



Analysis of Floating Cage Net Development Trends in West Java Province, Indonesia

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This study has the aim to analyze the trend of the development of fisheries floating cage net aquaculture in West Java Province. The research was conducted from September 2020 – July 2021. The method used was a literature survey to determine the development of aquaculture fisheries of floating cage net in regencies and cities in West Java Province. Data collected were analyzed descriptively. Secondary data on Floating Net Cage Aquaculture Fisheries (2004 – 2019) was obtained from the office of Maritime Affairs and Fisheries of West Java Province. The results of this study indicate that the development of aquaculture fisheries of floating cage net in the regencies/cities of West Java Province experienced fluctuating changes which tends to increase from 2004 to 2019.

Keywords: Floating cage net aquaculture; west java; fishery developments.

1. INTRODUCTION

A floating net cage is a fish rearing container in the form of a net bag that is located floating on

the surface of the water. Fish rearing in floating net cages is a community economic activity by utilizing available natural resources, labor, and technology. In addition, the business is expected

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to open up new job opportunities and business opportunities for the community [1].

Putri [2] reveals that the floating net cage business in Jatiluhur Reservoir can improve socioeconomic conditions in the community such as increasing income, increasing work networks, increasing community insight, and improving development conditions around the community.

Aquaculture activities with floating net cage systems have the aim of increasing production to get maximum profit. The aquaculture pattern used is intensive, where fish are kept in high density and using commercial feed [3]. With intensive aquaculture, farmers can harvest fish in a faster time and with good quality [4].

According to [5] for fish cultured in floating net cages, fish species should be selected with the following characteristics: have resistance to environmental changes and pest/disease disturbances, fast growth, fish can be kept in high density, fish seeds are easily obtained from hatcheries and fish to be cultured are in demand in the market both for domestic consumption and as export commodities. Carp and other types of fish, including catfish, tilapia, and pomfret are superior commodities and have been cultivated from the past until now [6].

The application of freshwater fish culture in floating net cages will provide more benefits when compared to using the land as a pond. These advantages are in the form of reduced production costs for providing land (to build ponds), which can overcome the decrease in fish aquaculture land due to being pressured by agricultural, industrial, and housing development activities. Technically, the benefits obtained include the intensification of fish production and optimization of feed use that can be applied, competitors and predators of fish are easy to control and management and harvesting are not too complicated [7].

The magnitude of this potential is not followed by the optimal utilization of fishery resources. Over time the aquaculture of floating net cages has led to several issues, such as controlling floating net cages [8], sources of fishery problems by various parties [9], and another disturbing threat is the decline in water quality [10]. When the water quality is heavily polluted, the production output will decrease, which triggers a low level of

competitiveness among the existing floating net cage industries.

The trend is a movement that tends to go up or down in the long term. The trend shows a relatively long and stable change in time. The forces that can influence trends are changes in population, prices, technology, and productivity. To determine the development trend of floating net cage aquaculture, data are needed covering human resources, facilities, infrastructure, production/production value, and area. So it will be seen how the trend of development in each regency/city in West Java Province. This is intended so that the data obtained can later be used as input or consideration in planning and managing the development of the fishery sector in floating net cage aquaculture in West Java Province.

2. STUDY AREA

Geographically, West Java Province is located between 5°50' - 7°20' South Latitude and 104°48' - 108°48' East Longitude. West Java Province has an area of 37.087,92 km² with a coastline of 832,69 km. Based on the marine management authority of 0-12 miles, the sea area of West Java Province is 15.528,90 ha and has 19 small islands [11].

Administratively, in 2019 the area of West Java Province is divided into 27 regencies / cities, covering 18 regencies and 9 cities, namely Bogor, Sukabumi, Cianjur, Bandung, West Bandung, Garut, Tasikmalaya, Ciamis, Kuningan, Cirebon, Majalengka, Sumedang, Indramayu, Subang, Purwakarta, Karawang, Bekasi, and Pangandaran as well as the City of Bogor, Sukabumi, Bandung, Cirebon, Bekasi, Depok, Cimahi, Tasikmalaya and the City of Banjar. Sukabumi Regency is the largest regency area in West Java Province with an area of 4.145,70 km² (11,72 percent of the area of West Java Province), while the smallest area is Cirebon City which is 37,36 km² (0,11 percent of the total area of the Province West Java). West Java Province consists of 627 regencies, 645 villages and 5.312 villages [11].

