

Fishery Supply Chains in Indonesia: Improvement Opportunities on The Downstream Side

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Abstract—This paper investigates improvement opportunities for fishery supply chains in Indonesia. A downstream perspective is taken, and Surabaya is employed as a case study. This research applies desk study and exploratory work to obtain existing landscape of the fisheries supply chains. This landscape is used to describe the characteristics of the supply chains, and identify the potential improvements for the supply chains. Three major issues in the downstream market are found in this study. They are related to the fish market governance, traditional business characteristics, and inflexible supply chain system that limits information visibility. Several approaches are identified in order to eliminate these problems. They are developing an online information system for fish market place and shifting the business perspective to be more competitive. All these findings of this paper provide an initial insight on what can be improved from the downstream stage.

Keywords—fishery, supply chain, downstream market

I. INTRODUCTION

Fisheries sector provides a significant contribution to the economic development of many coastal nations [1]. A good management in the fishery supply chain is believed to be able to alleviate poverty as well as increasing food security in the nation. In several countries, such as Iceland and Maldives, fish export has been a major contributor to the inland revenue. Fishery sector also encourages improvement in food nutrition and growth in other subsidiaries industries that enhances economic security.

As the biggest archipelago country in the world, Indonesia has a great potential in fishery business, not only in South East Asia but also in this globe. However, up to present, the Indonesian fishery potential that has been utilized is only around 7.5% [2, 3]. Although this figure has led Indonesia to be the leader of fishery producers in the South East Asia region [4], this

achievement has not made the fisheries sector to be adequately effective and competitive to improve the local economy in Indonesia.

Managing the fishery supply chains in Indonesia has many complex and unique challenges. The complexity is not only on the upstream side (i.e. process of catching and cultivating) but also on the downstream side (i.e. marketing and distribution). In general, the upstream aspect of fishery supply chains involves production and fish catching, while the downstream side is mostly associated with activities performed by the distributors and sellers in the fish market.

Much research in fisheries supply chains in Indonesia have been performed, but limited studies examine opportunities of fishery supply chains taken from the downstream perspective. Improving the downstream side of the fisheries supply chains can increase not only the fish consumption for a better nutrition of the end consumers but also generating awareness to achieve a fair trade of fisheries products. Having encouragement to improve the downstream aspect is expected to be a leverage to achieve better business interactions in the fishery supply chains.

This paper provides a basic landscape of the existing fishery supply chains, taking a case of Surabaya, East Java, as the downstream side of the supply chain. Having the initial knowledge of the fishery supply chains in Surabaya, an insight on understanding potential opportunities for further comprehensive work is produced.

The remaining contents of this paper are organized in 5 (five) sections. The next section presents the methodology used in this work. The section is followed by describing the characteristics of the fishery supply chains (section 3) and the challenges on the downstream side (section 4). Finally, the conclusion is presented in the last section.

II. METHODOLOGY

This paper provides the current fisheries supply chains in Indonesia. East Java Province is taken as a case study, with Surabaya (the capital city) as the main point of perspective. Fisheries sector in East Java contributes to 41.89 trillion IDR or 2.48% of GDP in East Java [5]. Meanwhile, Surabaya is the second largest city in Indonesia. Based on the available latest data, the economic growth in Surabaya in 2016 was 6.08%, exceeding the East Java province's economic growth of 5.62% and the national economic growth of 5.18% [6, 7]. While the economic growth is high, Surabaya has the largest inflation rate compared to other cities in East Java in 2016. A cause of this is because most food commodities in Surabaya is supplied from outside the city. Thus, a sustainable food supply system is critical to support a long-term economic growth, through the ease of access of the basic needs fulfilment including fisheries commodities.

The methodology of this paper involves three phases. The first phase is understanding the characteristics of fishery supply chains by performing a desk study. In this stage, secondary data and information of supply, demand, and price for all fisheries commodities in East Java are collected and reviewed. The initial supply chain configurations are also constructed based on the previous works. However, a complete information on supply and demand patterns is hardly available, as well as having a detail information on the flow of fish distribution. Thus, a hypothesized supply chain configuration in Surabaya is developed and the confirmed in the exploration phase.

The second stage is the exploration stage, which is performed by having a semi-structured interview. The interview is conducted with the team of Fishery and Agriculture Department in Surabaya, and the main questions are directed to identify the issues related to fisheries trading in Surabaya. Several issues that are confirmed in this phase are as follows.

- The supply chain structure of fisheries in Surabaya, particularly in capture fisheries and aquacultures.
- The significance of fisheries market in Surabaya relative to East Java.
- Business characteristics in the downstream fishery supply chains, including understanding the relationships between fisheries and middlemen.
- The price complexity at the downstream market.

