

## Conference Paper

# Handling Transportation Accidents caused by Human Error

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### Abstract

Human error is often stated as the main factor causing transportation accidents. For the general public, news about transportation accidents with human errors as the cause is often interpreted as human error by system operators such as machinists, pilots, ship captains, and other professionals. This perception is not correct. There are many factors that can directly or indirectly encourage an operator to take inappropriate actions. Error itself is generally defined as failure to perform the 'correct' and desired action in a given situation. In addition, an error can be defined as such when the final action or result may not be that which was intended. This study employs qualitative research methods to evaluate the best methods of dealing with transportation accidents caused by human error.

**Keywords:** Accidents; Human error; Others Factor.

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## 1. Introduction

Indonesia is a maritime country with an area of approximately 5.8 million km<sup>2</sup> of waters. The extent of these waters makes Indonesia one of the international shipping lanes. Therefore, Indonesia is one of the international sea transportation routes that is passed by ships from various countries in the world. From ships with domestic routes to ships with international routes operating across Indonesian waters.

A sea ship is a means of transportation or a mode of sea transportation needed to load or unload various kinds of goods for economic purposes, from the North to the East in all ports in Indonesia. This activity is to improve and prosper the people of provinces, cities, sub-districts and remote areas. To implement all policies in the field of safety, the Company must have a Safety Management System which is a facility for all personnel on land and at sea. The company built this system by following the guidelines and document examples provided by the International Safety Management Code (ISM code.). A ship is said to be sea worthiness, if the requirements for material, construction,

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building, machinery and ship electronics are met, all of which are proven by original certificates.

Before embarking on a voyage, instructions must be known about how to assist ship accidents, due to collisions, aground, drowning, fire, rubbing and forcemajor or natural accidents, ship maintenance procedures include:

1. It is time for the ship to dock
2. Annual maintenance.
3. Emergency care.
4. Quarterly care.

In addition, it is necessary to intervene and the shipping association to work hand in hand and always improve safety and prevent ship accidents to a minimum. (Suyono, R.P. (2007). Shipping Pengangkutan Intermodal Eksport Import Melalui Laut, Musibah Kapal, Pencegahan dan Penanganannya, Keamanan Pelabuhan. Jakarta: PPPM. p.28) Causes of Ship Accidents in various causes of a disaster onboard include:

1. Human error (human error).
2. Damage to the ship's machinery
3. External and internal factors, such as fire and collision.
4. Natural factors. or weather
5. A combination of all these causes.

In general, the disaster that may occur on a ship is the result:

1. Collision with another ship.
2. Stranded / grounded
3. Drowning due to bad weather (badweather)
4. Burning (fire)
5. Engine failure (engine blackout / breakdown).
6. The ship is in contact with other ships.

## 1.1. Transportation safety is something that absolutely must be fulfilled.

This safety includes land, rail, air and sea transportation modes. Sea transportation safety has several elements that must be met. Sea transportation safety, hereinafter referred to as shipping safety, must meet at least 2 proper criteria. First is seaworthy and second is screen worthy. Seaworthiness is the fulfillment of 12 criteria in accordance with the provisions contained in the International Safety Management (ISM) Code published by IMO in the 2014 edition, sailing is a condition of fulfilling the safety of the ship to sail which consists of 4 criteria. Ship security here includes the condition of the ship and crew that meet the requirements to maintain ship security (D.A, Lasse. (2012). *Manajemen Peralatan aspek operasional dan Perawatan*, Jakarta: Raja Grafindo Persada. p.32).

