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Evaluation Ratification HNS Convention in Indonesia

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Abstract:- The high of oil demand as a fuel causes the demand for supply to the community is also high. Therefore, the intensity of Indonesia's tanker shipping vessel also increased. Ship accidents can cause oil spills. Polluted seas and loss of lives are the result of oil spills. To tackle shipwreck accidents that result in oil spills, IMO issues related rules to prevent damage, including the HNS Convention. The Convention requires restrictions on costs incurred by the ship owner to prevent damage to oil spills. But until now Indonesia has not ratified the regulation.

The Formal Safety Assessment method is used to assist the steps in risk assessment and cost benefit analysis calculations if Indonesia considers ratifying the HNS Convention and its amendments. This method is used to identify potential hazards, determine the risk profile of each accident case and calculate the costs and benefits when ratifying the HNS Convention. The purpose of this research is to know the potential danger causing the oil tanker to have an oil spill accident, to analyze the cost of clean up given the happening of oil spill, and to recommend how far the ratification needed to regulate the compensation cost in case of tanker accident along with the effect obtained when considering ratifying the relevant rules.

The result of this research is the potential of ship accident causing oil spills such as fire, sinking, aground and collision. The risk profiles of all types of ship accidents are at level 9, level 10 and level 11. The cost of clean up for oil spill accident cases is varied, with the smallest cost of US $ 1,950 and the largest cost of US $ 390,000. Based on the calculation of the cost and benefit shows that Indonesia needs to ratify the HNS Convention.

Keywords:- *HNS Convention, Formal Safety Assessment, Risk, Cost and Benefit.*

I. INTRODUCTION

Strait is the sea between two islands. There are many straits in the world, but only a few straits are called the main strait. It is called the main strait because it is passed by many commercial vessels. There are 6 main straits in the world, 4 of which are in Indonesia, namely the Malacca Strait, Lombok Strait, Makassar Strait and Sunda Strait. Malacca Strait is the number one main strait in the world. This is because the strait passed by more than 100,000 commercial ships. Producing countries, such as China, Japan, Hong Kong and South Korea, send 20% of their ships to North America, while 80% are to East Asia, Southeast Asia, Africa and Europe. All of these ships pass through the strait in Indonesia [1] [2]. In fact there are 18 million barrels of fuel oil needs per day in the northern country of Indonesia. The increasing number of ships crossing the Indonesian strait makes the opportunity for ship accidents in Indonesian sea even greater[3] [4].

There are various factors that cause ship accidents including collisions, sinking, fire, exploding and others [2] [17]. In a report that was made by the International Tanker Owners Pollution Federation agency regarding tanker accidents, there are several factors causing the occurrence of oil tanker accidents such as a collision, sinking, damage to the hull, explosion, damage to equipment and others. One result of a ship accident is oil spills. Oil spills can cause some losses such as loss of life, damage to ecosystems and economic losses. Therefore there are international regulations governing oil spills. One of them is the HNS Convention. According to ITOPF (International Tanker Owners Pollution Federation), this convention applies to oil spills of non-persistent oil, vegetables oil, and chemical types that are carried in bulk or in packages [17]. But until now, Indonesia has not yet ratified the HNS Convention. This is a concern, why Indonesia has not ratified the HNS Convention. Whereas in Indonesian waters there is ship traffic carrying dangerous goods as mentioned in the HNS Convention.

II. RESEARCH BACKGROUND

In processing data, the Formal Safety Assessment (FSA) method is used. This method is used to identify potential hazards, determine the risk profile of each accident case and calculate the costs and benefits when ratifying the HNS Convention. The purpose of this method is to determine the potential hazards, analyze the clean up costs and compensation received when ratifying and also find out the effect that Indonesia gets when ratifying the HNS Convention. FSA consist of several stages, such as hazard identification, scenario definition, risk analysis, frequence analysis, risk summation, risk controlled, option to decrease frequence, option to decrease consequence and cost and benefit.

