THE EFFECTIVENESS OF THE OIL SPILL CONTINGENCY PLAN COMPLIANCES AMONG RELATED GOVERNMENT AUTHORITIES AT A PORT

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ABSTRACT

The study attempts to evaluate the effectiveness of the current oil spill contingency plan concerning the response of oil spill cases on a port in Malaysia and, to explore the relationship of the viability on the current oil spill possibility arrange among the government-related specialists towards the oil spill cases. The oil spill contingency plan highlights the resources and the roles of the government agencies involved in the oil spill response. There are four independent variables in this study which elements of *risk assessment, priorities for protection, strategic policy, and response techniques.* The dependent variable of the study refers to the effectiveness of the oil spill contingency plan compliances among related government authorities at a port. 125 respondents have participated in this study, which was from MMEA, DOE, Fisheries department, and Marine Department. The effectiveness of the oil spill contingency plan compliance is positively correlated with the response techniques, strategic policy, priorities for protection, and the risk assessment *by 0.793, 0.791, 0.789,* and *0.755* respectively. The collaboration from the related government agencies such as MMEA, DOE, Fisheries Department, and Marine Department in responding and controlling the oil spill incidents with the desired of the oil spill contingency plan at a port is vital. The role of the related government agencies is important to oil spill incidents.

Keywords: oil spill contingency plan, response team, government authorities

INTRODUCTION

The maritime industry is related in the carriage to activities in the delivery of cargoes as shipping and port operation, comprising a broad supportive action offshore oil and gas exploration and manufacture. Our country is surrounded by the mainland and involves maritime activity such as supply and logistics of the products and services. The coastline is important to our country and serves the economy as unique maritime features and extensive coastline (Khalid, 2012). However, it is important to protect our sea from marine pollution. Oil spill accident occurs due to several factors and affects several parties. There are cases where the oil spill is contributed to the human factor, technical error, and natural disaster. Technical error is a common contributor to oil spill incidents.

As a member of IMO, Malaysia is obligated to follow and apply with the annexes provisions by MARPOL as shown in Table 1.

Table 1. MARPOL 73/78 Annexes (IMO, 2017), (Code, I. S. P. S, 1998)

Annex	Functions
I	Regulations for the prevention of pollution by oil
II	Regulations for the control of pollution by a noxious liquid substance in bulk
III	Regulations for the prevention of pollution by harmful substances carried by sea in packaged forms, or freight containers, portable tanks, or road and rail wagons
IV	Regulations for the prevention of pollution by sewage
V	Regulations for the prevention of pollution by garbage from ships
VI	Regulations for the prevention of air pollution by ships

PROBLEM STATEMENT

This study concentrates on the effectiveness of the oil spill contingency plan compliances among related government authorities at a port in the northern region of Malaysia. This study aims at the response action to the oil spill by the related marine agencies that are responsible for responding to the oil spill incidents.

SIGNIFICANCE OF STUDY

Management and prevention of the oil spills at port includes the preparation and the response action. It involves an integration from a few main related marine government agencies such as the Malaysian Maritime Enforcement Agency (MMEA), Marine Department, Department of Environment (DOE), Fishery department. The oil and gas operations require a systematic and well-organized infrastructure to prevent such incidents from occurs. It is also concerned with an adequate supply of the machines and utility, minimizing the costs to rescue and the damage at the same time. The objective of this research is to analyze the effectiveness of the current oil spill contingency plan on the response of oil spill cases at a port and explore the relationship of the viability of the current oil spill possibility arrange among the government-related specialists on the oil spill cases.

LITERATURE REVIEW

The oil spill definition

The oil spill is an accident or ship corrosion with human error or technical error. The oil spill incidents occur either intentionally or unintentionally such as ship collision, leakage, and ship sunk and affect many parties. The oil spill is described as a release of liquid or raw natural fuel into the natural environment, especially into the ocean. The oil spill is a huge alarm as the oil spill threatens the marine flora and fauna. The natural oil spill incidents happen around petroleum seep and due to movement inside the earth triggering the escaping of liquid or gases to the world outward (Othumpangat & Castranova, 2014). The technical error involves machinery or equipment while human error occurs when the crews are fatigue and face ergonomic problems due to the tons of work onboard in an open sea. For example, a watchkeeper may lose his focus and tends to do a mistake during the voyage and could cause oil spill incidents (Othumpangat & Castranova, 2014).

