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Comparing Fishing Technology of Korea and Indonesia: An Evaluation of the Efficiency, Quality, and Sustainability of Fishery Resources

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A b s t r a c t

This article compares the fishing technologies used by Korea and Indonesia in efficiency, quality, and sustainability. The author uses the literature study method by collecting secondary data from various sources, such as scientific journals, government reports, mass media, and official websites. The analysis shows that Korea has more sophisticated, modern, and integrated fishing technology than Indonesia. This technology allows Korea to catch fish more efficiently and produce high-quality fishery products. In addition, Korea also has a fishery resource management system that is better than Indonesia. Korea implements various policies and regulations to maintain the sustainability and productivity of fishery resources. Indonesia still needs to face various problems and challenges in the fisheries sector, such as overfishing, fish theft by foreign vessels, damage to the marine environment, and low-quality fishery products. Indonesia also needs more research and development of fishery technology. This article recommends that Indonesia increase cooperation with Korea in fisheries technology through the Marine Technology Cooperation Research Center (MTCRC). This cooperation will help Indonesia improve its fishing technology and fisheries resource management system.

Keywords: Fishing Technology, Korea, Indonesia, Efficiency, Quality, Sustainability

1. Introduction

The fishery is an important sector for the economy and food security in the world. According to data from the Food and Agriculture Organization (FAO), world fishery production they have reached 179 million tonnes in 2018, valued at around US$401 billion. Around 96 million tons, or 53 percent of this amount, came from the capture fisheries sector. Capture fisheries are catching wild fish in the sea or other waters using fishing gear such as nets, trawls, and fishing rods [1][2].

Fishing technology affects fishery resources' efficiency, quality, and sustainability. Fishing technology is all tools or methods used to catch fish or other organisms in the waters. Fishing technology can be divided into several types based on the size of the fishing gear (large or small scale), the shape of the fishing gear (active or passive), the target species (tuna or non-tuna).

Efficient fishing technology is a technology that can catch fish with low operating costs, short time, and optimal results. Quality fishing technology is a technology capable of catching fish with high product quality, such as freshness, nutrition, and taste. Sustainable fishing technology can catch fish in a way that does not damage fishery resources and the marine environment [3][4].

Korea and Indonesia are two countries that have a significant and essential fishery sector in Asia. Korea

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is one of the world's largest producers and exporters of fishery products. According to FAO data, Korea's fishery production reached 3.2 million tons in 2018, valued at about 11.6 billion US dollars. Around 1.9 million tons, 59 percent of this amount, came from the capture fisheries sector. Korea is also a country that has advanced, modern, and integrated fishing technology. Korea has various types of fishing gear according to water conditions and target species, such as purse seines, longlines, gillnets, and trawls. Korea also has a sound fishery resource management system, including catch quotas, minimum fish sizes, and fishing zones [5][6].

Indonesia is one of the countries with large and diverse fishery resource potential in the world. FAO data shows Indonesia's fishery production reached 7.2 million tonnes in 2018, valued at around US$19.5 billion. Around 6 million tons, or 83 percent of this amount, came from the capture fisheries sector. Indonesia is also a country that has various traditional fishing technologies. Indonesia has various types of fishing gear that suit the conditions of the waters and the culture of the people, such as paying, Bagan, centering, and journal. However, Indonesia still needs to face various problems and challenges in the capture fisheries sector, such as overfishing, fish theft by foreign vessels, damage to the marine environment, and low-quality fishery products. Indonesia also needs more research and development of fishery technology [7][8][9].

This article compares the fishing technologies used by Korea and Indonesia in efficiency, quality, and sustainability. This article uses the literature study method by collecting secondary data from various sources, such as scientific journals, government reports and mass media.

2. Materials and Methods

This article uses the literature study method by collecting secondary data from various sources, such as scientific journals, government reports, mass media, and official websites [10]. The secondary data includes data on the types of fishing gear used by Korea and Indonesia, data on the efficiency, quality, and sustainability of fishing technology in the two countries, data on the fisheries resource management system in the two countries. The secondary data obtained were then analyzed using a comparative descriptive analysis technique to compare fishing technology between Korea and Indonesia from efficiency, quality, and sustainability [11].

3. Results and Discussion

Based on the comparative descriptive analysis that has been carried out, the followings are the results and discussion regarding the comparison of fishing technology between Korea and Indonesia from the aspects of efficiency, quality, and sustainability.

