

Small scale fisheries performance: comparative analysis before and during the Covid-19 pandemic in Indonesia

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Abstract. The incidence of the Covid-19 pandemic indirectly affects the decline in the activity of the processing industry and fish consumption by the community. In the short term, there is also a decline in fish prices. This study examines whether the decline in economic activity in the fisheries sector causes changes in the performance of small-scale fisheries, both before and during the Covid-19 pandemic in Tolitoli Regency, Central Sulawesi Province. The target of the research object is fishers who use trolling lines, handline, and beach seine. The analytical method used is Exponential Comparison Method. The results showed that capture fisheries belonging to SSF, which had high performance before covid-19, were fishing gear, and the lowest performance was Surrounding net. On the other hand, the surrounding net has a higher performance during the pandemic than the other three fishing gears, and the lowest is Trolling lines. However, there has been a significant decline in prices and market affordability, the economic contribution of small-scale fishing businesses from before and during the COVID-19 pandemic. For this reason, a policy to open up an export-oriented fish catch market and a wider market reach is required.

1 Introduction

Since the coronavirus outbreak (covid-19) in early 2020 in Indonesia, it has had a significant adverse impact on the increasing incidence of sick people, the number of deaths, and the limitation of all activities of daily life. The Indonesian government issued a policy of modifying the regional quarantine to become a large-scale social distancing that is localized according to the severity of each province, district, or city to cope with the spread of COVID-19 and its impacts [1]. This policy is based on Law Number 6 of 2018 concerning Health Quarantine, whose implementation of these regulations is Government Regulation Number 21 of 2020 concerning Large-Scale Social Distancing and Presidential Decree on Health Emergencies [2]. Policy implementation at the provincial level was carried out by issuing the

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Central Sulawesi governor's circular no. 443/141/DIS-KES dated 16 March 2020, regarding the Prevention and Anticipation of the Spread of COVID-19 in Central Sulawesi. The result of implementing the policies of the central and local governments is a decline in economic activity in both the production and distribution systems of goods. The next impact is the disruption of the level of demand and consumption of goods and services. One of the sectors affected by the COVID-19 pandemic is the fisheries sector, both in the upstream sub-system, production sub-system, and downstream sub-system. Worries about the impact of the pandemic because fishery activities such as fish landing activities in port areas and processing industries can pose a risk of virus transmission [3].

The form of social restriction policies such as restrictions on public transportation activities and urging offices of both the central government and the private sector to work from home has caused the production capacity of the fish processing industry to decrease half of its initial capacity. The fish processing industry is generally intended in the form of the fish freezing industry [4,5]. The same thing also happened to a cold storage company in Tolitoli Regency, Central Sulawesi Province, which has its head office and market center on Java Island and exports to Japan to limit fish demand from Tolitoli of the dismissal of several factory employees. This employee restriction follows government regulations which urge employees to work half of the total so that the company's management reduces the processing capacity of fishery products to half the initial capacity.

The decrease in the production capacity of the fish processing industry causes the demand for fish from the islands of Java and Kalimantan to decrease the number of traders and the purchasing capacity of fish from fishers. Various restrictions have been taken, such as the target market for fishery commodities, which are only around the local markets of Tolitoli City and Palu City, fish freezing companies in Bitung City (only skipjack tuna), as well as limiting the number of fish shipments to Surabaya and Jakarta. This effort is executed so that fisheries businesses in the Tolitoli area of Central Sulawesi, including cold storage companies, do not experience large losses. The decline in demand for fish commodities and fishing activities by fishers, including small-scale fishery businesses, are still running normally. This means that fishery production in the production centers remains constant, especially if the weather and climate are friendly. As a result, overproduction occurs, which causes the price of fish at the local level of Tolitoli to decrease or become low. The decline in fish prices began in May 2020 from an average price of IDR 24,944.44 in February to IDR 18,721.74. Even though it increased slightly to IDR 23,454.21 in the middle of the year, it continued to experience a decrease in the average price of fish until November, reaching IDR 18,202.38 [6].

