

Marine Pollution Supervision and Performance of Harbourmaster on Shipping Safety

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ABSTRACT

The purpose of this study is to identify the number of incidents of marine pollution caused by the disposal of dirty oil waste from commercial ships docked and berthed at the pier as a result of marine pollution. This study will also investigate whether they have an impact on the disruption of shipping safety and the marine environment. The method of data analysis is Structural Equation Modelling with Smart PLS version as its tool. The population in this study was 131 officers in the field of guarding, patrolling, and investigating. A sample of 99 respondents was obtained using the Slovin formula. The results show that the supervision of marine pollution has a positive effect on the performance of the harbourmaster. Marine pollution supervision can improve the harbourmaster's performance and positively impact shipping safety. Marine pollution supervision should be maintained, improved, and consistent, and make modern system breakthroughs so that the safety of marine transportation will be fulfilled and guaranteed.

Keywords: marine pollution supervision, performance, harbormaster, shipping safety, marine transportation

A. Introduction

Marine pollution is a problem that needs special and consistent handling by countries interested in maintaining safety aspects in maritime areas. The increasing demand for sea transportation will result in using the sea as a traffic route in the shipping sector. Freight that is loaded and unloaded has the potential to reduce the quality of the marine environment due to the spillover of heavy, toxic liquid material in the bulk of a large scale. To a certain extent, it may impact the safety of ships on the sea. The safety and alignment of activities of shipping are the responsibility of the port.

The duties and functions of the harbourmaster are specifically regulated by the regulation of the Republic of Indonesia Number 17 of 2008 concerning Shipping. Article 207,

paragraph (1) states that the harbourmaster carries out shipping safety functions, including implementing, supervising, and enforcing laws in water transportation, port, and marine environmental protection. The biggest problem in ship accidents on shipping is the problem of a person's ability and expertise to carry out their duties both in carrying out all duties in the port and in cooperating or getting connected to other business entities by conducting supervising, regulating, and enforcing the law.

According to the waste operator, the handling of ship waste at the Tanjung Priok water has not been done optimally. Of around 15,284 ships (domestic and foreign) 2018 visiting Tanjung Priok, only 50 ships (0.33%) were committed to disposing of waste through the reception facilities of Tanjung Priok Port.

This fact indicates that there were very poor law enforcement regulations regarding marine environment protection. The importance of safety and the alignment of activities in sea freight shipping is the responsibility of the port.

This study will focus on the impact of the harbormaster's performance on shipping safety, the indirect influence of marine pollution on the safety of shipping through marine pollution supervision, and the indirect influence of marine pollution supervision on shipping safety through the harbormaster performance. Performance appraisal, in this case, is based on the understanding, knowledge, expertise, and behavior needed to perform a job well, and the analysis of one's behavioral attributes according to the criteria determined for each position (Dharma, 2005). According to Karomah, (2021), supervision is a way for an organization to realize effective and efficient performance and support its vision and mission.

According to Bellas et al., (2020) monitoring marine pollution is a crucial part of contemporary environmental regulation that attempts to more efficiently preserve and protect marine ecosystems while boosting. In according with Rofik & Mokhtar (2021), the impact of environmental pollution is the destruction of natural ecosystems and environmental quality standards. The environment is polluted as a result of human activities themselves, either through industrial activities or household activities that produce waste and garbage. Based on research, Lambonan (2020) argues that pollution of the marine environment in Indonesian waters is caused by pollution from the mainland, sea activities, and air. Marine pollution can occur: in territorial waters or jurisdictional areas or from outside the territorial waters or from outside jurisdictional regions of Indonesia. Marine Disasters can occur due to environmental pollution; and global warming. Management of pollution of the marine environment according to Law Number 32 of 2014 concerning Maritime is carried out by the government by establishing policies for overcoming the impacts of marine pollution

and marine disasters through developing a disaster mitigation system and developing an early warning system as well as developing a national oil spill emergency response plan in the sea and developing a method for controlling marine pollution and damage to marine ecosystems including preventing the impact of remnants of buildings on the sea.

