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Research Article

The Needs for Main Facilities and Availability of the Capture Fisheries Production in Cilacap Oceanic Fishing Port until 2027

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Abstract

Fishing ports are an important factor in supporting various capture fisheries activities in Indonesia. The number of vessels that landed fish at Oceanic Fishing Port (PPS) Cilacap during 2005-2013 increased by an average of 1.33% annually, which has implications for port capacity. It is important to know the capacity requirements for the basic facilities of the dock, and port pond at PPS, therefore that the activity of landing fish catches can take place properly. The purpose of this research is to not only get an overview of the current condition, and capacity of the main facilities at PPS Cilacap, but also to predict the production of fish caught until 2027. The research method is a case study. The data used in this study are primary, and secondary data obtained from PPS Cilacap. The results showed that the length of the landing dock in 2016 was 648.8m with the area, and depth of the port pool of 155,000 m2 and -2.5 m. The predicted requirement for the length of the landing dock until 2027 is 1,380.1 m, with the area and depth of the harbor pool of 239,612 m2 and -4.1 m. Based on the results, it shows that PPS Cilacap requires additional capacity of the dock, and port pool. Predictions of fish catch in 2022, and 2027 are 20,104,259 tons and 25,407,506 tons.

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1. Introduction

Fishing ports play an important role in the provision of catch fish production (Jennings *et al.,* 2016) through various facilities for loading, and unloading services for fishing vessels. The availability of fish caught in fishing ports is used to meet the increasing global consumption needs of people (Norse *et al.,* 2012; Saptanto and Apriliani, 2012), and the need for raw materials for the fish processing industry (Das *et al.,* 2013; Hamzah *et al*., 2015). The availability of catch fish production can also be used as an indicator of the level of functionality of fishery port facilities or fish landing bases (Lubis, 2011). If the production of fish caught has increased, it must be ensured that the capacity of fishery port facilities is able to accommodate ships, and all landed fish production (Sampathkumar and Vanjina- than, 2015). Therefore, it is necessary to increase the capacity of fishing port facilities.

The fishing port has various facilities that support various activities ranging from landing to marketing of caught fish. Based on the Regulation of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia Number PER.08 / MEN / 2012, fishery port fa- cilities can be grouped into basic facilities, functional facilities, and supporting facilities. Various facilities at a fishing port are interrelated, either directly or indirectly, with the production of catches at a fishing port. Basic facilities are the basic facilities needed at fishing ports (Syakuro *et al.,* 2020). The main facilities at fishing ports generally consist of docks, port ponds, breakwa- ters, and navigation aids (KKP, 2012). Basic facilities are very important to be developed in order to increase the productivity of a fishing port, especially docks, and port ponds.

Dock and port ponds are used to land the fish caught, and load the needs of the sea. The capacity of docks and port ponds is influenced by the number of ships loading and unloading at fishing ports (Muammar *et al*., 2020). The number of fishing boats landing fish at Oceanic Fishing Port (PPS) Cilacap has increased by 1.33% annually during 2005-2013 (PPS Cilacap, 2017a). The area and depth of the port pool at PPS Cilacap in 2016 were 155,000 m2 and -2.5 m below the water level, respectively (PPS Cilacap, 2017a). This condition indicates that it is neces- sary to increase the depth of the port pool in accordance with the Regulation of the Minister of Marine Affairs, and Fisheries of the Republic of Indonesia number PER.08 / MEN / 2012 which states that type A fishing port must have a port pool depth of at least -3 m below the water surface with facilities, mooring of ships of at least 60 GT (KKP, 2012).

PPS Cilacap is the only type A fishing port in Central Java Province. The location of PPS Cilacap, which is directly facing the Indian Ocean, has a positive impact, which has great potential in increasing the production of fish caught in fishing ports. This is because the Indian Ocean waters are a potential commercial fishing area for important pelagic species such as tuna, and skipjack (Polacheck, 2006; Kaplan *et al*., 2014). The waters of the Indian Ocean consist of two Fisheries Management Areas of the Republic of Indonesia (WPP RI), namely WPP 572, and WPP 573 with the potential for sustainability in the two WPPs, respectively, of 717,299 tons and 190.24 tons per year (Suman *et al.,* 2017).

