

# **Mapping Maritime Logistics Collaborations in Fishing Industry: A Review of Literature**

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## **Abstract**

Fishing is one of the important primary industries and can contribute to economic development in many countries. As one of the countries with the largest islands and waters in the world, Indonesia has a large fishery production potential. In the fishing industry, many stakeholders are involved, from the capture process to distribution to customers. The many entities involved make division necessary so that stakeholders can carry out their duties and responsibilities properly and the process of distributing fishery products is efficient. In addition, inequality in the fishing industry, the benefits of each stakeholder, and the quality of cargo on cruise ships also underlies the need for collaboration. Therefore, the authors try to analyze the variables that affect collaboration from various aspects of the problems that exist in each stakeholder based on a survey and analysis of the literature. The author makes several collaboration schemes from fishermen, the performance of shipping companies, expeditions, terminals, and regulators that can be applied in industrial fisheries. The collaboration scheme formulated by the author from various stakeholders in the fishing industry can make the process from fishermen to consumers more efficient because no stakeholders take advantage of opportunities in fishery distribution. Collaboration with other stakeholder regulatory schemes can also protect marine ecosystems, qualified facilities and market certainty and positively impact various stakeholders, waste management and good regulatory implementation. Indonesia's fishery export potential in 2030 will reach 1.7 million tonnes. This export potential can be achieved if there is collaboration from various stakeholders.

## **Keywords**

Fishing cold chain, Fishing stakeholders, Collaboration, Maritime logistics, Fishing operational

## **1. Introduction**

The fishery is one of the important primary industries contributing to economic development in many countries. Its interests include economic production, diplomacy, trade, employment, and its role as the primary source of animal protein for humans. Indonesia is an archipelagic country that is rich in marine resources and has territorial waters for the development of the fishing industry. Based on data from the Ministry of Maritime Affairs, Indonesian fish production will reach 23.16 million tons in 2020. The fishing industry involves many entities that have their respective duties and responsibilities, and this causes a tendency for logistics collaboration to occur in ports and the maritime industry (Ascencio et al. 2014). Maritime logistics can become fragmented, and each entity's success measures become unbalanced if one entity is not carried out.

The logistical partnership can be defined as when two or more independent parties form a coalition to produce benefits that cannot be achieved individually (Simatupang and Sridharan 2002; D'Amours and Rönnqvist 2010). Organizations have many relationships: joint ventures, networks, consortia, alliances, trade associations, and directory interlocks (Barringer and Harrison 2000). Maritime logistics collaboration involves all parties operating through ports from the global logistics chain, including various stakeholders involved in the international trade process, such as port authorities, terminal operators, customs, and transportation companies (Ascencio et al. 2014). As stated in previous research, having hope in team members for collaboration will provide a mutually motivating future in partnership relationships (Bresnen and Marshall 2000).

However, it can be noted that there is still a lack of focus on the role of the owner of the goods in exploring maritime logistics collaboration, even though the owner of the goods is an important stakeholder in vertical collaboration (Sandberg 2005). In terms of increasing fisher's participation, many parties consider this important to achieve more sustainable, equitable, and efficient management (Jentoft and McCay 1995; Ostrom 1990; Pinto da Silva and Kitts 2006; Weber and Iudicello 2005). A new approach needs to be taken to consider the role and impact of the owner of the goods in the collaboration of maritime logistics entities, mainly in initiating and facilitating more connections and trade by giving the role and initiation to the owner of goods. Collaborative management of marine resources involves a shared responsibility between the government and fisheries stakeholders.

### **1.1 Objectives**

The next sections of this paper are organized as follows: firstly, the methodology is explained, and secondly, it outlines the concept of Maritime logistics from various literatures. The third part describes the fishing process starting from the fishing process to the consumer, the selection of modes of transportation is explained in this section. In the fourth section, it is explained about Stakeholders in the Fishery Industry, fishery potential, and existing port facilities in Indonesia. The author analyzes the factors that underlie collaboration from various aspects of the fishing industry based on various problems with each stakeholder in the fifth section. The author also analyzes the potential growth in the number of fisheries exports in the sixth section. The author provides potential solutions for collaboration from various parties as a reference for collaboration in the seventh part. With this research, it is hoped that challenges from various stakeholders in the fisheries sector can be overcome through collaboration and positively impact all existing stakeholders. This research can also be used as a guide by fisheries industry players in determining collaboration.