According to Act No. 17 of 2008 concerning Shipping in Chapter I concerning General Provisions Article 1 Paragraph 1, it is stated that Sailing is an integrated system consisting of transportation in waters, ports, safety and security, as well as protection of the maritime environment. In Paragraph 32, it is stated that the Safety and Security of Shipping is a condition where the safety and security requirements are fulfilled regarding transportation in waters, ports, and the maritime environment. In Paragraph 33, it is stated that the ship's seaworthiness is the condition of the ship that meets the requirements of ship safety, prevention of water pollution from the ship, manning, loading lines, loading, welfare of ship crews and passenger health, legal status of ships, safety management and prevention of pollution from ships, and ship security management to sail in certain waters. In Paragraph 34 it is stated that ship safety is the condition of the ship that meets the requirements for material, construction, building, machinery and electricity, stability, arrangement and equipment including auxiliary equipment and radio, ship electronics, which is proven by a certificate after inspection and testing. In Paragraph 41 it is stated that the skipper is one of the crew members who is the highest leader on the ship and has certain powers and responsibilities in accordance with the provisions of laws and regulations. (Law Number 17. (2008). Shipping. Chapter I concerning General Provisions Article 1 Paragraph 1) Shipping safety is listed internationally in the Safety of life at Sea (SOLAS) 1974 Article IX, namely the International Safety Management (ISM) Code, which was amended by the 1978 Amendment applies to all ships sailing between ports in the world. One of the things that needs to be considered in sailing safety, namely ship guidance. Guiding the ship starts when the ship is about to enter or exit the harbor pool. According to Lasse (2014)

in Indonesia's sign is divided into sea guides and port guides. Sea guides can be placed on board a commercial ship sailing to the port of destination. The port guide carries out his duties only limited to the work environment or port pool, so the port guide does not guide ships sailing between ports but only in the port waters. (D.A, Lasse. (2012). *Manajemen Kepelabuhan*, Jakarta: Nika. p.23)

As the industry develops and the need for transportation, especially sea transportation in Indonesia, is increasing, it cannot be denied that there is an increasing number of ships operating in Indonesian territory. Therefore, Indonesia is one of the countries with heavy marine traffic and it is inevitable that cases of sea accidents occur for various reasons. Based on data from the NTSC, from 2007 to 2011 alone there have been 27 cases of ship accidents in Indonesian territory. (Data on ship accidents investigated by the NTSC)

## **1.2. Ship accidents are difficult to predict and can happen anywhere.**

Therefore, to deal with a disaster in the middle of the sea before the ship leaves port, the ship is required to carry out the following preparations and requirements: (1) follow the International Management code (ISM code) regulations, (2) test how to operate the emergency steering wheel, (emergency Rudder), (3) checking the operation of the GPS (Global Positioning System), (4) the safety of the lifeboat (David) the helper is lowered and elevated, (5) checking the anchors and anchor chains are in good condition, (6) preparing to receive the pilot (guide), and lowering Pilots, (7) check smoke detectors on the elevators to anticipate fires in the hatches, (8) before sailing. Maps starting from the toll point to the destination have been corrected and up to date, (9) checking the generator, running test or not. (Haralambides, HE. (1998). *The Economic and Social Impact of Port Reform*. The Hague: 29th PIANIC Congress)

## **2. Research Methods**

This type of research is a qualitative method. According to stating that qualitative research methods are the most appropriate type of research method in capturing human perceptions only with direct contact and an open mind and through inductive processes and symbolic interactions, humans can recognize and understand something (Semi-awan, C. R. (2010). *Metode Penelitian Kualitatif: Jenis, Karakteristik dan Keunggulannya* (Arita L (ed.)). Grasindo. p.12). The research was conducted in the field with the object

of research in the form of effectiveness. The data collection technique used in this research is observation with an exploratory step, namely doing one of the recommended qualitative data collection techniques to obtain descriptive data. (Gunawan, I. (2017). Metode penelitian kualitatif. In Bumi Aksara. p.17)

### 3. Results and Discussion

Human error is often cited as the main factor causing an accident. For the general public, news about transportation accidents with human error as the cause is often interpreted as human error by system operators such as machinists, pilots, ship captains, and others. This perception is actually inaccurate, considering many other factors and aspects that can directly or indirectly encourage an operator to take inappropriate actions.