Research on the availability of fish and the capacity needs of basic port facilities at PPS Cilacap needs to be carried out to determine the projected production of fish caught in the next 10 years, and the actual capacity requirements for basic facilities, especially the fish landing dock, and port pond in the next 10 years. In addition, the queue of ships that want to land the fish caught at the PPS is also an indication of problems that need to be studied. The existence of a queue of ships that want to land the fish caught at the port will have an impact on the quality of the fish caught decreasing due to too long on the ship without adequate cooling facilities (Velazquez *et al*., 2008; Hesselberg *et al.,* 2020). Research related to the capacity needs of the length of the dock, and the width and depth of the port pool aims to ensure that capture fisheries activities at PPS Cila- cap can continue optimally. (Lubis, 2012) states that the implementation of port functions optimally can be used as an indicator of the successful performance of a fishing port. Increasing the capacity of port facilities is also needed in line with the increase in the production of fish caught on land until 2027.

2. Materials and Methods

The method used in this research was a case study research method on the need for basic facilities, and prediction of fish production in the Cilacap Oceanic Fishing Port. This case study method is very relevant, for example in calculating facility capacity along with the development of fish production in a fishing port (Lubis, 2012). In this study, the object under study was the production of landed fish, and the capacity needs of the main port facilities at PPS Cilacap which were limited to the dock and port pond. The research was conducted in May 2017 at PPS Cilacap.

This research was conducted to calculate the adequacy of the dock, and port pond in relation to the number and size of vessels landing the fish caught, and the availability of fish production for the next 10 years at PPS Cilacap. Measurement of basic facility requirements in this study were (1) the length of the fish landing dock, and (2) the width and depth of the port pond. Therefore, secondary data was collected, including the length of the dock, the width and depth of the port pond as well as the development of the number of ships landing fish. This study also predicted the product -ion of fish caught landed at PPS Cilacap until 2017 so that sufficient capacity of the dock, and port ponds at PPS Cilacap was needed.

2.1 The current condition of the main facilities for the Cilacap Oceanic Fishing Port

The current condition of the Cilacap Oceanic Fishing Port facilities (Figure 1) was analyzed descriptively qualitatively. Qualitative descriptive analysis was used to describe the object of research based on the facts that appeared as it should. Qualitative descriptive analysis described all the circumstances that existed at the time the research was conducted (Mukhtar, 2013). The current conditions at PPS Cilacap included basic fishing port facilities which were limited to the landing dock of catch fish and port ponds.

2.2 Projected volume of fish production currently caught in the next 10 years

The volume of fish caught landed in 2017, and the next 10 years (2027) can be calculated using the projected volume of fish caught through regression and correlation analysis. Good projection results are in decision making with the largest correlation coefficient value and the smallest error (Dajan, 1973).

$$\hat{Y} = a + bx \qquad (1)$$

Description:
α : Constant
b : Regression coefficient
Ŷ : Prediction of the volume of fish caught

$$b = b = (n\sum xy - \sum x \sum y) / (n\sum x^2 - (\sum x)^2) \qquad (2)$$

$$a = Y - bX \qquad (3)$$

Description:
Y : Average volume of fish caught
X : Average period (years, months)