## **2. Review Methodology**

In this paper, the author collects and analyzes the problems that arise from various fisheries industry stakeholders through literature studies and survey. A literature review assists authors in evaluating and analysing relevant literature, as well as identifying the field's conceptual content and contributing to theory development (Carvalho et al. 2019). This study uses a qualitative method with the argument that the collaboration process involves actors representing their respective institutions through identifying the actors involved, understanding and exploring the roles of each actor, exploring the perceptions and opinions of individual actors, and exploring the relationships between actors. This literature review was carried out by scanning and identifying several key themes in collaboration, the fishing industry, supply chain, and Maritime logistics. Table 1 shows the literature review results from various stakeholders on maritime logistics issues. The following databases were utilized to search for relevant papers to find the broadest possible range of scholar productions: Scopus, Elsevier, Emerald, Springer, Google Scholar, and Clausiupress.

Table 1. Literature Review

Authors	Challenges
(Silva et al. 2016)	Sea transportation collaboration
(Keller and Daugherty 2001)	Logistics cost in collaboration
(Yochum et al. 2008)	Development of fisheries
(Pinto da Silva and Kitts 2006)	Regional management collaboration in marine fisheries
(Heaver 2015)	Increase profits by collaborating
(Islam and Habib 2013)	Fisheries distribution process
(Jensen et al. 2010)	Optimizing aspects of the fisheries supply chain
(Gurning and Tangkau 2022)	Waste processing collaboration
(Budiyanto et al. 2018)	Improving the fisheries sector through the port governance system
(Yang and Lin 2017)	Analyze the relationship between ship transport operators
(Parikesit et al. 2018)	Identify obstacles in the implementation of policies, technologies and strategies
(Retnoningtyas et al. 2021)	National fisheries management plan involving local communities
(Caballini et al. 2012)	Rail transport system to the port
(Sopa and Saenchaiyathon 2020)	Reduce the supply chain disruption to the relationship between collaboration
(Zulbainarni et al. 2020)	Indonesia's fisheries management and governance in sustainable development.
(Cahyagi and Gurning 2018)	Determine the problems and solutions in fishermen life

Having read the paper and a survey to Ambon and Bitung to conduct FGD activities with fisheries industry stakeholders regarding the challenges and problems of the fishing industry in Indonesia. The authors identify that the success of maritime and fisheries logistics will depend on port and fish processing infrastructure, total costs, government and industry support in the region, road access, market certainty, labor availability and regulations, and growth production. The literature review results have been compiled, linked by problems, and analyzed to give fishermen prosperity solution options. Then the authors map maritime logistics concept, fishing processing, stakeholders, challenges, and collaboration scheme to success of maritime logistics and fisheries.

### **3. Maritime Logistics Concept**

In recent years, there has been an intense discussion of relationships in logistics, particularly in supply chain management, as the relationships between companies form the basis for supply chain management arrangements. Collaboration between companies participating in supply chain arrangements is generally believed to increase efficiency and lower costs. This is especially true for forecast collaboration, as firms spend valuable resources responding to unforeseen conditions (House and Stank 2001). However, the potential for efficiency improvements does not stop with collaboration in forecasting; firms create value enhancement by collaborating on equally valuable knowledge, resources, promotions, orders placed, etc. (Skjoett et al. 2003). Collaboration is a decision-making process among interdependent parties, including operators and LSPs (House and Stank 2001). The role of third-party service providers varies according to the level of outsourcing, from transportation-only services to fully integrated logistics value-added services and global management of customer logistics arrangements (Lieb and Bentz 2004). The results from the case study demonstrate a three-stage model for third-party logistics service providers including carrier, LSP, and LSI. This three-stage model, the CLM model, is shown in Figure 1.

