

The Role of Agribusiness Fisheries Floating Net Cages in Supporting the Economy of the Lake Toba Region

By

Dahri Tanjung

School of Vocational Studies, Bogor University, Bogor, 16128, Indonesia

Manuntun Parulian Hutagaol

Department of Economic, FEM, Bogor University, Bogor, 16680, Indonesia

Abstract

The floating net cage business (FNC) has developed in Lake Toba since the 1990s. This activity has become a profitable business for the community and supports the regional economy. However, recently the central government is aggressively seeking to reduce the production of FNC in order to support Lake Toba as a Super Priority Tourism Destination. This condition has disturbed FNC actors because it threatens the existence of their businesses, which also affects the regional economy. The research question is how big is the role of the FNC business on the economy of the Lake Toba area? For this reason, this study aims to analyze the role of the FNC business in supporting the economy in the Lake Toba area. The research method used is a survey method by collecting primary data in the field. Furthermore, the data were analyzed by multiplier effect analysis. The results showed that 64.5% of the total FNC is owned by the community and other FNC companies. FNC activities have encouraged the development of other businesses that are directly or indirectly related. The FNC business creates job opportunities for around 12,300 people. Thus the total business value generated is no less than IDR 4 trillion. These parameters indicate that FNC is an industry that has a very large role in the economy of the Lake Toba Region.

Keywords—economic impact, floating net cages, Lake Toba, multiplier effect, regional economic development

Introduction

The floating net cage (FNC) fishery business has been cultivated by the Lake Toba community since the 1990s[1]. Its production is increasing as open sea aquaculture has experienced almost exponential growth [2] or has exploded four times more than allowed in Cirata Reservoir, West Java[3]. This is due to the high demand for fish products for human consumption[4]. Its business has spread to almost all districts in the Lake Toba area and has become the main business for some people and positively impacted the livelihood[5]. Because the business is relatively on the edge of the lake, these activities are related to many village communities. The latest data shows that the number of villages operating FNC is 78 villages[6]. From these villages, there are several villages that become production centers, such as Haranggaol Village/Sub-district in Simalungun Regency, Silalahi Village in Dairi, and Tanjung Bunga Village in Samosir Regency. When viewed from the type of business, the people who operate the FNC in Lake Toba are the community and large companies (there are 2 PMA companies). The total area of the FNC is actually only 0.4 percent or 4.66 km² of the 1,156 km² of Lake Toba with current production of around 74 thousand tons.

The Central Government's plan to organize FNC in order to support Lake Toba as a Super Priority Tourism Destination has become a threat to the existence of the FNC. The

government uses the Decree of the Governor of North Sumatra No. 188/213/2017 of 2017 concerning the capacity of Lake Toba for pollution loads and carrying capacity for aquaculture which states that the total production of floating cage fisheries in Lake Toba is 10,000 tons in 2023. Furthermore, in 2021, Presidential Regulation No. 60 of 2021 concerning Critical Lakes in Indonesia states that the total floating fishery production in Lake Toba is 10,000 tons in 2024. This means that the community and large companies must start reducing their fish production which is now around 86% to only 10,000 tons in 2024. The determination of carrying capacity is carried out by direct research based on water quality conditions, which are slightly different from those carried out by Romero et al[7]. This condition has also become one of the obstacles to the development of aquaculture because it is in conflict with other sectors—such as fisheries and tourism[8]. The FNC arrangement has been carried out by the central and regional governments by urging the community to reduce the number of holes in their floating net cages. The district government has held a dialogue with cage owners and is planning a gradual reduction process starting from 10% to 20% in 2021 and some up to 45% in 2022, there are even some districts that are trying to make sure that there are no floating net cage businesses in their area¹. If this arrangement continues, the efforts of the community, which are directly or indirectly related to the FNC, will be disrupted. If the household economy of the community is disrupted, the subsequent impact of course is that the village's economic activities will be disrupted and so can disrupt the economy of several districts in the Lake Toba area which previously relied on the floating cage fishery business. However, the question is how big is the role of the FNC business in supporting the economy of the community and the Lake Toba region?

To better understand how big the role of the floating cage fishery business is in supporting the regional economy of the Lake Toba area, especially the villages of fishery production centers, this research was conducted. Furthermore, several possible business alternatives will be recommended for communities affected by the reduction of the FNC.

