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Analysis of Supply Chain Performance of Mackerel Fish (*Scomberomorus commerson*) in Tanjung Medang Village, Rupat Utara Sub-District, Bengkalis Regency, Riau Province

Analisis Kinerja Rantai Pasok Ikan Tenggiri (Scomberomorus commerson) di Desa Tanjung Medang Kecamatan Rupat Utara Kabupaten Bengkalis Provinsi Riau

Linda Safitri[1], Eni Yulinda[1*], Trisla Warningsih[1]
[1]Department of Fisheries Socio-Economic, Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru 28293 Indonesia
**email: eni.yulinda@lecturer.unri.ac.id*

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Abstract

The fisheries potential in Tanjung Medang Village is highly promising for development due to its predominantly coastal location. This research aims to identify the mackerel supply chain pattern in Tanjung Medang Village using the Food Supply Chain Network (FSCN) approach. The method used is a survey method. Data analysis uses supply chain pattern analysis with the FSCN approach. The research results show that the mackerel supply chain pattern in Tanjung Medang Village has a supply chain structure consisting of primary and secondary members. Supply chain targets include the export market (Malaysia) and the local market (Tanjung Medang). The application of supply chain management includes bound and unbound partner relationships between supply chain actors, contractual agreements that occur informally, and transactions between supply chain actors using credit and prepayment systems. Supply chain business processes include collaborative planning that appears in each supply chain actor; the risks faced by each supply chain actor are different. The resources owned by the supply chain are by needs (physical resources, capital, technology, and human resources).

Keywords: FSCN, Supply Chain, Tanjung Medang.

Abstrak

Potensi perikanan di Desa Tanjung Medang sangat prospektif untuk dikembangkan, karena sebagian besar wilayahnya merupakan pesisir. Tujuan penelitian ini adalah untuk mengidentifikasi pola rantai pasok ikan tenggiri di Desa Tanjung Medang dengan pendekatan *Food Supply Chain Network* (FSCN). Metode yang digunakan adalah metode survei. Analisis data menggunakan analisis pola rantai pasok dengan pendekatan FSCN. Hasil penelitian menunjukkan bahwa pola rantai pasok ikan tenggiri di Desa Tanjung Medang memiliki struktur rantai pasok yang terdiri dari: Nelayan, pengumpul, pengecer, eksportir, kosumen dan importir (Malaysia). Sasaran rantai pasok meliputi: pasar ekspor (Malaysia) dan pasar lokal (Tanjung Medang). Manajemen rantai pasok meliputi hubungan mitra terikat dan tidak terikat; kesepakatan kontrak terjadi secara informal sedangkan transaksi antara nelayan dengan pengumpul dan eksportir menggunakan sistem tempo. Proses bisnis rantai pasok yaitu hubungan bisnis antar pelaku rantai pasok yang meliputi aliran produk, aliran keuangan dan aliran informasi; perencanaan kolaboratif terjadi di setiap pelaku rantai pasok; resiko yang dihadapi setiap pelaku rantai

pasok berbeda-beda. Sumber daya rantai pasok tersedia dari sumber daya fisik, modal, teknologi dan sumber daya manusia.

Kata kunci: FSCN, Rantai Pasok, Tanjung Medang

1. Introduction

Riau Province has a fishery potential in the form of capture and cultivation fisheries spread across all districts (Ramadona et al., 2019). The waters of Bengkalis Regency are included in the Malacca Strait Fisheries Management Area (WPP), meaning they experience excess fishing. Rupat Island is the outermost island in Bengkalis Regency, directly bordering the neighbouring country (Malaysia). One of the villages on Rupat Island is Tanjung Medang Village, North Rupat District. Rupat Island, located on the coast of the Malacca Strait, is a vital fish export port in Riau due to its close location to Malaysia (Warningsih et al., 2021).

Tanjung Medang Village is an area that has very prospective fisheries potential for development; this is supported by the fact that most of the area is coastal. This village directly faces the Malacca Strait, which is a fishing area for people who make their living as fishermen. Fisheries are a source of livelihood for the people of Tanjung Medang Village, especially in fishing or as fishermen (Kurnia et al., 2019). Fishing is carried out in the waters of Bengkalis Regency. In contrast, fishermen use gill nets, stone nets, traps, and longlines, and the catch is mackerel (*Scomberommorus common*). Mackerel fish in Tanjung Medang Village has become an essential commodity commercialized intensively to meet domestic and export market needs (Mardiyah et al., 2022).