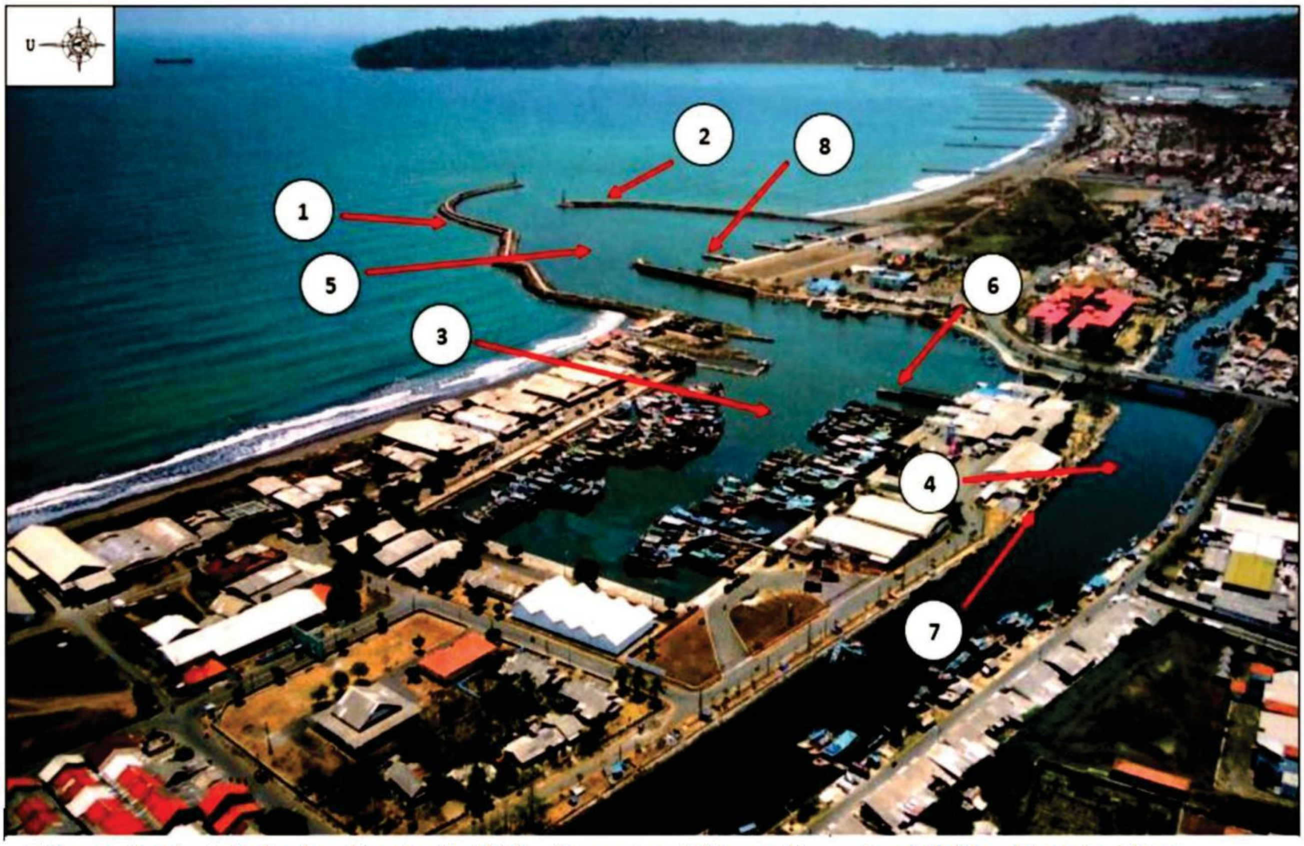

Figure 1. Aerial photo of main facilities layout at Cilacap Oceaning Fishing Port in 2016.
Description: 1 (North breakwater), 2 (South breakwater), 3 (Bassin A), 4 (Bassin B), 5 (Bassin C), 6 (Quay A), 7 (Quay B), 8 (Quay C).
Source: Cilacap Oceanic Fishing Port; (Reproccesed)

Pearson Correlation Coefficient $r_{xy\ Count}$

rxycount = ((n∑xy) - (∑x∑y)) / (√[{∑(n∑x^2) - (∑x)^2 }{(n∑y^2) - (∑y)^2 }]).........(4)

Hypothesis:

H0 : $r_{xy} = 0$, then there is no correlation between the x and y variables

H0 : $r_{xy} \neq 0$, then there is correlation between the x and y variables

Decision:

When $r_{xy\ count}$ <= r tab, then reject H0 : then there is no correlation between the x and y variables

When $r_{xy\ count}$ >= r tab, then accept H0 : then there is correlation between the x and y variables

SEE Value

SEE = √ (∑e^2) / n...(5)

Description:

SEE : *Standard Error Estimated*

e : *error*

n : number of sampel

The data used in calculating the prediction of the volume of fish caught in the next 10 years was the volume of fish production in the previous year (2008-2015). The level of accuracy of the correlation between variable X and variable Y is determined based on Table 1. The results of the prediction of the volume of fish caught in the next 10 years assumed that the conditions affecting the prediction results were the same as for the years 2008-2015. The data used in the calculation was data that had been treated with a moving average for 11 months with the aim of obtaining a prediction result with the largest correlation value, and the smallest SEE (Standard Error Estimated) value.

2.3 The length of the fish landing dock based on the approach to the volume of fish production landed

The length of the landing dock for fish caught, and loading the need to go to sea was calculated based on the approach to the volume of fish production on land which was developed from the equation of the length of the dock (Kramadibrata (1989). The length of the dock is assumed to be the same as the length of the supply loading dock. The calculation of the length of the fish landing dock using the longest vessel LOA variable is intended to determine the optimal length of the dock, assuming the number of ships with the longest size will make the landing of the fish (Pane, 2016).

Dp = (VPT(L+s)-s+2j) / (VPU × HPR × FP)...(6)

Description:

Dp : Length of fish landing dock using fish production volume approach the catch is landed

VPT : The volume of production of fish caught landed at the port fishery in a year (tonnes / year)

L : LOA of the longest ship (m)

S : Distance between 2 fishing vessels (5cm)

A : The distance of the bow or stern of the ship to the end of the dock (25m)

VPU : The average volume of landed fish production per unit ship landing at fishing port (ton / ship unit), equivalent with the average volume of fish production landed per landings (tons per landing)

HPR : Number of real catch landing days per year for each vessel; as a guideline (days per year)

FP : Many of the frequency of dock usage periods per day at the fishing port (for landed fish catch) (times period usage per day or times of period per day).

