Experience at sea under adverse weather conditions often forces fishermen to give up trips because small boats are vulnerable to high waves and have limited fishing gear. Many fishermen still rely on traditional fishing gear, making them depend more on experience and knowledge to catch fish. Therefore, the more experience a fisherman has at sea, the greater his or her capacity, including its technical, managerial, and marketing skills, and the ability to add more value.

Fishermen's confidence in going to sea affects their capacity in terms of technical, managerial, marketing, and added-value capabilities. This is based on field observations and interviews with fishermen, who stated that a fisherman's confidence is not courage but a deep belief in the ability to read the sea, operate equipment, and face natural uncertainties. The confidence shown by fishermen can be observed in the self-assurance that comes from mastering seafaring science and the practical skills gained through experience. Self-confidence grows from the ability to navigate without relying solely on technology; instead, natural signs such as stars, wind direction, waves, and water color are used. The fishermen are confident that the ship will not be lost based on the confidence possessed. Confidence in reading the sea is the ability to "know" where fish gather, simply by observing bird patterns, currents, water temperature, and depth. Greater confidence leads to greater capacity.

Fishermen's cosmopolitanism affects their capacity, which can be explained by the fact that fishermen who are open to interacting with others and the outside world, particularly with respect to market information, technology, and culture beyond the community, increase their marketing capacity. This reflects the extent to which fishermen adopt modern or global methods, break away from traditional isolation, and connect to the wider world. Cosmopolitanism can be observed from the access to and use of modern technology, as well as the ability to sell the catch. Fishermen with a high level of cosmopolitanism tend to use modern fishing tools such as GPS, sonar, and more efficient gear to increase their catch. Furthermore, openness to information, where fishermen are more exposed and receive market insights from media or external sources, which affects the knowledge of weather, fish markets, and innovations in the fishing industry, affects fishermen's marketing capacity.

The courage of fishermen in bearing risks at sea affects capacity. This is because fishermen face significant risks when they go to sea, especially during windy, high-wave seasons, when personal safety is at stake while catching fish. Risk-taking courage,

particularly while at sea, becomes a key factor in optimizing the catch. The courage of fishermen to bear risks while at sea also affects their technical skills, as men can make quick decisions when the boats sustain damage at sea and help prevent accidents.

Fishermen's motivation to go to sea affects their ability because fishermen generally have a strong desire to go out to sea. Even during the rough wave season, the fishermen still head to the ocean. This motivation originates from the need to support families. When fishermen do not go to the sea, families struggle to obtain enough food. Therefore, fishermen can improve their technical skills with a high motivation to go to sea. During high waves, fishermen can overcome problems at sea. A greater motivation to go to the sea leads to greater fishermen capacity.

Effect of external factors on fishermen's capacity. The effects of external factors, including capital support, government policy support, and support for facilities and infrastructure, affect the capacity of fishermen in terms of technical, managerial, and marketing skills, as well as the ability to increase added value. This implies that the greater the degree of capital support for fishing, the greater the level of support from government policies. More access to facilities and infrastructure for fishing provided in eight subdistricts in Serang Regency for fishermen leads to higher capacity of fishermen in terms of technical, managerial, and marketing skills, as well as the ability to increase added value from the catch.

Fishermen generally use fishing gear such as nets (gillnets and trammel nets) and fishing rods (longlines), which are the most common tools. In addition, auxiliary equipment such as outboard motors, anchors, buoys, and fish finders is used to support fishing activities. The availability of government assistance, such as new fishing gear or components, can increase fishermen's capacity. Means of transportation at sea, such as boats equipped with outboard motors, and supplies, including diesel or pertalite (gasoline) fuel, are necessary to operate boat engines. Consequently, the more readily available and accessible facilities and infrastructure for going to sea are, the greater the capacity of fishermen. The availability of capital also affects capacity. This is because the availability of capital for fishermen, particularly those operating vessels under 5 GTs (small-scale fishermen), is generally limited, posing a major challenge to increasing their capacity and productivity. This limitation forces many fishermen, such as middlemen, to rely on informal financing sources. This limited capital is often depleted to fulfill daily needs because of uncertain income caused by weather conditions and fluctuating catch yields. Fishermen's dependence on informal parties (middlemen) makes it difficult to access formal financing (banking). Fishermen often borrow from informal financial sources, such as capital owners or middlemen, who sometimes also purchase their catches. Dependency can limit fishermen's control over their income and business results.

