Eco-Fishing Port Assessment Model as an Environmental Management Tool on Coastal Fishing Port ‘Pondokdadap’ - Indonesia

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Abstract—To manage fishery resources in Indonesia with the principle of sustainability, it is necessary to apply the eco-fishing port concept. This study aims to develop a model for assessment of eco-fishing port with prevailing conditions and regulations in Indonesia. From the model that prepare, the application on Coastal Fishing Port (PPP) Pondokdadap has result value of the eco-fishing port is 67, with details of ecological indicator value 58, fishing indicator value 69 and port indicator value 76. The value indicates that PPP Pondokdadap has not met the criteria of eco-fishing port conformity (value 80-100) and in the process of applying the fishing port management principle of environmentally friendly. The non-fulfillment of these criteria is due to the environmental regulations not implemented properly, or the level of compliance under 100%. From the indicators obtained a fishing port environmental management index (FEMI) this study developing a model of eco-fishing port management, which use as a tool to check the fishing port environmental management development. Increased FEMI values will show that improvements in ecological, fishing, and port indicators to fulfill eco-fishing port assessment standards.

Index Terms—eco-fishing port, environmental management, indicator, PPP Pondokdadap.

I. INTRODUCTION

Fishing Port in Indonesia has economic and government functions, with activities consisting of a ship docked, storing and processing facilities for fishery products and related fishery activities [1]. Coastal Fishing Port (PPP) Pondokdadap is producing the best line tuna in Indonesia and has the potential of fishery products for domestic and export [2]. However, the potential of this fishery needs to get special attention in the management so fisheries resources remain sustainable. This step needs according to research on Catch Per Unit Effort (CPUE) 2013-2015 in PPP Pondokdadap which shows decreasing result of more than 25% in 1 year, and show that the use of tuna is overfishing [3]. In managing the potential of fisheries, the Ministry of Marine Affairs and Fisheries (MMAF) implemented a food security guarantee program throughout the production chain to support and improve fishery products quality. This step pursued by applying a good fishing port management fishery and environmental resources use [4]. Port management links to the role of ports that support regional economic development through goods distribution from the supply side of port facilities and infrastructure [5]. Environmental friendly port infrastructure development includes the implementation methods and materials used, and the wastewater treatment facility is the key to port environmental management in the pre-operational stage [6].

The ports and their activities are very vulnerable in causing environmental damage, to overcome this condition the port must have good and measurable environmental management [7]. The international issue states that the environmental impacts of port activities and maritime activities are increasing. Therefore, it is necessary to manage ports, especially small-scale ports. To carry out the program, need a tool to manage environmental impacts by applying environmental management principles [8]. The main aspect of port environmental management in addressing environmental concerns is regulatory compliance. This base on the first step of the environmental management system being implemented is the policies formula in providing protection to the port environment [9]. To support policies and regulations implementation, need a tool of a port environment with science-based management, systematic, and proper approaches [10].

Tools and methods of environmental monitoring have been developed, one of which is Environmental Performance Indicators (EPI) for port operational monitoring (eg. noise, dust, energy consumption, and dredging), port management (service and compliance), and environmental conditions (eg. water, air, and sediment) [11]. In addition, ports in European countries have also developed tools that help port authorities in assessing significant aspects and levels of environmental management of ports [10]. In terms of environmental management, the main components implemented by most ports in Europe are environmental managers appointment, the formulation of environmental policies, and environmental monitoring activities [12]. In addition, environmental management carries out by implementing ISO 14001. Implementation of ISO 14001 on ports will cut the risk of negative environmental impacts of ports, improve fishery products
quality, increase export potential of fishery products and improve environmental conditions of fishing ports [13]. Referring to the concept of eco-port used in Europe, fishing ports in Indonesia require adjustments to apply this concept. This is due to differences in characteristics, types of commodities, and port managers in Indonesia. Even though different of the condition, the key to port environmental management is the port authority must be committed and actively realize sustainable development in plan and action [14].

With the above conditions, it is necessary to develop the eco-fishing port model in Indonesia. Since port management on the environmental issue is heavily dependent on prevailing policies and regulations taking into account the economic, commodity, geographical, cultural, characteristic, and local community backgrounds [7]. Development of the eco-fishing port model bases on environmental indicators of fishing port and regulation on the port, environment, health, and fishery activities. This condition is under the Indonesian National of Standard on the Environmental Management System, which explains that the management of an organization must take into account the requirements of legislation and other provisions related to the environment [15]. The purpose of this research is to develop eco-fishing port assessment model in Indonesia, indicators, and index of environmental management in accordance with the fishing port condition in Indonesia that can be used as an environmental management tool.