Theoretical Background

Floating Net Cage Fishery Agribusiness

The term "agribusiness" has become increasingly popular, since its introduction by Davis and Golberg (1957)[9]. Today, the view of agribusiness that is generally considered appropriate is getting wider. According to Firdaus[10], agribusiness includes all activities starting from the procurement of agricultural production facilities (farm supplies), on-farm, to the trading system of agricultural products produced by farming or their processed products and their supporting activities.

Furthermore, fishery agribusiness is agribusiness based on floating and fishery resources. Moreover, fishery commodities have distinctive characteristics, such as perishable food, seasonality, labor intensive, small business scale, limited capital, and simple technology, so the application of management in fishery agribusiness with the right decision-making is the key to the success of fisheries agribusiness managers.

The pattern of fish exploitation is divided into cultivation and capture. For cultivation, some are in ponds, ponds and some are in cages. Floating net cages (FNC) are a method of keeping fish in cages made of nets that are shaped like a rectangle or cylindrical and floated in surface water using buoys and wooden, bamboo, or iron frames, as well as an anchoring system. The location chosen for the fish-rearing business in the FNC is relatively quiet, protected from

¹ Dinas LH Provinsi Sumut (2021). Rencana Pengelolaan Danau Toba. Unpublished.

storms, and easily accessible. The fish that are kept varies from freshwater fish, and various types of snapper, also grouper, and even lobster. This FNC is also a flexible process to convert traditional small fishermen into fisheries agribusiness entrepreneurs[11]. So far, floating net cages are the best way to cultivate fish intensively compared to other methods such as pens, ponds, tanks or stream ponds. When viewed in terms of management, it is very easy to implement. The level of quality of domesticated fish and the use of resources can be of economic value[12].

Regional Economy

In economic development, the linkage is an important application of the Input-Output (I-O) Model[13,14]. One industry (sector) is related to another sector in two links, namely forward linkage and backward linkage. The forward link shows the amount of output sold to other sectors to the total output of that sector. While the backward link shows the relationship between the number of purchases from other sectors to the overall input of the sector. By looking at the dependence of one sector on another in the Indonesian economy, the employment relationship seems to be still low. Likewise with other inter-industry links. This is normal in developing countries. Inter-sectoral links will become stronger in the next development process if the development of complementary industries with agricultural sector has developed rapidly.

Specifically in the fisheries sector, it has a large impact on the regional economy because it has links with many sectors from upstream to downstream[15], and also utilizes local resources, as well as food and nutrition sources and employment[16]. Even during a pandemic, their role is still large for the economy[17].

Methods

Data Collection and Analysis

The method used is a survey method by collecting primary data directly from the field plus secondary data. The types of data collected include data related to fishery business at the farmer level, development of fishery production, types of businesses related to marine cage fisheries, North Sumatra Gross Regional Domestic Product (GRDP), employment data, and North Sumatra Input-Output Table in 2019. North Sumatra was chosen as the research site because this region has great potential in the field of fisheries and is a significant contribution to the development of Indonesian fisheries. This research was conducted in March 2020, then stopped due to the Covid-19 pandemic, and continued from April 2021 to October 2021. The number of respondents who were interviewed was 80 people and conducted three Focus Group Discussions.

Furthermore, the data collected was then analyzed descriptively and quantitatively using simple statistical analysis. The role of the fisheries business is calculated using a multiplier effect analysis of both forward and backward business linkages.

Multiplier Effect Analysis

Multiplier effect analysis is an analytical method for calculating the number of income multipliers from new economic activity in society. Tiebout (1962)[18] defines the income multiplier (M) as follows:

$$M = 1/(1-kb).(1)$$

Where kb is that portion of each dollar that accrues to local factors of production that produce goods and services for local households. This portion, known as "non basic employment," can be estimated by the share of the regional workforce employed in the

production of goods and services that are consumed in the region. Equation 1 can thus also be expressed as equation 2, namely:

$$M = \frac{1}{1-(MPC \times PSY)} \quad (2)$$

where :

M = regional economic influence

MPC = Marginal Propensity to Consume (farmer's income spent in the village)

PSY = Total Revenue - Total Cost (Farmer Expenditures that generate income)

