Mitigating Risk of Maritime Regulatory Changes : Oil Tanker Owners’ Perspective

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Speaker Profile

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Background

Reason 1 (by Value):
“About 75% of World trade is carried by International Shipping Industry”
(International Chamber of Shipping, 2015)

<table>
<thead>
<tr>
<th>Year</th>
<th>World Merchandise Trade</th>
<th>World Seaborne Trade</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>200.00</td>
<td>150</td>
<td>75.00%</td>
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<tr>
<td>2001</td>
<td>199.19</td>
<td>152</td>
<td>76.31%</td>
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<tr>
<td>2002</td>
<td>205.92</td>
<td>155</td>
<td>75.27%</td>
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<tr>
<td>2003</td>
<td>217.56</td>
<td>162</td>
<td>74.47%</td>
</tr>
<tr>
<td>2004</td>
<td>239.25</td>
<td>170</td>
<td>71.05%</td>
</tr>
<tr>
<td>2005</td>
<td>253.60</td>
<td>175</td>
<td>69.01%</td>
</tr>
<tr>
<td>2006</td>
<td>274.43</td>
<td>185</td>
<td>67.41%</td>
</tr>
<tr>
<td>2007</td>
<td>292.00</td>
<td>199</td>
<td>68.15%</td>
</tr>
<tr>
<td>2008</td>
<td>298.21</td>
<td>207</td>
<td>69.41%</td>
</tr>
<tr>
<td>2009</td>
<td>259.71</td>
<td>191</td>
<td>73.54%</td>
</tr>
<tr>
<td>2010</td>
<td>294.45</td>
<td>220</td>
<td>75.32%</td>
</tr>
<tr>
<td>2011</td>
<td>310.03</td>
<td>217</td>
<td>69.99%</td>
</tr>
<tr>
<td>2012</td>
<td>316.29</td>
<td>224</td>
<td>70.82%</td>
</tr>
<tr>
<td>2013</td>
<td>324.13</td>
<td>230</td>
<td>70.36%</td>
</tr>
<tr>
<td>2014</td>
<td>332.64</td>
<td>249</td>
<td>75.08%</td>
</tr>
<tr>
<td>Total</td>
<td>4616.38</td>
<td>2870.00</td>
<td>72%</td>
</tr>
</tbody>
</table>

Source: Review of Maritime Transport 2015, United Nations Conference on Trade and Development (UNCTAD)

Reason 2 (by volume):
The biggest transported cargo type in the world is **Fossil fuel**, it’s covers 26% of total volume world seaborne trade.

COMPOSITION OF CARGO TRANSPORTED BY SEA IN 2014

- Fossil Fuel: 26%
- Containerized: 15%
- Minor bulks: 15%
- Coal: 12%
- Grain: 4%
- Gas and Chemical: 6%
- Other dry: 9%

Source: Review of Maritime Transport 2015
Background

World Seaborne Trade
75% World Trade (value)
- 17% Crude Oil
- 9% Product Oil

Maritime regulatory regime (social change) (Abrahamson, 1982)

How does the environment affect the ship?

to

How does the ship affect the environment?

Environment Regulation Change
Background

- Shipping Industry is very regulated! 
  (Knapp & Franses, 2009); (Alderton & Leggate, 2005); (Karahalios, 2015)

Why Ship Owners? 

- Purchasing a ship 
- Pay interest to bank 
- Pay the shipyard 
- Pay Classification 
- Pay insurance company 
- Pay to manager of ship 
- Pay to crew 
- Pay to port 
- Pay to the state

International Convention & its amendment

- IMO/ ILO
  - Ship-owners 
  - Charterers 
  - Terminal 
  - Classification Society 
  - Operator 
  - Port State 
  - Flag state 
  - Cargo Owner 
  - Shipyard 
  - Designer 
  - Oil Company 
  - Public 
  - Labor 
  - Union/Crew 
  - Trainer 
  - Investors 
  - Others