2.4 Area of port pond

L = Lt + (3 × n × l × b)..(7)

Description:

L : Port pond area (m2)

Lt : Area to rotate the ship (πr ^2

n : Maximum number of ships anchored (units)

π : 3.14

l : Average vessel length (m)

b : Average vessel width (m)

3 : Constants

r : Longest ship size (m)

2.5 Depth of port pond

D = d + 1/2 H + S + C.....................................(8)

Description:

D : Water depth (m)

d : Largest draft ship with full load (m)

H : Wave height (m)

S : Transport height of an oncoming vessel (0.1 to 0.3m)

C : Safe distance from the area of the ship to the bottom of the water (0.25m)

3. Results and Discussion

3.1 The Main Fishing Port facilities at PPS Cilacap

The main fishing port facilities were basic fishing port facilities needed to carry out various fishing activities. The main fishing port facilities functioned to ensure the safety, and smooth operation of ships when carrying out mooring, and anchoring activities at fising ports. According to Lubis (2012), some of the main facilities needed by a fishing port were a dock, a port pool, and a breakwater. The following is the layout of the main fishing port facilities at PPS Cilacap in 2016 (Figure 1).

3.1.1 Fishing dock

Cilacap Oceanic Fishing Port had three groups of fish landing docks. Three fish landing docks were group A dock with 10 units, group B dock with 3 units, and group C dock with 3 units. The landing dock for the fish caught at PPS Cilacap was combined with the loading dock for fishing needs. The number and size of the length, and width of the docks can be seen in Table 2.

The total number of landing docks at PPS Cilacap was 16 units. The fish landing dock A was divided into 2, namely A1 and A2, each measuring 42.8 x 4m with 2 units, and measuring 39.4 x 2.7m with 8 units. Fish landing dock B measuring 36 x 4.75m with a total of 3 units.

Table 1. The level of correlation accuracy between variables X and Y

R	Mean
100	Correlation between X and Y variables is perfect
85<=R<100	Correlation between X and Y variables is very strong
70<=R<85	Correlation between X and Y variables is strong
55<=<70	Correlation between X and Y variables is quite strong
40<=<55	Correlation between X and Y variables is weak
R<40	Correlation between X and Y variables is very weak

Description: R (Correlation value).

Table 2. Quantity and size of fish landing quay and loading quay at Cilacap Oceanic Fishing Port in 2016

Type of quay		Size (L x W; m)	Quantity (unit)
Quay A	Quay A1	42.8 x 4	2
	Quay A2	39.4 x 2.7	8
Quay B	Quay B	36 x 4.75	3
Quay C	Quay C1	48 x 5	1
	Quay C2	42 x 5	1
	Quay C3	50 x 5	1
Jumlah		Length : 648,8 m	16

Source: Cilacap Oceanic Fishing Port 2017 (reprocessed).
Description: P (Length), L (Wide), m (meter).

Table 3. Prediction of captured fish production at Cilacap Oceanic Fishing Port in the next 10 years

Years	Prediction of captured fish production (ton/month) $\hat{Y}$ = 7,365621x + 566,828945		
	(Ton/year)	(Ton/month)	Growth (%)
2018	15,861.661	1,321.805	-
2019	16,922.311	1,410.193	6.69
2020	17,982.960	1,498.580	6.27
2021	19,043.609	1,586.967	5.90
2022	20,104.259	1,675.355	5.57
2023	21,164.908	1,763.742	5.28
2024	22,225.558	1,852.130	5.01
2025	23,286.207	1,940.517	4.77
2026	24,346.857	2,028.905	4.55
2027	25,407.506	2,117.292	4.36
Range:			
Minimal	15,861.661	1,321.805	4.36
Maximal	25,407.506	2,117.292	6.69
Average	20,634.584	1,719.549	5.38

Decription: $\hat{Y}$ (The Prediction linier regression equation of captured fish production).

The fish landing dock for C was divided into 3, namely C1, C2, and C3, each measuring 48 x 5m of 1 unit, 1 unit of 43 x 5m, and 1 unit of 50 x 5m. In addition to the fish landing dock, there was also a report dock that functioned to land ships wishing to report administrative matters to PPS Cilacap. In general, the condition of all docks at PPS Cilacap was in good status and could function properly (PPS Cilacap, 2017b).

3.1.2 Fishing Pool

The Cilacap Oceanic Fishing Port had a port pool of 3 units, namely pool A, pool B, and pool C. Pool A had an area of 7.4 hectares with a depth of 1 to 3 meters below the water surface. Pond B had an area of 3.6 hectares with a depth of 0.5 to 1.5 meters below the water surface. Pond C had an area of 4.5 hectares with a depth of 2 to 3 meters below the water surface. Under these conditions, the port pool at PPS Cilacap could be entered by ships ranging in size from > 5 GT to 200GT vessels (PPS Cilacap, 2017b).