West Java Province is an area that has natural conditions suitable for the development of aquaculture, especially freshwater aquaculture. This is supported by a large number of freshwater resources in West Java because it is supported by high rainfall. Rainfall ranges from 2000-4000 mm/year, the amount of rain is

estimated at 180 days/year. So that West Java has many rivers, lakes, swamps, lakes, and other puddles. West Java Province has large reservoirs, namely Jatiluhur Reservoir, Cirata Reservoir, Saguling Reservoir, and Darma Reservoir with a wide range of each reservoir between 420 ha to 8.300 ha. The large potential of the reservoir used for the aquaculture of floating net cages in West Java Province is an opportunity to develop the region [11].

West Java is one of the provinces in Indonesia with the largest contribution to reservoir fisheries production. Most of the people of West Java use these public waters for fishery activities, both aquaculture, and capture. If you look at the production results, reservoir fisheries both in Indonesia in general and in West Java, in particular, are still dominated by aquaculture, while capture fisheries have a small contribution. One of the activities that utilize reservoir resources for aquaculture activities is floating cage net aquaculture This activity has contributed a lot to regional income and also the welfare of the people who do it [12].

The contributions of 27 regencies/cities in West Java Province to production, fisheries households, facilities, infrastructure, and fisheries areas of floating net cages can be seen through the data available at the Department of Marine Affairs and Fisheries located at Jl. Wastukencana No. 17, Babakan Ciamis, Sumur Bandung Regencies, Bandung City, West Java Province.

3. METHODOLOGY

The method used in this study is a literature survey to determine the competitiveness of floating net cage aquaculture production in 27 regencies/cities in West Java Province. A literature survey is research related to library data collection or research whose research objects are explored through various library information (books and scientific journals) [13]. The data used is secondary data which is realized in the form of numbers and analyzed using descriptive statistics. The secondary data collection technique was obtained from statistical data on Floating Cage Aquaculture Fisheries in 2004 – 2019 was obtained from the Department of Marine Affairs and Fisheries of West Java Province.

3.1 Research Location

The research took place at the Department of Marine Affairs and Fisheries, West Java Province, which is located at Jl. Wastukencana No. 17, Babakan Ciamis, Sumur Bandung Regencies, Bandung City, West Java 40117. This research was conducted from September 2020 – July 2021.

3.2 Data Analysis Method

Data analysis was carried out by using quantitative descriptive analysis. Data in quantitative descriptive research is shown by tables and graphs used to get a picture (profile) and trends in the development of competitiveness in the field of floating net cage aquaculture in the Regency/City of West Java Province. Data management and data analysis were carried out using Microsoft Office Excel 2013 software.

3.3 Development Trend Analysis

Trend analysis is a tool that can see the average changes that occur each year in the long term. In this study, we look at the development trend of floating net cage aquaculture in West Java Province. The following is the development index formula used according to the Annual Fisheries Index by Province 2006 – 2009 [14].

- a. Development Index of Floating Cage Net Aquaculture Fishery Production

$$IPP_{ijk} = \frac{Q_{ijk}}{Q_{ijkl}} \times 100$$

Information :

- IPP : Development Index of Floating Cage Net Aquaculture Fishery Production
- Q : Production Volume (tonnes)

The type of fish produced is in the hatchery and use stage

- i : Regency i (i = 1, ... , 27)
- j : Classification of Fisheries Types
- k : Period of Time (years)
- kl : 1 year before the time period

- b. Development Index of Floating Net Cage Aquaculture Fishing Households

$$IPN_{ijk} = \frac{N_{ijk}}{N_{ijkl}} \times 100$$

Information :

- IPN : Development Index of Floating Net Cage Aquaculture Fishing Households (person)
 N : Total of Fishing Households (person)
 i : Regency i (i = 1, ... , 27)
 j : Classification of Fisheries Types
 k : Period of Time (years)
 kl : 1 year before the time period

- c. Development Index of Floating Net Cage Aquaculture Facilities

$$IPF_{ijk} = \frac{Q_{ijk}}{Q_{ijkl}} \times 100$$

Information :

- IPF : Development Index of Floating Net Cage Aquaculture Facilities
 Q : Facility Volume (unit)

The types of facilities used include enlargement plots

- i : Regency i (i = 1, ... , 27)
 j : Classification of Fisheries Types
 k : Period of Time (years)
 kl : 1 year before the time period

- d. Development Index of Floating Net Cage Aquaculture Production Infrastructure

$$IPS_{ijk} = \frac{S_{ijk}}{S_{ijkl}} \times 100$$

Information :