In accordance with Ratnasari et al., (2021) human resources have a significant effect on employee performance, training has a substantial impact on employee performance, work discipline has a significant effect on employee performance, and the role of human resources, training, and work profession simultaneously has a substantial impact on employee performance. Work motivation and work environment are directly related to employee performance. Work motivation and the work environment felt by employees can reduce performance or increase employee performance. A comfortable work environment will motivate employees to improve their performance it will have an impact on improving the overall performance of an agency (Maswar et al., 2020).

According to the Regulation of the Republic of Indonesia, number 17 of 2008, article 1, paragraph 56 Harbormaster is a government official at the port appointed by the Minister. It has the highest authority to carry out and supervise the fulfillment of the provisions of laws and regulations to ensure the safety of shipping. It has the authority to supervise the ship's seaworthiness, safety, security, and order in the port. It also supervises the orderly ship traffic in the port waters and shipping lanes, the transfer activities in the port waters, salvage activities, underwater work, ship delay, guide the loading and unloading of hazardous materials, the refueling of dangerous and toxic waste, the order of embarkation and debarkation of passengers, dredging and reclamation, port facility construction activities, carry out search and rescue assistance, lead pollution mitigation and fire suppression at ports.

The completeness of the requirements, administration, and techniques can prove the ship's seaworthiness. This study shows

that the application of the ISM Code affects shipping safety according to Indriyani et al., (2021). Shipping safety referred to the International Safety Management Code (ISM) Code Chapter IX. The ISM Code states that shipping safety must meet two criteria: seaworthiness and shipping safety. Based on research conducted by Santosa & Sinaga, (2020), the Responsibilities of Masters, the Role of harbourmaster, and the Utilization of Navigational Auxiliary Facilities have a positive and significant effect on Shipping Safety at Tanjung Emas Port, Semarang.

The crew's communication skills, both orally and in writing, using objects, light, and sound to interact, both sending and receiving messages between individuals on board, communicating with other ships and with related parties, and the crew's ability to use and understand the use of codes signals are expected to achieve shipping safety (Kuncowati et al., 2020). According to Mangkunegara (2015), performance results from work in quality and quantity achieved by an employee in carrying out his duties following the responsibilities given to him. As to the benchmark in assessing performance, Sudarmanto in Kurniawati (2017), suggests four dimensions of performance to determine performance at the individual level. Quality, damage, accuracy, Use of time in work,

and Cooperation with others. There is a close relationship between ocean pollution surveillance and shipping safety. Shipping safety is everything that exists and can be developed about accident prevention measures when carrying out work in the shipping field (Santoso et al., 2013)

Regarding the aforementioned thoughts, the hypotheses will be stated as follows:

- H1. Marine pollution supervision significantly impacts shipping safety
- H2. Harbourmaster performance significantly impacts shipping safety
- H3. Marine pollution supervision impact on harbourmaster performance
- H4. Marine pollution supervision indirectly impacts shipping safety through harbourmaster performance

B. Methods

The method used in this research is quantitative, and the data analysis used is the SEM-Smart PLS. Data collection of the three variables with a total of 30 statements derives from marine pollution supervision with indicators making standards, comparing standard activities (Djadjuli, 2017); Harbourmaster performance with indicators of quantity, quality, punctuality, cost-