Having the primary and secondary information, the next step is structuring the downstream challenges in urban contexts. This phase discusses and concludes the improvement opportunities to optimize the potential economics of fisheries in urban market, where Surabaya is taken as a case study.

The following section summarizes the information collected in desk study and exploratory stages.

III. CURRENT SUPPLY CHAIN CHARACTERISTICS

The Indonesian Government has identified most critical issues of the fisheries supply chains, which are as follows [8]. In general, the chain of distribution is relatively long and involves many parties as middlemen. The logistics infrastructure with cold storage is still limited, which leads to a significant quality losses during

the distribution process. The profit margins among the business entities can be considered unfair, where the producers (or fishermen) only earn about 34% of the total supply chain's profit.

The popular fishery commodities in Indonesia are *Tuna*, *Tongkol*, and *Kembung* [9], and these commodities also prevalent in Surabaya. Cultivated fish commodities are also popular in Indonesia, such as *Bandeng*. In addition to fresh fisheries, Indonesian people also prefer to consume the preserved forms of fisheries products, such as salted boiled fish called *Pindang* and dried salted fish. A detail of weekly consumptions of fisheries products in Indonesia is presented in Table 1. Even though the data is in national level, the consumption behavior is perceived to represent the behavior of urban society. The table also shows that fish consumption increases consistently in Indonesia.

TABLE I. WEEKLY FISH CONSUMPTION IN INDONESIA

Type of food	Unit	2010	2011	2012	2013	2014	2015	2016	2017
Fresh fishery products ^a	kg	0.271	0.282	0.239	0.263	0.274	0.298	0.302	0.326
Preserved fishery products	kg	0.451	0.486	0.471	0.431	0.429	0.309	0.301	0.408

*This includes sea fish and cultivated fish

Meanwhile, Surabaya has the largest market for the fishermen in East Java. The fish supplies in Surabaya are from two sources: inside and outside the city. The supply from within the city of Surabaya comes from fishermen who mostly located on the coast of the city. The total supply from this source is only around one per cent of the total fish consumption in Surabaya, or it equals to 8,500 tons. Most supply of urban areas are from rural places in East Java, such as Sumenep, Banyuwangi, Situbondo, Gresik, Pekalongan, Tuban, Lamongan, Prigi-Trenggalek, Probolinggo, Pasuruan, and Jember. All these fish from outside Surabaya enter the city through a large fish market place in Surabaya called *Pasar Pabean*. However, about 30% of these fish in *Pasar Pabean* are distributed to out of the city, such as Probolinggo, Madura, Tulungagung, and Tuban.

As for the general supply chain configuration, it can be taken from the previous work, which are as follows [10]. In Surabaya, most downstream transactions are performed in the large market place.

1. Fishermen → Wholesaler → Exporter → Consumers in overseas
2. Fishermen → Wholesaler → Manufacturer □ End consumers
3. Fishermen → Small and Medium Enterprises (SMEs) → End consumers
4. Fishermen → Individual supplier → Exporter → Consumers in overseas
5. Fishermen → Individual supplier → Manufacturer □ End consumer
6. Fishermen → Individual supplier → SMEs → End consumers
7. Fishermen → Individual supplier → Traditional sellers → End consumers
8. Fishermen → Traditional sellers → End consumers

The individual suppliers and traditional sellers in the referred configurations can consist of several actors in a supply chain. The configuration number 7 is found to be dominant over the other channels. The end consumers identified in Surabaya mostly represents the domestic consumers in the city.

Most transactions between fishermen and middlemen (i.e. wholesaler, small and medium enterprises/SMEs, and individual supplier) are performed in the fish markets, namely *Tempat Pelelangan Ikan/TPI* [11]. The middlemen come to the market and participate to the auction process although most the price setting is still driven by the middlemen rather than the farmers/fishermen. Meanwhile, the large manufacturers do not need to come to the fish market as the middlemen (the wholesaler or individual supplier) deliver the fish to the plant. In this case, the fishermen, the middlemen and the manufacturer have a specific agreement about the supply quantity, quality, and price.

With regard to the pricing pattern, fishery commodities has a volatile price. This is due to the product characteristics that is perishable and price sensitive to the supply and demand gap [8]. The price distortion also occurs between fishermen and middlemen. This is because fishermen hard to understand the market behavior so that they rely on the middlemen to set up the price for them. Figure 1 summarizes the price fluctuation of several fishery commodities in Surabaya in 2017. From the chart, it can be seen that the variation of the price is relatively high.