4. Results and Discussion

FNC Fishery Business Location

Community floating net cages are growing and spreading around Lake Toba which includes districts around Lake Toba. The distribution of FNC belonging to the community is shown in Figure 1. The most widely cultivated fish species in Lake Toba are tilapia (*Oreochromis niloticus*) and then carp (*Cyprinus carpio*). In some villages, many also keep the type of goldfish because this fish is a type of traditional fish and is favored by the local community. While tilapia is mostly marketed around outside Lake Toba. The fish farming business in floating net cages carried out by local residents has been started in 1986 as part of the poverty alleviation program. Due to the success of profitable fish farming, the number of cultivators continues to increase.

The operation of floating cages in Lake Toba has a legal basis, namely Presidential Decree No. 81 of 2014 concerning Spatial Plans for the Lake Toba area and its surroundings, where in essence fish cultivation in Lake Toba is permitted, but with community-based and environmentally friendly control and based on quality standards water class I. The regulation states that FNC zonings, such as Zone A3.2 with a depth of 30-100 meters and zone A4 with a depth of >100 meters.

Until now, FNC in Lake Toba has spread to 7 regencies and 23 sub-districts. The widest distribution of FNC locations is in Toba Samosir, Samosir, and Simalungun Regencies. As for the other 4 regencies, each is only in 1 sub-district. Figure 1 below shows the location of the FNC distribution around Lake Toba. This is in line with the results of research by Rustini et al [19] that these areas are suitable for FNC.

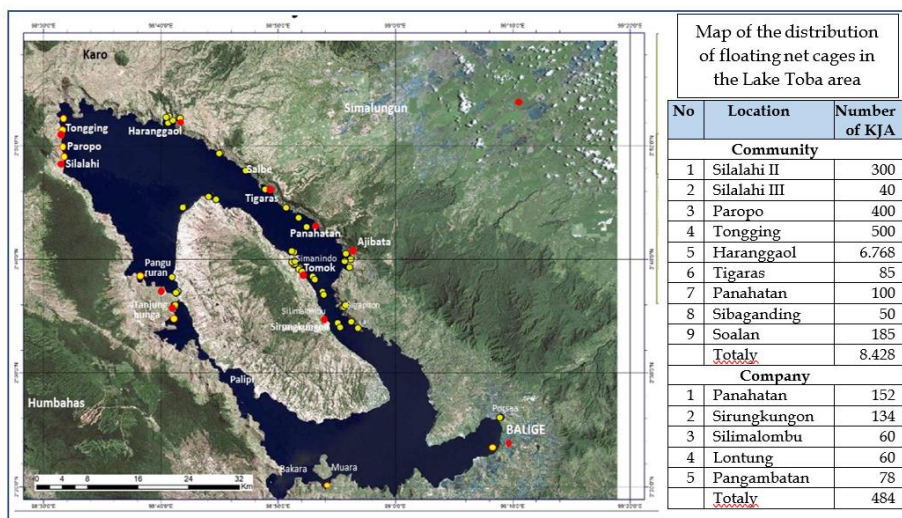


Figure 1. Distribution of floating cages in the Lake Toba area

Agribusiness System of FNC Fishery Upstream Sub System Fish Hatchery

In fish farming, the provision of good seeds is very important to produce high fish production. The seeds must be old enough and meet the requirements for release. In the fish farming business in floating nets, the availability of seeds is an obstacle because they are obtained from far enough locations. Therefore, cultivators buy seeds from other areas that are quite far away, namely from Siantar or Samosir which covers a distance of about ± 95 km or takes about ± 3 hours.

Feed

In addition to seeds, the feed factor also needs to be considered because one of the factors that determine the success of cultivation in nets is the amount and quality of the feed provided. In accordance with the opinion in one research that feed is very influential on the development and growth of fish when they are still seeds, the preferred food of carp and tilapia is zooplankton[20]. In addition, it also preys on algae or mosses attached to objects in their living habitat and aquatic plants that grow in aquaculture waters. After they grow up, caged fish can be given additional food such as pellets.

