

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 handline 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

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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		
in Preparation				127		127
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	Fishing Indicator	Port Indicator
Environmental documents	Fishing and processing	Port facilities
Environmental monitoring	Vessels	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.

TABLE III
A MATRIX OF INDICATORS AND COMPLIANCE OF RULES FOR ECO-FISHING PORT ASSESSMENT MODEL

No	Indicator	Regulation
A Ecology		
1	Pollution control Waste management	Minister of Environmental Decree (MED) Number 3 of 2014
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 Water pollution index activity	MED Number 115 of 2003 MED Number 51 of 2004
7	Air quality monitoring Air pollution index activity	MED Number KEP-45/MENLH/10/1997 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 Illegal fishing monitoring Fishing port management	Law number 45 of 2009 (fisheries)
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.

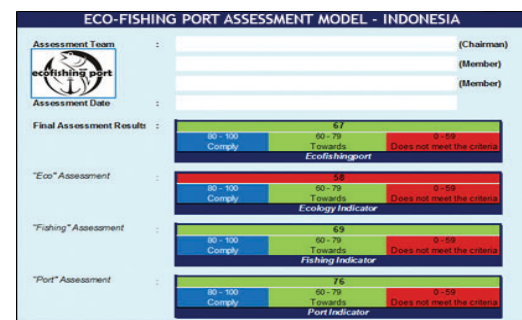


Fig. 1. Eco-fishing port assessment model

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
THE RESULTS OF THE ECO-FISHING PORT ASSESSMENT ON PPP PONDOKDADAP

Assessment result		Eco-fishing port assessment	
Total	67	standard	
Eco-indicator	58	Comply	80-100
Fishing indicator	69	Towards	60-79
Port indicator	76	Doesn't meet the criteria	0-59

Source: Analysis result (2018)

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

TABLE V
DISCUSSION OF PPP PONDOKDADAP'S ECO-FISHING PORT ASSESSMENT

No	Indicator	Cause activity	Information
A Eco			
1	Ship waste management	Ship waste pollution into sea water	Minister of Environmental Decree Number 05 of 2009
2	Wastewater treatment monitoring	Wastewater treatment not operated	Law Number 32 of 2009
3	Water quality monitoring	Are not done	Minister of Environmental Decree Number 115 of 2003 Minister of Environmental Decree Number 51 of 2004
4	Air quality monitoring	Are not done	Minister of Environmental Decree Number KEP-45/MENLH/10/1997 Bappedal Decree Number KEP-107/KABAPEDAL/11/1997
B Fishing			
1	Vessels	Uncompleted requirements	Minister of Marine and Fisheries Decree Number 52A/KEPMEN-KP/2013
2	Handling, storage, and fishing processing	Uncompleted requirements	Minister of Marine and Fisheries Decree Number 52A/KEPMEN-KP/2013
3	Fishing tools and distribution	Uncompleted requirements	Minister of Marine and Fisheries Decree Number 52A/KEPMEN-KP/2013
4	Fish auction condition and operation	Uncompleted requirements	Minister of Marine and Fisheries Decree Number 52A/KEPMEN-KP/2013
C Port			
1	Garbage management	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
2	Monitoring of food producing	Are not done	Minister of Health Decree No. 44 of 2014
3	Facilities of health and safety	Lack of facilities	Minister of Health Decree No. 44 of 2014
4	Restroom condition	Inadequate	Minister of Health Decree No. 44 of 2014
5	Drainage	Inadequate and separate	Minister of Health Decree No. 44 of 2014
6	Health and safety socialization	Are not done	Minister of Health Decree No. 44 of 2014
7	Health and safety	Inadequate and not fulfill the requirements	Minister of Health Decree No. 44 of 2014
8	Security	CCTV is not operated Inadequate security operation	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.

TABLE VI
COMPARISON OF ENVIRONMENTAL PRIORITIES OF FISHING PORT WITH ESPO

No	1996 ESPO	2017 ESPO	2018 Fishing port
1	Marine side development	Air quality	Garbage
2	Water quality	Energy consumption	Employment absorption
3	Dredging waste	Noise	Water pollution
4	Dredging operation	Water quality	Ship waste production
5	Dust	Dredging operation	Liquid waste production
6	Terrestrial side development	Garbage	Marine ecosystem degradation
7	Land pollution	Terrestrial side development	Air pollution
8	Loss of habitat	Social interaction	Sediment
9	Traffic volume	Ship waste	Energy consumption
10	Industrial waste	Climate change	Noise

Source: Analysis result (2018) and ecoports foundation (2017)

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 fishing ports management by the government. In addition, this indicator is used for assessment of the fishing port environmental management index (FEMI) which conducts annually by the government. This FEMI will show whether the government's performance in managing the port is pro-environment or not and the increase/decrease of environmental management performance monitoring every year.

TABLE VII
PPP PONDOKDADAP'S ENVIRONMENTAL MANAGEMENT INDEX

Fishing Port Environmental Management Indicator (FEMI)	Categories	percentage of deployment
A Certification of an environmental management system	<i>Eco</i>	0
B Monitoring of Significant Environmental Aspects	<i>Eco</i>	100
C Completeness of Port Facility	<i>Port</i>	87
D Port Management and Services	<i>Port</i>	100

Fishing Port Environmental Management Indicator (FEMI)	Categories	percentage of deployment
E Environmental Management Documents	<i>Eco</i>	90
F Fishing port Environmental Quality Monitoring	<i>Eco</i>	54
G Management of Fishing Ports (Hygiene, Health, Safety, Security, Order)	<i>Port</i>	58
H Quality Assurance and Safety of Fishery Products	<i>Fishing</i>	54
I Monitoring of Illegal Fishing	<i>Fishing</i>	83
J Environmental audit	<i>Eco</i>	0

Source: Research result (2018)

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

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.

TABLE VIII
COMPARISON ENVIRONMENTAL MANAGEMENT INDEX OF PORTS IN EUROPE AND PPP PONDOKDADAP

Environmental Management Index Value	ESPO		Pondokdadap	
	2013	2016	2017	2018
Percentage increase from the previous year	-	6,48	4,66	-

Source:ESPO (2017) and research result (2018)

IV. CONCLUSION

Fishing ports are ports that have special characteristics related to commodities and their activities. Therefore, an environmentally management of fishing port requires a specific model in its implementation. This research resulted in eco-fishing port assessment model prepared based on the regulations applicable in Indonesia with reference to ISO 14001. With ecological indicators, fishing and ports can

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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