A. Hazard Identification

Hazard identification is the first stage of the FSA, where at this stage it is divided into 2 more stages namely Hazard Identification and Scenario Definition. Hazard

Identification itself is the stage of identifying all hazards that may occur and are relevant.

B. Scenario Identification

Scenario definition is the stage of determining the potential hazard scenarios that are a priority and sorting potential hazard scenarios from beginning to end.

C. Risk Analysis

Risk analysis is the stage in determining the risks that occur due to ship accidents. The known risks are then displayed in the form of a risk matrix recommended by the FSA. Risk Analysis is divided into two stages of analysis, namely frequency analysis and consequence analysis.

D. Frequence Analysis

Frequence analysis is the stage of determining the cause of a ship accident and how often the accident occurs within a certain period of time.

E. Consequence Analysis

Consequence Analysis is the stage of determining the impact or consequences that occur due to ship accident.

F. Risk Summation

Risk summation is the stage of determining the risk level of a system into the risk matrix. The risk matrix used is a risk matrix of 6 x 6. The risk level might occur in risk level 1 to risk level 12.

G. Risk Controlled

Risk controlled is the stage in determining prevention efforts so that, the risk can be controlled. Efforts are made to prevent high risk. Risk Controlled has several stages namely option to mitigate frequency and option to mitigate consequences.

H. Option to decrease frequency

Option to decrease frequency is the stage in determining prevention efforts by reducing the frequency or number of events so that the risk level received is not high risk.

I. Option to decrease consequency

Option to decrease consequence is the stage in determining prevention efforts by reducing the consequence or impact of accidents so that the risk level received is not high risk.

J. Cost and Benefit Analysis

Cost and benefit assessment is the stage of analyzing costs incurred for clean up of oil spills and costs covered by the HNS Convention, in the event of an oil spill.

III. CASE STUDY AND RESULT

K. Hazard Identification of Tanker Accidents in Indonesia

Hazard Identification is a stage to identify potential hazards that might occur. Preliminary Hazard Analysis (PHA) is a method carried out by collecting data on potential hazards, causes and effects as shown in Table I [12].

System		**Preliminary Hazard**		**Analysis**
Sub system				***Date***
No.	Hazard	Causes	Effect	Recommendation
PHA- 01	Grounding	Oil Spill 300 ton	Environmental Damage	Clean up
PHA- 02	Sinking	Oil Spill 1.5 ton	Environmental Damage	Clean up
PHA- 03	Collision	Oil Spill 4 ton	Environmental Damage	Clean up
PHA- 04	Collision	Oil Spill 250 ton	Environmental Damage	Clean up
PHA- 05	Sinking	Oil Spill 3.7 ton	Environmental Damage	Clean up
PHA- 06	Fire	Oil Spill 20 ton	Environmental Damage	Clean up
PHA- 07	Fire	Oil Spill 45 ton	Environmental Damage	Clean up
PHA- 08	Fire	Oil Spill 4 ton	Environmental Damage	Clean up
PHA- 09	Fire	Oil Spill 5 ton	Environmental Damage	Clean up

Table 1:- Hazard Indentification

The table above shows that there are 4 types of hazard of accidents, such as grounding, sinking, collisions and fires or explosions. The effects of oil spills are pollution on the marine environment. Whereas the initial recommendation is to clean up the affected waters.

L. Risk Analysis

Risk analysis is a step to determine the level of risk from ship accidents that occur. Risk matrix is a measurement table used to measure the level of danger of a system or event. The risk matrix used is the risk matrix 6 x 7 as shown in Table II [5].

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Risk Index (RI)							
FI	FREQUENCY	SEVERITY (SI)					
		1	2	3	4	5	6
		Category 1	Category 2	Category 3	Category 4	Category 5	Category 6
7	Frequent	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)	**Level 2** (12)	**Level 1** (13)
6		**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)	**Level 2** (12)
5	Reasonably probable	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)
4		**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)
3	Remote	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)
2		**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)
1	Extreamly Remote	**Level 12** (2)	**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)

Table 2:- RISK MATRIX

To determine the risk, it requires to collect the value of frequence and consequence of an event. Frequence value is determined from the number of ship accidents causing oil spills. From 1979 to 2019, there had been 9 cases of oil spills. While the value of the consequences as a function of the number of spills as shown in Table III [5]. Risk analysis are grouped according to the type of accident. There are 4 types of accidents, namely fire, sinking, grounding, collision.