The main challenges faced by fishermen in terms of capital include relatively high operating costs, particularly for fuel, which is very expensive and often in short supply, leading to frequent shortages of subsidized fuel. Furthermore, poor financial management among fishermen also hinders the ability to manage business capital and access formal financial services (Rustan, 2024). Many fishermen lack sufficient assets to serve as collateral when they apply for bank loans that are borrowed from middlemen to sail. Based on the conditions faced in Serang Regency, less fishing capital available to fishermen leads to lower capacity. Conversely, more fishing capital available to fishermen leads to higher capacity. Government policies to facilitate financing and capital needs include providing direct assistance to strengthen business capital, providing special credit schemes such as People's Business Credit/KUR for business capital and operational costs, collaborating with financial institutions to fulfill capital needs, providing fisheries insurance to protect against workplace accidents and life insurance, and guaranteeing safety and security. Therefore, more government policies are implemented for fishermen, leading to greater capacity. The capacity decreases when no government policies are implemented.

Factors affecting fishermen's welfare. The factors affecting fishermen's welfare in Serang Regency indicate that external factors (X2) have significant, direct, and negative effects on welfare (Y2). Fishermen's capacity (Y1) has a significant, direct, and positive

effect on their welfare (Y2). Internal (X1) and external (X2) factors have significant, indirect, and positive effects on fishermen's welfare (Y2) through capacity (Y1).

Effects of external factors on fishermen's welfare. External factors have a significant, direct, and negative effect on fishermen's welfare (Y2), implying that higher external factors lead to lower welfare. This is evidenced by the government providing facilities and infrastructure for fishermen and building fish auction sites (TPIs) in eight subdistricts of Serang Regency, but only a few TPIs are functional. TPIs in the Tirtayasa, Pontang, and Tanara subdistricts do not function because of river silting, preventing boats from entering the TPI locations. Therefore, the TPIs cannot conduct transactions for the sale and purchase of caught fish. The TPIs in the Kramatwatu and Cinangka subdistricts are not functioning. The infrastructure of the fishing ports (PP) and TPIs remains minimal and inadequate. This forces fishermen to sell the catches directly to collectors on boats, reducing price transparency and the collection of local levies. The cold chain crisis is a major structural issue because of the lack of industrial-scale ice factories and government-owned cold storage facilities. Ice should be imported from the city, resulting in 10-20% shrinkage and reduced fish quality. Serang Regency has only four cold storage units with a total capacity of 240 tons, which is inadequate to support optimal harvest distribution.

In addition to building fisheries infrastructure and facilities, the government also provides loans to fishermen as capital support. Although the government encourages banks, including state-owned banks (KUR BRI Pontang unit, BNI, BTN, and Mandiri), to provide capital assistance, fishermen prefer to borrow from loan sharks or middlemen because the process is easier and without complicated conditions. This dependence forces the fishermen to sell the catches at below-market prices to the middlemen who have lent them fishing capital. The complexity of the loan procedures experienced by fishermen prevents them from borrowing from government-provided banks. Consequently, more fishermen borrowing from middlemen for fishing leads to lower welfare.

Government policies, such as the distribution of subsidized fuel, also face obstacles. Fishermen access subsidized fuel through the nearest SPBN (Fishermen's Fuel Station), but the men often experience stock shortages. Additionally, the absence of SPBN has become a challenge. An SPBN was once available in the Anyer subdistrict but is now damaged, further complicating access. Many fishermen lack vessel and fishing permits, preventing them from using subsidized fuel. The SPBN does not fully subsidize fuel for fishermen because the amount of government-provided diesel fuel is limited, leading to only a small number of fishermen benefiting from the government's fuel subsidies. To receive the government's fuel subsidies, fishermen should own a boat. Many fishermen who go out to sea do not own boats and borrow them from fishermen who do not go out to sea or are older. Therefore, because they lack a subsidy card, they should purchase retail diesel fuel, which is more expensive than the government-subsidized fuel. The government provides fishing gear assistance to fishermen, but this assistance is short-lived, requiring them to purchase gear when they go to sea. Even though the government has provided fishing facilities and infrastructure, capital, and policies, fishermen still experience less prosperity.