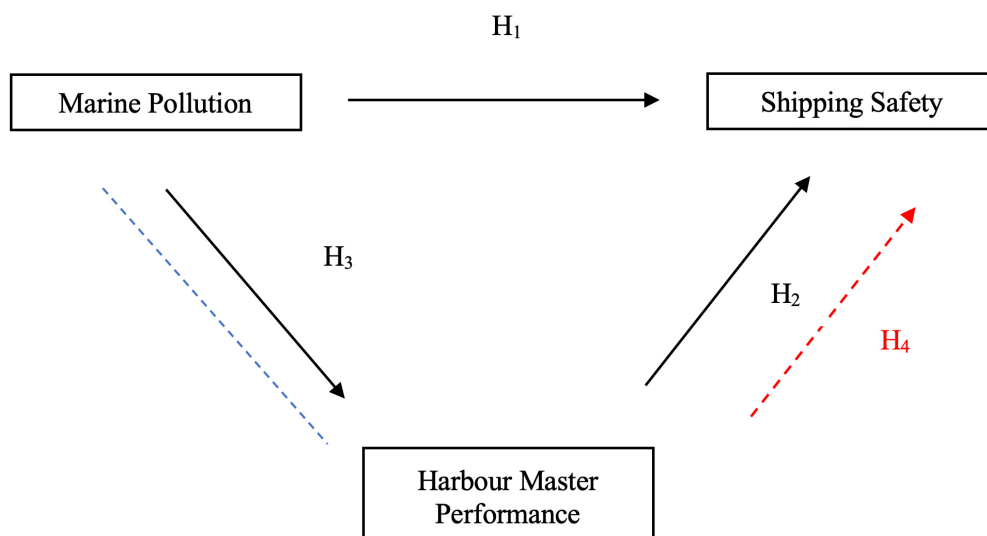


Figure 1 Conceptual Model

effectiveness (Setiawan, 2015), and shipping safety performance through marine inspector's capability and ship governance (Jackson & Lasse, 2020). The population in this study was 131 officers in the field of guarding, patrolling, and investigating. A sample of 99 respondents was obtained using the Slovin formula. The demographics of the respondents are education, namely Senior High, Bachelor, Master, and Doctoral degrees, with working experience of more than 5 years.

C. Results and Discussion

There are 2 measurement models to answer research problems: the outer model and the inner model. The objective of outer model measurement is to analyze the validity and reliability, whilst the analysis of the inner model is devoted to testing the hypothesis based on the value of the beta coefficient, t-value, and significant value.

1. The Outer Model Analysis

The criteria used in assessing the outer model are validity tests consisting of convergent validity and discriminant validity, as well as reliability tests consisting of Cronbach Alpha and Composite Reliability values. The convergent validity of the measurement model is assessed based on the correlation between the estimated item values (loading factor). Furthermore, the concurrent

validity analysis provides information about the reflection of the indicators that are closest to the research variables.

The results of the analysis show that all indicators in the study were valid, which is proven by the value of the loading factor which is greater than 0,70. Moreover, the value of AVE is greater than 0.5, so we can conclude that the test on convergent validity is completed. The next step is reliability testing, which is based on the Cronbach Alpha value and the Composite Reliability value. The results of the testing are exhibited in table 2.

Table 2 Reliability Testing Table.

From table 2, we can see that all variables studied have a value of Cronbach Alpha greater than 0.7. In the meantime, the computation of the composite reliability also produces a value greater than 0.7, so it can be concluded that all indicators used are reliable.

2. The Inner Model

The measurement of the inner model is used to find the relationship among constructs, that is to define their significance value, R-square, Q square, and f-square in the model. The model is

evaluated by R square for its dependent variable and by path coefficient value for its independent

variable. The principal of bootstrapping in SmartPLS, with a significance equivalent of 0.05, shows the relation among the latent

Table 1 Convergent Validity Test Table

Variable	Item	Loading Factor	AVE
Marine Pollution Supervision	X1	0.926	0.857
	X2	0.926	
	M1	0.859	
Harbormaster Performnace	M2	0.733	0.700
	M3	0.888	
	M4	0.857	
	Y1	0.847	
Shipping Safety	Y2	0.898	0.763
	Y3	0.850	
	Y4	0.898	

Table 2 Reliability Testing Table

	Cronbach's Alpha	Composite Reliability
Shipping Safety	0.896	0.928
Harbourmaster Performance	0.855	0.903
Marine Pollution Supervision	0.834	0.923

variables prevailing in the model. Following are the results of algorithm calculations and analysis of each variable in this model.

Figure 2 shows that all indicators are valid to measure each variable because they have an outer loading > 0.7 . Thus the measurement model meets the convergent

validity.

Based on the data, the inner model structural model test results show that the harbourmaster's performance positively influences shipping safety by 0.529, which means that the better the harbourmaster's performance, the greater the shipping safety.