The decline in fish prices was felt by small-scale fishing (SSF) businesses, the income of fishers, and fishers' households livelihoods [7]. This is based on the low catch of SSF fishers compared to capture fisheries businesses with large fishing capacities such as purse seine, pole-line, and *bagan* fishing gear. SSF, according to [8], is a fishery effort, which is managed at the household level so that the number of fishing personnel is limited, catching fish without or with fishing vessels under 5 GT, using fishing gear that is operated only by human power. The low price of fish received by small-scale fishers and the relatively low catch are feared to impact the declining performance of fishery businesses. The decline in the performance of fishers classified as SSF also multiplies the decline in business income from selling inputs and traders collecting fishery products. The decline in fishers's income and the business of trading fishery inputs and products locally can reduce the economy of Tolitoli Regency. Tolitoli's economic growth rate in 2019 was 4.79 percent, decreasing to -3.31 percent. Specifically, the agriculture and fisheries sector experienced a decline in growth rate from 3.47 percent in 2019 to -0.49 percent in 2020 [9].

Several studies examining the impact of COVID-19 on small-scale fisheries are mainly related to fishing activities, traders, the price of fish received [10], and the vulnerability of

small-scale fishing communities to impacts of the COVID-19 pandemic [11]. In contrast to this study, which examines the performance of SSF in terms of several dimensions, such as technical, social, and economic dimensions. Based on these problems, the purpose of the research is to examine whether the decline in economic activity in the fisheries sector causes changes in the performance of small-scale fisheries, both before and during the Covid-19 pandemic in Tolitoli Regency, Central Sulawesi Province.

2 Method

The research study area was carried out in Tolitoli Regency, Central Sulawesi Province, from November to December 2020. The selection of research locations was based on the consideration that villages and sub-districts were located in coastal areas and the main occupation of the community as fishers with the SSF category (7 sub-districts and 11 villages).

Types of fishing gear operated by fishers with SSF categories include Trolling lines, Hand lines, surrounding nets, and Set gillnets. The number of fisher respondents from the four fishing gears is 50 fishers consisting of 12 people from Trolling lines, 20 people from Hand lines, three people from the Surrounding net, and 15 people from set gillnets. Determination of respondents was carried out by purposive sampling by considering the representativeness of the population from the four groups of SSF lifting equipment.

The data type combines qualitative and quantitative data sourced directly from fishers, sellers of fishing facilities, and traders who collect fishery commodities. Types of quantitative data include the percentage of operating SSF fishing gear, the number of fishing trips, the price of fish, fishing facilities, and the income of fishers and traders. At the same time, qualitative data consists of fisher's perceptions of changes in fishing operations, market accessibility of fishery commodities, availability of fishing facilities, and marketing institutions.

The data collected were analyzed using the Multi-Criteria Decision Making (MCDM) approach with the specification of the analytical method, namely the Exponential Comparison Method [12]. The formulations used to measure the performance value of SSF before and during the covid-19 pandemic are:

$$Performance\ value = \sum_{j=1}^m (RK_{ij})^{TKK_j} \quad (1)$$

Where RK_{ij} = the value of the existence of performance criteria j on fishing gear i ; TKK_j = importance weight of performance criteria j ; TKK_j value = 0 - 1; i = number of SSF (4 types of fishing gear); j = number of SSF performance criteria (4 criteria). The four SSF performance criteria to be analyzed are catch and fishing patterns (A), price and market accessibility (B), input availability (C), and economic contribution (D). Assessment of fishing gear performance criteria in the SSF category using the Likert scale measurement method from score 1 to 4, where 1 = poor, 2 = adequate, 3 = good, and 4 = very good. Criteria whose presence is high or good in the SSF will have a high score as well. Calculate the weight of the performance criteria for each SSF fisheries business using the Analytical Hierarchy Process (AHP) method, commonly called the pairwise comparison method. The AHP method procedure can be describe as follows [13] :

1. Assessment of the four performance criteria using [13] with a scale of 1 to 9, where a score of 1 = criterion A is as important as other criteria; score 3 = criterion A is slightly more important than the other criteria; score 5 = criterion A is more important than others; score 7 = criterion A is more important than others, and a value of 9 = criterion A is more important than the others. Values 2, 4, 6, 8 are given when in doubt between two adjacent

- values. The comparison value of criteria A with other criteria is 1 (one) divided by the comparison value of other criteria with criteria A.
2. Determination of the weight of the criteria in the AHP method is done by determining the eigenvalues (eigenvectors). The determination procedure is [12]: a) make the results of pairwise comparisons for each performance criterion as a 4 x 4 matrix, then square the matrix, or multiply two matrices that have the same members, b) adding up the value of each line of performance criteria, then adding up the four criteria values, and c) determining the weight of the criteria by normalizing the value of each performance criterion, dividing each value of the total performance criteria. The value of the four performance criteria in more detail is present in Table 1.