II. Method

The research on the eco-fishing port assessment model as an environmental management tool on PPP Pondokdadap used a quantitative approach. This research was conducted from January to April 2018. There are six steps taken in this study, namely: 1) Eco-port and fishing port literature study, 2) Environmental regulation collection and review, 3) Data collection related to the environmental activities, impacts, and aspects of the fishing port by survey, 4) Eco-fishing port assessment model preparation, 5) Determining eco-fishing port assessment model, and 6) Apply and compare assessment results with European standards.

Assessment model use matrix and questionnaire forms that adjusted to the condition and regulation of fishing ports in Indonesia (Fig. 1 and Table V). The eco-fishing port assessment model matrix and questionnaires fulfillment was addressed to the PPP Pondokdadap managers, Fisheries Supervisors, and Non-Government Organizations through interviews and data comparison of literature and survey results. The questionnaire fulfillment and interviews were only conducted by the respondents who were directly engaged in the fishing port environment management.

III. Result and Discussion

In preparing an eco-fishing port model in Indonesia, an appropriateness of approaches between environmental management system standards (ISO 14001) for environmental regulations and policies is adapt. This is because the environmental management system has become one of the main tools used by companies to discuss environmental aspects and the impact of their activities on the environment [16]. With an environmental management, activities that occur can control not to pollute the environment and conserve natural resources [17].

A. Identification of fishing port manager

Fishing ports in Indonesia are almost entirely managed by the government, both central and local governments. Data from the Directorate General of Capture Fishery MMAF shows that only 2 fishing ports managed by private parties from a total of 816 fishing ports in Indonesia [18]. This condition indicates that the government as the primary stakeholder and the main authority of fishing port management in terms of policy determination, authority control, priority setting and condition [9].

| TABLE I | THE CONDITION OF FISHING PORTS IN INDONESIA |
|---------|---------------------------------------------|
| Port Status | Fishing Port Classification | Private | Amount |
| PPS | PPN | PPP | PPI |
| Operated | 6 | 14 | 44 | 581 | 2 | 647 |
| in | | | | | | |
| Preparation | | | | | | |
| not Active | 1 | 41 | | 42 | | |
| Total | 6 | 14 | 45 | 749 | 2 | 816 |

Source: Strategic Plan of Directorate General of Capture Fisheries 2015-2019

Pondokdadap categorized as Coastal Fishing Port (Class C Fishing Port) and able to serve the vessel up to the size of 48 GT and become a fisheries business center in the southern region of East Java. PPP Pondokdadap located in Sendangbiru Sub Village, Tambakrejo Village, Malang Regency - East Java, that managed by the Government of East Java Province.

B. Preparation of eco-fishing port assessment model

The preparation of eco-fishing port model is in line with the applicable port environmental regulations in Indonesia, with the procedures taken are 1) determination of indicators, 2) regulation collection and review, and 3) preparation of the model and assessment.

1. Determination of indicator

The main indicators used as a reference in the fishing port management of environmentally friendly are ecological indicators (eco), fishing activities (fishing) and port management (port).

| TABLE II | DETERMINATION OF THE MAIN INDICATORS OF ECO-FISHING PORT MANAGEMENT |
|-----------|---------------------------------------------------------------|
| Ecology Indicator | Environmental documents | Environmental monitoring |
| Fishing Indicator | Fishing and processing | Vessels |
| Port Indicator | Port facilities | Port management |

Source: Analysis result (2018)
2. Environmental regulation collection and review

Regulations in Indonesia that related with the environment inventories based on components to environmental management of fishing ports. From the inventory will be known regulations that discuss the ecological, fishing, and port indicators then arranged in the form of a matrix in Table III.