Error itself is generally defined as failure to present a right and desired action in a situation. This error can only occur if there is proper attention, to respond to the events that are observed while the final action is not as intended. So it can be concluded that the final result of the error is an event, so that later there will be an event that can be observed. This error is not only limited by bad or serious output. Errors caused by human factors are likely caused by repetitive work with a 1% probability of error. (Iftikar, Z & Suta laksana. (1979). Teknik Tata Cara Kerja. Bandung: Jurusan Teknik Industri Institut Teknologi Bandung. p.24) The existence of errors that occur due to this repetitive work should be prevented or reduced as much as possible, the aim of which is to increase one's reliability by decreasing the rate of errors that occur. So it is necessary to improve human performance to reduce the error rate. An error rate of 1 in 100 occurs with a probability of 1%. If something like this happens, it can be said that the conditions are in good condition.

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Meanwhile, what is meant by accidents are events that are not planned, expected, or wanted and usually result in unfavorable outcomes. Errors are psychological events caused by psychological factors, so it is possible that some or all of the errors that occur have not been identified.

### 3.1. Human Error Classification

Basically, there is a human error classification to identify the cause of the error. The general classification of the causes of human error is as follows: (Ibid)

1. Induced Human error system. Where the mechanism of a system allows humans to make mistakes, for example, which management does not apply discipline properly and strictly.
2. Induced Human error design. The occurrence of errors is caused by the design or design of the work system that is not good. In accordance with Murphy's law (Murphys law) states that if an equipment is designed less suitable for the user (ergonomic aspect) then there will be a possibility that a mismatch will occur in the use of the equipment, and sooner or later it will happen.
3. Pure Human error. An error that occurs purely comes from within humans themselves, for example because of skill, experience, and psychology.

### 3.2. Causes of Human Error

The causes of human error can be divided into:

1. Primary Causes Primary causes are causes of human error at the individual level. To avoid errors at this level, technologists tend to advocate measures that relate to individuals, for example improving training, education, and personnel selection. (Drake, P.R. (1998). "Using the Analytic Hierarchy Process in Engineering Education". *International Journal of Engineering Education* 14(3): 191–196. Accessed on 18 November 2020) However, such advice cannot solve the errors caused by fraud and negligence.
2. Managerial Causes It is inaccurate to emphasize the role of the individual offender in error. Mistakes are something that cannot be avoided, training and education have a limited effect and fraud or negligence will always occur, no single emphasis on the correct use of technology will prevent mistakes. This fact has been widely recognized in the error literature in high-risk industries. (Ibid) It is therefore the role of management to ensure that workers are doing the job properly, to ensure that resources are available when needed and to allocate responsibilities accurately among the workers involved.

3. Global Causes Errors that are beyond management's control, include financial pressures, time pressures, social pressures and organizational culture.

### 3.3. Effort to Reach the Purpose of Safety

To achieve safety objectives, the following efforts are required:

1. Providing safe practices in ship operations and the work environment.
2. Building protection against all identified risks,
3. Continuously improving ground and personal safety management skills on board.

Every company is very important to develop, implement and maintain a Safety Management System which includes:

1. Safety and environmental protection policies.
2. Procedures for reporting ship accidents and deviations from code requirements
3. Instructions and procedures to ensure the safety of ship operations and environmental protection, workers on board strictly comply with international regulations and the laws of the flag State of the ship concerned. (D.A, Lasse. (2014). Keselamatan Pelayaran dilingkungan teritorial Pelabuhan Pemanduan Kapal. Jakarta: Raja Grafindo Persada. p. 26)

AHP (Analytical Hierarchy Process) is a decision support model developed by Thomas L. Saaty. This decision support model will describe a complex multi-factor or multi-criteria problem into a hierarchy. Hierarchy is defined as a representation of a complex problem in a multi-level structure where the first level is the goal, followed by the factor level, criteria, sub-criteria, and so on down to the last level of the alternative. (Saaty, L & Thomas. (1980). The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation. ISBN New York: McGraw-Hill 0-07-054371-2,) With a hierarchy, a complex problem can be broken down into groups which are then arranged into a hierarchical form so that the problem will appear more structured and systematic. AHP is often used as a problem solving method compared to other methods for the following reasons:

1. A hierarchical structure, as a consequence of the selected criteria, to the deepest sub-criteria.
2. Taking into account the validity up to the tolerance limit for inconsistencies of various criteria and alternatives chosen by decision makers.