3.1. Efficiency

The efficiency of fishing technology can be measured by several indicators, such as the number of catches per unit effort (CPUE), operational costs per unit effort (CUE), and revenue per unit effort (revenue per unit effort). REE). Based on the available data, Korea has more efficient fishing technology than Indonesia. The following are some examples of data showing differences in the efficiency of fishing technology between Korea and Indonesia [12].

1. According to FAO data for 2018, the average CPUE for the Korean capture fisheries sector is around 0.9 tonnes per day per vessel, while for Indonesia, it is around 0.2 tonnes per day per vessel. It is shown that Korea can catch more fish using fewer vessels than Indonesia [13].
2. According to data from the Ministry of Marine Affairs and Fisheries (KKP) for 2019, the average CUE for the Indonesian capture fisheries sector is around IDR 1,500,000 per day per ship, while the average RUE is around IDR 2,000,000 per day per ship. It shows that Indonesia has a low- profit margin from its capture fisheries activities [14].
3. According to data from the Ministry of Oceans and Fisheries of Korea for 2019, the average CUE for the Korean capture fisheries sector is around 1,200,000 won or around Rp. 15,000,000 per day per vessel, while the average RUE is around 2,400,000 won or around IDR 30,000,000 per day. It shows that Korea has a high-profit margin from its capture fisheries activities [15].

Differences in the efficiency of fishing technology between Korea and Indonesia can be caused by several factors, such as the type of fishing gear used, the condition of the fishing gear used, the condition of the waters caught. The following are some examples of factors affecting the efficiency of fishing technology between Korea and Indonesia.

1. Korea has more sophisticated, modern, and integrated fishing gear than Indonesia. Korea has

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fishing gear with informationand communication technology (ICT), such as GPS, sonar, radar, and cameras. This fishing gear can help fishermen to determine the location, depth, and number of targeted fish more accurately and quickly. Korea also has fishing gear that can adapt to changing water conditions, such as purse seines that can catch fish at various depths and distances from the coast. Korea also has fishing gear that can reduce the bycatch and damage to marine habitats, such as longlines that can target specific species using unique bait [15].

2. Indonesia has a more diverse and traditional type of fishing gear than Korea. Indonesia has fishing gear that suits the conditions of the waters and the culture of its people, such as paying, Bagan, centering, and journal. This fishing gear can catch fish cheaply, but it has some drawbacks. This fishing gear is not equipped with information and communication technology (ICT), so it is difficult for fishermen to know the exact and efficient location, depth, and number of fish targeted. This fishing gear is also less able to adapt to changing water conditions, such as catering, which can only catch fish on the seabed and near the coast. This fishing gear also tends to have a high amount of bycatch and damage to marine habitats, such as paying, which can catch fish regardless of species and size [8].
3. Korea has better fishing gear conditions than Indonesia. Korea has a regular and quality fishing gear maintenance and repair system. Korea has facilities such as shipyards, machine shops, quality testing laboratories. Korea also has standards and regulations regarding criteria for fishing gear that must be met by fishermen, such as net size, hook shape, fishing gear materials. Korea also has a fishing gear inspection and certification system conducted by the government or independent agencies [15].
4. Indonesia has poor fishing gear conditions compared to Korea. Indonesia needs a regular and quality fishing gear maintenance and repair system. Indonesia needs facilities such as shipyards, engine repair shops, quality testing laboratories. Indonesia also lacks standards and regulations regarding criteria for fishing gear that fishermen, such as net size, shape of fishing line, fishing gear material, must meet. Indonesia also needs a government or independent institutions' fishing gear inspection and certification system [9].

3.2. Quality

Several indicators, such as freshness, nutrition, taste, color, texture, can measure fishing technology's quality. Based on the available data, Korea has higher-quality fishing technology than Indonesia. The following are some examples of data showing differences in the quality of fishing technology between Korea and Indonesia.

1. According to 2018 FAO data, the export value of Korean fishery products reached 2.6 billion US dollars, with an average price of about 5,000 US dollars per ton. Meanwhile, the export value of Indonesian fishery products reached US$4.6 billion, with an average price of around US$2,000 per ton. It is shown that Korean fishery products are of higher quality and are more in demand by the international market than Indonesian fishery products [15].
2. According to data from the Ministry of Maritime Affairs and Fisheries (KKP) for 2019, the damage to fish caught in Indonesia reaches around 30 percent of total production. It is due to poor post- harvest handling, lack of refrigeration and processing facilities, and the distance between fishing grounds and markets. It shows that Indonesian fishery products could be better quality and easily damaged [16].
3. According to data from the Ministry of Oceans and Fisheries of Korea for 2019, the damage to fish caught in Korea only reaches about 5 percent of total production. It is due to good post- harvest handling, sufficient cooling and processing facilities, and the close distance between fishing locations and markets. It shows that Korean fishery products are of high quality and long- lasting.