Below, the operator describes the services provided by three third-party service providers. The service is most convenient in point-to-point network settings where transportation operators carry product transport from one point to another, often with a full truckload (Sink et al. 1996). Similarly, in a multi-stop network setup, the transport operator transports full truckloads or LTL with multiple stops along a predefined route. By transporting the product on time to the customer, time utility is generated, and even the utility of the place when the product is available to the customer (Coyle et al. 1996). The services provided by the carrier in all inspected cases are incoming and outgoing transportation, door-to-door transportation services, and contract delivery. Apart from that, several administrative

services are also provided: transportation administration documentation handling, transportation scheduling track and trace information, and delivery performance tool.

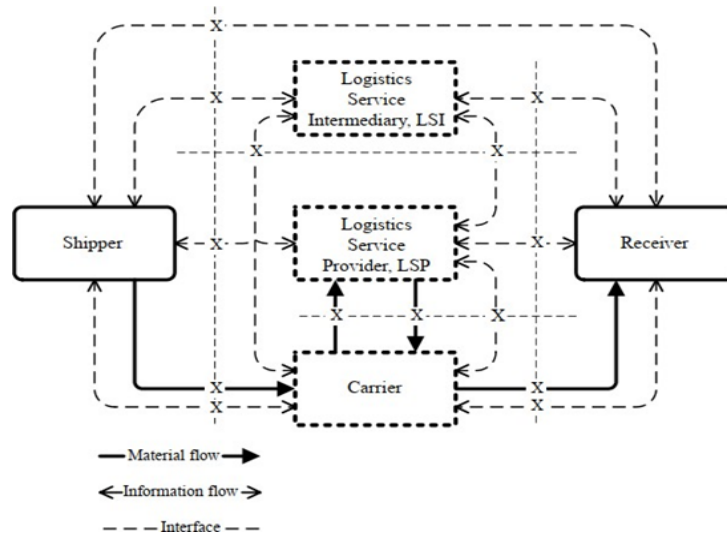


Figure 1. Logistics collaboration model (Jacobsson et al. 2018)

Some carriers provide customized services to some extent, but the above are the usual ones. The scope of carrier services, both physical and administrative, includes activities that need to be carried out at the bottom of the PDT model, especially carrying out physical transport within the transport structure. Operators can provide a transshipment function in transport arrangements where unit loads are transferred from one mode of transportation to another. This service is often applicable in rail-to-truck intermodal arrangements where the rail operator operates its terminal. Larger carriers can even operate cross-dock terminals where cargo units, pallets, or the like, are moved from one truck lane to another. Thus, the carrier can take over the structure of the transportation network, partially or completely. Carriers often own most of their resources, are the owners or tenants of the trucks and equipment necessary for their operation, and in that sense are asset-based operators.

#### 4. Fishing Processing

Supply chain management is a process that includes planning and managing all activities involved in sourcing, procurement, conversion and logistics management. This also includes coordination and collaboration with channel partners, suppliers, intermediaries, third party service providers or customers. No organization or individual entity in the fish supply chain is independent. Actions taken by any member of the supply chain can affect, enhance or disrupt the entire chain and the livelihoods of fishers who make fishing their main source of income (Mohan et al. 2021). In Indonesia, port integration has become a port reference for increasing operational efficiency. The currently integrated elements are ports, industrial areas, distribution and warehousing. In its operational pattern, the port functions as a logistics gateway. The industrial area functions as a center for business activities. The distribution aspect is intended to manage freight services for further cargo distribution. While warehousing functions to provide a buffer zone as a temporary storage area. This will provide benefits to each sector.

