Environmental Insurance Model in the Shipyard Industry

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ABSTRACT— ***The shipyard industry is a capital- and labour-intensive industry, which also supports Indonesia's industrial development. In carrying out its activities, which include shipbuilding and ship repair works, the shipyard industry is challenged by a number of risks, one of the crucial ones being the risk of deterioration of the shipyard environmental quality due to the great number of ships repaired in the docks. Risk management practice in the Shipyard Industry involves transferring risks to manage potential environmental risk threats through the use of Environmental Insurance. Environmental risk transfer analysis is determined by risk analysis factors (risk values), risk estimates (risk characteristics), and environmental insurance modeling (preventive cost & risk-based margin) using SAST (Strategic Assumption Surfacing and Testing) and PPA (Participatory Perspectives Analysis) methods. The results demonstrate that the biggest risk factor – also a driving factor – is the risk of shipyard contamination due to the sandblasting process in a series of activities in ship repair, followed by leverage factors, which are paint wastes, rust, barnacles, and others. The most suitable progressive environmental insurance model for environmental risk transfer within the scope of ship repair suggests the installation of environmentally friendly docks, namely Graving Docks. Water blasting, the use of environmentally friendly anti-fouling paints, or charging preventive costs to stakeholders may be calculated based on the Environmental Insurance premium calculation formula and are charged to ships repaired on such docks.***

Keywords: shipyard, risk management, environmental risk, environmental insurance modeling.

1. INTRODUCTION

Shipyard industry is a capital intensive industry and labor intensive industry who participated in developing industry in Indonesia. It requires sustainable management of the environment, especially in the management of the shipyard as the venue for the shipping industry. Environmental sustainability must be viewed from the perspective of ecological, economic, and social. Ecological perspective is represented by the maintenance of environmental quality in shipyards, the economic perspective is represented by the growth of the shipping industry in the global competition, and social perspective is represented by maintained of savety and health on shipyard workers.

Indonesian shipping industry is currently facing a very thight competition both at national and international level. As a capital-intensive manufacturing industries, labor-intensive and technology-intensive, the shipping industry is expected to have advantages shipyard, job quality, speed of service and competitive prices.

The shipping industry can basically be divided into two major activities, namely ship building and ship repair. The second main activity was always requires a series of process activities that include calculation stage materials, labor, production equipment, infrastructure, cost, and work environment. Besides, a series of processes ongoing activities also involve interaction between the units in the shipyards, supporting industry, external agencies, and the surrounding of natural environment. The series of events that take place in the shipping industry has the possibility of varying risk.

Risk is the likelihood or uncertainties which could potentially generate events/occurences that took effect or consequence, unintended negative on the goals and objectives to be achieved. The risk of losses in the form of physical and non-physical in small, medium, or large scale can disrupt the continuity of the company. [12]

The shipping industry as an entity large-scale industry, faces several risks: (1) Financial risks, such as different of interest rate time to time, level of credit, liquidity of assets; (2) Strategic risks, such as changes in customers, competition, new investment; (3) Operational risks, such as the availability of supply, control accounting, recruitment; and (4) Hazard risks (labor accidents, loss of property, damage to the environment, etc.)

One of the important risk in this research is the risk of environmental degradation in shipyard. Environmental management in activities of shipyard still very low. The shipping industry in Indonesia is still not implementing the process of zero waste, especially in PT DKB Shipyard which being the location of this research.

Environmental management has become a major concern of each employers, workers and governments around the world. Moreover, the industrial activity in Jakarta, with the publication of Jakarta Governor Decree No. 11 of 2005 on the Implementation of Environmental Management Zone, each company industry in Jakarta seeks to draw up a document management environment. The obligation to have the document management of the environment is also the company's implementation of the obligations contained in the Minister of Environment No. 12 of 2007 on Document Management and Environmental Monitoring Business and / or activities already underway. Each party has an interest in the preservation of safety, health and environmental safety in every business activity. Environmental management correlated with the preservation of the health of workers and the environment.

Until now it's been happened the process of waste management to prevent sea pollution in the Industrial Shipyards which has not been up to the transfer of environmental risks. The management of the shipyard to minimize the waste only to the reduction as a result of ship repair, but have not been able to overcome adverse conditions of the vessel leaked to tumble at the launch of the ship which resulted in spills of fuel, lubricants and other fluids such as: paint thinner, rust and barnacle in the waters around the shipyard so that poor conditions are still yet to be resolved.

These problems was happened in the shipbuilding industry because the shipyard until now have not been optimal to dealing with the waste from ship repair both in terms of waste treatment and financing to address the environmental consequences of waste which discharged. Data say that the shipbuilding industry (PT. DKB) produce highly hazardous waste production of about 8.000 tons per year. That potential of waste is major for environmental pollution.

