HAZARDOUS CARGO PRACTICES TOWARDS GREEN PORT PERFORMANCE: EVIDENCE FROM PORT OF TANJONG PELEPAS (PTP)

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ABSTRACT

Obtaining green port status is a novel idea for ports, particularly in Malaysia. Preventing and reducing pollution at the port is a critical factor to address in order to have the safest port operation possible. The term "green" refers to new ideas, innovations, and transitions, which includes the port's technical development process. Because the green port is still in its early stages of implementation, it is vital to determine what elements should be monitored by ports in their everyday operations. The management of dangerous goods (DG) in PTP is governed by the Johor Port Authority (JPA) By-Law and the International Maritime Dangerous Goods Code (IMDG Code). With the following goals and objectives, JPA has developed the Green Port Policy, which will serve as a general guide for all port operators in their efforts to achieve a green port environment. The purpose of this study is to investigate into the PTP's current hazardous cargo management practices and relationship toward green port performance. The port operator will be able to protect the environment and hazardous cargo management system and facilities at the port as a result of this research.

Keyword: *Green Port, Dangerous Goods, Hazardous Cargo, PTP*

1.   INTRODUCTION

The management of dangerous goods (DG) in PTP is governed by the Johor Port Authority (JPA) By-Law and the International Maritime Dangerous Goods Code (IMDG Code). The JPA is the governing organization for Johor's two major ports, Pasir Gudang Port (PGP) and the Port of Tanjung Pelepas (PTP). Both continue to expand and handle an ever-increasing volume of goods. Furthermore, both ports are experiencing rapid growth in oil and gas activity, particularly at PTP. Managing and maintaining a good safety, health, and environmental record has become an increasing challenge for all those involved in port operations as a result of these developments. With the following goals and objectives, JPA has developed the Green Port Policy, which will serve as a general guide for all port operators in their efforts to achieve a green port environment. Under JPA's Strategic Plan 2013 - 2020, the Green Port Policy has been selected as one of the Key Performance Indicators (KPI) for establishing a safe and healthy port working environment.

2.   LITERATURE REVIEW

The literature review is critical since it provides an overall idea of the aspects to be researched in addition to answering the questions posed by this study. Through the literature review, the researcher will peel and develop on a deep understanding of an idea, information, and retrieval from previous studies, topics, articles, and so on [1]. This section will cover the following topics: the concept of a green port, hazardous cargo (HC) handling and Green Port Development Challenges. These themes will provide relevant data and information from related articles and journals, which will aid in the study. According to [2] in their study 'Contribution to the Implementation of "Green Port" Concept in Croatian Seaport,' port is a common term that denotes a conflict between human action and the

environment, posing a threat to environmental protection. Developing ports without a good environmental and ecological preventive policy could endanger residents as well as nearby flora and fauna [3]. The number of challenges or issues relating to the port's environment that have arisen in the maritime industry is now high or increasing. When considering about this, various ports nowadays are attempting to achieve the 'Green Ports' concepts or the 'greener' status of port by introducing new technology and upgrading the ports infrastructure [4]. The main methods for implementing the idea of "Green Port" development, according to [4] are the introduction of the terms "green" growth in the continued development of port systems and the implementation in environmental planning within port areas.

2.1 Impact of port activity.

Port locations are chosen to maximize access to land and navigable water while also providing protection from thunderstorms, winds, and waves. According to [5] said that, the seaport could be artificial or natural. A natural seaport is bordered by many land features, while an artificial seaport is surrounded by breakwaters, sea barriers, or jetties. As a result, it can be stated that the port and harbor are either placed in the sea or on rivers in inland locations far from the sea, but general criteria apply to both. According to OECD (2009) studies, while ports play an important role in economic development in the surrounding areas and hinterland, port activities can have detrimental environmental consequences. Noiseful vessel engines, machinery for loading and unloading cargo that releases toxic particles, and others are examples of negative environmental impacts.