Port integration in cold chain management is planned by combining several supply chain elements (Budiyanto et al. 2018). The literature review shows that these elements include handling fish products, processing fish, cold storage, shipping fish products, and handling fishing vessels as shown in Figure 2. Some species require additional processing, such as refrigeration, packaging, and canning. Fresh fish is highly perishable, and optimal storage temperatures and proper handling procedures are critical to maintaining high quality and ensuring a safe product. Handling of fish products is a function of handling fresh fish when fishing vessels arrive. Fish products caught will be unloaded, classified, and reported. After the data collection, the fish products will be brought to the fish processing stage. Handling of fishing vessels - in addition to the fish trade process, fishermen can also access the ship facilities provided by the port. Fishermen can refuel water and supplies before the ship.



## 5. Stakeholders Fishing Industry

It is necessary to identify the parties involved and have an interest in maritime logistics related to concentration and collaboration, including incorporating elements within the institution and defining relevant relationships for further analysis. Stakeholder analysis identifies vital actors and their characteristics and interests (Grimble and Chan 1995; Pomeroy and Douvere 2008). Based on their importance, several ways to identify stakeholders in maritime logistics can be adapted and applied to the observed system. Von and Will (2011) provides a structured overview to identify stakeholders based on logistics activities. Regarding the type of service, it can be distinguished between logistics service providers offering transportation services and infrastructure service providers offering the required infrastructure. Carriers offer services from assets owned or leased to perform transportation services, for example, shipping companies or transportation companies by rail. Forwarders offer services for organizing, planning, and marketing transportation services, ocean freight forwarders, road freight forwarders, joint transport operators. Meanwhile, terminal operators operate terminals at ports.

The port as a fishing port has the function of government and entrepreneurs to support activities related to managing and utilizing fish resources and their environment from pre-production, production, processing to marketing. In the field of fishing, one of the efforts to achieve the goal of increasing production is to provide facilities in the form of facilities needed by fishermen, namely by building a center that needs fish. Fishing ports in Indonesia are divided into 4 port categories. The category is:

- Class A fishing port, called Ocean Fishing Port (PPS)
- Class B fishing port, called Nusantara Fishing Port (PPN)
- Fishing Port class C, called Coastal Fishing Port (PPP)
- Fishing Port class D, called Fish Landing Base (PPI)

## 6. Challenges Facing Stakeholders

The complicated fishery logistics system raises many challenges that arise from various stakeholders. The author formulates from literature studies and interviews through FGD various stakeholder challenges in the fishing industry as shown in Figure 4. Existing challenges for various stakeholders can affect availability, distribution and markets. Poverty in coastal communities is caused by a lack of income, actions and behavior, fishing capacity, overfishing and destructive fishing, and unregulated supply chains. These problems exist in the fishing industry. An explanation of the challenges faced by each stakeholder is explained in this section.