Table 1. Procedure for weighting criteria using the AHP method

SSF performance criteria	SSF performance criteria Value as a matrix				Squaring the criterion value				Total value	Weight per criteria
	A	B	C	D	A	B	C	D		
A	a ₁	a ₂	a ₃	a ₄	a ₁ ²	a ₂ ²	a ₃ ²	a ₄ ²	Σai ²	Σai ² /ΣΣij ²
B	b ₁	b ₂	b ₃	b ₄	b ₁ ²	b ₂ ²	b ₃ ²	b ₄ ²	Σbi ²	Σbi ² /ΣΣij ²
C	c ₁	c ₂	c ₃	c ₄	c ₁ ²	c ₂ ²	c ₃ ²	c ₄ ²	Σci ²	Σci ² /ΣΣij ²
D	d ₁	d ₂	d ₃	d ₄	d ₁ ²	d ₂ ²	d ₃ ²	d ₄ ²	Σdi ²	Σdi ² /ΣΣij ²
Grand Total									ΣΣij ²	1,00

3 Results

Based on the fisheries regulations of the Republic of Indonesia, Small Scale Fisheries (SSF) are defined as people whose livelihood is fishing using traditional tools to meet the needs of daily life using fishing vessels with a maximum size of 5 (five) gross tons (GT). Fishermen classified as SSF are not subject to a business license and are free from taxes and are free to catch fish in all fisheries management within the territory of the Republic of Indonesia. Based on the criteria and identification of types of fishing businesses in Tolitoli Regency, Central Sulawesi Province, four types of fishing gear classified as SSF were obtained, namely Trolling lines, Hand lines, Surrounding nets, and Set gill nets. Furthermore, the identified SSF performance was measured based on four criteria for developing capture fisheries business during the Covid-19 pandemic. The results of the field data analysis of the four criteria are present in the following sub-chapters.

3.1 Performance of fishing pattern and catch

The assessment of the performance of SSF fishing patterns and fish catches has five sub-criteria, namely changes in the percentage of fishing gear operating, fishing time, number of fishing trips, distance to the fishing ground, and number of catches. The average score of the five sub-criteria is the value of the existence of performance from the performance criteria of fishing patterns and fish catches. The performance value of the performance criteria for fishing patterns and fish catches obtained from the analysis of the exponential comparison method is presented in figure 1.

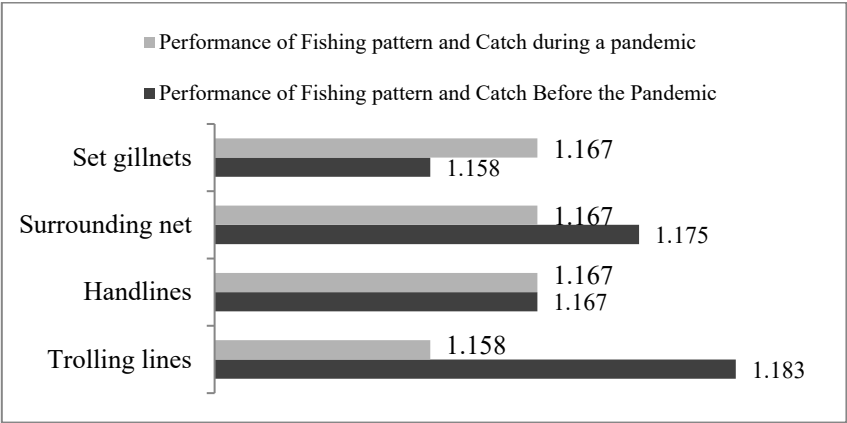


Fig. 1. SSF performance based on fishing pattern and catch criteria

Figure 1 shows that there was a decline in performance in the pandemic for Trolling lines and Surrounding nets in terms of catch and fishing patterns performance. The main causes of the decrease in the performance value of fishing patterns on the Trolling lines fishing gear are the number of fishing trips, fishing time, and catches while Surrounding nets. Only the number of fishing trips decreased. The results of the AHP weighting analysis show an importance weight of 0.13 for the fishing pattern and catch criteria for SSF performance. This criterion has the lowest weight compared to the other three criteria, so that its influence on SSF performance during the pandemic is also quite low.