3.2 Availability of catched fish production at PPS Cilacap

The production of fish caught could be used as an indication of the productivity of a fishing port, so fish catched production data must be accurated. The production of catch fish which continued to increase every year indicated that a fishing port had good productivity. The productivity of a port would also affect the development of a fishing port. (Velazquez *et al.*, 2008). A fishing port could be said to be developing if it had ever-increasing productivity.

3.2.1 The development of the availability of the volume of production of monthly catch landed at PPS Cilacap in 2008-2015

The development of the volume availability of fish caught monthly in PPS Cilacap in 2008-2015 was illustrated by the linear regression analysis model equation on the data that had been cleaned and moving average for 11 months (Figure 2). The calculation of the regression equation for the monthly catch fish product ion produced a prediction equation $\hat{y}$ = 7,365621x + 566,828945 [$\hat{y}$ = volume of fish production landed per month (tones); x = time index month, years 2008- 2015; 11 month moving average data]. This equation illustrated that each additional number of x = 1 month would increase the volume of landed fish production by $\hat{y}$ = 7,365621 tons per month. The closeness relationship between the variable landed fish production (y) tones and time index (x) was expressed by the correlation coefficient r = 0.86 which meant it had a very strong correlation. The calculation of this linear equation produced an estimated standard error value (SEE) of 10.34% which meant that the prediction error value was relatively small so that the prediction model could be said to be quite good. The smaller the SEE value, the more accurate the regression model was in predicting the dependent variable (Janie, 2012)

3.2.2 Prediction of the volume availability of fish caught at PPS Cilacap in the next 10 years

The predicted volume of fish production landed at PPS Cilacap during the period 2018-2027 had increased every year. The volume of catch fish production in 2018 was predicted to be 15,861,661 tons, and would increase to 20,124,259 tons in 2022, and 25,407,506 tons in 2027. The average increase in the volume of fish production landed at PPS Cilacap during the period time 2018-2027 was 20,634,584 tons per year or the equivalent of 1,719,549 tons per month (Table 3).

The increase in the production volume of fish caught per year as predicted above was in line with the percentage growth in production volume which had increased every year for the next 10 years in the same period. The growth in the volume of caught fish production at PPS Cilacap in 2018 was predicted to increase by 6.69% from the previous year, in 2022 and 2027, increasing by 5.57%, and 4.36% respectively from the previous year.

The calculation of the predicted volume of fish production at PPS Cilacap was intended to determine the production volume of fish caught in the year 2022-2027, to find out the needs of basic facilities for the dock, and port pond at PPS Cilacap for the next 5-10 years. The volume of catch fish production that continued to increase must be balanced with the increase in basic facilities so that fishery activities at PPS Cilacap could take place properly.

The prediction data in Table 3 needed to be considered the accuracy of the statistical data on the production of fish caught at the fishing port. This was also stated by Paramita (2018) that there was a mismatch between the data of the fish caught on land at the Cilacap oceanic fishing port with the caught fish recorded on the fishing logbook sheet. Logbook filling that was not done on board when fishing was a factor in the existence of a very large data deviation value, which ranges from 3.4-62.1% with a data accuracy rate of 37.9 -96.6%. In European countries such as France and Belgium, electronic devices were always used in filling logbooks, weighing, and sorting fish before auctioning fish at fish auction places (TPI) so that the weight of fish caught was recorded automatically, and accurately (Bradley *et al.*, 2019). Fish auction place was a fish marketing system that must be carried out in European countries (Bigot *et al.*, 2008).

3.3 Development of basic facilities at PPS Cilacap

Basic facilities were essential facilities needed by a fishing port so that port activities could run smoothly. The main fishing port facilities could also be related to the success of a fishing port in facilitating various port activities. This was also reinforced by the opinion of Lubis (2012) which stated that the implementation of port functions optimally could be used as an indicator of the success of a fishing port. According to Fujita *et al.*, (2014) efforts to develop basic fishery port facilities were important in optimizing the function of fishing ports in the future. The development of facilities would also have a positive impact on improving fishermen's welfare and regional economic development (Rosana and Prasita, 2016).

3.3.1 Development of the number of fishing fleets at PPS Cilacap in 2005-2013

The fishing fleet at PPS Cilacap had an increasing trend from 2005 to 2013. The increase in the number of fishing fleets is presented in graphical form in Figure 3.The development of the fishing fleet at PPS Cilacap had fluctuated with an increasing trend from year to year since 2005 until 2013. The number of fishing fleets in 2005 was 680 units, and reached 750 units in 2013. The average increase in the number of fishing fleets at PPS Cilacap was 1.33% annually.