Differences in the quality of fishing technology between Korea and Indonesia can be caused by several factors, such as fishing methods used, post-harvest handling methods used, cooling and processing facilities available. The following are some examples of factors affecting the quality of fishing technology between Korea and Indonesia [15][16][17].

1. Korea has better fishing methods than Indonesia. Korea has fishing gear that can catch fish in a way that does not damage the quality of the fish, such as purse seines that can catch fish live and intact, longlines that can catch fish selectively and quickly. Korea also has fishing gear that can keep fish fresh during fishing, such as coolers or preservatives installed on boats or fishing gear.

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2. Indonesia has less suitable fishing methods than Korea. Indonesia has fishing gear that can catch fish in ways that damage the quality of the fish, such as catering, which can catch fish non-selectively and cause injuries or bleeding to fish; paying, which can catch dead and damaged fish. Indonesia also lacks fishing gear that can keep fish fresh during fishing, such as coolers or preservatives installed on boats or fishing gear.
3. Korea has better post-harvest handling methods than Indonesia. Korea has a standardized and integrated post-harvest handling system. In Korea, fishermen must follow post-harvest handling protocols, such as cleaning fish from dirt or blood, classifying fish based on species and size, storing fish in boxes filled with ice or preservative solutions. Korea also has a fishery product tracking system (traceability system) that can inform consumers about fishery products' origin, process, and quality.
4. Indonesia has poor post-harvest handling methods compared to Korea. Indonesia lacks a standardized and integrated post-harvest handling system. Indonesia needs post-harvest handling protocols that fishermen must follow, such as cleaning fish from dirt or blood, classifying fish based on species and size, storing fish in boxes filled with ice or preservative solutions. Indonesia also lacks a fishery product tracking system (traceability system) that can provide consumers with information about fishery products' origin, process, and quality.
5. Korea has better refrigeration and processing facilities than Indonesia. Korea has the infrastructure and equipment to support the refrigeration and processing fishery products. Korea has cold storage, ice plant, fish processing plant. Korea also has freezers, chillers, dryers, smokers. Korea also has standards and regulations regarding criteria and processes for cooling and processing fishery products that businesses must meet, such as temperature, humidity, and sanitation.
6. Indonesia has less good refrigeration and processing facilities than Korea. Indonesia needs the infrastructure and equipment to support the refrigeration and processing of fishery products. Indonesia needs cold storage, ice plants, fish processing plants. Indonesia also lacks freezers, chillers, dryers, smokers. Indonesia also lacks standards and regulations regarding criteria and processes for cooling and processing fishery products that business actors must meet, such as temperature, humidity, and sanitation.

3.3. Continuity

The sustainability of fishing technology can be measured by several indicators, such as the fishing utilization rate (FUR), the fishing exploitation rate (FER), the fishing stock rate (FSR). Based on the available data, Korea has a more sustainable fishing technology than Indonesia. The following are some examples of data showing differences in the sustainability of fishing technology between Korea and Indonesia [15][16].

1. According to FAO data for 2018, the average FUR for the Korean capture fisheries sector is around 0.6 or 60 percent of the maximum sustainable yield (MSY), while for Indonesia, it is around 1 or 100 percent of MSY. It shows that Korea can catch fish in a way that is within the limit of the ability to regenerate fishery resources. At the same time, Indonesia can catch fish in a way that exceeds the limit of the ability to regenerate fishery resources [15][16][17].
2. According to data from the Ministry of Maritime Affairs and Fisheries (KKP) for 2019, the average FER for the Indonesian capture fisheries sector is around 0.8 or 80 percent of the optimal exploitation rate (OER), while the average FSR is around 0 .5 or 50 percent of the optimal stock (optimum stock/OS). It shows that Indonesia has carried out overfishing, which has decreased fishery resource stocks (overexploitation)
3. According to 2019 data from the Ministry of Oceans and Fisheries of Korea, the average FER for the Korean capture fisheries sector is about 0.4 or 40 percent of OER, while the average FSR is about 0.8 or 80 percent of OS. It shows that Korea has carried out fishing with the ability to regenerate fishery resources (sustainable fishing), resulting in a balance of stocks of fishery resources (sustainable exploitation).