| No | Indicator | Regulation |
|----|-----------|------------|
| A  | Ecology   |            |
| 1  | Pollution control          | Minister of Environmental Decree (MED) Number 3 of 2014 |
|    | Waste management           |            |
| 2  | Environmental management documents (Environmental Impact Assessment) | MED Number 05 of 2012 |
| 3  | Environmental permit document | Government Regulation of the Republic of Indonesia Number 27 of 2012 |
| 4  | Suitability of spatial and regional plans | Government Regulation of the Republic of Indonesia Number 26 of 2008 |
| 5  | Suitability of masterplan  | Minister of Marine and Fisheries Decree (MMAFD) Number 45/KEPMEN-KP/2014 |
| 6  | Water quality monitoring   | MED Number 115 of 2003 |
|    | Water pollution index activity | MED Number 51 of 2004 |
| 7  | Air quality monitoring     | MED Number KEP-45/MENLH/10/1997 |
|    | Air pollution index activity | Bappedal Decree Number KEP-107/KABAPEDAL/11/1997 |
| 8  | Cleanliness of area monitoring | Law number 18 of 2008 (garbage management) |
|    |                         | MED Number 01 of 2013 |
| 9  | Green Open Space monitoring | Minister of Public Work Decree Number 05/PRT/M/2008 |
|    |                         | MED Number 01 of 2013 |
| 10 | Fisherman monitoring      | Government Regulation Number 33 of 2013 |
|    |                         | East Java Government Regulation Number 3 of 2016 |
| 11 | Ship waste management     | MED Number 05 of 2009 |
| 12 | Port development          | Law number 1 of 2014 |
| 13 | Energy consumption        | Minister of Transportation Decree Number KP. 201 of 2013 |
| 14 | Pollution controlling and prevention | Law number 32 of 2009 |
| B  | Fishing                 |            |
| 1  | Quality of fisheries products  | MMAFD Number 45 of 2014 |
| 2  | Quality assurance and food security | MMAFD Number 52A/KEPMEN-KP/2013 |
| 3  | Fishing licenses          | Law number 45 of 2009 (fisheries) |
|    | Fake fishing monitoring   |            |
|    | Fishing port management   |            |
| C  | Port                    |            |
| 1  | Fishing port facilities   | MMAFD Number PER.08/MEN/2012 |
| 2  | Fishing port management and services | Law number 45 of 2009 (fisheries) |
| 3  | Fishing port equipment, health, security and safety | Minister of Health Decree Number 44/2014 |

Source: Analysis result (2018)

3. Preparation of the model and assessment

The inventoried regulations preparation based on the ecology, fishing, and port indicators, assessment based on applicable regulations and compliance with specified requirements. This model compiles in the form of simple application tools with formulas, so the results of the assessment will automatically be known after the form provided fully fill.

Fig. 1. Eco-fishing port assessment model

C. PPP Pondokdadap’s Eco-fishing port Assessment

From the analysis results of applying eco-fishing port assessment model in PPP Pondokdadap (Table IV) obtained value 67, which means the condition of fishing port management in PPP Pondokdadap included in the categories "towards" eco-fishing port implementation. The
non-fulfillment of eco-fishing port standard is in PPP Pondokdadap, due to non-fulfillment of the requirements on the applicable regulations. The existence of a mismatch between the implementation of the regulations and the policies and activities carried out also causes the incorrect port environmental management [19].

**TABLE IV**

| Assessment result | Eco-fishing port assessment |
|-------------------|----------------------------|
| Total             | 67                         |
| Eco-indicator     | 58                         |
| Fishing indicator | 69                         |
| Port indicator    | 76                         |

**TABLE IV**

| Eco-fishing port assessment on PPP Pondokdadap |
|-----------------------------------------------|
| Assessment result | Eco-fishing port assessment |
|-------------------|----------------------------|
| Total             | 67                         |
| Eco-indicator     | 58                         |
| Fishing indicator | 69                         |
| Port indicator    | 76                         |

Discussion about the value of eco-fishing port assessment at PPP Pondokdadap on all indicators is seen in Table V.