- IPS : Development Index of Floating Net Cage Aquaculture Production Infrastructure
 S : Production Infrastructure (tonnes)

Types of facilities and infrastructure used include feed and fuel

- i : Regency i (i = 1, ... , 27)
 j : Classification of Fisheries Types
 k : Period of Time (years)
 kl : 1 year before the time period

- e. Development Index of Floating Net Cage

$$IPL_{ijk} = \frac{QL_{ijk}}{QL_{ijkl}} \times 100$$

Information :

- IPL : Development Index of Floating Net Cage
 QL : Volume of Floating Net Cage (m²)
 i : Regency i (i = 1, ... , 27)
 j : Classification of Fisheries Types
 k : Period of Time (years)
 kl : 1 year before the time period

4. RESULTS AND DISCUSSION

Based on the research that has been done, the index value for the development of floating net cage aquaculture is obtained for the period 2004-2019. This development index includes the development index of human resources (fishing households), the facility development index, the infrastructure development index, the area development index, and the floating net cage aquaculture production development index.

4.1 Fishery Household Trend Development Index

The data used in this study was for a period of 15 years from the period 2004 – 2019. During this period the development of fishery households for floating net cage aquaculture in West Java Province is growing rapidly as shown in the following graph (Fig. 1).

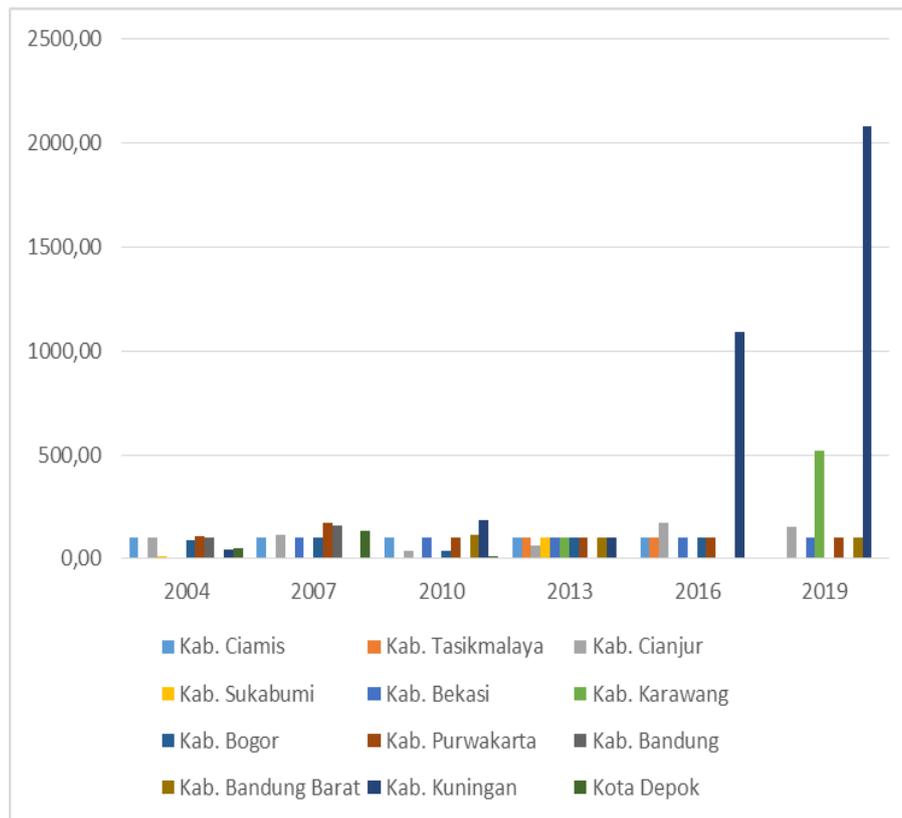


Fig. 1. Development Index of Floating Cage Net Aquaculture Household

In 2004 - 2019, the household development index of floating net cage aquaculture in West Java Province each year sequentially was 602,12 (2004), 882,23 (2007), 689,23 (2010), 964,79 (2013), 1.767,02 (2016) and 3.055,02 (2019) compared to the previous year. This condition reflects that the largest increase in floating net cage aquaculture households occurred in 2019 while the lowest occurred in 2004. The development index of floating net cage aquaculture households in 2019 was 3.055,02, which means the number of floating net cage aquaculture households increased by 30,08 percent. compared to the number of floating net cage aquaculture households in 2004. The highest increase in the number of floating net cage aquaculture households was Kuningan Regency with an index of 3.498,54, while the lowest occurred in Sukabumi Regency at 110. The activities of floating net cages that are experiencing rapid development can be seen in how their development trends are with the calculation of the development index [15].