The effect of fishermen's capacity on welfare. Fishermen's capacity (Y1) has a significant, direct, and positive effect on welfare (Y2). This implies that the higher capacity of fishermen in terms of technical, managerial, and marketing skills, as well as the ability to increase added value, leads to greater welfare. According to Anwas (2009), formal education can enhance competency when the curriculum and learning process are correlated with individuals' job requirements. The technical capacity of fishermen refers to the knowledge and ability to manage fishing activities, including understanding fishing technology, handling catches (including cold chains), business capital management, and institutions such as cooperatives. Efforts to improve competency can essentially be achieved only through a learning process. Learning in this context is not limited to formal education but also comprises informal learning processes in everyday life (Anwas, 2013). Capacity development aims to improve fishermen's welfare, maintain the sustainability of fish resources, and increase the added value of their catches, such as in the production of salted fish. High capacity can improve fishermen's welfare by enhancing health, consumption, and income and increasing their families' formal education.

The indirect effect of internal factors on fishermen's welfare. The internal factors of fishermen (X1) have a significant, indirect, and positive effect on welfare (Y2) through capacity (Y1). This implies that more experience at sea leads to greater confidence, openness to the outside world (cosmopolitanism), risk-taking, and motivation. This is supported by increased capacity, including technical, managerial, and marketing skills, as well as the ability to increase the added value of the catches, which leads to higher welfare. This is understandable because more experienced fishermen tend to have better knowledge of adverse weather and traditional fishing gear, which can increase income. Similarly, the confidence of fishermen, built on the experience at sea and the understanding of fishing techniques, sea conditions, and the use of appropriate gear, tends to increase self-confidence. With this confidence, fishermen increase catches and income. Cosmopolitanism is often associated with a more market-oriented mindset, in which catches are supplied to both domestic and international markets rather than solely to local or traditional markets. High levels of cosmopolitanism can improve the welfare of fishermen through managerial and marketing capacities, enabling them to adopt technology and gain broader market access, potentially increasing their income and welfare. The courage to take risks at sea and strong motivation can further enhance the ability to achieve larger catches. This can increase the income from fishing through technical skills and the ability to increase added value, thereby contributing to greater overall welfare. The internal factors possessed by fishermen and supported by the capacity can improve welfare (Wicaksono & Fahmi, 2021; Sanjaya & Handayani, 2025). Accordingly, improving the welfare of fishermen requires more than fishing experience alone (Daulay et al., 2025; Utami et al., 2026). In addition to possessing strong self-confidence, openness to external environments (cosmopolitanism), the capacity to withstand risks at sea, and high levels of motivation, fishermen should also be supported through enhanced capacity development. This includes strengthening technical, managerial, and marketing skills and improving the ability to generate greater value addition from fishing activities.

Efforts to improve fishermen's welfare are supported by government policies through outreach and empowerment, the provision of fishing facilities and infrastructure, and the provision of capital for fishermen (Sjioen et al., 2020; Amirullah et al., 2021; Alghiffari & Slipilia, 2026). A government policy supporting fishermen's welfare is increasing the number of fishery extension workers in Serang Regency. Therefore, increasing the capacity of fishermen can be achieved through government policies to increase the number of fishery extension workers, which is currently only 9 for 38 villages, where most of the population is fishermen. This finding supports that of Noviyanti (2015), who suggested that key indicators for developing fishermen's capacity include knowledge, competency, mentality, commitment, and understanding of laws and regulations. These indicators can serve as the foundation for developing bottom-up empowerment programs for fishing communities.

Conclusions and suggestions. The research revealed that internal and external factors affect fishermen's capacity. The factors affecting fishermen's welfare indicate that external elements have significant, direct, and negative effects on welfare. Fishermen's capacity had a significant, direct, and positive effect on welfare. Finally, internal and external factors were found to have significant, indirect, and positive effects on fishermen's welfare through capacity. The results of this study will serve as a crucial foundation for the development of impactful empowerment programs for the coastal community.

Authors contributions. ZD, AM and A designed the study. The experiments and data collection were carried out by ZD. Data analysis and manuscript writing were completed by ZD. All authors reviewed and approved the final version.

Conflicts of interest. The authors declare that there is no conflict of interest.

Data availability. The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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