The importance of the oil spill contingency plan effectiveness

The oil spill crisis creates a difference to minimize potential peril to human well-being and the environment by ensuring a convenient and facilitated reaction. A well-designed nearby, state, territorial, and national contingency plans help the response workforce in their endeavors to contain and clean up the oil spills. It provides information that the reaction groups require in combating the oil spill incidents and allows the response community to work together effectively. The basic components of the contingency plan cover: a) Marine life: sensitive or important physical and biological resources in or near the sea, including marshes, unusual plants, and wildlife, b) Habitats: environments required by various species for spawning, feeding, or migration, c) Climate: weather pattern and tides, d) Shoreline characteristics and, e) Proximity: to roads, airports, and other transportation-support provisions.

The government has outlined the oil spill response plan which is known as the National Oil and Unsafe Substances Pollution Possibility Arrange or is called the National Oil Spill Contingency Plan. This plan guarantees resource utilization and the accessibility of the related government's ability in reacting to the oil spill.

The oil spill contingency plan

The Area Possibility Plans (EPA) have been developed to cater to several plans and areas. This plan portrays the variety range secured by the arrangement that portrays the responsibilities of the government agencies to expel, moderate or anticipate a discharge, to list all gear, dispersants, or other mitigating substances and gadgets accessible to the government offices to guarantee viable and immediate evacuation, moderation, or anticipation of a discharge.

The oil spill contingency plan is a detail of the oil spill response and removal that addresses controlling, containing, and recovering an oil discharge in quantities that may be harmful to navigable water or adjoining shoreline. It is a legal requirement practice for operations in the offshore oil and gas industry, vessel operations in ports and harbors,

and the international shipping sector (Othumpangat & Castranova, 2014). The plan provides secondary control for qualified oil fill-up operating equipment for an operator to prepare in responding to the oil spill incidents (Ishak, 2019). The plan is a recorded dedication of workforce, equipment, and material to quickly regulate and removed discharge oil. It also consists of an examination or observing system to detect a collapse or release of any oil spill (Othumpangat & Castranova, 2014).

The elements of the oil spill contingency plan cover: a) Definition of the authorities, responsibilities, and duties of all entities involved in oil operations, b) Removal operations, c) Procedures for early detection and timely notification of an oil discharge, d) Assurance of full resource capability and the following discharge, e) Actions after discovery and notification of a discharge and, e) Procedures to facilitate recovery of damages and enforcement measures.

The primary objective of the oil spill response plans cover: (a) Allow response personnel to prepare for and safely respond to the oil spill incidents, (b) Ensure an effective and efficient response that highlight and account for geographical challenges, (c) Identify potential equipment, manpower, and other resources necessary to implement a spill response, (d) Outline response procedures and techniques for combating the spill at a specific location and, (e) Improve regulatory compliance efforts (Carmichael, 2013).

Government-related agencies involved in oil spill

There are several related governments agency involves in the oil spill response such as the following:

Marine Department: it is a government agency of the minister of transport marine, Malaysia. The objective relates to administering matters related to shipping and ports including maritime affairs within Malaysian waters in an open sea. The primary objective is to ensure recognition of the competencies of Malaysian seafarers by outside and outside the country following the provision of the STCW convention and merchant shipping ordinance 1952. The second main objective is to protect the seafarer's welfare and affairs. The last objective is to ensure all ports and jetties under the supervision of the marine department are always safe and operational. The department is also covered management of competencies certification, management of maritime training institution accreditation and management of seafarers, and management of the port.

Table 2. The main activity of the marine department

Registration of ships and licensing of boats
Regulating shipping laws
Inspection of ships' safety
Inspection of Flag State and Port State Control
Regulating the International Safety Management Code (ISM Code)
Verification of International Ship and Port Facility Security (ISPS) Code
Investigation on ships accident
Maritime safety and inspection of ships
Training and examination
Prevention and control of marine pollution
Implement and monitor the implementation of an international convention

Department of Environment (DOE)

The establishment of DOE is based on the Environmental Quality Act, 1974 which was enacted in March 1974 and came into force on 15 April 1975. The key purpose of the DOE is to avoid, eradicate, monitor contamination, and enhance the natural environment, reliable with the objectives of the Environmental Quality Act 1974 and the regulations thereunder. DOE is also responsible for the implementation of the resolutions decided by the conventions of the international environment such as the Vienna Convention for the protection of the Ozone Layer 1985, Montreal Protocol on Substances That Deplete the Ozone Layer, 1987, the Basel Convention on the Transboundary Movement of Hazardous Waste and Their Disposal Act 1989 and other areas while the success of programs of bilateral

cooperation and multilateral cooperation between Indonesia, Singapore and other (ASEAN countries on environmental management).