Fisheries households involved in the cultivation of floating net cages in Kuningan Regency showed a very rapid increase. This increase in fishery households is in line with the high production yield of floating net cages in the Kuningan Regency. According to Febriani [16] empowerment has been carried out by the community around the reservoir, one of which is taking advantage of the opportunity for floating net cage cultivation in Darma Reservoir. As a result, the development of the floating net cage business can improve the local economy well and reduce poverty and unemployment. The community empowerment process, which is carried out through the development of the floating net cage business, forms a more independent and creative community character.

4.2 Facility Trend Development Index

The data used in this study is for a period of 15 years from the period 2004 – 2019. During this period the development of floating net cage cultivation facilities in West Java Province tends to decline as shown in the following graph (Fig. 2).

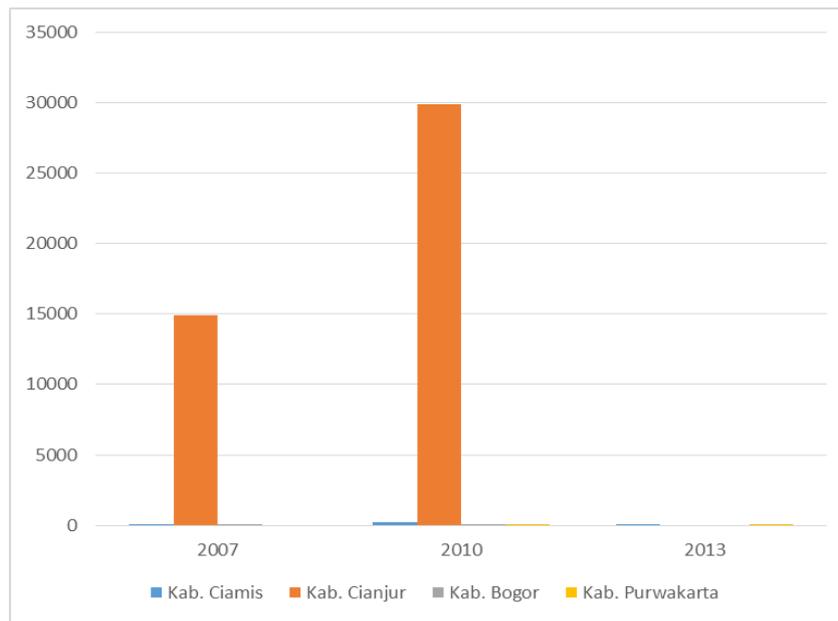


Fig. 2. Development Index of Floating Net Cage Aquaculture Facilities

In 2007 - 2013, the development index of floating net cage aquaculture facilities in West Java Province was 15.130 (2007), 30.305 (2010), and 200 (2013) respectively compared to the previous year. This condition reflects that the largest increase in floating net cage aquaculture households occurred in 2010 while the lowest occurred in 2013. The index for the development of floating net cage aquaculture facilities in 2013 was 200, which means that the number of floating net cage aquaculture facilities decreased by 32,71 percent compared to the number of floating net cage aquaculture facilities. floating net cage aquaculture in 2007. The highest increase in the number of floating net cage aquaculture facilities was in Cianjur Regency with an index of 44.790, while the lowest occurred in Bogor Regency at 200.

According to Nurhayati and Herawati [17], the development of marine cage construction in Cirata Reservoir experienced three phases of construction development using marine cages. The first is traditional using bamboo construction, the second phase is semi-modern using a mixture of bamboo and styrofoam construction and the third phase is modern using fiber construction.

4.3 Infrastructure Trend Development Index

The data used in this study were for a period of 15 years from the period 2004 – 2019. During

this period the development of floating net cage cultivation facilities and infrastructure in West Java Province tends to decline as shown in the following graph (Fig. 3).