2.2 Impact on surrounding

In general, the sources of port environmental impacts can be separated into three categories: difficulties created by port activities that operate at the port, problems caused by ship sailings, and emissions that emanate from international networks specifically designed to serve the port hinterland. According to the environmental management plan for ports, most ports are built near residential settlements and metropolitan areas. The impact of that, port diesel engines, which power ships, vehicles, railroads, and cargo-handling equipment, polluted on surrounding environment.

2.3 Hazardous cargo (HC)

Hazardous cargo is loosely referred to as 'dangerous cargo (DC)', 'hazardous materials (hazmat)' or 'dangerous goods (DG)' in maritime logistics literature [6]. Although these terms may be used interchangeably, the best way to distinguish the terms is through highlighting the three functional areas in which dangerous substances are involved – production, logistics and transportation, and consumption. The IMO documents make use of both 'dangerous goods' and 'dangerous cargoes' (IMO 2018). According to the United Nations (UN) classification, there are more than 3000 items listed as DG in the IMDG Code. If mishandled, DG may result in accidents through toxic releases and explosions, hence impacting the environment.

2.4 Hazardous cargo handling

In-port transportation is defined as the moving of cargo within the port region from one place to another. The incorrect handling of HC during in-port transportation may result in collisions within the port waters, and accidents within the port area [7]. The port environment will eventually be destroyed as a result of this. The International Maritime Dangerous Commodities Code (IMO 2018) specifies how various categories of goods, packages, or containers should be separated. The code, which is amended every two years (IMO 2018), also provides for the appropriate codes, symbols and terms used in the securement and segregation of HC. These must be closely adhered to in order to avoid and/or limit avoidable dangers [8]. The code also specifies the stowage categories for the various DGs classes, so addressing the previously mentioned necessity for segregation. It's not enough to have the right product and follow the proper packing and repackaging methods. There is need for appropriate marking, labelling and documentation of the cargo, and this is particularly significant in the case of HC. The nature of the goods with which they are dealing must be known by all parties engaged in the handling and transportation chain. According to the IMDG Code (IMO 2018), relevant placards with the right international UN numbers assigned for distinct goods from different DG classes must also be placed. The IMDG code requires proper documenting, labelling, and marking, which is beneficial, especially in emergency situations where the response team may need to take specific preventive actions.

2.5 The Challenges of Green Port development

Previous studies have outlined of green initiatives that could help the port attain sustainability. To begin with, there's no global standard for green port indexes or certification [8], However, an Egyptian study has proposed a Green Port Performance index (GPPI) to assess a port's environmental performance. The proposed index, which is based on the relative weights assigned to key green port performance indicators, can be used to assess the overall greenness of a port n any country in terms of environmental regulations [9]. Aside from the lack of a standardized green port index, the green port deal necessitates effective organization and leadership, suitable legislation and regulations, innovations, and a management system for environmental energy efficiency and sustainable development. Because port operations are complicated, the engagement of all management and personnel is critical to ensuring the implementation of the green port concept. Port environmental management techniques and methodologies need to be created and promoted.

The risk associated with the managing of hazardous cargo in a port environment are related to various aspects of human, the port environment, infrastructure and facilities itself and issues with the port authorities and governing bodies [9]. While on the other hand, PTP was faced issues of dangerous goods (DG) that are landed from Romania. According to state media Bernama (2020), a total of 110 containers from Romania were discovered abandoned at the Port of Tanjung Pelepas (PTP) and were laden with dangerous electric arc furnace dust (EAFD). EAF residue is classified as a toxic and dangerous material under the Basel Convention and as a scheduled waste under the Environment Quality Regulations [10].

PTP operates in a high-risk profession that needs employees to deal often with big equipment, heavy loads, and dangerous cargoes. PTP's sustained economic development has necessitated continual port expansion to meet business expectations since its inception. DG management must continue to improve operational activities to ensure environmental performance and long-term business success. The Pulai River is Peninsular Malaysia's biggest riverine mangrove belt, which is a natural heritage habitat for endangered species such as the Long-tailed Macaque, Smooth Otter, Mangrove Pitta, and Mangrove Blue Flycatcher. The estuary of the Pulai River is a Ramsar site. If PTP's activities and development go unchecked, the Pulai River's environment would suffer. As a result, PTP takes habitat conservation measures to ensure that this natural riche is preserved for future generations.