EU

Port States

Ex: Tokyo Mou, Paris Mou

Unilateral Regulations Zone

Ship is an asset with high capital and operational value

(Rajadural, 2004)
**Background**

Data from ABS, 2016 (American Bureau of Shipping)

There are **834** maritime regulation changes (2006 – 2019)

USD **500 billion**

Compliance funds needed over the next decade

(International Chamber of Shipping, 2016)

98.5 million USD/ VLCC

Equal to **> 5000** VLCC

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<table>
<thead>
<tr>
<th>No</th>
<th>Regulation</th>
<th>Compliance Date</th>
<th>Impact Area</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Year</td>
<td>Ship Instrument</td>
</tr>
<tr>
<td>1</td>
<td>SOLAS</td>
<td>2019</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2018</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2017</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2016</td>
<td>8</td>
</tr>
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<td></td>
<td></td>
<td>2015</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2014</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2013</td>
<td>2</td>
</tr>
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<td></td>
<td></td>
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<td>7</td>
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<tr>
<td></td>
<td></td>
<td>2011</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2010</td>
<td>9</td>
</tr>
<tr>
<td></td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2007</td>
<td>1</td>
</tr>
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<td></td>
<td>2006</td>
<td>2</td>
</tr>
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<td></td>
<td></td>
<td>2015</td>
<td>1</td>
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<tr>
<td></td>
<td></td>
<td>2013</td>
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<tr>
<td></td>
<td></td>
<td>2010</td>
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<tr>
<td></td>
<td></td>
<td>2007</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>MARPOL</td>
<td>2017</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2016</td>
<td>66</td>
</tr>
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</tr>
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<td></td>
<td></td>
<td>2013</td>
<td>1</td>
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<td></td>
<td>STCW</td>
<td>2017</td>
<td>1</td>
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<td></td>
<td>2016</td>
<td>1</td>
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<td>2015</td>
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<td>2013</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>TOTAL</td>
<td>2017</td>
<td>66</td>
</tr>
</tbody>
</table>

- 1 Regulation affect ENVIRONMENT
- 66 Regulation affect SHIP’s INSTRUMENT
- 83 Regulation changes that affect TANKER
- 17 Regulation affect SHIP OPERATION
- 4 Regulations affect CREW OF SHIP
Statement of Problems
Basic Theory

- **Risk management** is the **continuing process** to identify, analyze, evaluate, and treat loss exposures and monitor risk control and financial resources to **mitigate** the adverse effects of loss. (Marquette University, 2016)

1. **strategic risk**
2. **compliance risk**
3. **operational risk**
4. **financial risk**
5. **reputational risk**

- **Identified the Risk**
- **Estimate the Impact**
- **Estimate the Likelihood**
- **Control & Monitor**
- **Make a plan & Decide How to handle Each Risk**
- **Create Risk Scorecard/Risk Assessment**

1. **very unlikely**
2. **quite unlikely**
3. **medium likelihood**
4. **quite likely**
5. **very likely**

- minimal impact
- low impact
- medium impact
- high impact
- devastating impact

Risk management is the continuing process to identify, analyze, evaluate, and treat loss exposures and monitor risk control and financial resources to mitigate the adverse effects of loss. (Marquette University, 2016)
Basic Theory

Real System

System:
- A set of Components
  - Interacting
  - Interdependent
Source: Hyunjung Kim, 2016

MODELLING USING SYSTEM DYNAMICS

- Jay W. Forrester founder of System Dynamics (MIT) at 1950s
- Modeling process (Sterman, 2004)

Model

“a representative or an abstraction of an object or the actual situation” (Eriyatno 1998)
Why System Dynamics?