No	Vessel Name	Amount of Oil Spill (Tons)	Amount of loss/clean up (USD)	Type of accident
1	Tanker Choya Maru	300.0	$390,000	Grounding
2	Tanker Golden Win	1.5	$1,950	Sinking
3	MV Bandar Ayu	4.0	$5,200	Collision
4	Tongkang PLTU	250.0	$325,000	Collision
5	KM Mitra Bahari	3.7	$4,810	Sinking
6	MT Srikandi	4.0	$5,200	Fire
7	KM Samudra	5.0	$6,500	Fire
8	Kapal Samudera Jaya 99 and Sinar Maros	20.0	$26,000	Fire
9	KM Fajrul Putra	45.0	$58,500	Fire

Table 3:- ESTIMATED COST OF LOSS (CLEAN UP)

- *Risk analysis for fire cases*

The frequency of ship accident due to fire is 4 times from the period 1979 – 2019 as shown in Table IV . To calculate the frequency per year, the equation is used,

Frequency = event : (ship in one year x number of years) (1)
Frequency = 4 : (45.488 x40)
Frequency = 2.22 x 10^{-6} (Extreamly Remote)
So, the result of frequence per year is 2.2 x 10^{-6}.

No	Vessel Name	Location	Ship in one year	Amount of Oil Spill	Consequence
1	MT Srikandi	Banjarmasin	4994	4 ton	*Category* 2
2	KM Samudra	Southeast Sulawesi	34448	5 ton	*Category* 2
3	Kapal Samudera Jaya 99 dan Sinar Maros	Papua	4252	20 ton	*Category* 3
4	KM Fajrul Putra	North Maluku	1794	45 ton	*Category* 3
	Sum		45488		

Table 4:- FREQUENCE AND CONSEQUENCE OF FIRE CASES

After knowing the value of frequency and consequences, the value is then plotted into a risk matrix table as shown in Table V

Risk Index (RI)							
FI	FREQUENCY	SEVERITY (SI)					
		1	2	3	4	5	6
		Category 1	Category 2	Category 3	Category 4	Category 5	Category 6
7	Frequent	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)	**Level 2** (12)	**Level 1** (13)
6		**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)	**Level 2** (12)
5	Reasonably probable	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)
4		**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)
3	Remote	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)
2		**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)
1	Extreamly Remote	**Level 12** (2)	**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)

Table 5:- RISK MATRIX FIRE CASES

From the table above it can be seen that the results of the risk assessment of 4 ship fire incidents are at level 10 and level 11. Level 10 is obtained from frequency values that are at the extremely remote level and consequence values that are at level category 3. While for level 11, it is obtained of the frequency value at the extremely remote level and the consequence value at the category 2 level.

- Risk analysis for collision cases

The frequency of ship accident due to collision is 2 times from the period 1979 – 2019 as shown in Table VI . To calculate the frequency per year, the equation is used,
Frequency = event : (ship in one year x number of years) (1)
Frequency = 2 : (2721 x40)
Frequency = 1.84 x 10^{-5} (Extreamly Remote)
So, the result of frequence per year is 1.84 x 10^{-5}.

No	Vessel Name	Location	Ship in one year	Amount of Oil Spill	Consequence
1	MV Bandar Ayu	Cilacap	1530	4 ton	*Category* 2
2	Tongkang PLTU	Palembang	1191	250 ton	*Category* 4
	Sum		2721		

Table 6:- FREQUENCE AND CONSEQUENCE OF COLLISION CASES

After knowing the value of frequency and consequences, the value is then plotted into a risk matrix table as shown in Table VII.