3. Taking into account the durability of the output is the sensitivity of decision making.

In general, there are 3 stages in preparing a priority using AHP which can be seen in the process diagram below:

1. decomposition problem
2. assessment to compare the elements of decomposition elements
3. synthesis of priorities

**Decomposition**, every problem or problem that has been defined needs to be decomposed, break down the main problem into several criteria and each criterion can be further divided into several sub-criteria. This problem-solving process is called a hierarchy. There are two kinds of hierarchy, namely complete hierarchy and incomplete hierarchy.

**Comparative Judgment**, the purpose of this stage is to make an assessment of relative importance that compares between two elements at a certain level in relation to the level above it. The assessment will affect the priority of each element. The results of the assessment are easier to understand when presented in a matrix form.

**Synthesis of Priority**, from each pairwise comparison matrix, the eigenvectors are then searched to get local priority. Synthesis among local priorities must be done in order to obtain global priority because pairwise comparison matrices are present at each level.

**Logical Consistency**, the consistency of the answers given by respondents in determining the priority of elements is the main principle that determines the validity of data and the results of decision making. In general, respondents must have consistency in making comparisons of elements. If  $A > B$  and  $B > C$  then logically the respondent must state that  $A > C$ , based on the numerical values provided.

In the AHP method, the following steps are carried out:

1. Defining Problems and Determining Solutions In this stage we try to determine the problem we will solve in a clear, detailed and easy to understand manner. From the existing problem, we try to determine a possible solution to the problem. The solution to the problem may be more than one. We will develop this solution further in the next stage.
2. Create a Hierarchical Structure. After compiling the main objectives as the top level, a hierarchical level will be arranged under it, namely the criteria of the suitable



criteria to consider or assess the alternatives we provide and determine these alternatives. Each criterion has a different intensity. The hierarchy is continued with sub-criteria (if necessary).

3. Creating a Pairwise Comparison Matrix. The matrix used is simple, has a strong standing for the consistency framework, obtains any other information that may be needed with all possible comparisons and is able to analyze the overall sensitivity of priorities for changing considerations. The approach with matrices reflects the dual aspects of priority, namely dominating and being dominated. Comparisons are made based on the judgment of the decision maker by assessing the importance of an element compared to other elements. To start the pairwise comparison process, a criterion is selected from the top level of the hierarchy, for example K, and then from the level below it is taken the elements to be compared, for example E1, E2, E3, E4, and E5.
4. Defining Pairwise Comparisons, the result of comparisons of each element will be a number from 1 to 9 which shows the comparison of the level of importance of an element. If an element in the matrix is compared to itself, the result of the comparison is given a value of 1. A scale of 9 has been shown to be acceptable and can distinguish the intensity between elements. The results of the comparison are filled in the fish in the cells corresponding to the elements being compared.
5. Calculating Eigenvalues and Consistency Test if inconsistent then data retrieval is repeated.
6. Repeating Steps 3, 4, and 5 repetitions performed for all levels of the hierarchy.
7. Calculating Eigenvectors Calculate the eigenvectors of each pairwise comparison matrix which is the weight of each element for prioritizing elements at the lowest hierarchical level until they reach the goal. The calculation is done by adding the value of each column from the matrix, dividing each value from the column by the total column in question to obtain the normalized matrix, and adding the values of each row and dividing by the number of elements to get the average.
8. Checking Hierarchy Consistency. What is measured in AHP is the consistency ratio by looking at the consistency index. The expected consistency is one that is close to perfect in order to produce a decision that is close to valid. Although it is difficult to achieve a perfect fit, the expected consistency ratio is less than or equal to 10% ( $<0.1$ ).