Mapping of environmental risks in ship repair activites, as mentioned previously, has not been fully performed in environment management of shipyard. Thus the need for the integration of environmental insurance models of shipyard which can ensure the productivity of companies that maintain the carrying capacity of the shipyard industry.

2. METHODOLOGY

This research used a quantitative approach with survey methods. This research using secondary and primary data from respondents, and used a descriptive statistical analysis from secondary and primary data. This research was conducted from October 2014 to April 2015.

The population in this research is all employees of PT. DKB Shipyard I, which has expertise in the field of ship repair and has position and influence in policy making at the Company, so the total of population is 30 employees. Based on the population, sample of this research as follows:

a. Population 1
   For the risk analysis, the sample was chosen to 8 employees because it has knowledge of risk assessment in marine ship repair activities in the shipyard.
b. Population 2
   To determine the degree of interest and risk certainty of risk accepted in ship repair, so the sample on this research is 30 people who have influence in making decisions on all units in PT. DKB (Persero).

Stages of research conducted with the following stages: risk analysis, risk estimation and modelling of environmental insurance.

2.1. *Risk Analysis*

The process of risk analysis is done in stage as follows:

a. For risk which has identified measure with level of result or consequence of losses on specified goals or objectives, based on criteria of result level and index (Table 1).

Table 1: Criteria Level of Impact and Result Index

No.	Due Levels	Description Impact	Due Index (A)
1.	Level I: No weight (insignificant)	No one was injured, a small financial loss.	1
2.	Level II: Somewhat heavy (minor)	Required first aid, leakage of waste can be handled, the financial loses is medium.	2
3.	Level III: Weigh (moderate)	Keep in media handling, leakage of waste can be dealt with outside help, financial loss is quite high.	3
4.	Level IV: Very severe (major)	Severe injuries, waste disposal is not in properly place, but doesn't give effect to destroy, huge financial losses.	4
5.	Level V: Doom (catasthropic)	Dead, waste disposal is not in properly place with the effect of wiping out, huge financial losses.	5

(Data Source: AS/NZS 4360, 1999)

The parameter used to measure the result level on Table 1 is a parameter related to environmental risk, namely: (1) human, (2) society, (3) environment, (4) security, (5) health and safety.

b. For risk that have been identified after measuring result level or consequences losses incurred against specified targets or goals, then must be determined the level of likelihood of occurrence, based on the degree criteria (Table 2).

Table 2: Incidence Index and Description of Genesis

No.	Incidence Levels	Recurrence (Frequency)	Genesis Single (Probability)	Indicence Index (K)
1.	A: Rarely	The possibility of > 25 years ahead	1. Ignored. 2. The probability is very small, close to zero.	1
2.	B: Unlikely	May occur once in 25 years	1. It's unlikely, but not overlooked. 2. The probability is low, but greater than zero.	2
3.	C: Possible	May occur once in 10 years	1. The possibility is less than, but still quite large. 2. The probability is less than 50%, but still high enough.	3
4.	D: Likely	May occur about once a year	1. Maybe not. 2. Opportunity 50/50.	4
5.	E: Almost Certain	Can occur several times a year	1. The possibility of more than or less. 2. The probability of more than 50%.	5

(Data Source : AS/NZS 4360, 1999)

c. After the establishment of level and the frequency of risk, can be formulated matrix 5 x 5, then the risk index can be determined by the formula:

Due to Risk Index = Due Index (A) x Incidence Index (K)

So can be assigned the level of risk esposure based on the following criteria:

E : Very High Risk/Extreme
T : High Risk
M : Moderate Risk
R : Low Risk
S : Very Low Risk

Table 3: Risk Exposure Level (Risk Matrix)

Frequency	Dampak				
	Not Significant	Minor	Moderate	Major	Very Dangerous
Almost certainly	Moderate	High	High	Extreme	Extreme
Tends to occur	Low	Moderate	High	High	Extreme
May occur	Low	Low	Moderate	High	High
Sometimes it happens	Very Low	Low	Low	Moderate	High
Very rare	Very Low	Very Low	Low	Low	Moderate

(Data Source: AS/NZS 4360, 1999)

Risk exposure level be relied upon in making risk maps for each stage of the process on ship repair activity.