On-farm Sub System

FNC aquaculture is one type of fishery business that is a source of economic growth in several villages on the out shores of Lake Toba. The FNC Fishery Business is considered important by the community, especially for people in the FNC center villages because it is one of the sources of community income. One type of fish that is widely cultivated by business actors is tilapia. Tilapia from Lake Toba is well-known both domestically and in the export market as Toba Tilapia because it has a good taste compared to tilapia produced elsewhere. For entrepreneurs themselves, this tilapia cultivation business can provide great results or profits for them.

The results showed that 45 fish farmers interviewed in various villages around Lake Toba indicated that fish agribusiness activities were their main business. Various activities that are routinely carried out are preparing cages, buying seeds, and maintaining by feeding 2-3 times every day until harvesting. These activities relate to the provision of production facilities, on-farm activities, harvesting of production, to supporting activities, and these activities require manpower to carry out the process. This fishery business activity has a big role in the life of the community in the village because it is through this fishery agribusiness activity that other and interrelated activities appear called backward linkage and forward linkage.

Barriers to Floating Net Cage Management

Technically, fish farming in cages is easy to implement. However, in some cases, failures often occur which are generally caused by the application of inappropriate fisheries management. The following are the obstacles to fish farming in floating net cages that are currently experienced by cultivators:

1. Seed. The business of raising fish is very basic. If the seeds that are stocked are of good quality, the business opportunity to obtain good production will be even greater. From the results of interviews with fish cultivators, FNC often complains about bringing in seeds, this is because the seeds imported from outside have a fairly long distance of ± 95 km plus the road with potholes so that the fish experience stress sometimes the newly imported seeds isn't able to adapt to the environment and experience death and cause

- losses for fish farmers, meanwhile, the seeds in the nearest hatchery are sometimes of poor quality compared to seeds obtained from other areas.
2. Disease management. If there are fish that are sick, the cultivators do not know how to deal with them because of the lack of knowledge about the disease. If the fish is dead, then there is a treatment for the fish, namely lifting it from the cage using a tangguk to minimize transmission and then being isolated and processed into animal feed.
 3. Capital. Fish farming activities in floating net cages require input in the form of money as capital as well as other suggestions that are not small. Therefore, before starting a business, preparation must be done seriously to minimize failure.
 4. The cage net is damaged. Cages and cages are sometimes damaged by nature, namely strong winds that can tear the nets. If the net is torn, the fish will be released and the farmer will lose.

With various obstacles, ranging from low quality seeds, diseases that cause fish to die, and damaged equipment causing fish to decrease, it will cause business losses for farmers.

Downstream Sub-system

Marketing

After harvesting, the fish produced are mostly sold to collectors who come from outside the area, such as from Siborong-borong, Sibolga, Pematang Siantar, or Medan. From the village, the reared fish are transported using bags filled with water and oxygen and some are transported using boxes filled with ice. This is done by collectors so that the freshly harvested fish can be maintained in a fresh condition. Collecting traders come directly to the field to buy fish from the farmers where the cost of transporting the fish to the transport car is fully borne by the collecting traders. Collectors will then market the fish to the destination areas.

Marginal Propensity to Consume (MPC)

Marginal propensity to Consume (MPC) or farmer's income spent in the village is consumption expenditure issued by fish farmers to meet the living needs of farmers and their families, in the form of primary, secondary, and tertiary expenditure types. The types of expenditure and the average expenditure of needs from fish farmers in the village can be seen in Table 1.

Table 1. *Average MPC or Farmer Needs Expenditure per Month in Fish Production Center Villages in Lake Toba*

No	Expenditure Type	Amount (IDR/Month)
1	Cooking	750,000
2	Rice	641,667
3	Cigarette	450,000
4	Fuel	203,000
5	Cell Phone Pulse	200,000
6	Sugar	150,000
7	Coffee-Tea	135,000
8	Cleaning	100,000
9	Electricity-Water	95,000
10	Milk	83,000
	Total	2,807,667

Source: *processed from primary data, 2021*

Table 1 shows several types of expenditure for FNC farmers' needs that are spent by farmers in the village per month in order to meet the living needs of farming families in the

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village. From the table, it can be seen that the total expenditure on farmers' needs per month is IDR 2,646,247. This expenditure is the sum of several types of consumption expenditures for the needs of farmers' households, which are 11 (eleven) expenditures spent in the village. To obtain the MPC value, the following calculations are carried out: From the above calculation results, the MPC value is 2.13 or 0.0213. This means that 2.13 percent of farmers' income is spent in the village.