The calculation of the fishing fleet regression equation at PPS Cilacap produced the equation ŷ = 15.033x - 29460 (ŷ = fishing fleet per year at PPS Cilacap (unit); x = year). The closeness of the variable fishing fleet (y) and time (x) was strong which was indicat- ed by the correlation coefficient r = 0.75. The estimated standard error (SEE) obtained in this equation was 8.56 which meant good.

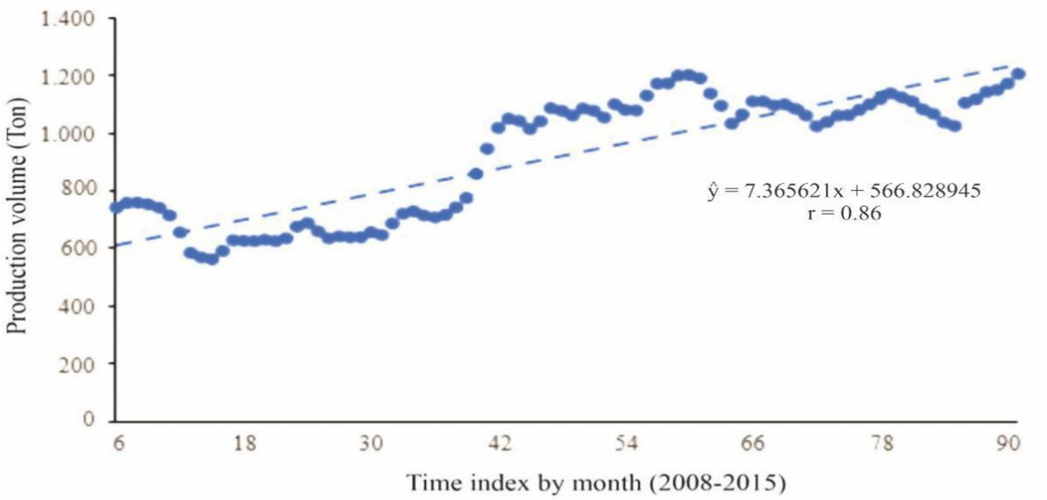

Figure 2. Growth and linier regression equation of captured fish production volume by month at Cilacap Oceanic Fishing Port in 2008-2015.

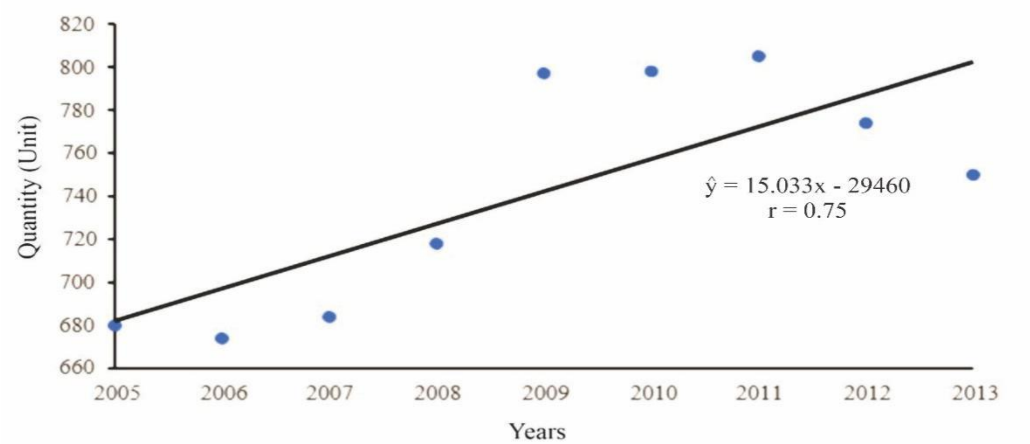

Figure 3. Growth and linier regression equation of fishing vessel quantity by years at Cilacap Oceanic Fishing Port in 2005-2013.

Table 4. Prediction of fishing vessels quantity at Cilacap Oceanic Fishing Port in 2018-2027

Years	Prediction of fishing vessels quantity in 2018-2027 $\hat{Y}$= 15.033x -29460	
	Quantity (unit)	**Percentage growth (%)**
2018	877	-
2019	892	1.7
2020	907	1.7
2021	922	1.7
2022	937	1.6
2023	952	1.6
2024	967	1.6
2025	982	1.6
2026	997	1.5
2027	1.012	1.5
Range:		
Minimal	876.594	1.5
Maximal	1,011.891	1.7
Average	944.242	1.6

Description: $\hat{Y}$ (The Prediction linier regression equation of fishing vessels quantity in 2018-2027).