3.2 Performance of price and market accessibility

Assessment of fish price performance and accessibility or reach to the market of the SSF commodity has three sub-criteria: changes in fish prices, a number of fish traders, and reach to the market. The average score of the three sub-criteria is the value of performance from the criteria of fish price and reach to the market or final consumer. The exponential comparison method analysis results on the performance of the fish price criteria and reaches to the market or final consumer are present in figure 2.

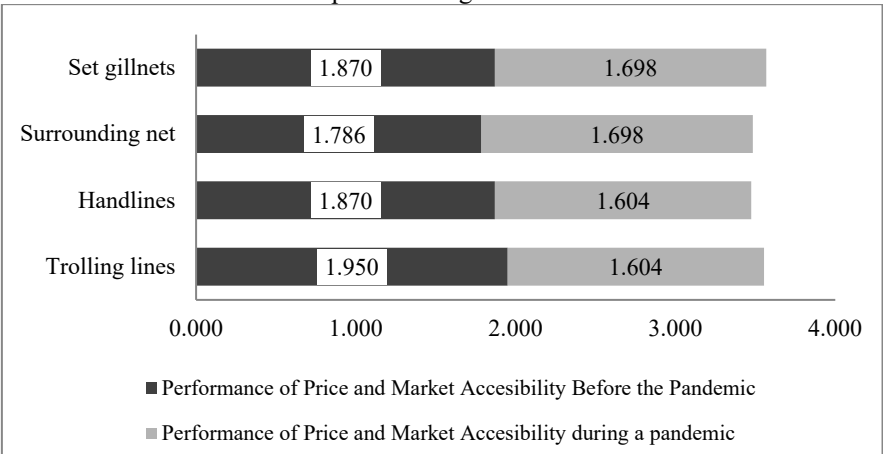


Fig. 2. SSF performance based on price and market accessibility criteria

Figure 2 shows that in terms of fish prices and reach to the market/consumer. There is a decline in performance for all fishing gear classified as SSF. The results of the AHP

weighting analysis show an importance weight of 0.48 for the price and market accessibility criteria for SSF performance. This criterion has the highest weight compared to the criteria, which means it significantly influences the performance of SSF during the covid-19 pandemic.

3.3 Performance of input availability

The performance assessment for the criteria for the availability of SSF facilities (inputs) has three sub-criteria, namely changes in the availability of inputs, changes in input prices, and changes in the number of sellers of fishing facilities. The average score of the three sub-criteria is the value of performance from the criteria for the availability of production or fishing inputs. The results of the exponential comparison method analysis on the performance of the criteria for the availability of operational fishing inputs are present in figure 3.

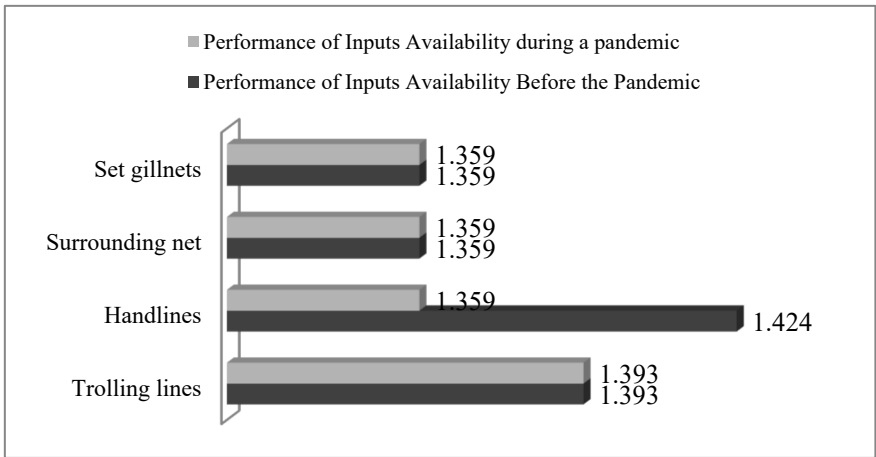


Fig. 3. SSF performance based on input availability criteria

Figure 3 shows that only Handlines fishing gear has a declining performance in terms of the availability of fishing facilities. The availability of capture fisheries production inputs at affordable prices in the Tolitoli Regency during the pandemic is generally quite available such as fishing aids, bait, and ice cubes. The results of the AHP weighting analysis show an importance weight of 0.25 (second highest after price and market accessibility criteria) for the input availability criteria for SSF performance.