Mackerel fish production in the Rupat Utara District is 7.2 tons (DKP, 2022). This situation could lead Bengkalis Regency to explore opportunities to export fish catches to Malaysia, including mackerel. Many people like mackerel fish due to its versatility in transforming into a range of delectable products, including empek-empek, crackers, and marinated fish (Wahyudi & Maharani, 2017). Fishery products are perishable and depend on the season, so to reach consumers, a reasonable and adequate supply chain management system is needed (Retnowati et al., 2014). The fishing season for mackerel occurs in March, April, October, and November. During this month, mackerel production is estimated to peak (abundance) in March (Situmorang et al., 2018). According to Devaraj *in* FAO (1983), the mackerel spawning phase occurs from January to September, with the peak phase in April. Siddeek *in* Poisson (2006) said that the mackerel spawning season lasts throughout the year with two peak seasons, April-July and September-November, indicating that plankton and small pelagic fish are abundant in those months.

A well-functioning supply chain is said to be successful if there is a flow of fish from fishermen to customers (collectors, agents, retailers, wholesalers, exporters, and consumers), a flow of money from customers to fishermen, and the flow of information between fishermen and customers can run smoothly (Yulinda, 2024). These entities are fishermen (fishing companies) and tauke. Their relationship is very strong, but there are differences in the relationship patterns between tauke fishermen and fellow tauke (Yulinda et al., 2021). The stability of fish production is necessary to ensure the performance of the fisheries industry supply chain, namely the smooth flow of information, flow of goods, and flow of money (Yulinda et al., 2021). The supply chain concerns the continuous relationship between goods, money, and information. Goods generally flow from upstream to downstream, cash flows from downstream to upstream, and information flows from upstream to downstream and downstream to upstream (both ways) (Arief & Pradini, 2019).

The Food Supply Chain Network (FSCN) framework analyzes the five supply chain elements. The aspects reviewed include supply chain targets, supply chain structure, supply chain management, supply chain resources, and supply chain business processes (Setiadi, 2018). The results of Qalsum's (2018) research using the FSCN approach show that, in general, the seaweed supply chain in Takalar Regency already has a target market with clear targets. However, there are problems in developing targets. Namely, fishermen are not supported by knowledge about good-quality seaweed, so there is still a need to create ways to improve the quality and quantity of seaweed.

Mackerel fish in Tanjung Medang Village is highly economical and has become an essential commodity after fish, which has been commercialized intensively to meet domestic and export market needs. The primary purpose of this study is to identify the pattern chain supply fish mackerel in the Tanjung Medang Village with the FSCN approach.

2. Material and Method

2.1. Time and Place

This research was carried out in December 2023 in the Tanjung Medang Village Subdistrict, Rupat Utara Regency, Bengkalis. The selection of research locations was carried out deliberately (purposive sampling) based on consideration of the conditions of the research area, which is a fish export center for mackerel.

2.2. Methods

This survey method was used in this research. According to Sugiyono (2020), the survey method uses questionnaires as a research tool for large and small populations.

2.3. Procedure

Respondents were determined using purposive sampling. Sugiyono (2018) states that purposive sampling is a technique for deciding respondents based on particular or specific considerations. The total number of respondents is 59 people. Data was collected using non-participant observation, with interviews, questionnaires, and documentation distributed to study respondents.

2.4. Data Analysis

Analysis was carried out using supply chain pattern analysis, which is based on the FSCN framework. This research will use a supply chain analysis framework developed by Vorst (2005), Food Supply Chain Networking (FSCN)