- Tanker industry has many variables that make causal effect (TaeSoo, 2004), (Dikos et al, 2006), (Coyle, 1976).
- System-dynamics modelling has three advantages over the time-series models used in tanker industry (Dikos et al, 2006)
  - (1) it is easy to incorporate managerial experience, intuition, and qualitative knowledge,
  - (2) it supports constructivism, and
  - (3) it accommodates the use of simulations when data are insufficient to support statistical methods or when exogenous shocks make statistical models seem ambiguous and do not allow control for external policy events.
- Tanker Industry is very dynamic because of long time delays in the supply and long life span of a vessels. (TaeSoo, 2004)
- System-dynamics can be applied to any dynamic system, with any time and spatial scale. (Sterman, 2004)
Research Methodology

- Problem Identification
- Literature Study
- Variable Identification
- Risk Assessment
- Verification and Validation
- Simulation
- Stock and Flow Diagram
- Causal Loop Diagram

- Scenario
- Result Analysis

- Hazard Identification
- Frequency Analysis
- Consequence Analysis
- Define Risk
- Establish Acceptable Level of Risk
Data Analysis
Frequency Analysis

Result:
- SOLAS, 73 times
- MARPOL 8 times
- STCW 2 times
- Average of regulation changes 7 times per year (Frequency/likelihood)

Source: ABS, 2015
Every regulatory changes has an impact area or more than one
66 regulatory changes impact on SHIP INSTRUMENTS
17 regulatory changes impact on SHIP OPERATIONS
2 regulatory changes impact on CARGO
4 regulatory changes impact on CREW
1 regulatory changes impact on ENVIRONMENT
RISK ASSESSMENT
Financial Impact affected to regulatory changes

Total Financial Impact to regulation changes implementation

USD 1.78 million per 1 Motor Tanker unit, Medium Range (MR) size

“The Bigger Fleet owned by company “The greater the Financial Impact for the Company also (Setyohadi, 2016)
Data Analysis
Consequence Analysis by PT.XYZ

✓ Initial Cost= Implementation Cost
➢ Maintenance Cost= 6% of Capital Cost (Smith, 2015)
➢ Service Cost= 5% of Capital Cost (Smith, 2015)
✓ Average of implementation cost = 2,391 million USD per year

<table>
<thead>
<tr>
<th>No</th>
<th>Name of Ships</th>
<th>DWT</th>
<th>Year of Built</th>
<th>Regulation Implementation Cost</th>
<th>Financial Impact</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>MT.SEI PAKNING</td>
<td>29755</td>
<td>2011</td>
<td>Initial Cost: $1,847,000</td>
<td>$2,050,170</td>
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<tr>
<td>2</td>
<td>MT.SAMBU</td>
<td>29755</td>
<td>2011</td>
<td>Annual Cost: $110,820</td>
<td>$2,050,170</td>
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<tr>
<td>3</td>
<td>MT.SANGGAU</td>
<td>40600</td>
<td>2015</td>
<td>Service cost: $92,350</td>
<td>$2,050,170</td>
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<tr>
<td>4</td>
<td>MT.GAMKONORA</td>
<td>88312</td>
<td>2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>MT.SUNGAI GERONG</td>
<td>29755</td>
<td>2012</td>
<td></td>
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<td>6</td>
<td>MT.SENIPAH</td>
<td>29754</td>
<td>2013</td>
<td></td>
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<tr>
<td>7</td>
<td>MT.SANANA</td>
<td>40600</td>
<td>2015</td>
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<tr>
<td>8</td>
<td>MT.GUNUNG GEULIS</td>
<td>107538</td>
<td>2009</td>
<td></td>
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<tr>
<td>9</td>
<td>MT.SERUI</td>
<td>40600</td>
<td>2015</td>
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<td>10</td>
<td>MT.GEDE</td>
<td>88312</td>
<td>2010</td>
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<td>11</td>
<td>MT.GAMSUNORO</td>
<td>105638</td>
<td>2014</td>
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<td>12</td>
<td>MT.GAMALAMA</td>
<td>88312</td>
<td>2011</td>
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<tr>
<td>13</td>
<td>MT.PANGKALAN BRANDAN</td>
<td>17400</td>
<td>2014</td>
<td></td>
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<tr>
<td>14</td>
<td>MT.PAGERUNGAN</td>
<td>14454</td>
<td>2014</td>
<td></td>
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</table>