In 2004 - 2013, the index of development of floating net cage aquaculture facilities and infrastructure in West Java Province each year respectively was 5.726,42 (2004), 10.505,74 (2007), 510,24 (2010), and 856,38 (2013) compared to the previous year. This condition reflects that the largest increase in floating net cage aquaculture facilities and infrastructure occurred in 2007 while the lowest occurred in 2010. Infrastructure facilities for floating net cage aquaculture include the amount of feed and fuel used. The index of floating net cage aquaculture facilities and infrastructure in 2013 was 856,38, which means the number of floating net cage aquaculture facilities and infrastructure decreased by 27,67 percent compared to 2004. The highest increase in the number of floating net cage aquaculture facilities and infrastructure was Cianjur Regency with an index of 15.229,24. The high use of feed carried out by the Cirata Reservoir is because the reservoir area is close to feeding producers who cooperate with several large feed agents in the Cirata Reservoir such as SH (Sayap Heulang), JP (Janari Perdana), AP (Agung Pratama) and SD (Sari Dagang) [18]. However, the high use of feed also causes a high amount of sedimentation in the waters of the Cirata Reservoir which has reached 325.712 tons. Where the growth has reached 5,6% since

2007. According to Rahmani et al. [19] the amount of sedimentation/m² is 5,25 kg. One solution to overcome the sedimentation problem is by controlling it in the form of dredging/recovery. If the recovery of the waters of the Cirata Reservoir is carried out by dredging, then technologically, the waters of the Cirata Reservoir can produce even if the fish are not fed, this is because the waters are environmentally conducive for fish production.

The lowest increase in the number of floating net cage aquaculture infrastructure facilities occurred in Tasikmalaya Regency at 54,44. According to the Investment Profile of Tasikmalaya Regency, the utilization of the fishery sector in Tasikmalaya

Regency is dominated by pond cultivation, reaching 80-89 percent of its utilization compared to floating net cage cultivation which only uses 24,7 percent. The low utilization of floating net cage cultivation in Tasikmalaya Regency is due to its potential only consisting of 150 fishery households.

4.4 Production Trend Development Index

The data used in this study is for a period of 15 years from the period 2004 – 2019. During this period the development of floating net cage cultivation production in West Java Province tends to decline as shown in the following graph (Fig. 4).