Table 5. Need for quay and bassin at Cilacap Oceanic Fishing Port in 2016

Type of main facilities	Size in 2016	Size needs	Difference/needs for additional
Length of quay landed (m)	648.8	1,322.4	673.6
Large of bassin (m^2)	155,000	159,596	4,596
Depth of bassin (m)	-2.5	-4.1	-1.6

Table 6. The need prediction of quay fish landing length at Cilacap Oceanic Fishing Port in 2022 and 2027

Type of main facilities	Size needs		
	The year 2022	**The year 2027**	**Difference/needs for additional**
Length of quay landed (m)	1,351.2	1,380.1	29
Large of bassin (m^2)	221,857	239,612	17,755
Depth of bassin (m)	-4.1	-4.1	-

3.3.2 Prediction of the number of fishing fleets at PPS Cilacap in 2018-2027

The prediction of the number of fishing fleets at PPS Cilacap in 2018-2027 was calculated using the application of the linear regression formula resulting in the equation $\hat{y}$ = 15.033x – 29.460.This equation illustrated that each additional number of x = 1 year would increase the fishing fleet by $\hat{y}$ = 15.033 units per year. The prediction of the number of fishing fleets at PPS Cilacap in 2018-2027 can be seen in Table 4.

The calculation results showed an increase in the number of fishing fleets from 2018 to 2027. The number of fishing fleets was predicted to reach 877 units in 2012, and would increase to 937 units in 2022 or an increase of 6.7% from 2018. Increasing the number of fishing fleets fish also continued to occur, reaching 1,021 units in 2027 or an increase of 7.8% from 2022. The overall increase in the number of fishing fleets at PPS Cilacap in 2018-2027 was predicted to reach 14.5%. The fishing fleet played an important role in supplying fish production in a fishing port (Lubis, 2012).

The increasing number of fishing fleets that land the fish caught in a fishing port has resulted in an increase in the production of fish caught at the port. The increase in the number of fishing fleets that land captured fish at fishing ports must be balanced with the development of basic facilities at fishing ports such as docks, and port ponds.

The increase in the number of fishing fleets each year at PPS Cilacap had resulted in the potential for increased fish production every year. The increased production of fish caught every year implied an increase in the length of the landing dock, the area and depth of the port pond at PPS Cilacap, so that the landing process of the fish caught could run smoothly. This was supported by the statement of Suherman (2011) which stated that the development, construction, and management of fishing ports was one of the indicators for the success of capture fisheries development.

The development of basic facilities at a port could be an indication that the port was experiencing improvement. Yusrini (2016) stated that the development of a fishing port, and port pond caould encourage the development of a fishing port as a whole. This was in accordance with the statement of Syahputra (2015) which stated that the development of basic facilities at fishing ports, namely docks and port ponds, could generally affect the development of a fishing port.

3.3.3 Adequacy of basic facilities at PPS Cilacap

Adequacy of basic facilities at a fishing port was necessary so that fish landing activities in a port could be carried out properly. The adequacy of the length of the dock as well as the depth, and area of the port pond had an impact on the smooth landing of the fish caught (Lubis, 2012). The lack of length of the fish landing dock can hamper the fish landing process, marked by a queue of ships that will land the fish. The lack of width and depth of the port pool could have an impact on ships entering the port area. A port pond that was too shallow would also make it difficult for ships with large sizes to land the fish they catch. This was supported by Sciortino (2010) which stated that the size of fishing ports and the infrastructure in them greatly affects the way and speed of exploitation of fish resources in a country.

a. The adequacy of the dock and port pool at PPS Cilacap in 2016

The landing dock for fish caught at PPS Cilacap in 2016 was 648.8 meters long (PPS Cilacap, 2017b). After calculating the landed fish production volume approach, it could be seen that the need for a fish landing dock at PPS Cilacap in 2016 was 1,322.4 meters long. Thus it can be seen that in 2016 the PPS Cilacap had a shortage of dock length of 673.6 meters.

The condition of the port pool at PPS Cilacap in 2016, which had an area of 155,000 m2, and had a depth of 2.5 m below the water surface (PPS Cilacap, 2017b). After calculating the number of ships using the dock (formula 3 and 4), the port pool requirement at PPS Cilacap required an area of 159,596 m2 with a depth of 4.1 meters below the water surface (Table 5).