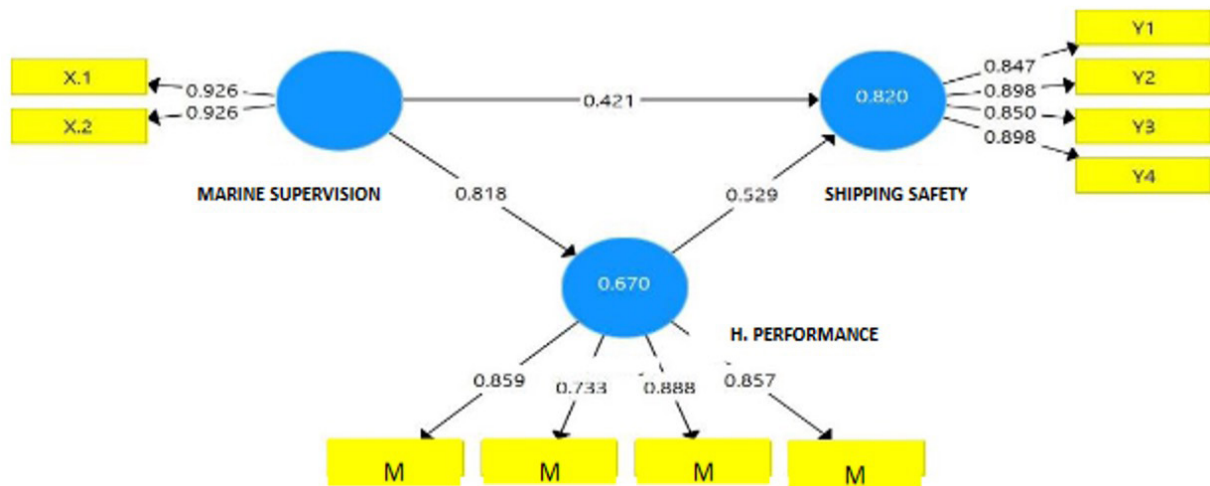


Figure 2 Results of Full Model (Outer Model)

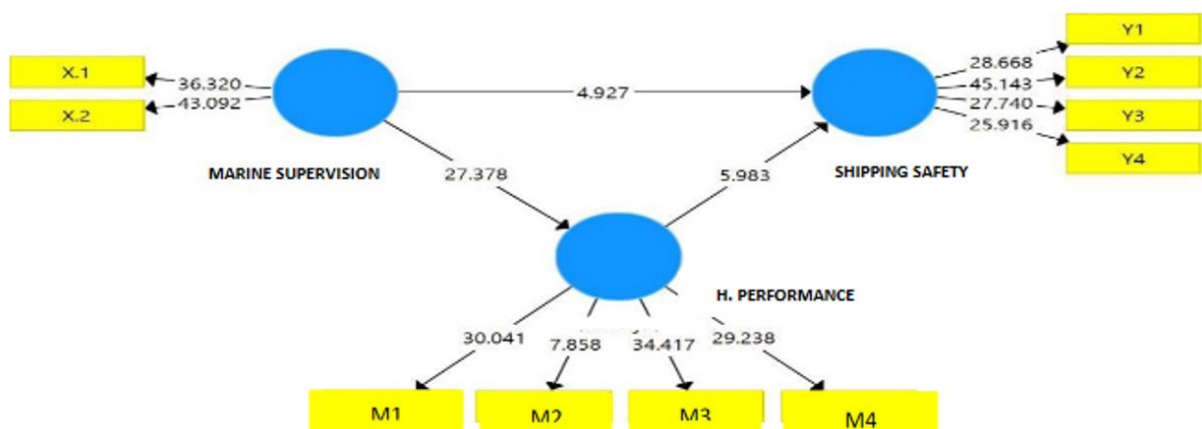


Figure 3 Results of Full Model (Inner Model)

Table 3 Path Coefficient Estimation Results and Statistical Tests

	Original Sample	Sample Mean	Standard Deviation	statistics	P Value _s
Supervision → Performance	0.818	0.822	0.030	27.378	0.000
Supervision → Safety	0.421	0.410	0.085	4.927	0.000
Performance → Safety	0.529	0.539	0.088	5.983	0.000
Supervision → Performance → Safety	0.433	0.443	0.074	5.860	0.000

Marine pollution supervision positively affects shipping safety by 0.421, which means better marine pollution supervision.