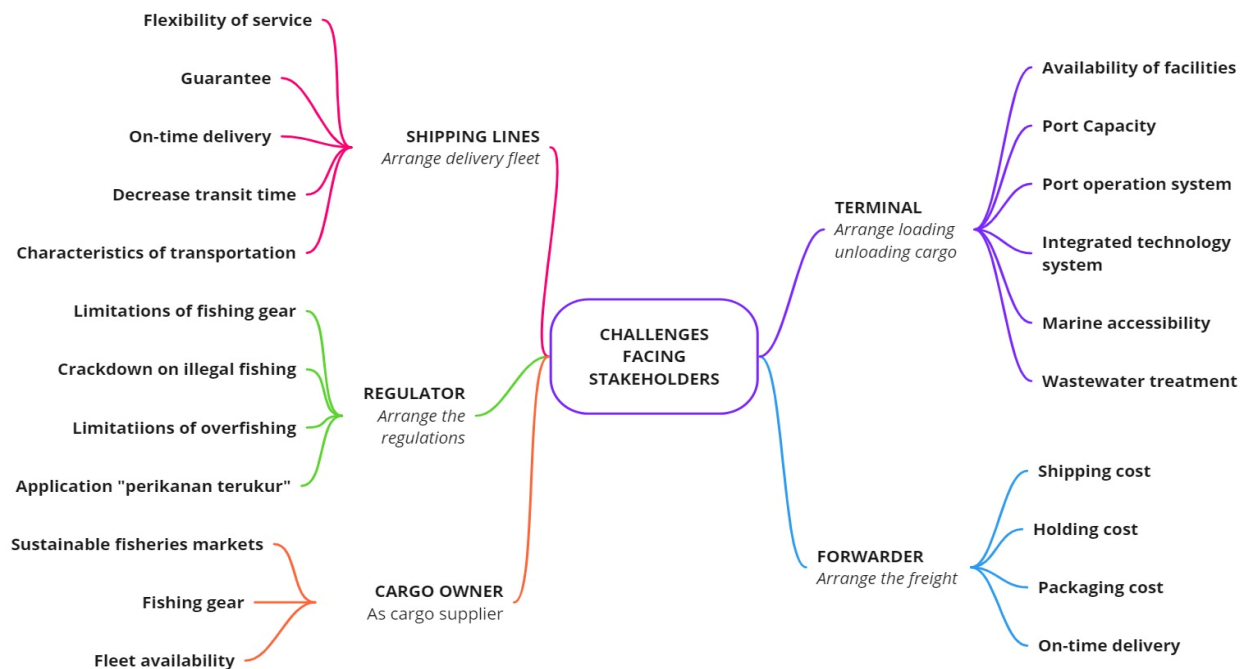


Figure 4. Challenges facing stakeholders

## **6.1 Fisherman**

Fishermen are one of the most important actors in the fishing industry. Many fishermen live in poverty, the literature provides several aspects that affect fishermen's poverty, there is education level, experience, age of vessel ownership, fishing gear assets, assets outside fishing activities, lack of understanding of cooperatives, and lack of knowledge of the process of selling fish to collectors. In addition, the extra involvement of intermediaries keeps fishers and markets apart from enabling them to be market-responsive (Islam and Habib 2013). Distribution activities and market aspects should also be considered an integrated part of the chain from catch to consumption. Fishing communities expect market certainty and stable prices in the sale of the catch. The problem of fishing gear and boat facilities is also a problem for fishermen, and many still use the old methods of catching fish. The fishermen need modern fishing gear so that they can increase their catch.

## **6.2 Shipping**

Transportation is a significant supply chain driver, so it requires responsive transportation to centralize supplies and operate with limited facilities (Chopra and Meindl 2006). The suitability of the fleet to the needs is critical in supporting a good supply chain process through transportation characteristics: type, quantity, and capacity (Venus Lun and Browne 2009; Yang and Lin 2017). One of the main challenges is the complexity of port operations due to the many parties involved and the complex nature of business processes. Coordination is necessary to avoid operating with high costs, improve service, and avoid suboptimal use of resources. Port is an important part of the logistics and transport operators' cluster.

## **6.3 Forwarder**

Companies must decide to handle their exports or leave them to a freight forwarder. If they want to handle exports instead of letting outside agents do it, then to meet the growing demand for demand, they must invest in the latest logistics infrastructure, technology and expertise to handle the related tasks. They should weigh the costs and benefits of such a move before proceeding. A freight forwarder is an intermediary between a shipper and a distribution point, such as a port. They arrange land transportation, port and customs documentation, ships on board, and other ancillary activities. For that, they need to have a good communication network with the government and other relevant agencies, both exporting and importing countries (McKinnon 2003; Shannak 2013; Zheng et al. 2021).

## **6.4 Terminal**

Ports are places where there are facilities for berthing or anchoring ships and cargo handling equipment to process cargoes from ships to shore, shore to ships, or ships to ships (Lun et al. 2010). The absence of a network of roads, transport, and landing points has opened up opportunities for some intermediaries to bridge the gap and make money, which is a loss for fishermen and additional costs for consumers. Product quality is also affected due to the absence of a planned landing center and transport network. There is no organized effort for cooperative distribution facilities and also no mechanism for small-scale fishermen to immediately sell their products to organized outlets. The involvement of several intermediaries does not seem necessary, whose presence only adds to the costs for consumers and harms fishermen (Islam and Habib 2013). Some of the facilities needed in the terminal are:

- a. For fish handling - Fish boxes, storage, freezers, wastewater treatment facility, and fish market
- b. For fishing boats and gear - Ice supply equipment, oil supply equipment and station, oil storage tanks, fishing gear storage, and slipway
- c. For personnel - Auction building and administration office

Pollution problems also arise in the fishery terminal; sources of pollution were identified as follows: change of ship oil, fuel spill, cleaning of ships, cleaning of fishing nets, and disposal of the waste directly into the sea. Most of the pollution in fishing ports is caused by the inappropriate behaviour of fishermen. They do not follow environmental ethics due to a lack of awareness.

## **6.5 Regulator**

Maritime law is often defined as the body of rules, concepts and legal practices governing specific central concerns of the business of carrying goods and passengers by water. Generally, it is used to denote any legal matters about the sea: the laws of the sea (Reynolds 2000). Regulations on fisheries management are often made through a mix of national and international laws. Enforcing fishery regulations, including bans, minimum catch sizes, the type of fishing gear allowed, and monitoring to avoid activities such as poaching in restricted areas or catching threatened species,

are the issues that require attention to reduce the impacts on biodiversity arising from the overfishing, bycatch, and degradation of habitat. With the vastness of Indonesia's oceans, the government needs to monitor and improve the security of water areas so as to reduce the illegal entry of foreign vessels. Illegal transshipment is also a current problem, the lack of market certainty makes many fishermen prefer to transship in the middle of the sea. The government's plan to implement "measurable fishing" is a very good thing to provide supervision of Indonesian fisheries catches.

### 7. Indonesia's Fishery Export Growth Potential

Indonesia is the largest archipelagic country in the world with a total of 1,708 islands (Coordinating Ministry for Maritime Affairs and Investment of the Republic of Indonesia). This makes Indonesia one of the fish producing countries in the world. Based on data from the Ministry of Maritime Affairs, nationally national fish production will reach 23.16 million tons in 2020. In 2020, Indonesia will be able to export 1.3 million tons of fishery products to various countries. The ten export destinations with the largest volume of fishery products in 2020 are China, the United States, Japan, Thailand, Malaysia, Vietnam, Taiwan, Singapore, South Korea, and Saudi Arabia. Fishery products can continue to grow if stakeholders agree to protect natural ecosystems. In Figure 5, the author makes a growth trend in the volume of exports of fishery products to various countries by processing data from 2016-2020. This data is processed based on the Ministry of Fisheries export data for 2021. The export potential will grow by 700 thousand tons in 2030. A pattern of collaboration is needed to achieve and increase the growth in production and exports of these fishery products.