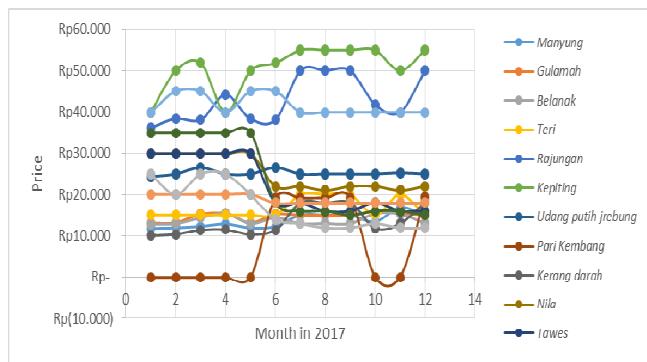


Fig. 1. Price fluctuation of several fish commodities in Surabaya

In the market place of *Pasar Pabean*, various types of sea fish are traded in the market place, such as skipjack, tuna, red snapper, grouper, and dorang. The price of fish in the market is quite dynamic - if the stock is abundant because the supply of fish of the city is high and the demand does not rise, then the price of fish will decrease. Conversely, when fish production declines and it causes the fish supply to Surabaya is less than the demand, the fish price increases.

Although the price of fish follows the common market law, it does not necessarily benefit fishery producers (fishermen) or traders in the market place. A factor of this is that many fishermen do not know how much the price of fish is on the day they will sell it. They sell to the middlemen who are their customers and from this middleman some fish are supplied to Surabaya, while the rest are sold to the local market in the rural areas. As a consequence, the fishermen often rely on the traders in the market place to determine the fish prices at the time they sell it. This is where the possibility of "price

manipulation" can be detrimental to suppliers or consumers.

The problems and chances to improve the downstream side of the fishery supply chains are discussed in the next section.

IV. DISCUSSIONS: DOWNSTREAM CHALLENGES AND OPPORTUNITIES FOR IMPROVEMENT

The main activity in the downstream supply chain is distribution. The distribution process is started from collecting the fish from the fishermen, storage, and selling the fish to the customers. These activities are important as quality of the product depends on the handling processes along the distribution channel. Moreover, a good distribution process can provide a lower operational cost, a stable product availability and price. However, achieving these goals require a good collaboration between stakeholders along the supply chain [12, 13], including fishermen, middlemen, transporter, seller, fish market management.

In general, most of the problems in the downstream supply chain are in the fish market. The current fish markets have not been able to record the supply and demand data. This information is critical for developing policies and business plans of all stakeholders in the supply chain. The fish market does not yet have a system that can communicate the needs of customers on a regular basis to the sellers or fishermen. In addition, the government's role in watching the market mechanisms has also not optimal yet. The government has not been able to assist the business entities to access the information about the market needs.

With regard to the business interaction, the middlemen have the higher bargaining position, including in the auction process at the market place (*TPI*). The official fish market managed by the government does not always guarantee a fair fish trade. In other words, the fish market tends to be a landing place only for trade transactions without a fair auction system.

We find 3 (three) issues that can be the major causes of this problem, which are described as follows. Firstly, the management of the fish market (or *Tempat Pelelangan Ikan*) still has limited good management practice for creating a fair market. The government should reinforce their role by improving the existing system for a more effective, efficient, and fair auction process. Fish market governance as part of concept of smart governance and smart economy. If the *TPI* function can be performed properly, a better fair market will be able to achieve.

The second cause is the conventional business performed in the downstream market. At present, the fishermen tend to be highly dependent on their current buyers. The fishermen also do not have the ability to select their catches on demand because they have very limited information from the market. Moreover, they have limited use of modern communication facilities for doing business, and are reluctant to share information with other stakeholders including with the government. If the fishermen have an increased awareness in changing their conventional mindset and behavior in carrying out their business transaction, they will be able to leverage their bargaining position in the market.

The third factor is the lack of supply chain visibility in the market. In a year, there are significant-sudden-increases in several periods that disrupt the fisheries commodity market (see Figure 1). Most cause of this volatility is that the available stock is not able to fulfil the demand. This supply-demand gap is not only led by the lack of production quantity and seasonal-related reasons but also the lack of information visibility along the supply chains. This gap causes adverse impacts for economic development both in the field of fisheries and urban economics.

These three factors can be eliminated by creating a new system, such as online information system. Applying a real time information system can be an effective alternative to improve visibility in the auction process, so that all the stakeholders at the downstream supply chain can access real time information about the market situation. In addition, an online marketing information system can ease the interaction between sellers and buyers, facilitate lower transaction costs, simplify promotional activities and expanding market share, and increase transparency and service to consumers. A project for this will also be beneficial to support a smart economy in the city where the market is located. Moreover, an online system is also considered as an instrument to achieve economic growth for the New Urban Agenda developed by the United Nations.