Total Expense: $1,847,000 | $28,702,380
Data Analysis

Consequence Criteria

<table>
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<tr>
<th>Criteria Rating</th>
<th>Financial Impact (thousand USD)</th>
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<tbody>
<tr>
<td>1 Insignificant</td>
<td>$0 &lt; x \leq 685$</td>
</tr>
<tr>
<td>2 Minor</td>
<td>$685 &lt; x \leq 1370$</td>
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<tr>
<td>3 Moderate</td>
<td>$1370 &lt; x \leq 2056$</td>
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<tr>
<td>4 Significant</td>
<td>$2056 &lt; x \leq 2741$</td>
</tr>
<tr>
<td>5 Catastrophic</td>
<td>$x &gt; 2741$</td>
</tr>
</tbody>
</table>

Source: PT.XYZ, 2015
Data Analysis
Level of Risk

**CONSEQUENCE:**
2,391 million USD = 2391 thousand USD

**LIKELIHOOD:**
83 regulation changes on 2006-2019 = 7 regulation per year

**RISK = CONSEQUENCE x LIKELIHOOD:**
RPN = 4 x 4 = 16
Data Analysis

Level of Risk

\[
\text{RISK} = \text{CONSEQUENCE} \times \text{LIKELIHOOD}:
\]
\[
\text{RPN} = 4 \times 4
\]
\[
= 16 \text{ (CATASTROPHIC)}
\]
Data Analysis
Input-Output Diagram

- **Uncontrollable input**
  - Inflation
  - Oil Price

- **Indirect scope impact**
  - Regulation Changes
  - Oil Demand

- **Intended Output**
  - Decreasing Financial Risk
  - Decreasing CAPEX
  - Decreasing OPEX
  - Increasing Freight Rates

- **Controlable Input**
  - Instrument cost
  - Maintenance

- **Control management**

- **Modelling the impact of IMO regulatory changes on tankers industry**

- **Unintended output**
  - Increasing Financial Risk
  - Increasing CAPEX
  - Increasing OPEX
  - Decreasing Freight Rates
Data Analysis
Causal Loop Diagram

- Bunker
- Oil Price
- Ship Price
- CAPEX
- OPEX
- Insurance
- Ship Instrument
- Maintenance
- Crew
- Freight
- Voyage Cost
Data Analysis

Result

<table>
<thead>
<tr>
<th>Time</th>
<th>Freight</th>
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<tbody>
<tr>
<td>Jan 1, 2006</td>
<td>$0.00</td>
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<tr>
<td>Jan 1, 2007</td>
<td>$3,284,336,611.13</td>
</tr>
<tr>
<td>Jan 1, 2008</td>
<td>$6,568,673,222.39</td>
</tr>
<tr>
<td>Jan 1, 2009</td>
<td>$9,853,009,833.77</td>
</tr>
<tr>
<td>Jan 1, 2010</td>
<td>$13,137,346,445.27</td>
</tr>
<tr>
<td>Jan 1, 2011</td>
<td>$16,421,683,056.90</td>
</tr>
<tr>
<td>Jan 1, 2012</td>
<td>$19,706,019,668.65</td>
</tr>
<tr>
<td>Jan 1, 2013</td>
<td>$22,990,356,280.52</td>
</tr>
<tr>
<td>Jan 1, 2014</td>
<td>$26,274,692,892.52</td>
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<td>Jan 1, 2015</td>
<td>$29,559,029,504.65</td>
</tr>
<tr>
<td>Jan 1, 2016</td>
<td>$32,843,366,116.90</td>
</tr>
</tbody>
</table>

Freight as revenue
Conclusion

- Changes maritime regulations causing financial risk
- Among the players, tanker owner is the most affected party
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Thank you for your Attention