**TABLE V**

| No | Indicator                           | Cause activity                                  | Information |
|----|-------------------------------------|-------------------------------------------------|-------------|
| A  | Eco                                 | Ship waste pollution into sea water             | Minister of Environmental Decree Number 05 of 2009 |
|    |                                     | Wastewater treatment not operated               | Law Number 32 of 2009 |
|    |                                     | Are not done                                    | Minister of Environmental Decree Number 115 of 2003 |
|    |                                     |                                                  | Minister of Environmental Decree Number 51 of 2004 |
|    |                                     | Are not done                                    | Minister of Environmental Decree Number KEP-45/MENLH/10/1997 Bappedal Decree Number KEP-107/ KABAPEDAL/11/1997 |
| B  | Fishing                             | Uncompleted requirements                        | Minister of Marine and Fisheries Decree Number 52A/KEPMEN-KP/2013 |
|    |                                     | Uncompleted requirements                        | Minister of Marine and Fisheries Decree Number 52A/KEPMEN-KP/2013 |
|    |                                     | Uncompleted requirements                        | Minister of Marine and Fisheries Decree Number 52A/KEPMEN-KP/2013 |
|    |                                     | Uncompleted requirements                        | Minister of Marine and Fisheries Decree Number 52A/KEPMEN-KP/2013 |
|    |                                     | Uncompleted requirements                        | Minister of Marine and Fisheries Decree Number 52A/KEPMEN-KP/2013 |
| C  | Port                                | No temporary dump site, Lack of garbage management facilities, Irregular schedule of garbage management, No Reuse Reduce, Recycle activity | Minister of Health Decree Number 44 of 2014 |
|    |                                     | Are not done                                    | Minister of Health Decree No. 44 of 2014 |
|    |                                     | Lack of facilities                              | Minister of Health Decree No. 44 of 2014 |
|    |                                     | Inadequate and separate                         | Minister of Health Decree No. 44 of 2014 |
|    |                                     | Are not done                                    | Minister of Health Decree No. 44 of 2014 |
|    |                                     | Inadequate and not fulfill the requirements     | Minister of Health Decree No. 44 of 2014 |
|    |                                     | CCTV is not operated Inadequate security        | Minister of Health Decree No. 44 of 2014 |

Source: Analysis result (2018)

**D. Environmental priorities of the fishing port**

Based on the results of significant environmental aspect analysis and eco-fishing port assessment in Pondokdadap, it is found that the order of environmental aspects should be a priority in port management (Table VI). These results compare with the European Sea Ports Organization's environmental priorities to decide whether environmental sustainability is the same.
The environmental priority of fishing port at PPP Pondokdadap in 2018 has some similarities to the priorities of ports in Europe by 2017 and only 1 priority in 1996 [20]. However, it differs in the priority and priority sequences of employment absorption that exist only in fishing ports. This happens because, at fishing port, fishing activity is affected by the natural reason, that is a fish season. At the time of not the fish season, there will be a drastic decrease in employment and activities that occur in the port.

**E Fishing port environmental management index**

From the eco-fishing port assessment model known as the environmental management indicators that figure fishing port management position that compliance with eco-fishing port standards. This indicator is a reference for evaluating the environmental management indicators that figure fishing port management position that compliance with eco-fishing port standards. In addition, the increase/decrease of this indicator is used for assessment of the fishing port management by the government. In addition, environmental management index (FEMI) which conducts the index value of (1.15 - 0.36) / year, if continuous improvement of environmental management indicator is done then, predicted of Pondokdadap FEMI value achievement above 7 will be achieved within 5 years.

FEMI= $Ax1.5 + Bx1 + Cx0.75 + Dx0.75 + Ex1 + Fx1.25 + Gx1 + Hx1 + Ix1 + Jx0.75$  
(1)

The calculation results of PPP Pondokdadap Fishing Port Environment Management Index (FEMI) in 2018 are: FEMI= $0x1.5 + 100x1 + 87x0.75 + 100x0.75 + 90x1 + 54x1.25 + 58x1 + 54x1 + 83x1 + 0x0.75$  

FEMI = 5.93

From PPP Pondokdadap’s FEMI calculation, the value in 2018 is 5.93, but the improvement of environmental performance will be known in the next index assessment (2019, etc.). This is because the new FEMI is compiled and implemented in 2018 so that evaluation cannot be done. To provide an overview of the conditions of the environmental management index, the FEMI value of the PPP Pondokdadap compare with the average value of the environmental management index of 91 ports in Europe from the compliance of its environmental management indicators (Table VIII). With the analysis of the increase of the index value of (1.15 - 0.36) / year, if continuous improvement of environmental management indicator is done then, predicted of Pondokdadap FEMI value achievement above 7 will be achieved within 5 years.
represent the characteristics of different between fishing ports with public ports. From the eco-fishing port assessment model that applies to PPP Pondokdadap knowing port management categories is towards eco-fishing port. This means that port managers are still improving the port environmental management system to comply with eco-fishing port standards and improving compliance with the prevailing regulations in Indonesia.

Through the eco-fishing port model are also obtained an index of fishing port environmental management (FEMI) that can use to check and evaluate port environmental management performance development. According to the research result, the eco-fishing port assessment model can use as a tool for environmental management on fishing ports in Indonesia.

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