Marine pollution supervision has a positive influence on harbourmaster performance by 0.818. The results shipping safety R-Square value is 0.820, and R-Square Adjusted is 0.816. Marine pollution supervision and harbourmaster performance variability explain the 82% safety rate. Meanwhile, the Adjusted R-Square value is a prediction of the effect value. Furthermore, the performance R-Square is 0.670, and R-Square Adjusted is 0.666. That is, marine pollution supervision explains 67% of port performance. In addition, the R-Square value > 0.67 is interpreted as having a strong influence, so the research model produces an R-Square value > 0.67 .

The model for marine pollution supervision and harbourmaster performance produces a Q^2 value of 0.456, and the model for marine pollution supervision and harbourmaster performance on shipping safety is 0.613. This means that the two models have good predictive relevance because of the value of $Q^2 > 0$. Furthermore, the effect size of $Q^2 = 0,789$, and the results of the calculations above show the predictive-relevance effect size value of 0.789 (> 0) and close to 1. Thus the overall model has a good predictive relevance value.

The F square score shows the impact of exogenous on endogenous variables. To assess the impact of F square, we refer to the following rule: 1) The Score 0.02-0.14 is categorized as weak. 2) The Score 0.15 – 0.34 is classified as moderate, and (3) The score > 0.35 is categorized as a strong influence of exogenous variables at the structural level.

Based on the calculation results, the

influence of marine pollution supervision on harbourmaster performance is strong in the structural model because the F-Square value is $2.028 > 0.35$. Furthermore, the path of the effect of harbourmaster performance on shipping safety is strong in the structural model because the F-Square value is $0.513 > 0.35$. Finally, the direction of the influence of marine pollution supervision on shipping safety is moderate in the structural model because the F-Square is $0.325 < 0.35$ and > 0.15 .

3. Hypothesis Testing

The estimated values for the path relationships in the structural model must be significant, this can be obtained by implementing the procedure of bootstrapping. According to Hair et al., (2014), and Ghozali, (2021), for the criteria of significance, we can see the t table with the alpha of 0.05, which is 1.96. The score of 1.96 was then compared with t statistics. The statistical analysis results are tabulated as follows:

The test results of hypothesis 1 explain that marine pollution supervision has a direct effect on harbourmaster's performance, likewise, based on hypothesis 2, the test yields a direct effect of marine pollution control on marine safety, this means that supervision on marine pollution has a direct and significant impact on shipping safety. The direct effect of harbourmaster performance on shipping safety is accepted, this means that the performance of the harbourmaster has a direct and significant impact on shipping safety. As to the indirect effect of supervision of marine pollution on Shipping safety through harbourmaster performance, the hypothesis

is accepted, this means that the performance of the harbourmaster mediates the relationship between marine pollution supervision and shipping safety.

One of the important causes of marine pollution begins with the ship oil spill. According to (Anh, 2019), technology has the potential to help officers to control and overcome pollution originating from an oil spill.

Based on the study it is confirmed that the most important internal factors to influence the harbourmaster's performance are complying with the enforcement of the law and hard supervision of ship pollution, meanwhile, the main external factors are the discharge of water from the tank washing, the direct discharge of ballast, and the direct discharge of waters from the bilge of ships. These findings are confirmed by (Efe et al., 2022). The shipboard marine pollution emergency plan for dangerous liquid substances is an innovation for ships carrying dangerous cargo. (Giacometti, 2006).

D. Conclusion

Marine pollution supervision positively affects the harbourmaster performance and shipping safety in the shipping industries. This conclusion is evidenced by the strong correlation between variables. Several studies also support this finding, so the measure should be maintained and improved, that the safety of marine transportation will be fulfilled and guaranteed. Resolving marine pollution problems can be done through coordination and collaboration in shipping safety, maritime security, and environmental impacts.

Implementation of marine pollution supervision under statutory regulations, and maritime law by establishing a standard operational procedure (SOP) for each marine pollution control activity. This program should be done periodically by checking the availability of adequate oil pollution equipment and the Shipboard Oil Pollution Prevention Emergency Plan (SOPPEP) and guiding the ship master and crew to carry out oil pollution drills on regular basis and keep

the record in the ship log book on board.

The next research can be carried out in other Indonesian ports, especially the main ports which have busy activities or traffic. The next research may be developed by involving different targets of respondents, such as the private sector, shipping companies, port management companies, and other stakeholders.

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