The findings of this research will be useful to PTP's Operations Department, allowing them to concentrate on environmental conservation and long-term operations. In addition, this study is expected to result in a decision-making model that can be used to assess the port's green performance. The port operator will be able to protect the environment and hazardous cargo management system and facilities at the port as a result of this research. Looking for or finding material on the green port idea in Malaysia is similarly tough. As a result, our research should help to fill a gap in the literature on this subject.

3.0 RESEARCH METHODOLOGY

This section explains how the research was conducted. The research planning/progress is described first, followed by the study framework. The term "research planning" refers to the activity carried out within a particular time range. The research framework is the general concept of the study, defining everything from the research problem through the study's conclusion. In addition, this section explained the data gathering process, which comprises primary data, secondary data, and the sampling method implemented. It also describes the research equipment that was used in the study. Furthermore, the research's data collection technique and data analysis are described, both of which are necessary for obtaining the desired research outcomes.

A. Data Collection

There are two types of data collections in this study: primary and secondary data. The researcher collects primary data using the survey method questionnaire. The poll is carried out among PTP's targeted respondents. The survey data has been translated into credible information, and the research has provided considerable results. Secondary data is gathered by analyzing the qualitative content of literature reviews.

- *Primary Data*

The questionnaire method is employed to obtain primary data for this study. Following the needed pilot testing, the researcher created a questionnaire and disseminated it to the intended respondents. The questionnaire's questions were designed to identify the PTP's current hazardous cargo management methods. Through data analysis, the researcher was able to obtain useful information about the research from the data and results of the respondents' questionnaire evaluations.

The researcher's questionnaire is divided into two types of formats: open-ended and closed-ended. In two rounds of surveying, the questionnaire was distributed to the respondents. The researcher gathered qualitative data from open-ended questions, whereas quantitative data was obtained from closed-ended questions.

- Secondary Data

Secondary data for this study came from a literature review and was analyzed using Qualitative Content Analysis. The research began with a review of previous studies by other researchers that were relevant to the main research goal. The literature review's data and information were gathered from a variety of sources and translated into useful knowledge.

A. *Data Analysis*

The data analysis is based on the questionnaire responses. The information gathered from the respondents is compiled and analyzed. After the data has been gathered, it will be assessed and analyzed. Microsoft excel 2016 is used to analyses the data. A descriptive test was undertaken because the information was as stated by the Likert scale. The researcher can utilize excel to determine which test is appropriate for this study. The Pearson correlation test was utilized. The test statistic Pearson's correlation coefficient assesses the statistical relationship, or association, between two continuous variables. It provides information on the amount and direction of the relationship's association, or correlation.

B. *Population Sample*

Sampling is the process of selecting a representative of a group from the study's population. The population's target is the total group of people from which the sample could also be drawn. A sample, on the other hand, refers to the group of people who take part in the research or investigation. People who take part are referred to as participants or respondents. Some research's population target may be as broad as all humans, but some research's population target may be a smaller group, such as teenagers, pre-school children, or workers divided into departments. Furthermore, it is nearly impossible to study every single person in the target population. As a result, psychologists choose a subset of the population that is likely to be representative of the target population and is interested in the study. Port of Tanjung Pelepas has a large number of workers. Researchers were unable to collect data from each respondent due to population size. The researcher only selected the worker that involved in green port to assist the researcher in collecting accurate data for this study. The target of population for this research was 80, and the target sample research has selected 66 respondents based on table for determining sample size of population.

Table 1:The breakdown of sample and population

Target	Population (N)	Sample (S)	Data Obtained
PTP worker that involved with green port	80	66	60

C. Pilot Test (Cronbach's Alpha)

As for the research, the researcher has included several methods beneficial to read the data. Essentially, a pilot test needs to be conducted since the researcher has to know the result from the reliability test of the questions constructed before it could be distributed to the actual respondents. For the pilot test, the researcher has a total of 12 respondents as the sample who are required to answer the questionnaires. The samples are from the expert student and lecturer in UniKL MIMET. According to the range of reliability test, the greater result the better the reliability.