Based on Table 5, it could be seen that the difference between the current port pool area in PPS Cilacap, and the pool area based on the calculation was 307,613 m2. The difference between the current port pool depth in PPS Cilacap, and the calculated port pool depth was -1.6 meters. This indicated that the additional pool area of 4,596 m2 with an additional depth 1.6 meters below the water surface were essentially needed. The same thing was also in accordance with the Regulation of the Ministry of Fisheries and Marine Affairs Number PER.08 / MEN / 2012 which stated that type A ports (PPS) must at least had a port pool depth of -3 below the water surface (KKP, 2012).

The increase in the capacity of basic facilities in the form of the length of the dock, and the width and depth of the port pond aims to make the landing process of the fish caught ran smoothly. Increasing the capacity of basic facilities would also increase port utility which would attract fishing vessels to make landings (Sampathkumar and Vanjinathan, 2015). Jackson *et al*., (2013) stated that the fish landing dock was the center of the fishing fleet. This required that the fish landing dock must be in its ultimate condition so that there were no problems with the fishing fleet such as collisions between fishing fleets, and also difficult access to the landing dock due to insufficient dock capacity. Syahputra (2015) stated that sufficient capacity of the dock, and port pool could have a positive impact on the ease of carrying out the fish landing process.

b. Prediction of the need for docks and port pools at PPS Cilacap in 2022 and 2027

The prediction of the length of the fishing landing dock, the area and depth of the port pond at PPS Cilacap in 2022 and 2027 was calculated using the length formula of the dock with the approach to the volume of fish production in formulas (1), (2), (3), and data on the volume of fish catch production and fishing fleet in 2022, and 2027. The results of these calculations can be seen in Table 6.

Required length of the fish landing dock; The width and depth of the port pool at PPS Cilacap in 2022, and 2027 are predicted to increase. The predicted requirement for the length of the fishing landing dock in 2022 is 1,351.2 meters. The difference in the length of the dock from 2022 is 28.8 meters. The need for the length of the landing dock for fish caught at PPS Cilacap continues to increase until it reaches 1,380.1 meters in 2027. The need for the port pool area at PPS Cilacap in 2022 is 221,857m², and continued to increase to reach 17,755 m² in 2027, the required port pool depth in 2022, and 2027 was -4.1 m.

The calculation of results showed that it is necessary to increase the area, and depth of the port pool in 2022, and 2027. The required additional port pool area is 62,261m². The need for additional fishing port pool area in 2027 is 17,755m² from 2022. The total need for additional port pool area at PPS Cilacap until 2027 is 80,016m².

The addition of the capacity of the fishing landing dock, and the depth and area of the port pond is needed, so that the fish landing activity is not disturbed, such as queues of ships and ships that cannot enter the port pond during tides. In addition, services from the port that are not optimal also have an impact on how long the ship takes to land the fish it catches. Lubis and Mardiana (2011) stated that the greater the size, and number of fishing fleets, the need for fish landing docks, and the depth of port ponds would also increase so that ships could lean. This is supported by the statement of Paulauskas (2016) which stated that the condition of the dock which was suitable for the fishing fleet was very important so that there is no damage to both the ship and the dock itself.

The width and depth of the port pool at PPS Cilacap in 2016 was no longer in accordance with its capacity if there was no addition of the area or depth of the port pool, so that it would have an impact on the difficulty of large ships to dock and land the fish caught. This was supported by the statement of Sharaan *et al.,* (2017) that the condition of the port pond which was silting was a problem that made it difficult for fishing fleets to enter the port pool area. In addition, inadequate facilities could also cause damage to these facilities because they exceed their capacity (Uda *et al.,* 2015). This was in line with the statements of Yusrini (2016), Le Ry (2005) which stated that the increase in the use of docks, and port pools if they were not matched by adequate capacity of docks and port pools, it would increase the risk of damage to the dock and port pool.

4. Conclusion

In 2016 PPS Cilacap had 16 fish landing docks with a total length of 648.8 m, while the port pool area was 155,000 m2 with a depth of -2.5 m. The prediction of the length of the dock in 2022 is 1,351.2 m or requires the addition of a dock of 702.4 m, while the prediction of the length of the dock in 2027 is 1,380.1m or requires the addition of a dock of 731.3m from 2016. The port pool in 2022 is 221,857m^2, while in 2027 it will reach 239,612m^2 or requires an additional port pool area of 84,612m^2 from 2016. The need for a port pool at PPS Cilacap until 2027 is -4.1 m. The volume of catch fish production in 2022, and 2027 is predicted to increase to 20,104,259 tons each with an average growth of 5.38% per year.

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Authors' Contributions

All authors have contributed to the final manuscript. The contribution of each author as follow, Pujiono; collected the data, drafted the manuscript, and designed the figures. Ernani devised the main conceptual ideas, and critical revision of the article. All authors discussed the results, and contributed to the final manuscript.

Conflict of Interest

The authors declare that they have no competing interests

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