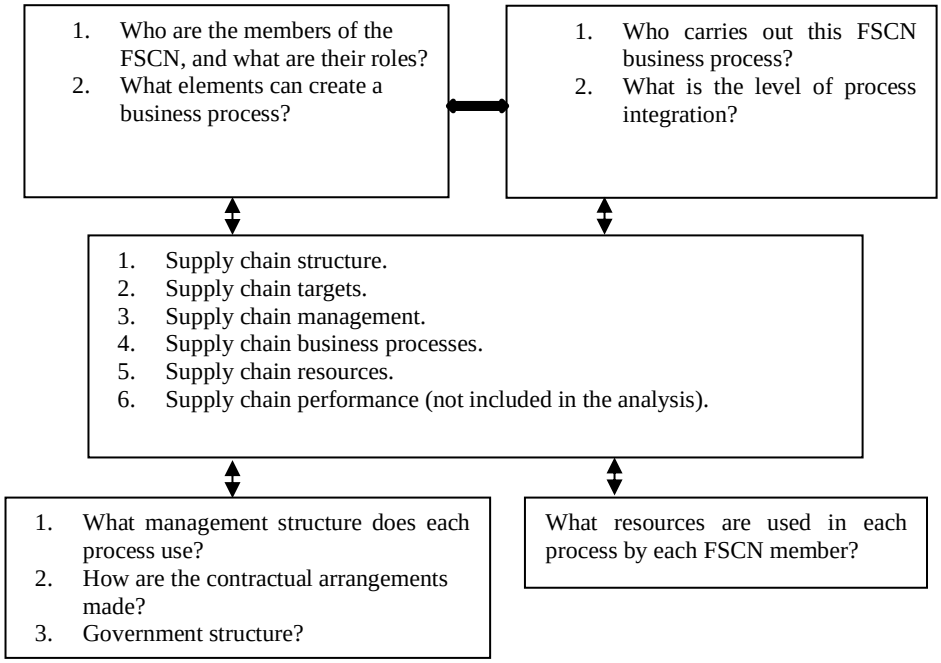

Figure 1. Analysis framework: Descriptive chain supply
Source: Vorst (2005)

3. Result and Discussion

3.1. Structure, Target, Management Chain Supply

The Primary members. The primary members of the mackerel fish supply chain in Tanjung Medang Village are fishermen as mackerel fish suppliers, collecting traders, retailers, consumers (Tanjung Medang community), exporters, and importers (Malaysia). Coordination between members is based on the awareness that the success of the supply chain depends on the strength of all its elements.

Secondary members. The secondary supply chain plays a crucial role in enabling supply chain activities to deliver the necessary goods or services, beginning with the requirement to embark on the sea. The secondary members involved in the mackerel fish supply chain in Tanjung Medang Village are responsible for various tasks such as preparing the ship for sea, which is done by the crew, getting the trapping equipment ready, and conducting engine checks. Apart from that, they are also employees who work with exporters who are employed to assist in the mackerel production process, such as weighing and storing, which is carried out by workers on duty in the storage warehouse. This is in line with research (Triyanti & Yusuf, 2015), which analyzes the supply chain, revealing a supply chain structure consisting of primary members and secondary members of the supply chain.

Target market. The target market for mackerel in Tanjung Medang Village is 80%, aimed at the export market, and the local market is 20%. This is due to the low consumption of mackerel fish by local communities and the significant demand for mackerel fish from abroad (Malaysia) to consume mackerel fish, so exporters work together with fishermen to supply fish in large quantities and of good quality (non-existent mackerel fish rotten).

Target development. The development target to be achieved in the mackerel fish supply chain in Tanjung Medang Village is to strengthen the supply chain through sustainable cooperation. Exporters have collaborated by involving partner fishermen with mackerel fish from Tanjung Medang Village to supply mackerel fish. In line

with Qalsum's (2018) research, there are two targets in the supply chain: market suggestions and development targets.

Structure Management. Partner and freelance fishermen are suppliers responsible for locating and capturing mackerel fish in the sea, meeting the required quantity, and organizing their catch. Traders specializing in collecting mackerel sourced from freelance fishermen play a crucial role in the supply chain. They acquire the catch and distribute it to retailers, who make it available to the discerning customers of the Tanjung Medang market. Exporters purchase mackerel catches from partner fishermen and proceed with weighing, storage, and delivery operations to the importer in Malaysia.

The organizational structure on the exporter's side has created divisions of tasks for employees according to the needs of activities in the field, including the tekong section, fish collection section for fishermen, ice block grinding section, weighing section, packaging section (storing fish in fiber boxes), warehouse cleaning department, and product delivery department (mackerel fish). In each division of tasks, a coordinator is assigned to oversee and execute tasks within each division, ensuring everyone fulfils their responsibilities in the field.

Partnership. Mackerel fish partner fishermen do not set specific criteria in selecting partners to buy their catch, nor do freelance fishermen set special criteria for collecting traders who buy the fish they catch. Cooperation is built on mutual trust and commitment to mutual responsibility. The trust to establish cooperation arises out of mutual need and mutual benefit between partner fishermen and exporters. Exporters also do not set specific criteria for selecting partner fishermen. However, a special consideration when choosing partner fishermen is that they must sell the fish they catch to exporters. With this trusted capital, exporters dare provide capital loans to fishermen who must go to sea to catch fish. Exporters also do not have specific criteria for selecting importers. However, they are still based on mutual trust, providing market information, and maintaining a commitment to long-term, mutually beneficial cooperation.