2.2. *Risk Estimation*

In this stage, the risk estimates to describe the characteristics of risk based on aspects of social, economic and ecological. This stage uses an analysis of the impact from environmental risks measured. Data obtained from the mapping and interview results are tabulated in matrix combined with the analysis of the potential dangers that may be

posed at a later date. Matrix of tabulation on impact and potential hazards will be grouped based on the economic, social and ecological. Based on interviews and questionnaires about mapping the impact and potential hazards at every stage of business processes on the environment ship repair for living environment of shipyard, will be used for insurance modelling environment based on the prevention cost and risk-based margin.

2.3. *Modelling of Environmental Insurance*

Insurance modeling environment in the process of ship repair using the concept of risk transfer analysis. Risk derived from the previous phases based on economic, social and ecological, translated into prevention cost and risk-based margin.

3. RESULT AND DISCUSSION

PT DKB is a company that engaged in shiphyard industry which have five locations in Jakarta and six locations outside Jakarta (Cirebon, Semarang, Padang, Palembang, Sabang and Banjarmasin). Location PT DKB in Jakarta are:

1. Shipyard I, located in Jalan Penambangan Port I, Tanjung Priok
2. Shipyard II & III, and Head Office located in Jalan Sindang Laut No. 101, 104 and 119, Cilincing.
3. Shipyard IV, located in Jalan RE Martadinata ½ Volker, Tanjung Priok.
4. Shipyard Paliat, located in Jalan Paliat Uung No. 1, Tanjung Priok.

The activities in Shipyard I PT DKB with the site boundary as follows:

1. North: Sea Waters of Tanjung Priok Port
2. East: Pelindo Area
3. South: PELNI Warehouse
4. West: AIRUD and Lantamal III Pondok Dayung

Activities in Shipyard I PT DKB has been operated since 1891 and occupies an area of 150.000 m^2. Details of land use are:

Table 4: Land Use in Shipyard I PT DKB

No.	Type of Building	Area	
		m^2	
1	**Restricted Land**		
	a. Workshop	16.370	
	b. Fabrication	1.200	
	c. Assembly and Welding	4.000	
	d. General Warehouse	2.600	
	e. Warehouse Plat and Tools	3.000	
2	**Open Space**		
	a. 4 Dock	1.000	
	b. Army Equipment	90.000	
	c. Waters	100.000	
	d. Depth of Water	6-9 M	
	Total of Land	± 150.000	

(Data Source: PT DKB Persero)

Based on observations and interviews, within the last two years the productivity of marine ship repair activities by PT DKB is good, it is marked with the number of ship repair acitivies which has been handled. In 2013, there were 257 ship repair acivity with the production value of Rp. 111.576.731.455,-. Whereas in 2014 there is a decrease in the amount reparation activities as many as 92 with a production value of Rp. 105.816.797.362,-. The series of processes of ship repair activities carried out in Shipyard PT DKB is:

1. Tank Cleaning and Free Gas.
2. Docking
3. Vessel Cleaning
4. Maintenance and Repair Machines
5. Electrical Equipment Repair
6. Smoothing Ships
7. Painting
8. Launch

Based on observation of the process in reparation of ships who conducted in PT DKB, risks and dangers potential that may occur are as where in Table 5.

Table 5: Stages of Activities, Risks and Dangers Potential, and Government Responsible

No.	Activities	Risks and Danger Potential	Person in Charge
a.	*Tank Cleaning* dan *Free Gas*	Risk disposal of oil, fuel and gas into the sea. Potentially damage on the sea and marine ecosystems	Shipowners
b.	Docking	The risks involved in the accident workers	PT DKB
c.	Vessel Cleaning	Risk of rust, barnacles, and other impurities management. There is a potential to damage the environment around the dock, as well as land disposal and further disposal	PT DKB cooperate with a third party, namely PT Bina Samsurya Mandala Putra.
d.	Maintenance and Repair Machines	Risk of the rest of steel plate and wire management. Risk of work accidents in the welding process. Risk of noise management. Has the potential damage to the ecosystem around the shipyard	PT DKB
e.	Electrical Equipment Repair	Risk of leftover cable and replacement cable management. Has the potential damage to the ecosystem around the shipyard	PT DKB
f.	Smoothing Ships	Risk of sandblast management. Risk of noise management. Has the potential damage to the ecosystem around the shipyard	PT DKB
g.	Painting	Risk of spilled paint and thinner management. Has the potential damage to the ecosystem around the shipyard.	PT DKB
h.	Launch	Risk which happen on trudity and work accident. Has the potential damage to the ecosystem around the shipyard and sea when trials.	PT DKB

Before discussing the risk management on this paper, the author has done a review of previous studies related to risk management and insurance in the field of shipping and shipbuilding as follows:

1. Research conducted by Krozer, Mass and Kothuis [6] states that for noise reduction and cost effectiveness of shipping vessel is from sales aspect. If sales are good, then it can have possibility of controlling speed reduction and anchored in the harbor, which provide fuel storage ship as much as 20% and reduce the waiting time at the port. This enhancement reduces the cost of shipping berths cycle, but it requires more investment than ever before.
2. Research conducted by William G. Pitchard Jr., ERM. [9] mentions that the insurance environment becomes an important and effective part of risk management. Environmental insurance policies that have been developed are expected to protect a company or society of environmental damage caused by chemicals contaminated.
3. Research conducted by Alviggi and Avega [2] states that environmental insurance is a cost effective tool for borrowers and lenders, as well as tools for agents and brokers to be held at their disposal.
4. Research conducted by Ammarandos and Strauss [3] states that insurers have an obligation to protect the environment, like other risk management, one of which is: Pollution Legal Liability (PLL) Policy. This policy includes the recovery of property damage, injured workers, and the cleaning costs of pollution conditions are obtained.

5. Research conducted by Ned Abelson [1] states that the current environmental insurance increasingly attractive to reduce the risk and often as a way to reduce risk in the facilitation process transactions that involve the potential contamination in the upper classes. Things that range from environmental insurance is usually included:

   a. Pollution Legal Liability Insurance. This type of insurance covers the cost of the third party for cleanup costs, property damage and injuries of workers from contamination in certain areas.

   b. Stop Loss or "Lost Cap" Coverage. This type of insurance suited to the diversity of environmental problems.

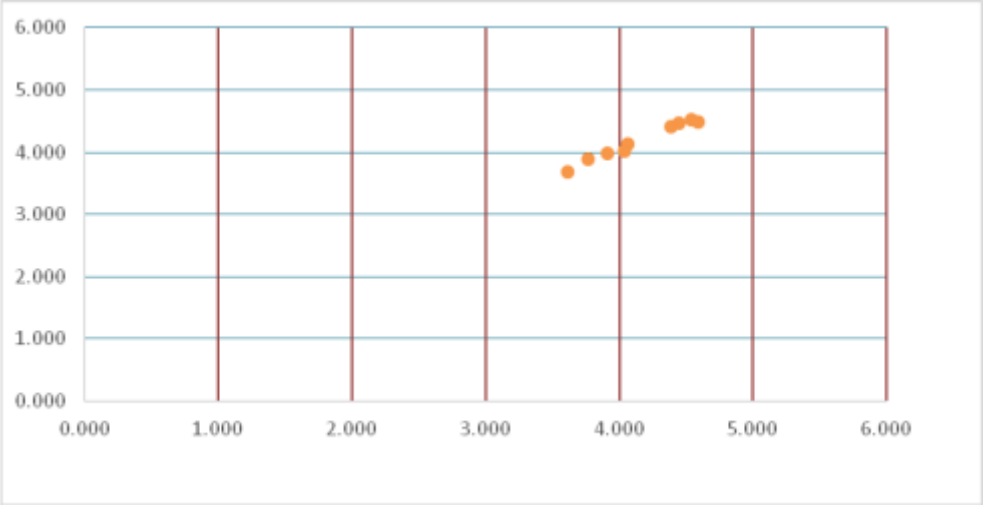
Based on the five previously mentioned study, then one of the ways to manage such risks on this paper is through risk management practices, which refer to a series of activities comprised of risk management identification processes and their implementations. Risk management may also be considered as a structured approach in managing uncertainty arising due to risk threats. PT Dok dan Perkapalan Kodja Bahari (Persero) is a shipyard company that, among others, provides ship repair services – a type of service carried out in the shipyard and will affect the assessment of environmental potential risk threats. One of the methods used in the management of such risks is by transferring environment-related risks to another party through the potential use of environmental insurance to achieve sustainable shipyard environmental management. In the management of risk transfer, the share margin of preventive cost is used to fund company activities that reduce or eliminate all forms of undesired future incidents. Such preventive measures will result in a more efficient use of production resources and lower funding requirements.

In risk management through the transfer of risks to another party, it is necessary to have a risk analysis prepared to portray the risk mapping at each stage of the ship repair business process. Such identification is done in stages and matched against the identified risks that are quantified based on their levels of consequences and frequency, ultimately resulting in a risk index. The next stage consists of risk estimation to describe the characteristics of risks based on their social, economic, and ecological aspects. This stage also analyses the impact brought about by quantified environmental risks.

Environmental insurance financing within the scope of ship repair processes is based on an analysis of risk transfer as financed by preventive costs and risk-based margin, while also adhering to the steps in a logical thinking process. A logical thinking process is a thought process used as a systems approach to solve complex and complicated problems. A systems perspective describes a series of business processes that demonstrates traits of interdependency among its components, which are then used to build an environmental insurance model.