In addition, as urbanization challenges continue to grow and further consolidation of the Information Age takes place around the world, it will become increasingly critical to utilize all possible ways to improve urban living along with social inclusion, economic development, and environmental sustainability [17]. The concept of smart cities has been growing for the last decades as a concept to manage the challenge to optimize the potential of population and data explosion. The key principle is to merging city services into one platform, interconnected, and improved through digitization. Smart cities consist of six main blocks: two of them are smart economy and smart governance.

Smart economy as part of smart city concept requires attributes such as understanding of the economic DNA, driven by innovation and universities that focus on cutting-edge research, offers its citizens diverse economic opportunities, strive for sustainable natural resource management and understand that without this its economy will not function indefinitely. While smart governance requires attributes such as a city which practice accountability, responsiveness, and transparency in its governance, also the use of big data, spatial decision support systems and geospatial technologies in urban and regional governance [17]. Studies in several countries show that there is a surge of economic growth by investing smart cities as engines of smart economy. In India, the estimated increase of the investment is 12% in the urban share of the GDP with its Winning Leap scenario that includes investment in human, and R&D innovations. Surabaya, as in this article's case, would be very promising to enhance its economic growth through the developing of smart economy and smart governance concepts on coastal resources supply chain.

On the other hand, the objective of the fish market (or *TPI*) should be shifted from “the public service center” to “the marketing center”. This idea can encourage a fair

interaction between stakeholders involved in the market that leads to achieve a more balanced supply and demand. Moreover, with a more competitive and transparent market, fishermen can have a better information access to know what commodity needs to be supplied more. This concept supports a mutual marketing channel that will ultimately affect the social, economic and cultural aspects of the community, especially all stakeholders throughout the supply chain.

Supply-side approach also possible as strategy in restructuring the business perspectives. Comparative advantage with regard to natural resources, labor, capital and infrastructure to local economic development focuses on building infrastructure and focuses on supply side spatial planning approach to fostering economic development. Fishermen's settlements in the urban coastal area that in fact always embedded with the local fish ports and fisheries transaction could be managed as an economic center of fisheries resources [18].

Last but not least, the infrastructure for cold chain in the downstream supply chain is also required to be improved. The lack of cold storage infrastructure causes quality losses which is highly sensitive to product price. Moreover, cold chain has been part of smart logistic instrument since it supports the strive for coastal resource management and make it function definitely. A study in Brussel about cold chain in coastal resource logistic revealed that an integrated and novel technology, that is cold chain modified with smart system improve safety, transparency, and quality assurance of chilled or frozen supply chain especially for fish. It influences economic factors, such as cost-benefit ratio and improved supply chain management [19]. Nevertheless, an effective use of cold distribution chain can only be achieved if critical information in the supply chains is managed properly, such as supply and demand volume and price.

By improving the information visibility in the supply chain, the material flow within the supply chains will be more organized and the distribution lead time is expected to be more efficient. The faster the distribution process from the time of fishing to the consumers on the downstream will provide a more stable fish price and availability of goods.

In other words, if an information technology application (i.e. online system) is designed and applied in the fisheries trading market, it will be beneficial to all parties involved in fish trading activities, including the fishermen, the wholesalers or collectors, and consumers. The information system suggested here should be able to provide a real time (or close to real time) information of fish prices, the production level in various regions, and the level of demand in Surabaya. The system will enhance the downstream market transparency.

Although information technology can be the best driver in improving fisheries supply chains, the role of the government remains crucial. The government should have capability to watch and monitor the information so that the implementation of the technology is optimal. Also, all entities involved in the fish market should also be trained to be well adjusted with the new system.

V. CONCLUSIONS

An initial landscape of fishery supply chains in Indonesia and the opportunities to improve the downstream supply chains for fishery commodities are discussed in this paper. This work complements the previous fisheries studies, which still have not considered the supply chain aspect, particularly in the downstream market. As for the opportunities identification, it can be suggested that improving the downstream market will likely increase the competitiveness of the fishery supply chains. The improvement recommendations for the supply chains are restructuring the market system by applying an online technology and shifting the business perspective from “the public service center” to “the marketing center”. This paper provides an initial insight on what can be improved from the downstream stage. Further research for the identified improvement opportunities are required for having a more detail analysis on fishery supply chains. A research on designing an information system to support a fair market in fisheries will also useful.

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