Risk Index (RI)							
FI	FREQUENCY	SEVERITY (SI)					
		1	2	3	4	5	6
		Category 1	Category 2	Category 3	Category 4	Category 5	Category 6
7	Frequent	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)	**Level 2** (12)	**Level 1** (13)
6		**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)	**Level 2** (12)
5	Reasonably probable	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)
4		**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)
3	Remote	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)
2		**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)
1	Extreamly Remote	**Level 12** (2)	**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)

Table 7:- RISK MATRIX COLLISION CASES

From the above table it can be seen that the results of the risk assessment of 2 ship collision events are at level 11 and level 9. Level 11 is obtained from the frequency value at the extremely remote level and the consequence value at level category 2. Whereas for level 9, it is obtained of the frequency value at the extremely remote level and the consequence value at the category level 4.

- Risk analysis for sinking cases

The frequency of ship accident due to collision is 2 times from the period 1979 – 2019 as shown in Table VIII . To calculate the frequency per year, the equation is used,
Frequency = event : (ship in one year x number of years) (1)
Frequency = 2 : (39040 x40)
Frequency = 1.28×10^{-6} (Extreamly Remote)
So, the result of frequence per year is 1.28×10^{-6}

No	Vessel Name	Location	Ship in one year	Amount of Oil Spill	Consequence
1	Tanker Golden Win	Aceh	2592	1.5 ton	*Category* 2
2	KM Mitra Bahari	Southeast Sulawesi	36448	3.7 ton	*Category* 2
	Sum		39040		

Table 8:- FREQUENCE AND CONSEQUENCE OF SINKING CASES

After knowing the value of frequency and consequences, the value is then plotted into a risk matrix table as shown in Table IX.

Risk Index (RI)							
FI	FREQUENCY	SEVERITY (SI)					
		1	2	3	4	5	6
		Category 1	Category 2	Category 3	Category 4	Category 5	Category 6
7	Frequent	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)	**Level 2** (12)	**Level 1** (13)
6		**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)	**Level 2** (12)
5	Reasonably probable	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)
4		**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)
3	Remote	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)
2		**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)
1	Extreamly Remote	**Level 12** (2)	**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)

Table 9:- RISK MATRIX SINKING CASES

From the table above it can be seen that the results of the risk assessment of 2 ship sinking incidents are at level 11. Level 11 is obtained from the frequency value at the extremely remote level and the consequence value at the category 2 level.

- Risk analysis for grounding cases

The frequency of ship accident due to grounding is 1 times from the period 1979 – 2019 as shown in Table X . To calculate the frequency per year, the equation is used,
Frequency = event : (ship in one year x number of years) (1)
Frequency = 1 : (2195 x40)
Frequency = 1.14×10^{-5} (Extreamly Remote)
So, the result of frequence per year is 1.14×10^{-5}.

No	Vessel Name	Location	Ship in one year	Amount of Oil Spill	Consequence
1	Tanker Choya Maru	Bali	2195	300 ton	*Category* 4

2		**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)
1	Extreamly Remote	**Level 12** (2)	**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)

Table 10:- FREQUENCE AND CONSEQUENCE OF SINKING CASES

After knowing the value of frequency and consequences, the value is then plotted into a risk matrix table as shown in Table XI.

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Risk Index (RI)							
FI	**FREQUENCY**	**SEVERITY (SI)**					
		1	**2**	**3**	**4**	**5**	**6**
		Category 1	**Category 2**	**Category 3**	**Category 4**	**Category 5**	**Category 6**
7	Frequent	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)	**Level 2** (12)	**Level 1** (13)
6		**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)	**Level 2** (12)
5	Reasonably probable	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)	**Level 3** (11)
4		**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)	**Level 4** (10)
3	Remote	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)	**Level 5** (9)
2		**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)	**Level 6** (8)
1	Extreamly Remote	**Level 12** (2)	**Level 11** (3)	**Level 10** (4)	**Level 9** (5)	**Level 8** (6)	**Level 7** (7)

Table 11:- FREQUENCE AND CONSEQUENCE OF SINKING CASES

From the table above it can be seen that the results of the risk assessment of one ship grounding incidents are at level 9. Level 9 is obtained from the frequency value at the extremely remote level and the consequence value at the category 4 level.