Total Revenue-Total Cost

Farmer Expenditures that Generate Income are expenditures or costs of production facilities that are spent by farmers in the village to support agribusiness activities to obtain income or production results. The types of production facilities and the average cost of production facilities for one business cycle spent in the village can be seen in Table 2.

Table 2. *Average Cost of Production Facilities*

No	Type of Production Cost	Amount (IDR/6 Month)
1	Feed	38,000,000
2	Hatchery 9000 fingerling	5,850,000
3	Labour	632,222
4	Transportation/Freight	308,888
5	FNC reparation	166,667
6	Harvest (plastics, gas, etc)	130,000
	Total	45,087,777

Source: *processed from primary data, 2021*

Table 2 shows several types of production facilities and the average cost of infrastructure for agribusiness activities purchased in the village. With the total cost of infrastructure is IDR 45.087.777 expenditures incurred by farmers purchased from within the village. The average income of farmers for agribusiness production in the village in one business cycle is seen in Table 3 below.

Table 3. *Average Farmer Income for Production*

Description	Amount
Production/6 Month (kg)	2,304
Price (IDR)	23,000
Revenue (IDR)	53,000,000
Benefit (IDR)	7,912,223

Source: *processed from primary data, 2021*

In Table 3, it can be seen that the average production of one business cycle for 5-7 months amounted to 2,304 kg, with a selling price of IDR 23,000 per kg, with revenues of IDR 53,000,000. The results of the calculation show that the income obtained by farmers is IDR 7,912,223. This income is the result of production per cycle for approximately six months. For one harvest divided by income of IDR 7,912,223, the PSY value is 0.126. This value is the farmer's income obtained from agribusiness activities in the village.

Estimated Economic Value and Dual Effects of FNC

Multiplier effect analysis is a data analysis method that is intended to calculate how much income multiplier is obtained from fish agribusiness activities. The value of MPC expenditure is 0.213, meaning 21.3 % of income has been spent in the village to meet needs. Then PSY of 0.126 is the income obtained from agribusiness activities during the production of one harvest. Then the income multiplier (M) is as follows:

$$M = 1/(1-(MPC*PSY))$$

$$M = 1/(1- (0.213*0.126)) = 1.033.$$

This means that an increase in economic activity of 1 million gives an increase in wages of IDR 33,000 for activities related to agribusiness activities. This shows that agribusiness activities carried out by farmers have an influence on improving the community's economy both backwards and forwards, among others, on the workforce getting an increase in income, then affecting the providers of facilities and infrastructure and affecting other economic activities in the village. Other research found that the multiplier revenue was 1.090 for tomato horticulture business[21].