Fisheries Department

Department of Fisheries Malaysia has been established in 1894 as the colonial Fisheries Unit. The department's main function is to manage and develop the fisheries industry in line to establish a modern and commercial sector, provide maximum opportunities and benefits for all stakeholders of the industry (Department of Fisheries Malaysia).

Malaysian Maritime Enforcement Agency (MMEA)

The MMEA was formed as a result of a study undertaken by the Malaysian government in April 1999. The study revealed that enforcement was not effective because too many agencies were involved that resulted in overlapping function, overlapping jurisdiction, and uneconomical use of resources. The MMEA began with the creation of a Nucleus team, tasked with making the necessary efforts in the establishment of the agency. The agency was formally established with the enactment of the Malaysian Maritime Enforcement Agency Act 2004. The MMEA is known as the Malaysian Coast Guard for international identification is the coast guard organization of Malaysia, and the principal government agency tasked with maintaining law and order, coordinating search and rescue operations in the Malaysian maritime zone and on the high open sea. (Prime Minister of Malaysia Department).

Table 3. The function of MMEA

To control and prevention of ocean pollution
Prevent piracy and illicit trafficking of narcotic drugs on the high seas
To execute maritime search and rescue
To establish and manage maritime institutions for training
To carry out coastal and air surveillance
To prevent any offenses in the Malaysian Maritime Zone
Prevent piracy and illicit trafficking of narcotic drugs on the high seas

Table 3 shows the main function of MMEA in Malaysia's open sea zone. The agency also portrays an essential responsibility towards prepare and respond to the oil spill cases in Malaysia. This agency gives strength to the Malaysian sea zone from danger or an emergency.
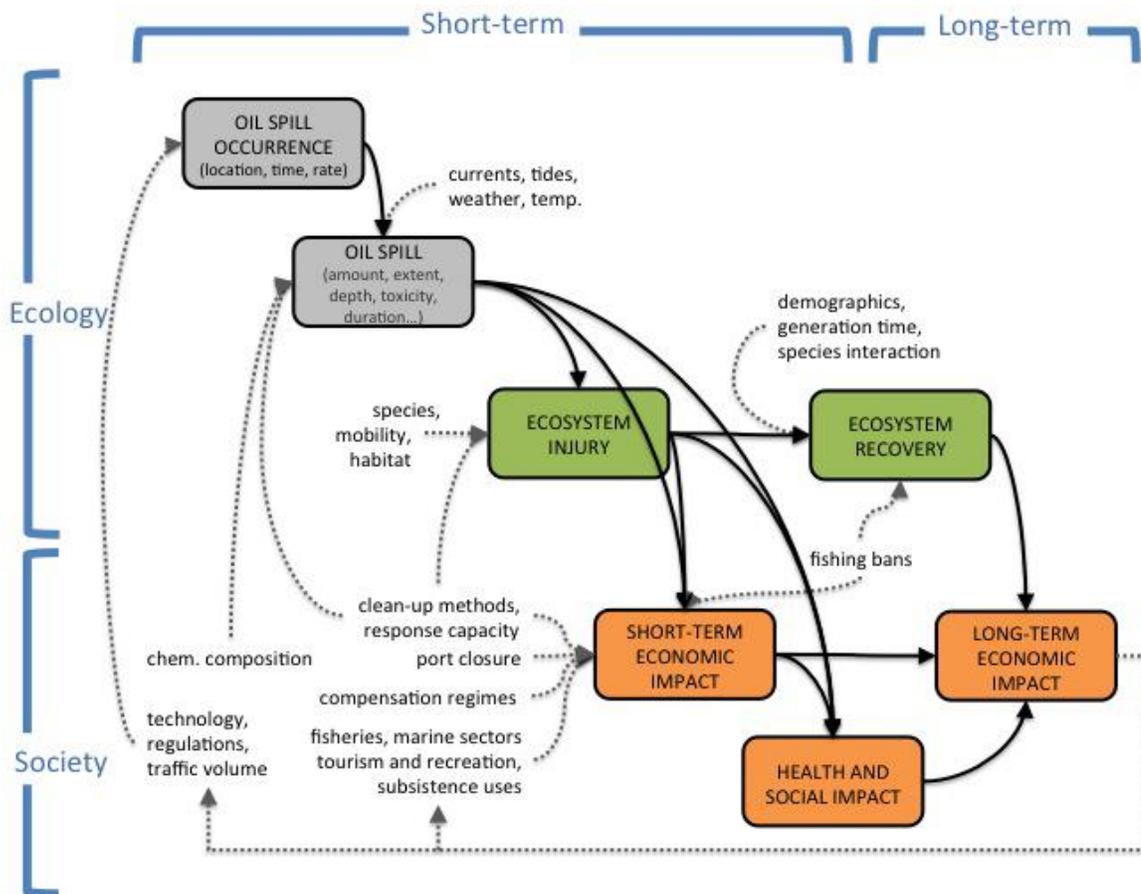
The effect of the oil spill