Contract agreement. Contract agreements in cooperation between freelance fishermen, traders, and retailers occur informally. The same thing is done by exporters and partner fishermen in Tanjung Medang Village, informally or informally. The agreement between fishermen and exporters is that partner fishermen must sell or supply all their catch (mackerel fish) to the exporter according to the quality (not rotten mackerel fish). In contrast, the exporter will fulfil the fisherman's fishing capital needs through a loan paid when fishermen sell their catch to exporters.

Meanwhile, the agreement between partner fishermen and exporters is that exporters are obliged to pay for all mackerel fish that fishermen have supplied according to the price agreed upon by both parties. Cooperation agreements between exporters and importers also occur informally or not in writing. These agreements are payment agreements specifying the cost and quality of the commodity according to demand (non-rotten mackerel).

Transaction system. The transaction system between fishermen and exporters operates on a credit basis. This means that payment is made through one to two debt notes or sales of mackerel fish from fishermen to exporters, made seven days after the first debt note. After verifying the note, the exporter pays the fisherman in cash upon the fisherman's arrival. The transaction system that occurs between exporters and importers in Malaysia is prepayment. In the direct payment system, the importer makes a payment to the exporter when the importer sends the mackerel. Before the exporter sends fish, the exporter will send an invoice (bill) to the importer. For invoices, the exporter includes a specific date and time that dictates the deadline for the importer to pay. According to a study by Setiadi et al. (2018), it is essential to analyze four critical aspects of supply chain management: management structure, partnerships, contractual agreements, and transaction systems.

3.2. Business Process Chain Supply

Business process relationships supply chain. Within the mackerel fish supply chain in Tanjung Medang Village, a comprehensive analysis reveals the existence of three distinct cycles. These cycles encompass the stages of product procurement, replenishment, and customer orders, each playing a crucial role in the overall functioning of the supply chain. The mackerel supply chain does not have a manufacturing cycle as it does not include direct processors among its supply chain members. Fishermen engage in fishing activities at sea, explicitly focusing on supplying mackerel fish. Meanwhile, traders, retailers, and exporters are involved in the production process of the mackerel fish, from receiving and weighing the product to packaging, loading, and shipping it to consumers and importers in Malaysia.

The procurement cycle is conducted by exporters who cater to the demand of Malaysian importers by sourcing products from the catches of fishermen, specifically mackerel fish. During this process, the exporter provides the fishermen with the necessary information regarding the quantity of orders (mackerel fish) that must be completed within the specified timeframe. Exporters also conduct the replenishment cycle through an increase in orders in anticipation of additional orders from consumers or in case of product damage (mackerel fish).

Distribution pattern. The distribution pattern of mackerel fish in Tanjung Medang Village will explain three main components: information flow, product flow, and financial flow. The distribution pattern of mackerel fish in Tanjung Medang Village flows from upstream to downstream, and money (financial) flows in the opposite direction from downstream to upstream. Meanwhile, the information flow pattern flows from upstream to

downstream and vice versa. The flow of the mackerel fish supply chain in Tanjung Medang Village can be seen in Figure 2.

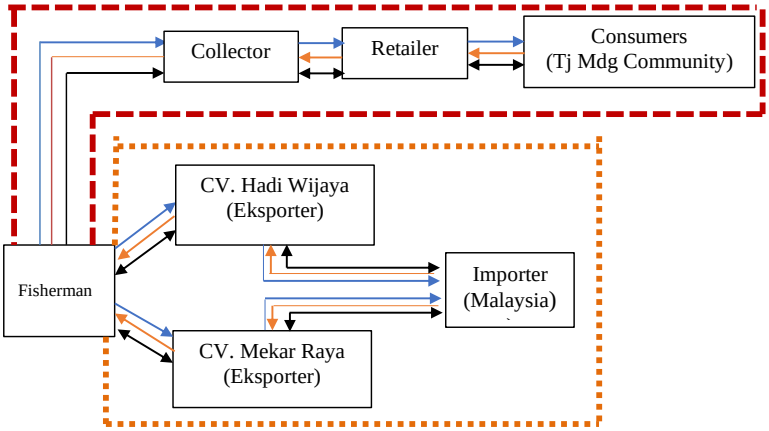

Figure 2. Mackerel fish supply chain flow

Two mackerel supply chain channels occur in Tanjung Medang Village. In channel I, the mackerel fish are obtained from freelance fishermen, and in channel II, they are received from partner fishermen.