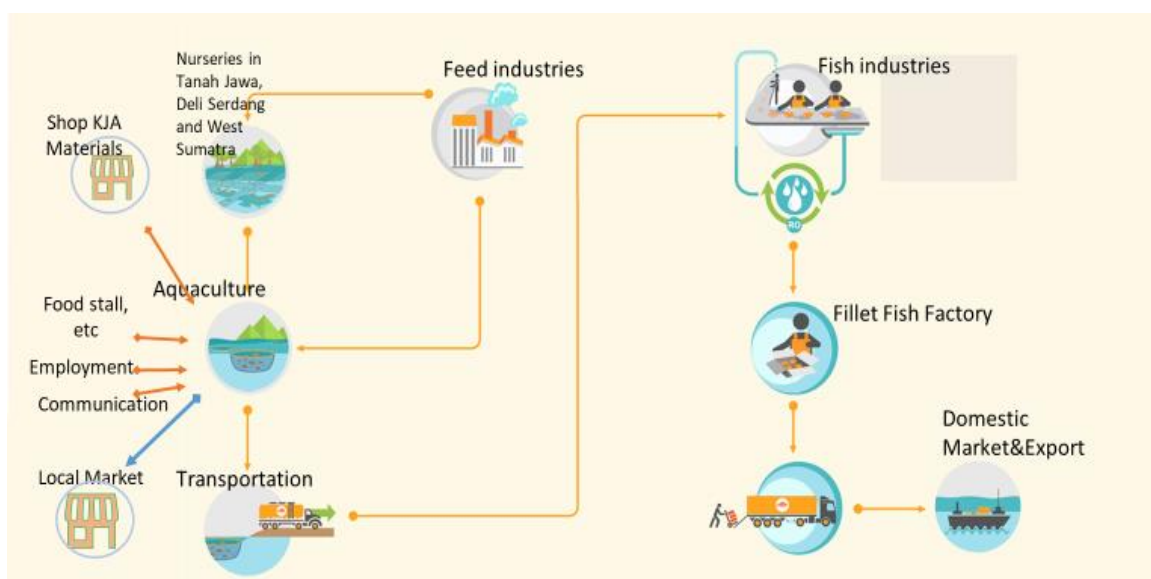


Figure 2. *The FNC Fisheries Business Linkage in Lake Toba*

Fish production from floating net cages (FNC) in Lake Toba in 2021 is estimated at a total of 75,000 tons. Especially in Haranggaol Village, there are + 3,000 owners with an average of 3 holes or a total of 9,000 holes. In 2016 the government wanted to completely close the FNC in Lake Toba, including in Haranggaol, but the community refused because the benefits of tourism were not necessarily enjoyed by the community. The FNC business in Haranggaol started around 1999 and boomed in 2010. Almost all of the existing FNCs were initiated by the community.

The selling price of tilapia in Haranggaol (at FNC) is IDR 23,000/kg size 2 – 3 fish/kg. Then the fish are sold to other areas. Marketing of fish produced by the community FNC is generally to district markets in North Sumatra, such as Medan, Kabanjahe, Pematang Siantar, Balige, Rantau Parapat, Bagan Batu, and others.

The results showed that 64.50% of the total FNC area in the Lake Toba area were community-owned floating cages and other company floating cages. FNC activities have encouraged the development of other businesses that are directly or indirectly related. Those that are directly related, such as the fish seed business with a value of up to IDR 158.40 billion. fish feed business reached a value of IDR 1.30 trillion. as well as fish trade for local needs worth IDR 1,90 trillion and exports of IDR 1.50 trillion. FNC tools trading business. as well as creating job opportunities for around 12,300 people. Indirect economic impacts include transportation businesses as well as food stalls and basic necessities.

Aquaculture in floating net cages is one of the main economic sources for residents in the Lake Toba area. The FNC center is located in Simalungun Regency, Samosir and Humbang Hasundutan, where in terms of the number of cage holes more owned by the public than private companies. However, in terms of production, although the number of FNC holes for private companies is less, the production level is higher. The velocity of money in the floating cage industry with a fish price of Rp. 25,000 per kg reaches IDR 2.50 trillion per year, a very large amount for the regional economy. FNC also absorbs a large number of workers, which is around 35,000 people. These parameters indicate that FNC is an industry that has a very large role in the economy of the Lake Toba Region.

The parties who are directly affected by the enactment of the Governor's Decree are FNC actors, both corporate FNC actors and the community. Currently, the number of corporate floating cages is 2 companies and 5,000 people are community floating cages. Two FNC companies currently produce up to 45,000 tons per year. while the community FNC produces as much as 30,000 tons per year.

The total production value of floating cages in Lake Toba in 2020 is IDR 2.5 T (assuming the fish price is IDR 25,000 per kg). All of the company's FNC production is exported and the foreign exchange generated from this export reaches IDR 1,474.6 billion. Meanwhile, the community's FNC production is marketed at the local level to meet the protein needs of fish for residents in 7 regencies around Lake Toba plus the Medan City and its surroundings.