M. Risk Controlled

Risk controlled are steps to control the accepted risk. To control risk, there are two options: reducing frequency and reducing consequences. To reduce the frequency (number) of ships crossing Indonesian sea, it cannot be done, because it can interfere with the availability of goods. While to reduce the level of consequences, several alternatives are used [18] [19] [6] [7] [9]:

1. Indonesia ratifies the HNS Convention.
2. The government tightens the rules for the transportation of cargo.
3. Shipowners are required to take ship insurance.
4. Enforcement of government regulations in terms of minimal compensation costs for oil spills.
5. Implement and supervise SMS (Safety Management System).
6. Implement and supervise the maintenance system in the ship.
7. Ensure navigation equipment is functioning properly.

N. Cost and Benefit Analysis

Cost benefit assessment is based on costs incurred as a result of ratifying the convention and the benefits obtained. Costs incurred to ratify the convention are calculated from the total costs of ratifying and clean up costs when an oil spill occurs. For Indonesian waters, the cost of clean-up follows the cost of clean-up in countries that have income per capita that is almost the same as Indonesia, in this case, countries in the Middle East such as Tunisia and Armenia. In that country, the use of clean-up costs was $ 1,300 per ton. Whereas the benefits of ratifying the HNS Convention are calculated from the maximum amount of compensation received which is 1500 SDR or equivalent with $2,074 [8] [10].

No	**Vessel Name**	**Oil Spill (Tons)**	**Cost (Oil spill x $ 1,300)**	**Benefit (Oil spill x $2,074)**
1	Tanker Choya Maru	300.0	$390,000	$5,150,239
2	Tanker Golden Win	1.5	$1,950	$4,148,400
3	MV Bandar Ayu	4.0	$5,200	$46,783,581
4	Tongkang Pltu	250.0	$325,000	$4,148,400
5	KM Mitra Bahari	3.7	$4,810	$4,148,400
6	MT Srikandi	4.0	$5,200	$5,538,114
7	KM Samudra	5.0	$6,500	$4,148,400
8	Kapal Samudera Jaya 99 and Sinar Maros	20.0	$26,000	$4,148,400
9	KM Fajrul Putra	45.0	$58,500	$4,148,400

Table 12:- COST AND BENEFIT

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IV. CONCLUSION

Based on the results of research that starts from risk assessment to economic analysis, conclusions can be drawn as follows:

1. The potential hazard of ship accident are :
a) Collision
b) Grounding
c) Sinking
d) Fire
2. As shown in Table XII, Indonesia can get a lot of benefits if it ratifies the HNS Convention because the amount of compensation provided by the HNS Convention will be very sufficient for clean up and rehabilitation costs:

4. The weaknesses and strengths when ratifying the HNS Convention are as follows:

Strengths :

- If the compensation costs exceed the responsibility of the ship owner, the compensation fee will be paid by the HNS Fund, with a maximum compensation fee of 250 million SDR.
- Cases of oil spill accidents are limited to the territorial sea and EEZ.
- Compensation costs ranging from 10 million SDR - 250 million SDR.
- Applies to all forms of HNS both in bulk and package
- Applies for loss of life and personal injury claims on and off the ship, including from transportation of all types of oil (for example from fire or explosion).

Weaknesses:

- To begin operation of the HNS Convention, it must meet the minimum amount of content contribution.
- There is a premium fee per year to join the HNS Fund.

3. The most suitable risk control option for ship accident cases in Indonesia that caused oil spills is to ratify the HNS Convention. By ratifying the convention there are impacts, advantages and disadvantages of ratifying the convention. Among the effects of the consideration of ratifying the HNS Convention are as follows:

- Cost of annual contributions to the HNS Convention.
- Compensation is given if there is a claim from the owner / victim for the accident case.
- The HNS Convention can only take effect when the total quantity of cargo / cargo received from member countries reaches the minimum load limit as follows:

✓ 350 million tons for oil content
✓ 20 million tons for LNG cargo
✓ 15 million tons for LPG loads

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