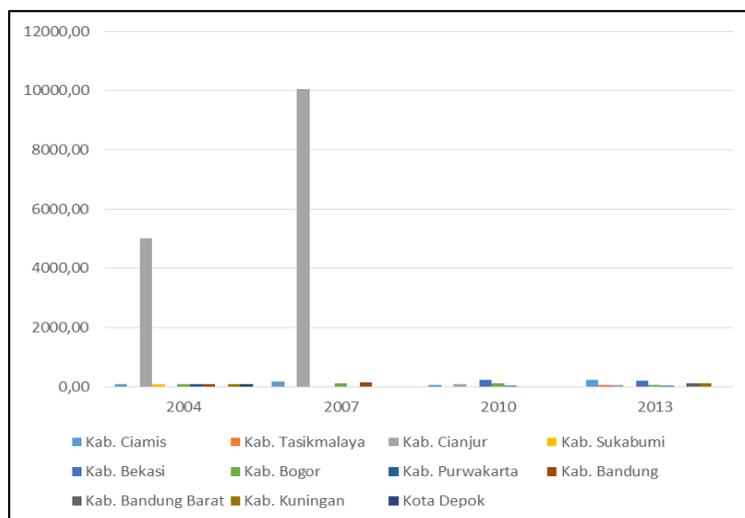


Fig. 3. Development Index of Floating Net Cage Aquaculture Infrastructure

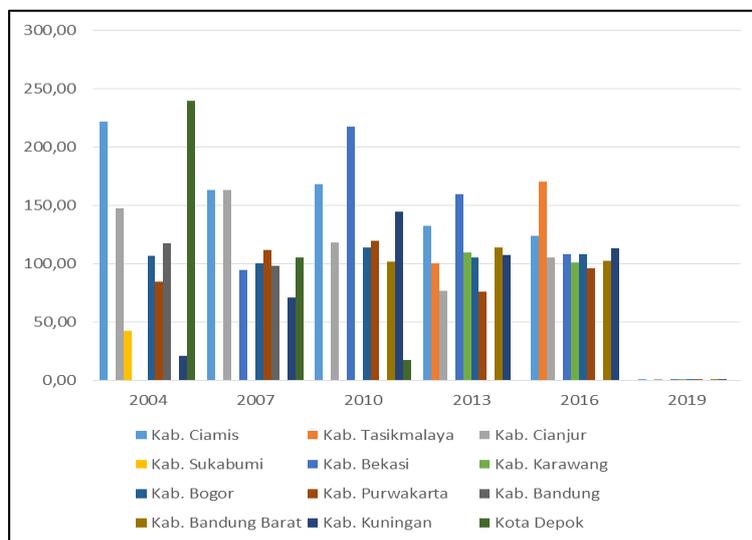


Fig. 4. Development Index of Floating Net Cages Aquaculture Production

In 2004 - 2019, the development index of floating net cage aquaculture production in West Java Province every year sequentially was 980,79 (2004), 906,55 (2007), 1.001,48 (2010), 981,47 (2013), 1.028,97 (2016) and 0,64 (2019) compared to the previous year. This condition reflects that the largest increase in floating net cage aquaculture production occurred in 2016 while the lowest occurred in 2019. In 2019, the development index of floating net cage aquaculture production in West Java Province was 0,64, which means floating net cage aquaculture production in West Java Province decreased by 20 percent compared to production in 2004. The highest increase in floating net cage aquaculture production was in Cianjur Regency with an index of 611, while the lowest occurred in Sukabumi Regency at 42,7.

4.5 Area Trend Development Index

The data used in this study is for a period of 15 years from the period 2004 – 2019. During this period the development of floating net cage

cultivation area in West Java Province tends to decrease as shown in the following graph (Fig. 5).

In 2004 - 2019, the development index of the area of floating net cage aquaculture in West Java Province every year sequentially was 879,67 (2004), 966,96 (2007), 683,33 (2010), 10.888,44 (2013), 20.782,49 (2016) and 2.481,63 (2019) compared to the previous year. This condition reflects that the largest increase in the area of floating net cage aquaculture occurred in 2016 while the lowest occurred in 2010. The development index for the area of floating net cage aquaculture in 2019 was 2.481,63, which means the total area of floating net cage aquaculture increased by 4.3 percent. compared to the total area of floating net cage aquaculture in 2004. The highest increase in the total area of floating net cage aquaculture was Cianjur Regency with an index of 30.546,27, while the lowest occurred in Sukabumi Regency of 100.

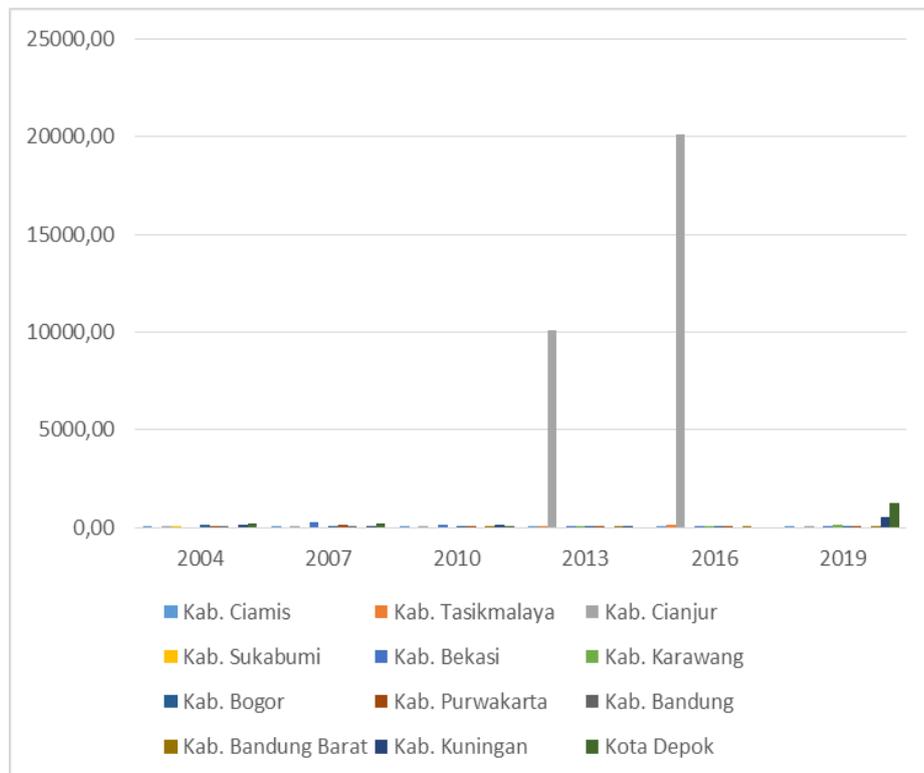


Fig. 5. Development Index of Floating Net Cage Aquaculture Area

5. CONCLUSION

The development of floating net cage aquaculture in the Regency/City of West Java Province is seen from the aspect of human resources, facilities, infrastructure, production, and the area of aquaculture experienced fluctuating changes which tends to increase during 2004 – 2019.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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