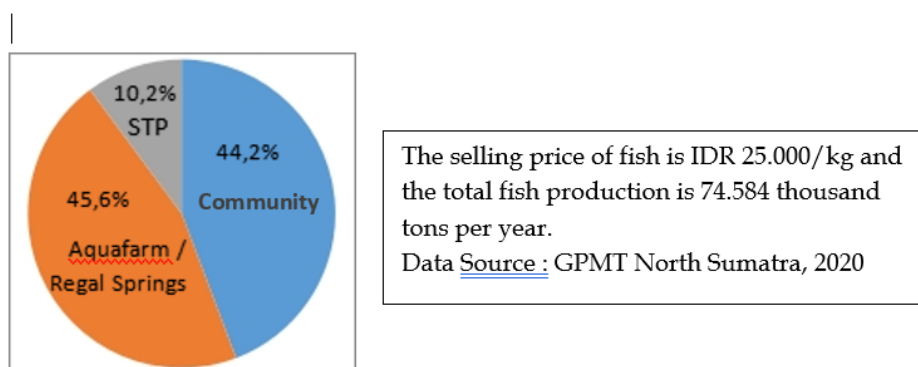


Figure 3. Total Tilapia Production in the Lake Toba area

When viewed from the amount of investment that has been allocated by both the company and the community, it can be estimated as follows. For company A where the production capacity is 34,010 tons per year (the number of FNC is 418 holes). while for company B the production is 7,608 tons with a total of 184 FNC holes. If the price per hole is around IDR 200 million, then the investment value is IDR 120.4 billion. For community FNC, the calculation of the initial capital value issued is calculated based on the capital issued for each 1 floating net hole, which is IDR 9 million. So for all FNCs owned by the community (8,420 holes), the amount of investment that has been spent is IDR 75.78 billion.

FNC Economic Value

The economic value of floating net cage exploitation in Lake Toba in detail can be seen in Table 4. This economic analysis is qualitative and quantitative and based on the results of the analysis are shown below. Dampak positifnya telah menumbuhkan berbagai aktivitas ekonomi lain yang terkait baik secara langsung maupun tidak langsung dengan bisnis FNC. Hal ini juga sejalan dengan hasil penelitian Puluhulawa et.al[16].

Table 4. *Economic Value of FNC*

No	Group	Benefit	+/0/-
1	FNC Actors	Income (million IDR)	2,478,443,030,000
2	Feed Factory	Income (million IDR)	1,281,000,000,000
3	Hatchery Actors	Income (million IDR)	133,875,000,000
4	Employment		29,300,400,000
5	Food merchant	Income (million IDR)	3,000,000,000
6	Government	Tax Income from community FNC (million IDR)	
7	FNC Material		1,500,000,000
8	Transportation		2,000,000,000
9	Packaging	plastic. Gas, etc	200,000,000
	Totally		3,929,318,430,000

Source: *processed from primary data, 2021*

Conclusion and Recommendation

Conclusion

The results show that 64.50% of the total FNC area in the Lake Toba area is FNC owned by the community and other FNC companies. There are 8,428 FNC communities and 484 FNC companies in the Lake Toba area spread over 7 regencies and 23 sub-districts, with the widest distribution in Toba Regency, Samosir, and Simalungun regencies.

FNC business in Lake Toba has encouraged the development of other businesses that are directly or indirectly related. Directly related business activities such as fish hatchery with a value of up to IDR. 158.40 billion, the fish feed business reached a value of IDR 1.30 trillion, the local fish trading business worth IDR 1.90 trillion, and exports of IDR 1.47 trillion and also to the trading business of FNC production facilities. The Lake Toba FNC business has created job opportunities for around 12,300 people. Indirect economic impacts include transportation businesses as well as food stalls and basic necessities. Thus the total business value generated from the FNC business is no less than IDR 4 trillion. These parameters indicate that FNC is an industry that has a very large role in the economy of the Lake Toba Region.

The value of the income multiplier (k) is 1.033. This means that an increase in economic activity of 1 million gives an increase in wages of IDR 33,000, - for various businesses related to agribusiness activities. This shows that agribusiness activities carried out by farmers have an impact on improving the community's economy.

Based on the results of the cost-benefit analysis conducted, the parties directly affected by the enactment of the Governor's Decree are FNC actors, both company and community FNC, supporting industries (feed & hatchery industry), and the government itself regarding tax revenues.

Recommendation

Even though the KJA business in Lake Toba has a very important role in supporting the economy in the Lake Toba Region, its existence still has the potential for conflict in relation to the development of the tourism sector. For this reason, it is necessary to conduct further studies related to the integration of the FNC business with tourism development plans in the Lake Toba area as a form of conflict resolution for the development of sustainable tourism areas.

It is necessary to conduct further studies related to the recommendation of the number of FNCs that are allowed as well as the zoning of the allowed FNC areas in an effort to maintain the economic viability of the community.

It is also necessary to provide assistance to existing community FNCs regarding the implementation of environmentally friendly FNCs.

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