Marine life: The oil spills caused through smashed transporters, pipes, or offshore oil rigs frequently cause instant and extended-term ecological harm that can last for decades and among the most notable areas of environmental damage caused by spills. Once an oil slick from a large spill gets a beach, oil coats and clings to each rock and piece of beach. If the oil splashes into coastline wetlands, mangrove plantations, or other marshes, stringy plants and grasslands soak up oil, which can harm plants and create a zone unacceptable as flora and fauna environment. When the oil spill sooner or later breaks fluctuating on the water's surface and initiates to sink into the maritime atmosphere, it could consume similar destructive effects on delicate submerged ecologies, killing or polluting fish and lesser creatures that are vital associations in the worldwide food cable (Zhou, 2019) and (Kennish, 2019).

Human life: The oil spills may occur all around us. Since oil products include a lot of common fuels, it is obvious that oil spills might happen at high rates and in many locations, including residential areas. Surface oil spills are easy to identify and will leave visible traces such as oil stains, as well as other characteristic signs such as odors due to the vapors emitted by the spilled oil. The oil spill effects include a variety of diseases, negative economic impact, pollution with crude oil or petroleum products, and the aesthetic issues that affect the residents of the affected areas in multiple ways (Zhou, 2019) and (Kennish, 2019).

Economic effect: It is the main effect of the oil spill contamination that could affect the community once the oil spill occurred in several ways. The long-term ceasing of activities such as fishing in the polluted waters could affect

fishermen and fisheries and affect the tourism industries too. The oil spill incidents also affect and disturb land and sea traffic and affect import-export activities (Medline Plus, 2014).

Figure 1. The oil spill effect framework (Medline Plus, 2014).

Figure 1 shows the oil spills provides an effect on the environment, human, economy, and others in a short term or long-term effect. The effects could be direct exposure and indirect exposure. *Direct exposure*: By breathing contaminated air since the oil and petroleum products have many volatile compounds that are emitted as gases from spilled oil, the air becomes contaminated with those volatile oil products or vapors producing specific odors. The direct contact affects the people's skin while living in the contaminated area and the contaminants may be absorbed through the skin and enter the human body. *Indirect exposure:* By bathing in contaminated water for example swimming in a contaminated water stream, even when the oil sheen may not be visible, dissolved oil contaminants may exist in the water if it was impacted by the oil spill. Besides that, by eating contaminated food which some oil compounds bioaccumulate in living organisms and may become more concentrated along the food chain. Humans may become exposed to concentrations of contaminants in the food that could be orders of magnitude higher than in the contaminated environment (Medline Plus, 2014).

RESEARCH METHODOLOGY

The questionnaire survey method

This questionnaire survey method was applied in this study. There are 21 items in the questionnaire formed into four sections. *Section A:* Respondents background: It comprises of age, sex, race, education level, working experiences, and position in the organization. *Section B*: Company background: It covers the number of response members, experiences of the agencies in dealing with the oil spill incidents. *Section C:* Safety measure: It covers the steps to

anticipate the oil spill incidents and the safeguard steps to avoid oil spill incidents. *Section D:* The effectiveness of the oil spill: It covers the elements of the effectiveness in responding to the oil spill incidents.