3.4 Performance of economic contribution

Performance assessment for the fourth criterion, namely the economic contribution of SSF, has three sub-criteria: changes in fishers' income, income from sellers of fishing facilities, and income from fish traders. The average score of the three sub-criteria is the value of performance from the SSF economic contribution criteria. The exponential comparison method analysis results on the performance of the criteria for the economic contribution of fishery businesses in the Tolitoli Regency are present in figure 4.

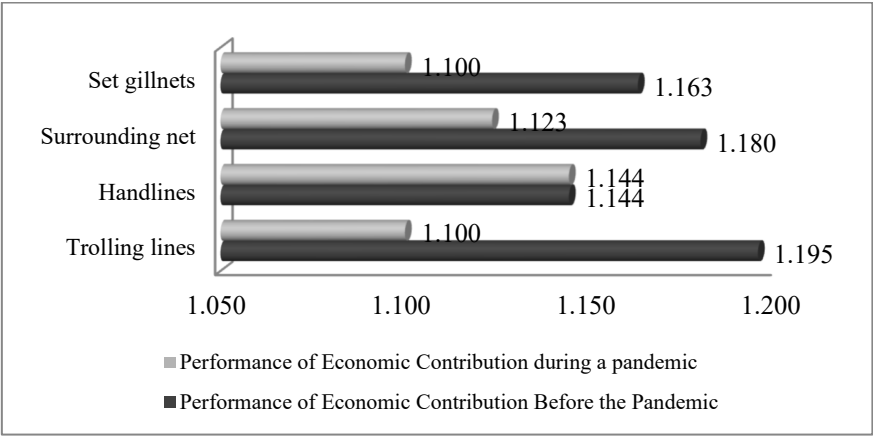


Fig. 4. SSF performance based on economic contribution criteria

Figure 4 shows three types of fishing businesses classified as SSF that experienced a decrease in income, namely Surrounding nets, Trolling lines, and set gillnets. The decrease in income contribution of both fishers and traders who support fishing activities is in the Trolling lines fishery business. Meanwhile, handlines did not experience a decline in the performance of its economic contribution, considering that this fishing gear still has a large market share in the local Tolitoli and Palu City areas, especially the food stall market segmentation. Despite the decline in the price of reef fish as the main type of catch for Hand lines fishers, the demand side is still quite large. The results of the AHP weighting analysis show an importance weight of 0.14 for the economic contribution criteria for SSF performance.

3.5 Total performance of SSF

The sum of the performance values of the four criteria in fisheries businesses in the Tolitoli Regency is the total performance value of each SSF both before and during the covid-19 pandemic in Tolitoli Regency. The complete analysis results are present in Figure 5.

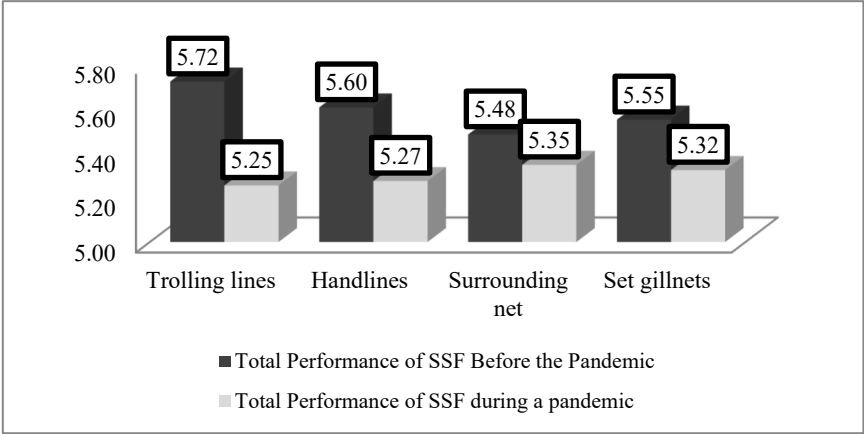


Fig. 5. Total Performance Value of SSF before and during the Covid-19 Pandemic

Figure 5 shows that fishery businesses classified as SSF have the highest performance values before the covid-19 pandemic, in order are Trolling lines, Handlines, Set gillnets, and Surrounding nets. This is because the economic value of fish commodities is very high, and

the marketing reach of fish catches of both fishing gear (Trolling line and Handlines) is generally an export commodity and has a fairly high demand. However, due to the pandemic, which caused a decrease in market demand, the performance of the two tools also experienced a very deep decline, especially Trolling lines.