In Indonesia, which investigates marine ship accidents is the NTSC (National Transportation Safety Commission). About the data of the ship in the accident and its causes. In the case of conducting investigations using the PSC, it is very careful to determine if the cause has been determined by other investigators to ensure that this cause is found by consensus and scientifically as well as certain observations only with the decision of the leadership. The results are inform the public, government, owners, and law enforcers whether at the shipping court or if there are elements of criminal acts, then a PPNS (Civil Servant Investigator) will make an investigation report (BAP) forwarded to the Police of the Republic of Indonesia (Polri) as KORWAS to be followed up.

It is better if the government actively participates and collaborates with various associations, academics and ship accident research centers and then forms its own marine accident investigation forum which can compile various policy rules.

In addition, training in marine resources is required which is carried out seriously and responsibly for the crew (ABK), ship's officers (officer and crew), such as BST (Basic Standard Training) training. These skills and expertise are the basis of certificates that must be possessed by both the captain, officers and crew. This training aims to:

1. Crew members are skilled in dealing with any dangers on board.
2. Officers, especially the captain who is responsible as the leader of the ship.
3. Representatives.

## 4. Conclusion

Error itself is generally defined as failure to present a right and desired action in a situation. This error can only occur if there is proper attention, to respond to the events that are observed while the final action is not as intended. The causes of Ship Accidents in various causes of a disaster onboard include: Human error; Damage to the ship's machinery; External and internal factors, such as fire and collisions; Natural factors or weather, and the Combination of all these causes. In general, the disaster that may occur on a ship is the result: Collision with another ship; Stranded/grounded; Drowning due to bad weather (badweather); Burning (fire); Engine blackout / breakdown, and the Ship is in contact with other ships. The efforts to Prevent Ship Accidents at sea that occur and are treated as a secret for several reasons. For this reason, it is necessary to pay attention to efforts to prevent ship accidents by obtaining input from various parties including academics, accident analysis and aid experts.

## References

- [1] Ship accident data investigated by KNKT.
- [2] Lasse, D. A. (2012). *Manajemen Peralatan aspek operasional dan Perawatan*. Jakarta: Raja Grafindo Persada.
- [4] Lasse, D. A. (2014). *Keselamatan Pelayaran dilingkungan teritorial Pelabuhan dan Pemanduan Kapal*. Jakarta: Raja Grafindo Persada.
- [4] Lasse, D. A. (2012). *Manajemen Kepelabuhan*. Jakarta: Nika.
- [5] Drake, P. R. (1998). Using the Analytic Hierarchy Process in Engineering Education. *International Journal of Engineering Education*, vol. 14, issue 3, pp. 191–196.
- [6] Gunawan, I. (2017). *Metode penelitian Kualitatif*. Jakarta: Bumi Aksara.
- [7] Haralambides, H. E. (1998). *The Economic and Social Impact of Port Reform*. The Hague: 29<sup>th</sup> PIANIC Congress.
- [8] Iftikar, Z. and Iaksana, S. (1979). *Teknik Tata Cara Kerja*. Bandung: Jurusan Teknik Industri Institut Teknologi Bandung.
- [9] Saaty, Thomas L. (1980). *The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation*. New York: McGraw-Hill.
- [10] Semiawan, C. R. (2010). *Metode Penelitian Kualitatif: Jenis, Karakteristik dan Keunggulannya*. Jakarta: Grasindo.
- [11] Suyono, R. P. (2007). *Shipping Pengangkutan Intermodal Ekspor Import Melalui Laut, Musibah Kapal, Pencegahan dan Penanganannya, Keamanan Pelabuhan* Jakarta: PPPM.
- [12] Act No. 17 of 2008 on Shipping.