Differences in the sustainability of fishing technology between Korea and Indonesia can be caused by several factors, such as the fishery resource management system applied, the level of public awareness and participation in fisheries issues. The following are some examples of factors affecting the sustainability of fishing technology between Korea and Indonesia [7][8][15][16].

1. Korea has a better fisheries resource management system than Indonesia. Korea has various policies and regulations to maintain fishery resources' sustainability and productivity. Some examples of these policies and regulations

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are as follows.

2. Catch quota (total allowable catch/TAC), which determines the maximum number of fish that fishermen can catch in a certain period based on the results of scientific research.
3. The minimum size of fish (minimum size limit/MSL) sets the minimum size that fishermen can catch to protect immature and breeding fish.
4. Fishing zones that determine certain areas that fishermen may or may not catch in order to protect particular habitats or species.
5. Time of fishing (fishing season) which determines certain times that fishermen may or may not be caught to protect the life cycle or behavior of fish.
6. Selective fishing gear that sets the types of fishing gear that can or cannot be used by fishermen to reduce bycatch and damage to marine habitats.
7. Indonesia has a fishery resource management system that is less good than Korea. Indonesia has several policies and regulations to maintain the sustainability and productivity of fishery resources, but they could be more effective and efficient in their implementation and supervision. Some examples of these policies and regulations are as follows.
8. Cantrang moratorium (trawl ban) prohibits using centering fishing gear by fishermen because they are considered to damage the marine environment and catch fish non-selectively. However, this ban was rejected by most fishermen because catering is their main fishing gear, and there is no alternative fishing gear that is suitable for their waters and economic conditions.
9. Certificate of operational worthiness (SLO) requires fishermen to have a certificate certifying that their boat and fishing gear meet safety, health, environmental standards. However, the certificate issuance process often encounters obstacles such as high costs, complicated procedures, corruption.
10. Marine protected areas (KKP) which designate certain areas as fisheries resources and marine environment protection areas. However, establishing and managing MPAs often need help with problems such as conflicts with local communities, lack of community participation, lack of funds and human resources.
11. Korea has more public awareness and participation in fisheries issues than Indonesia. Korea has a culture and tradition that respects and protects fishery resources and the marine environment. Korea has active civil society organizations that play a role in developing and supervising the fisheries sector, such as fishermen's associations, cooperative groups, non-governmental organizations. Korea also has educational and outreach programs that convey information and
12. knowledge about the importance of the sustainability of fishery resources to the public, such as fishery schools, museums, and festivals.
13. Indonesia has lower public awareness and participation in fisheries issues than Korea. Indonesia has a culture and tradition needs more respect for and care for fishery resources and the marine environment. Indonesia needs more active civil society organizations that play a role in developing and supervising the fisheries sector, such as fishermen's associations, cooperative groups, non-governmental organizations. Indonesia also needs educational and outreach programs that convey information and knowledge about the importance of the sustainability of fishery resources to the public, such as fishery schools, museums, and festivals.

4. Conclusion

This article has compared the fishing technologies used by Korea and Indonesia in efficiency, quality, and sustainability. Based on the results of the analysis that has been done, it can be concluded that Korea has more sophisticated, modern, and integrated fishing technology than Indonesia. This technology allows Korea to catch fish more efficiently and produce high-quality fishery products. In addition, Korea also has a fishery resource management system that is better than Indonesia. Korea implements various policies and regulations to maintain the sustainability and productivity of fishery resources.

Indonesia still needs to face various problems and challenges in the capture fisheries sector, such as overfishing, fish theft by foreign vessels, damage to the marine environment, and low- quality fishery products. Indonesia also needs more research and development of fishery technology. This article recommends that Indonesia increase cooperation with Korea in fisheries technology through the Marine Technology Cooperation Research Center (MTCRC). This cooperation will help Indonesia improve its fishing technology and fisheries resource management system.

This article also provides some suggestions for further research, which are as follows.

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1. Conduct empirical research to measure the economic, social, and environmental impacts of adopting fishing technology in Korea and Indonesia using appropriate quantitative or qualitative methods.
2. Conduct experimental research to test the effectiveness and efficiency of various fishing gear used by Korea and Indonesia using appropriate laboratory or field conditions.
3. Conducting innovative research to develop fishing technologies that are environmentally friendly and adaptive to water conditions and the culture of people in Korea and Indonesia.

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