Table 2 Cronbach's Alpha Internal Consistency

Cronbach's alpha	Internal consistency
$0.9 \leq \alpha$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

Table 3: Actual Result of Cronbach's Alpha

Question	20 Question	
sum of the item variances	11.57396	sum of the item variances
variance of total scores	126.2249	variance of total scores

Thus, the table showed a result once the pilot test has been done. The score obtained from the pilot test is 0.956 which is considered as excellent reliability.

D. Method Used

After considering numerous factors, the overall sample size for the questionnaires in this study is 60 respondents. A collection of 27 questions has been prepared and delivered to the intended respondents in order to perceive the information required and most importantly relevant to the research objectives. The method employed in this study is survey-based research. The data analysis is based on the responses to the questionnaire. The data collected from respondents is assembled and examined.

E. Descriptive Analysis

The data is analyzed using Microsoft Excel. Because the information was as expressed on the Likert scale, a descriptive test was conducted. The researcher used the descriptive statistics and Pearson correlation to analyze the result, the researcher used mean score analysis into five levels of score which are very low, low, medium, high and very high. The mean is average by mixing all scores divided by the number of respondents or items.

F. Pearson Correlation

The second objective data of statistical analyses in this study use Pearson correlation to examine the relationship between the independent and dependent variables. The Pearson correlation test was used to investigate the association between hazardous cargo management and PTP's green port performance. There are two elements for the dependent variables, which are green port performance and the hazardous cargo management practice, which is the independent variable for this study. The correlation will reveal the link between the variables in greater detail. This method can be used to decide whether the statement question for this study should be rejected or approved.

4.0 RESULT AND DISCUSSION

This section provides an overview and detailed results from the analysis obtained from the questionnaires given to the respondent which are workers in PTP. Basically, the date is divided into 4 sections which are the section A (demographic), section B, objective 1; to investigate the current hazardous cargo management practices at PTP, section C, objective 2; To determine the relationship between hazardous cargo management and green port performance at PTP. The collected data will be analyzed carefully and will be presented in tables, pie and bar chart. This followed by Microsoft excel on the Descriptive Statistic and Pearson correlation. The main objective of this research to determine the relationship between hazardous cargo management and green port performance at PTP.

Section A: Demographic Analysis

The data shows that there were 60 total respondents. The Ages majority of the respondents were between the ages of 31 and 50, with 32 (53 %), while those under 30 were 26. (43%). The age group 51 and up has two people in it (3%). The education plurality of the respondents had a degree background of approximately 34 (56%). Meanwhile, 19 percent of respondents had a postgraduate background (32%). And the diploma/technical level was 7(12%). According to the findings position of respondent, the majority of the respondents are professionals with an educational background. The position of respondent with 26 (44%) from the contractor line and 18 from executive / officer (30%). There are 14 technical personnel respondents (23%). There were two top managers involved (3%). The majority gender of the respondents is male. Male respondents received 38 (63%) and female respondents received 22. (37%). The setting is more suitable for males than females in the shipping business because it is a heavy sector. The familiarity of respondent with green port major portion were medium, with 25 of them working in the green port (41%). Meanwhile, the minimal involvement with green port was reported by the minority of 13 respondents (22%). And 22 people were involved in the green port of response (37%). While no one from the responder that unfamiliar with green port concept (0%).

Section B: Descriptive statistics objective 1

To investigate the current hazardous cargo management practices at PTP. The researcher used mean analysis into five levels of mean score which are very low (1), low (2), medium (3), high (4) and very high (5). The mean is average by mixing all scores divided by the number of respondents or items. List of the current hazardous cargo management practice in the Table B questionnaire which are:
- written permission
- Packing
- Labelling
- Placard
- Documents
- Segregation
- Stowage and separation
- Emergency Response Procedures