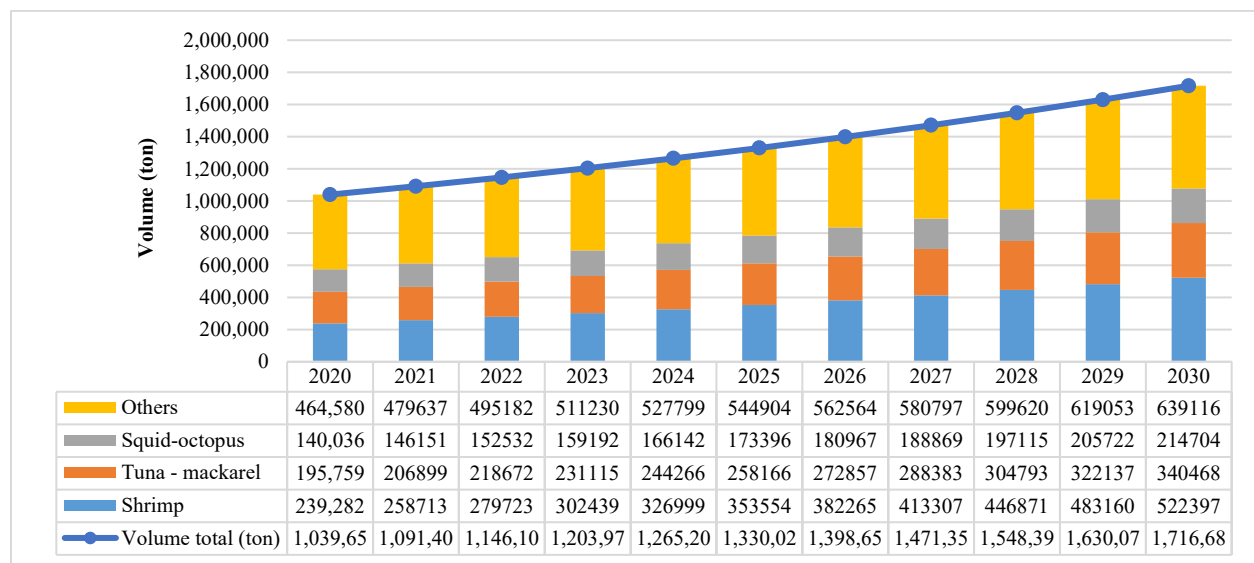


Figure 5. Fishery export potential growth

### 8. Collaboration Scheme

Collaborative management of marine resources involves shared responsibilities between the government and fisheries stakeholders. It also suggests that barriers to collaborative behavior can occur at the regulatory, community, family, and individual levels (Rountree et al. 2008). Based on the various problems that arise, the author analyzes the potential for collaboration from various stakeholders. The authors propose the potential for collaboration in Table 4. Parties involved, where a mutually beneficial situation and mutual understanding's business is the reason for establishing the collaboration (Sandberg 2005). The relationship in collaboration is usually initiated by trust and trust between the parties involved, where a mutually beneficial and mutually beneficial situation for each other's business is the understanding of the establishment of the collaboration. Commitment is also required from all parties involved. In general, it can be said that collaboration is done when two or more companies share information and jointly negotiate and decide on something of mutual interest. This means two-way communication with mutually agreed goals. Collaboration must improve the quality of service, the ability of both parties to benefit from such collaboration is important, otherwise there is a risk that so much of the improvement in service delivery may be lost in a win-win situation.



Table 4. Collaboration Scheme

Stakeholders	Attributes of Collaboration	Collaborators	Output
Fishermen	Market	Fishermen – regulator	fisherman's welfare
	Fishing gear	Fishermen – regulator	
	Fleet availability	Fishermen – regulator	
Shipping	Flexibility of Service	Shipping – terminal	Increase shipping performance
	Guarantee	Shipping – forwarders	
	On-time Delivery	Shipping – forwarders	
	Transit Time	Shipping – terminal	
	Characteristics of transportation	Shipping – forwarders	
Forwarders	Shipping Cost	Forwarders – shipping	Increase forwarder performance
	Holding Cost	Forwarders – terminal – cargo owner	
	Packaging Cost	Forwarders – cargo owner	
Terminal	Facility	Terminal – forwarder – shipping	Increase terminal performance
	Capacity	Terminal – shipping	
	Port operation system	Terminal – forwarder	
	Integrated technology system	Terminal – shipping – terminal	
	Marine accessibility	Terminal – regulator	
	Wastewater treatment	Terminal – regulator	
Regulator	Fishing Method	Regulator – fishermen	Long-term preservation and responsible and rational exploitation of fisheries resources
	Overfishing	Regulator – fishermen	
	Illegal fishing	Regulator – fishermen	
	Application “perikanan terukur”	Regulator – fishermen – terminal	