Channel I. Product flow (mackerel fish) starts with fishermen looking for and supplying fish; when the fishermen have landed, the collecting traders will come to the fish landing place to pick up and buy the mackerel fish caught by the fishermen. Collecting traders get 200 to 300 kg of fish from fishermen weekly. Furthermore, after the collector gets the fish, it will be distributed to retailers. Finally, after collecting traders, retail traders will sell consumers around 30 to 50 kg of mackerel fish daily.

The financial flow in the mackerel fish supply chain in Tanjung Medang Village is from downstream to upstream. Consumers will buy mackerel fish for IDR 52,000 - 55,000/kg from retailers. Consumers will pay the retailer directly if an agreement on the price and quantity of fish purchased has been reached. Furthermore, after all the fish are sold, the retailer will pay the mackerel fish to the collecting trader for IDR 50,000/kg. After receiving payment from the retail traders, the collecting traders will pay the fishermen for the fish they have previously taken.

The flow of information in the mackerel fish supply chain in Tanjung Medang Village occurs from two directions, namely from upstream to downstream and from downstream to upstream, namely from fishermen to consumers and vice versa (from consumers to fisherman). The information provided Between supply chain actors is about fish prices, fish quality, fish supplies, and quantity purchased. Supply chain actors from upstream (from fishermen to consumers) will provide information about the cost of mackerel, the amount of catch, fish quality, and fish supplies. Meanwhile, supply chain actors from downstream (consumers to fishermen) will provide feedback on price negotiations, fish quality conditions, and the number of orders and purchases of mackerel. Channel II. The flow of goods (mackerel fish) starts from partner fishermen to the importer (Malaysia); mackerel fish is distributed from fishermen as suppliers to importers (Malaysia) via exporters.

The money flow occurs in one direction, from the importer (Malaysia) to the fishermen (suppliers). In the flow of money from importer to exporter, the importer (Malaysia) will pay via transfer to the exporter with the condition that the importer must make an advance payment to the exporter before the mackerel fish is delivered. Meanwhile, the payment system from exporters to fishermen is carried out when fishermen supply fish. Payments from exporters to fishermen are made in *cash using* a credit system after the fishermen supply the mackerel fish to the exporter. The exporter makes credit payments to the fishermen with two notes in one payment.

The flow of information occurs in two directions, from fishermen to importers (Malaysia) and vice versa. The flow of information in the mackerel supply chain includes planning activities, order quantities, prices, delivery status, and market conditions. All information obtained in supply chain activities can help make it easier to plan the amount of supply needed.

They are planning collaboration. Exporters carry out collaborative planning with fishermen as their partners. Importers provide information to exporters regarding the demand for mackerel fish. Exporters plan to meet exporters' demand for mackerel fish supplied by Tanjung Medang fishermen. The collaborative planning in the mackerel supply chain in Tanjung Medang Village is good because collaboration and coordination in disseminating accurate and reliable information among supply chain actors can create effective communication.

Aspect risk. One challenge fishermen face, whether they work independently or in partnerships, is the impact of unfavourable weather conditions. Strong winds and bad weather can significantly limit their fishing time and reduce catches, naturally impacting their income. In addition, the fluctuating availability of mackerel throughout the year can present challenges for fishermen, as they may experience reduced or non-existent catches.

Exporters may also need more mackerel fish supplies due to natural factors, lousy weather conditions, and the lean season. The risks exporters face are the lack of fish stocks supplied by fishermen during the lean season and the bad weather. This will, of course, impact meeting import demand. The risk experienced by importers (Malaysia) is a reduction in the amount of mackerel fish supplies received from exporters if, during the famine season, even though the amount of supply is reduced, exporters can still meet the demand of importers (Malaysia) by carrying out supply chain management so that they can still meet the demand for mackerel fish, on time.

Trust-building process. A sense of trust grows between supply chain members because of the long-standing cooperative relationship. This relationship was built because of mutual interests between fishermen and exporters. This research also formed trust between exporters and mackerel fishing partners because they knew each other. Exporters see the ability and commitment of partner fishermen in supplying mackerel fish. At the same time, partner fishermen also believe that exporters, as wholesalers of mackerel fish in Tanjung Medang Village, will provide capital and accommodate and buy all the fish they catch (mackerel fish) to maintain price commitments with partner fishermen. When determining the quantity, the exporter should consider the importer's situation. To ensure smooth communication, the exporter should provide the necessary information to the importer through WhatsApp or direct phone calls at least three days before the delivery of mackerel fish.