The logical thinking process is used in combination with Strategic Assumption Surfacing and Testing (SAST) [8] and Participatory Perspectives Analysis (PPA) [5] methods.

a. The Strategic Assumption Surfacing and Testing (SAST) method is used to determine the assumptions to be considered in the formulation of risks to be assessed. SAST assists in ensuring that the risk assessment covers the formulation and development of a risk structure into a risk mapping. The formulation of strategic assumptions used in building an environmental insurance model relies on questionnaires distributed to all parties involved in ship repairs.

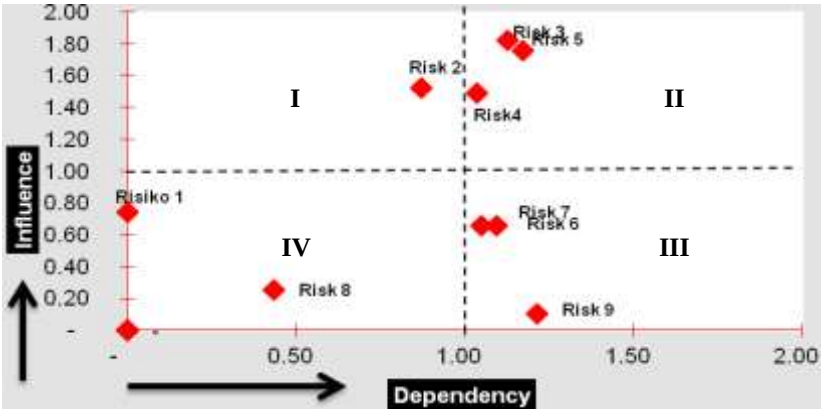


Fg. 1 Degree of Interest Risk 1 to 9

b. Participatory Perspectives Analysis (PPA)

The formulation of the environmental insurance model within the scope of the ship repair process of PT DKB is carried out through a prospective analysis to predict a number of planned possibilities in the future. A prospective

analysis determines the degree of influence and dependency of factors used in assessing policies relevant to sustainable development.



Fg. 2 Importance Risk Impact on Environmental Insurance Model Shipyard

Such prospective analysis is used to assess the direct influence among the assumed risk management factors inherent in the ship repair processes. Stakeholders are directly involved in determining the direct influence posed by one factor against the other and its assessment will follow a tabulated assessment guideline, which is based on the results of combined analysis of stakeholders that has been processed using a prospective analysis software. The result of such computation is presented in a diagram (Fg. 2) demonstrating the degree of influence and dependency among the factors in the system, with the following axes: degree of influence (y-axis) and degree of influence (x-axis). The first quadrant (1) contains the determining or driving variables, including the most influential in the system. The second quadrant (2) contains the leverage variables that demonstrate high degree of influence and dependency. The third quadrant (3) contains the output variables which are factors that display low degree of influence but high degree of dependency. The fourth quadrant (4) contains marginal variables which are factors displaying a low degree of influence and dependency, or a degree of independence in the system.

a. The highest risk factor that proves itself to be a driving factor in the environmental insurance model is the risk of shipyard contamination caused by sandblasting wastes. Such driving factor may pose no threat when it is equipped with leverage factor management, namely shipyard environment contamination management as a consequence of cuttings, splicing, and welding processes, as well as paint and thinner spilling, rust, barnacles, and other contaminants.
b. The best form of compromise in factor operationalization can be done by upgrading Floating Docks to Graving Docks, the use of high-pressure water (water blasting), and the use of environmental friendly anti-fouling paint.
c. The best environmental insurance model is based on the transfer of environmental risk inherent to ship repair which becomes feasible once paired with a progressive scenario of an environmental insurance model requiring the construction and installation of graving dock facilities.

Using this formula in the environmental insurance model in the shipyard industry is to bridge the obligation shipyard in payments of environmental insurance to the insurance company. This formula applied by the shipyard which has been charged by the ships which perform repairs at the dock. This payment included in the cost of ship repair. The use of this formula as the uniqueness of this model because until now the National Insurance Company in Indonesia has never handled environmental insurance, especially for environmental bodies in Dockyard.

To develop the Indonesian shipyard business, the government, as represented by the Ministry of Industry and Ministry of Environment and Forestry, must play an active role and readily support the Indonesian shipyard industry by providing funding incentives for the construction and renovation of outdated equipment, as well as to develop environmental insurance businesses among the maritime industry stakeholders to promote an environmental friendly shipyard industry.

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