The closed-ended questionnaire

The closed-ended questions were applied in this study to gather the information from the respondents. It gives the best answers and involved less demanding for the respondents to select the best answer among the given choices. The answers will be collected and analyzed to achieve the study objectives.

The population, samples, and respondents

Population: Table 4 shows the breakdown for population, sample, and respondents involved in this study. The population was among MMEA, DOE, Fishery department, and Marine department. The total number of populations was 505 from these four agencies. *Sample:* Sample is a little scope that has been taken from the recognized populations. The sample size was more than by a minimum of 25% from each of the population groups (Sekaran, 1992). The total number of samples was 152 individuals which were taken at 30%. *Respondents:* 125 respondents participated in this study which has given the response rate at 82.24%.

Table 4. The population, sample, and respondents

Item	Agencies	Population	Sample	Respondents
1	MMEA	120	36	30
2	DOE	70	21	17
3	Fisheries Department	85	26	21
4	Marine Department	230	69	57
	Total	505	152	125

The proposed conceptual theoretical framework

Independent variables   Dependent variable
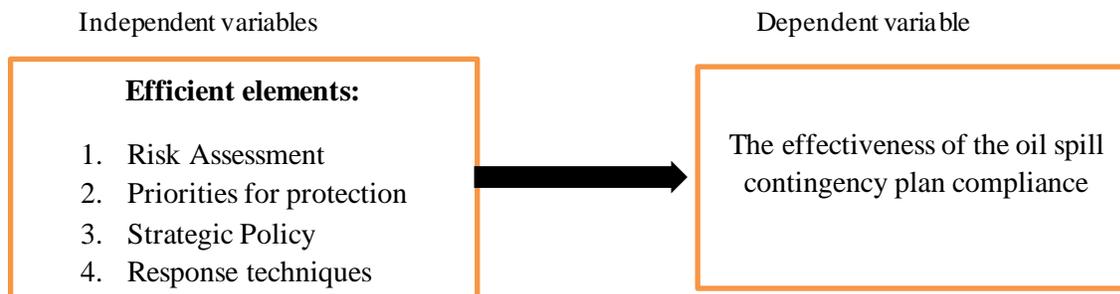
Figure 2. The proposed conceptual theoretical framework

The proposed conceptual theoretical framework consists of the independent variable and the dependent variable. The element of the independent variables consists of *risk assessment, priorities for protection, strategic policy, and response techniques*. The dependent variable covers the *effectiveness of the oil spill contingency plan compliance*.

Likert scale

To evaluate the respondent's degree of understanding on statements supplied in the questionnaires utilizing the usage of the Likert scale (Dittrich, Francis, Hatzinger & Katzenbeisser, 2016). It is applied as an essential instrument in the field of psychology, social survey, and accumulating attitudinal statistics. The Likert scales require respondents to select including the 5-points degree of agreement for that statement created on their viewpoint as displayed in Table 5. The subsequent scale shows quantify remained applied by utilizing a Likert scale by a score of 1 to 5 (Sullivan, & Artino, 2013). The information collected will be prepared and dissected in arrange to urge the result to assist discourse (Nguyen, Nisar, Knox & Prabhakar, 2018).

Table 5. Likert scale score

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Table 5 indicates the Likert scale utilized in Section C of the surveys in offering respondents to convey the intensity of agreement. The Likert scale dimension involves a person to react to a sequence of a proclamation by showing whether strongly agree, agree, neutral, disagree, and strongly disagree.

RESULTS AND DISCUSSION

The accumulated information has been evaluated by utilizing Statistical Package used for the Social Science (SPSS) version 25. The investigation included reliability test, normality test, descriptive analysis, frequency analysis, and reporting frequency distribution, percentage of the demographic characteristics of the respondents, and connection among dependent and independent variables from multiple correlation and regression.

Pilot Test

A pilot test was conducted engaged a minor study to review study procedures, information compilation methods, sample enrollment approaches, and additional methods in formulation for study (Nguyen, Nisar, Knox & Prabhakar, 2018). The pilot test included the dissemination of a survey to 10 samples of government authorities from the Department of Environment and Marine Department in Lumut, Perak.