### 8.1 Fisherman Welfare

Fishermen are one of the most important actors in the fishing industry. Many fishermen live in poverty, the literature provides several aspects that affect fishermen's poverty, there is education level, experience, age of vessel ownership, fishing gear assets, assets outside fishing activities, lack of understanding of cooperatives, and lack of knowledge of the process of selling fish to collectors. In addition, the extra involvement of intermediaries keeps fishers and markets apart from enabling them to be market-responsive (Islam and Habib 2013). Distribution activities and market aspects should also be considered an integrated part of the chain from catch to consumption. fishing communities expect market certainty and stable prices in the sale of the catch. The problem of fishing gear and boat facilities is also a problem for fishermen, and many still use the old methods of catching fish. The fishermen need modern fishing gear so that they can increase their catch. The government as a regulator, must provide market and price certainty to fishermen. This is because income depends on the distribution and quantity of production. In peak periods, fish prices fall, when there is a production shortage, fish prices tend to be higher. Restriction of fishing gear is a collaboration between fishermen and regulators. The enactment of this regulation impacts fishermen's activities because trawls and trawls are the main tools used by fishermen. The government needs to socialize and subsidize fishing gear that does not damage natural to fishermen.

### 8.2 Shipping Performance

This shipping time KPI measures supply chain performance, the time from the order's receipt to the day it's shipped. A longer shipping time means something went wrong during the process, whether the orders aren't shared quickly enough with the distribution center, the current inventory levels aren't adequate, inventory accuracy is problematic, shipping capacity is limited, or there's a back-up in the picking and packing process. Shipping companies must also be able to adapt to customer needs. The fleet's suitability with the cargo owner's needs is very good. In the transportation of fishery products in particular, it is very important to ensure the quality of the product during shipping.

### **8.3 Forwarder Performance**

Collaboration between forwarders and other stakeholders can create a more efficient fisheries supply chain system. Collaboration involving forwarders is also expected to reduce costs in the distribution process. Established freight carriers are reliable and help efficiently plan, coordinate, and move your cargo to its destination. They may also be required to liaise with different government agencies depending on the type of cargo to be exported, for example, limited goods, certain types of food products, and others. Freight forwarders must also follow the importing country's laws, rules and regulations. Because of their relationship with the government and other service agencies, they can get the job done smoothly, apart from getting fares, favorable schedules, etc.

### **8.4 Terminal Performance**

The terminal must have adequate facilities and capacity to accommodate ships and cargo, this is because the terminal has a function as a place to lean on ships in loading and unloading cargo. The application of technology is also very important to support the processes that occur at the Port. Therefore, collaboration between terminals and other stakeholders can provide port facilities and operating systems. Accessibility challenges and the need for collaboration with regulators. Regulators have a very important role in dealing with pollution in fishing ports.

### **8.5 Regulator Applications**

Collaboration between fishermen and regulators is formed when fishing gear regulations. Trawl regulations and trawling nets are implemented due to reduce marine damage. Trawls and trawl nets are used to catch demersal fish and provide the most excellent yields. Therefore, the government issued a ban on trawling and seine net. The government needs to collaborate with fishermen and terminals in implementing "perikanan terukur" which is expected to reduce overfishing and illegal transshipment. With this collaboration, long-term conservation and responsible and rational exploitation of fisheries resources will be.

## **9. Conclusion**

The maritime logistics collaboration system is important in distributing fishery products from fishermen to consumers. In maritime logistics collaboration, all related stakeholders influence each other. Therefore, all stakeholders must be able to adjust their respective fisheries distribution. So that the quality of the cargo sent is maintained and of high value. In this study, the authors analyze the factors of various stakeholder issues in the fishing industry. The author makes several collaboration schemes from fishermen, cruise ship performance, forwarders, terminals, and regulators that can be applied in the fishing industry. The collaboration scheme formulated by the authors from various stakeholders in the fishing industry can make the process from fishermen to consumers more efficient because no stakeholders take advantage of opportunities in fisheries distribution. Fishermen as one of the main players in the fishing industry get welfare, because they get market certainty, facilities and regulations that support fishermen. Regulatory collaboration with other stakeholders can also maintain the sustainability of the sea, and better waste processing in the fishing industry. The potential growth in Indonesia's fishery product exports in 2030 reaching 1.7 million tons is also inseparable from the support and collaboration of various relevant stakeholders. The projected growth in exports of Indonesian fishery products can be realized if the relevant stakeholders work together.

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