Table 4 Descriptive Statistics Research Question Section B

NO	INDICATOR	Scale	
		Mean	Mean score level
1	Each and every port worker in the logistics chain give pay close attention to the safe carriage of dangerous goods.	4.55	Very high
2	The classification of all dangerous goods is being implemented to make sure the safe of cargo handling practices.	4.62	Very high
3	Hazardous cargo requires written permission from the Johor Port Authority or PTP before being landed at the port.	4.53	Very high
4	Packing material for dangerous goods are tested at port for sustainability and compliance with rules and regulations	4.52	Very high
5	The activity of labelling is being carried out to ensure the safety of dangerous goods at the port.	4.6	Very high
6	Carrying dangerous goods at port must display at least one placard on each side and one on each end of the unit.	4.57	Very high
7	Dangerous goods documents Practice at the port was just as vital for applying safety during hazardous cargo operations.	4.5	Very high
8	The port was developed that some classes of dangerous goods might be loaded and transported with another class of dangerous goods by following segregation standards.	4.55	Very high
9	One of the most important aspects that apply in port of managing the transport of dangerous goods is the stowage, segregation and separation of these goods.	4.6	Very high
10	Managing of dangerous goods at port contains guidance on Emergency Response Procedures for Ships Carrying Dangerous Goods.	4.57	Very high

Based on the data, the majority value for every question is 4 which the respondents are Agree based on the Likert scale score and only two item has minimum value of 2 Disagree. Also, the maximum value for every item is 5 which the respondents strongly agree with the question. This shows that there is every worker in PTP agree that all list of hazardous cargo management practice is practically in PTP operation.

On other hand, the respondents answered strongly agree with the items and affect most the mean score above 4.20, which is high. The highest mean score, which is question 2 (4.62) and the lower mean score was question 4 (4.52). Then, the total mean got 4.561, that means every worker in PTP agree that all list of hazardous cargo management practice is practically in PTP operation.

Section C: Pearson Correlation

Objective 2 question: What is the relationship between hazardous cargo management and green port performance at PTP?

Table 5: The relationship of variables

	The hazardous cargo management practice.	Green port performance
The hazardous cargo management practice.	1	0.9985
Green port performance.	0.9985	1

Correlation value	Dependence interpretation
0.01 − 0.09	Trivial or none
0.10 − 0.29	Low to medium
0.30 − 0.49	Medium to essential
0.50 − 0.69	Essential to very strong
0.70 − 0.89	Very strong
0.90 − 0.99	Almost perfect

Source: De Vaus, 2002

Figure 1: The correlation coefficient rate

Pearson Correlation test was computed to examine the relationship between hazardous cargo management and green port performance at PTP. The finding shows that there was relation between the variables ($r = 0.961$). Based on the table correlation given (De Vaus, 2002), the relationship by almost perfect. There has significant relationship between the hazardous cargo management practice and green port performance. This shows that the hazardous cargo management give effect to the green port performance.

Section D: Open ended question

Question 1: What practice do you think contributes the most to green port performance, based on your experience?

Question 1 posed the question of what is the best hazardous cargo management practice that contributes to green port performance. Many practices that apply in PTP were mentioned by the 11 respondents, including IMDG Code, Cargo manifest, Bill of Lading, and so on. The finest presentation was on a Material Safety Data Sheet (MSDS), which is a document that contains information on potential dangers (health, fire, reactivity, and the environment) as well as how to work safely with a chemical product. It is a necessary first step in the establishment of a comprehensive health and safety programmer. Other than that, A cargo manifest is a list of the items comprising the cargo (freight) being transported. The cargo manifest contains information on the items, such as transport document numbers, sufficient space, logistics providers, marks and numbers, package number and type, descriptions and quantities of the goods. Aside from that, the majority of respondents stated "Take note of hazardous handling or pollution" and "Take note of worker responsibility during hazardous cargo management to contribute to green port performance."

  Question 2: Based on your knowledge and experience, what is your perspective on whether PTP reaches the Green Port Policy Percentages in managing hazardous cargo in daily operations?

  Question 2 inquired about respondents' opinions on whether PTP achieves the Green Port Policy Percentages in daily operations when handling hazardous cargo. The first opinion from managerial was that PTP operation complied with green port policy in daily operations, and that respondent also agreed to two procedures for dangerous cargo management, namely the safety document and approval from relevant duties to land hazardous cargo (HC) in PTP.