Reliability test

Table 6 illustrates the value of Cronbach's alpha of 0.887 is acceptable among 10 pilot test respondents. The Cronbach's Alpha with less than 0.5 suggested questions to be removed.

Table 6. The reliability statistic

Cornbrash's Alpha	N of Items
.787	21

Table 7 shows the Cronbach's alpha for each one question whether it is higher than 0.5 or lower. Once the value is fewer than 0.787 the question should be denied or eliminated from the questionnaire. If the value is higher than Cronbach's Alpha, the reliability and validity of the questionnaire rise.

Table 7. Cronbach's alpha if item deleted

Item-Total Statistics				
Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cornbrash's Alpha if Item Deleted
21	64.22-65.22	684.235-705.765	0.712-0.853	0.685-0.887

Normality test

Table 8. The Kolmogorov-Smirnova

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Items	Statistic	df	Sig.	Statistic	df	Sig.
21	.209-.473	126	.000	.481-.868	126	.000

a. Lilliefors Significance Correction

A normality test is utilized to establish the sample, or every unit of statistics fits standard average dissemination besides is executed statistically or graphically. Table 8 states the Kolmogorov-Smirnova significance value at 0.000

which means that the data comply with the necessity for the normality of the statistics and be able to be presumed that the normality of the sample gets not any disparity with the population.

The demographics of respondent review

Descriptive analyses are used to describe and understand the respondents' background by using frequency and percentage as shown in Table 9 (Connor, Kaufman, Ward & Lieber, 2020).

Table 9. Demographics of respondent summary

Details	Descriptions	Frequency	Percentage
Gender	**Male**	**82**	**65.6**
	Female	43	34.4
	Total	125	100
Age	Below 20 years old	9	7.2
	20-29 years old	**92**	**73.6**
	30-39 years old	21	16.8
	40 years old and above	3	2.4
	Total	125	100
Race	**Malay**	**106**	**84.8**
	Chinese	11	8.8
	Indian	5	4
	Others	3	2.4
	Total	125	100
Working experiences	Less than 1 year	46	36.8
	1-5 years	**64**	**51.2**
	6-10 years	12	9.6
	More than 10 years	3	2.4
	Total	125	100
Education level	SPM	20	16
	STPM	21	16.8
	Certificate	11	8.8
	Bachelor	**63**	**50.4**
	Master	10	8
	Total	125	100

Gender: Male has 82 respondents or 65.6% and it is dominant. Female by 43 respondents or 34.4%. The data shows that the male is majority since it is related to the maritime industry where men or dominant compares to the female gender. *Age:* The highest number of respondents are in category 20 – 29 with 92 respondents or 73.6%. The second category is 30-39 years old by 21 respondents or 16.8%. The age below 20 years old by 9 respondents or 7.2%. There are 3 respondents by 40 years old and above or 2.4%. *Race:* Malay is the highest with 106 respondents or 84.8%, Chinese at 11 respondents or 8.8%, Indian by 5 respondents or 4%, and Others by 3 respondents or 2.4%. *Working experiences:* The highest amount of respondent is 64 respondents or 51.2% who have working experiences between 1-5 years, less than 1 year at 36.8% or 46 respondents, 6-10 years by 12 respondents or 9.6% and more than 10 years at 3 respondents or 2.4%. *Education level:* the highest with bachelor at 63 respondents or 50.4%, The second highest is STPM level which 16.8% or 21 respondents and, the third-highest for education level is SPM level is 16% or 20 respondents. The certificate level was 8.8% or 11 respondents and, the master level by 10 respondents or 8%.

The multiple correlation analysis

The multiple correlation evaluation is applied to measure the intensity of a correlation among independent and dependent variables (Puth, Neuhäuser & Ruxton, 2014). It is used to determine the cause-and-effect relationship (Connor, Kaufman, Ward & Lieber, 2020).