Trust between exporters and importers is established when the exporter consistently meets the demand for mackerel fish while ensuring sustainable practices and maintaining the high quality of the product. Another important aspect is based on the trust surrounding the exchange of information about prices. This involves setting prices before sending any further communication. The relationship between the exporter and the importer (Malaysia) is governed by an unspoken agreement, which can evolve.

This aligns with research by Tunnisa et al. (2022), showing that supply chain business processes consist of business relationships between supply chain actors; fisheries business processes include product, financial, and information flow: risk aspects, collaborative planning, and trust-building processes.

3.3. Source Power Chain Supply

Source power physique. The physical resources in the mackerel fish supply chain in Tanjung Medang Village are fishing areas. In addition to fishing areas, fishermen own 3-5 GT boats, fishing equipment (nets and longlines), tarpaulin, buoys, anchors, fiber boxes, and other fishing necessities. Another physical resource is an import-export agreement letter from the government agency and the exporter. Equipment and facilities required in the mackerel production process, such as fiber boxes and transportation equipment, are essential for exporters to ensure the physical capacity of the mackerel fish supply chain. Regarding the means of transportation used by exporters for their export activities, ships are commonly used. Exporters opt for fiber boxes to ensure the proper packaging and storage of mackerel fish. These boxes can hold anywhere between 800 to 1000 kg of mackerel fish. Exporters also possess various physical resources such as ice block grinding machines, trolleys, storage warehouses, scales, and offices to facilitate mackerel marketing activities. The physical strength of the mackerel fish supply chain in Tanjung Medang Village for traders and retailers is determined by the condition of the transportation roads in the Tanjung Medang Village area, which is the location for selling mackerel fish fortotailers and transportation facilities.

Source power technology. The fishermen already have boats with 3–5GT, which are used when they want to the sea; some fishermen use outboard motors; apart from that, fishermen also have robots or cranes (net-pulling equipment), which are used when going to sea to lift the fishing nets they catch. The results of field observations show that fishermen and exporters have implemented modern technology. Collectors and retailers in Tanjung Medang Village also have technological resources, such as cell phones for communication and motorbikes for buying and selling mackerel fish.

Source powerman. The human resources employed by mackerel fishermen are two to three people, usually called ship crew members (ABK), who operate and maintain the ship and look after the cargo (fish) on board. Exporters have more human resources. In this case, each exporter employs 13 employees who are tasked with collecting and shipping fish from Tanjung Medang Village and have their duties. Employees work during working hours or the mackerel production process. There are three people: tekong, two people (ice block grinders), one person for weighing, three people for storing fish in fiber boxes, one person for cleaning, and three other people for sending mackerel fish.

Source capital power. The capital resources of the mackerel partner fishermen in Tanjung Medang Village are obtained from their capital (30%), but more people get loans from exporters (70%). Loans are made not only for needs when carrying out fishing activities but also for daily needs such as children's school fees, shopping needs, medical treatment, and so on.

Freelance fishermen have their capital, so they do not have partner relationships with exporters. Likewise, collecting traders and retailers have their capital for buying and selling mackerel fish, so they do not have a binding relationship with exporters and are free to sell fish at the Tanjung Medang Village market. This is in line with research by Wiranata et al. (2022) that there is a need for a manfish supply chain development policy to build and help manfish farmers so that in the future, the farmers get maximum results in quantity and quality.

4. Conclusions

Based on the FSCN approach, the mackerel supply chain pattern in Tanjung Medang Village has a supply chain structure: fishermen, collectors, retailers, exporters, consumers, and importers (Malaysia). Supply chain targets include the export market (Malaysia) and the local market (Tanjung Medang). Supply chain management comprises tied partner relationships (partner fishermen and exporters) and non-bound partners (free fishers, collectors, retailers, and importers); contract agreements occur informally, while transactions between fishermen and collectors and exporters use a credit system and exporters and importers pay in advance. The supply chain business processes include procurement of mackerel fish, adding orders, and consumer orders; distribution patterns occur from product, financial, and information flows; collaborative planning occurs across every supply chain actor; and each supply chain actor has different risks. Supply chain resources are available in physical, capital, technology, and human resources.

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