4 Discussion

Based on the results, SSF fishers generally provide information that there is almost no change in fishing patterns directly caused by the pandemic. Fisher's activities such as fishing duration, fishing techniques, number of fishing fleet personnel, and interactions between fishers normally occur. However, along the way, due to the decline in fish prices, the number of fishing trips also decreased. Results of the research [14] indicated the covid pandemic's impact, which causes a decrease in fishing activity for the head of the family. In turn, it impacts a decrease in the family income so that other family members, such as mothers and children, have to do additional work as a form of family responsibility.

The biggest decline in performance was in the Trolling lines and Handlines fishing gear, which was caused by the drop in fish prices and market reach for the two fishing gears. The types of fish caught by Handlines are generally groups of reef fish such as grouper and snapper, with high economic value. They are fishery commodities with market reach outside Sulawesi and export to Hong Kong. Similarly, Trolling lines catch tuna and skipjack, which have quite high prices and marketing areas to Java and Japan. The decline in the price of tuna and reef fish reached more than 50.00 percent. The results of this study are in line with [15], which explains that there has been a 50 percent decline in fish prices in Thailand due to decreased demand for fish and restrictions on fish trade transportation.

Meanwhile, for fishing gear, Surrounding nets and set gillnets are generally of lower value, only reaching the local markets of Tolitoli and Palu City. However, as a result of competition for catches with modern fishing gear such as the Purse seine, which catches larger numbers of fish, the price of fish in the local market decreases. To increase SSF's resilience in the face of the COVID-19 pandemic, [16] stated that it needed the ability to change strategies (including direct sales of seafood, switching species, and supplementing their income with government payments [17] that were more successful for local economic institutions and improve connectivity and important innovations with processing technology and commodity markets.

The problem of availability of inputs only occurs in fuel oil, especially gasoline, which is quite high, and its availability is sometimes limited. The reduced availability of inputs, especially in fuel oil (gasoline), caused the selling price to increase from IDR 7,800 - 10,000 per liter to IDR 17,000 per liter. Another reason for the increase in gasoline prices in line fishing is that generally, the fishers who operate the fishing gear are located in coastal (rural) areas far from the fuel oil sales center (fueling stations) in Tolitoli City and the poor condition of road infrastructure. To reduce and stabilize the price of fuel oil, a government program is needed related to road repairs and the establishment of fuel oil filling stations. On the other hand, the global slowdown from the economic recovery due to the pandemic should lead to a continued decline in the prices of goods, including the price of fishing equipment such as gasoline, ice cubes, other fishing aids, resulting in lower fishing operational costs. Globally, the COVID-19 crisis has reduced oil consumption worldwide by a large amount, thereby lowering global and local oil prices [18].

If it is specifically examined, the biggest change in fisher's income has decreased, namely in Surrounding nets fishers by 214 percent. It is necessary to diversify the livelihoods of family members of SSF fishers [19] to reduce dependence on fisheries and increase family income, improve the fishery commodity market chain and increase women's access to social security, health insurance, and social security [20]. Increasing the contribution of fisher's

income can be done by increasing the role of fisher household members, especially women, to food and livelihood security [21] by increasing the added value and value chain of fishery commodities produced by fisher's household heads.

During the pandemic, the surrounding net has slightly better performance than the other three fishing gears. This is because the fish catch capacity of these tools is larger. Small pelagic fish generally have a selling price of a fish commodity is cheaper. Although there is a decline in public income in general, the community can still spend their money to fulfill the consumption of fish produced by a Surrounding net. Improvements are needed in marketing and supply chain management through collaboration with companies and the government to improve the performance of Trolling lines and Handlines [22]. In addition, effective coordination, planning, and implementation in the short and medium-term between stakeholders such as the government, development organizations, NGOs, donor agencies, the private sector, and researchers are needed to accelerate the economic recovery of SSF, coastal fishing communities, and other civil society due to the impact of the COVID-19 [23].

5 Conclusion

Based on the performance of four criteria and MCDM analysis, this study concludes that the four capture fisheries businesses classified as SSF had decreased performance, especially trolling lines and hand lines, which before the pandemic had the highest performance value. The type of SSF that has the highest performance during the COVID-19 pandemic is the surrounding net, and the lowest is trolling lines. The implication of this research is, to increase the resilience of hand line and trolling lines fisheries from the impact of the pandemic, it is necessary to increase market reach, especially to Java and exports, livelihood diversification, and government involvement in providing social and health insurance for fishers.

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