Table 10. Correlation Between Independent variable and dependent variable

Correlations		Risk Assessment	Priorities for protection	Strategic Policy	Response techniques	The effectiveness of the oil spill contingency plan compliance
Risk Assessment	Pearson Correlation	1	.662**	.885**	.793**	**.755****
	Sig. (2-tailed)		.000	.000	.000	.000
	N	125	125	125	125	125
Priorities for protection	Pearson Correlation	.662**	1	.721**		**.789****
	Sig. (2-tailed)	.000		.000		.000
	N	125	125	125		125
Strategic Policy	Pearson Correlation	.885**	.721**	1		**.791****
	Sig. (2-tailed)	.000	.000			.000
	N	125	125	125		125
Response techniques		.793**			1	**.793****
		.000				.000
		125			125	125
The effectiveness of the oil spill contingency plan compliance	Pearson Correlation	.755**	.789**	.791**		1
	Sig. (2-tailed)	.000	.000	.000		
	N	125	125	125		125

**Correlation Is Significant At The 0.01 Level (2-Tailed)

Table 10 shows the correlation response techniques and the effectiveness of the oil spill contingency plan compliance which is positively correlated and can be proved by the high value of 0.793. This positive relationship means that the relationship between response techniques and the effectiveness of the oil spill contingency plan compliance is strongly correlated. This correlation value is the second-highest for strategic policy by 0.791, followed by priorities for protection by 0.789 and risk assessment by 0.755 respectively.

The multiple regression analysis

The multiple regression analysis is applied as a statistical process for assessing the connections among a dependent variable and independent variables. The linear form of regression analysis is applied to find the line or a more complex linear function that extremely closely fits the data according to the precise statistical measure (Pajares & Miller, 1995).

Table I1. The multiple linear regression analysis

Multi Regression			Standard Coefficients		
Model		B	Beta	t (value)	Sig.
Adjusted R Square				**.745**	
F				8.169	.000
Constant		3.633		4.791	
1	The effectiveness of the oil spill contingency plan compliance	.131	.173	.690	.742
2	Risk Assessment	.108	.093	.690	.769
3	Priorities for protection	.276	.000	.643	.770
4	Strategic Policy	.108	.093	.590	.759
5	Response techniques	.108	.093	.562	.795

a. Dependent variable　b. The independent variables

Table 11 shows that 74.5% of the overall difference in the dependent variable of the effectiveness of the oil spill contingency plan compliance is described by the independent variables. The findings remain statistically substantial because the F value is significant at p<0.01.

CONCLUSION

The success of the response to the oil spill includes the appropriate preparation and response. Thus, marine activities should give an effect on the oil spill contingency plan. The oil spill contingency plan highlights the entire plan that contains avoidance, existing incident, and post occurrence of the oil spill. In conclusion, the data which have been collected and analyzed have achieved the research objectives. It is proved that the objective of the effectiveness of the current oil spill contingency plan on the response of oil spill cases at a port is crucial. Thus, the effectiveness of the oil spill contingency plan compliance is positively correlated with the response techniques, strategic policy, priorities for protection, and the risk assessment by 0.793, 0.791, 0.789, and 0.755 respectively. The collaboration from the related government agencies such as MMEA, DOE, Fisheries Department, and Marine Department in responding and controlling the oil spill incidents with the desired of the oil spill contingency plan at a port is vital. The role of the related government agencies is important to oil spill incidents. Besides, the effectiveness of the oil spill contingency plan plays an important role when face with oil spill incidents by making sure that the incident should be solved in the best method.

RECOMMENDATION

The suggestion to solve the issue of the oil spill incidents at a port may cover the following. *A regular and proper update:* the existence of the oil spill contingency plan should be updated and revised necessarily according to the changes in the environment and regulations. Besides, *the proper monitoring and feedback:* from the related government agencies in responding to the oil spill incidents, may help the organizations who are involved in the marine environment to solve the marine environment pollutions efficiently. *The adequate exercises for the response team*: with sufficient information concerning the oil spill preparedness and response facilitate to improve the effective percentage of the oil spill disasters protected. In the concurrence of the oil spill contingency plan, the *sufficient technology application* particularly in a delicate map is valuable in responding to the oil spill incidents. An *urgent response* is the essence of response to oil spill incidents. Lastly, *prevention* is constantly safer than treatment, the overflow of the oil is constant and harm the natural environment. This study indicates that the effectiveness of the oil spill contingency plan contributes to the preparedness and response on the oil spill. Efficient preparation and response are the crucial components to monitor the upcoming oil spill disasters concerning the maritime natural environment that might generate additional contamination and impacts on the population and human being condition.

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