One of the markers in PTP to handle HC as a greener port is documentation and formal consent from JPA. Aside from that, one respondent mentioned the -Port Management Information System (PMIS), which was created to manage the administrative procedures associated with a vessel's arrival and departure, as well as to control traffic within the port basin. A project management information system (PMIS) is the logical structure of the data needed for a company to complete projects properly. A project management information system (PMIS) consists of one or more software applications as well as a methodical approach for gathering and using project data. Following that, the majority of respondents agree with the question statement on whether PTP meets the Green Port Policy Percentages in daily operations when it comes to managing hazardous cargo.

The study of this research is to investigate the current hazardous cargo management practices and to determine the relationship between hazardous cargo management and green port performance at PTP. The collected data is from the PTP worker that involved in the production site. The findings obtained revealed that the relationship between HC management and green port performance is strong based on the total mean result on each of the items inside each the section and the score of Pearson correlation test on objective 2. The current HC practice of total mean shows semblance that makes it important to manage the HG in PTP. Based on the mean indicator by [10], the mean obtained from this research can be concluded as in high mean scores. It is because both variables revealed the score above the mid-point of scale, current HC practice (total mean score= 4.561) and the relationship (total mean score= 4.564). Same goes to Pearson correlation score, the finding shows that there was relation between the variables (r = 0.961). Based on the table correlation given (De Vaus, 2002), the relationship by almost perfect. There has significant relationship between the hazardous cargo management practice and green port performance when the mean was examined further, the mean for most of the items in the questionnaire obtained above the mid-point scale. It seems therefore fair to state that the respondents in this study generally have a positive attitude towards safety at work.

5.0 CONCLUSION AND RECOMMENDATION

The top administration of the Port of Tanjung Pelepas (PTP) is advised to keep track of hazardous cargo operations daily. The recommendation that can be implemented is to concentrate on complying to the top three determinants, as they have an impact on hazardous cargo performance in green ports. The first major determinant can be adhered to by engaging expert managers and experienced staff to improve hazardous cargo management. The second major determinant can be adhered to by providing relevant information, practices, and creating awareness about hazardous cargo management. Hiring a hazardous cargo specialist contractor and developing a better hazardous waste strategy and master plan. The third most essential determinant can be adhered to by preventing dust pollution by improving equipment maintenance or replacing diesel operating equipment with electric equipment, both of which can contribute to a more environmentally pleasant environment around PTP. If the expense of resource, operation, and maintenance of the top determinants are difficult to use and comply with, other lower weightage determinants such as port greenery and staff training should be explored as alternatives.

Future study should concentrate on the top three determinants, according to the recommendations. These top three important criteria can help the green port perform better in PTP. With a larger number of expert respondents, this study can be improved even more. The outcomes of a data questionnaire might be more accurate and surer if more experts are involved. Furthermore, it is critical for the researcher to closely watch and assist respondents in evaluating the questionnaire if they require assistance. It will assist them in being adequately led and informed in their evaluation. These two suggestions are thought to aid in generating a better outcome in terms of prioritization and consistency of judgments, hence increasing the study's dependability. It is also recommended that a longer period of research be allocated so that data gathering, and analysis can be enhanced, ultimately leading to beneficial outcomes.

Overall, all the objective of this research had been achieved successfully which is to investigate the current HG management practice, and relationship between HC management and green port performance. Besides that, this study was also conducted to identify the respondents' perception to the recommended green port performance at PTP. From this study, the researcher can conclude that, most of the respondents are notice about hazardous cargo management.

So, all the daily operation in port toward hazardous cargo management are going smoothly, safe and might improve their green port performance. Based on the objective findings of the second study, the hazardous cargo management practice has significant relationship toward green port performance. This positive outcome is related to the findings obtained revealed that the relationship between HC management and green port performance is strong based on the total mean result on each of the items inside each the section and the score of Pearson correlation test on objective 2. The Green Port Policy proposes some proactive measures and easy solutions for better managing the consequences on the local population and the environment.

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