A Study of Ship Accidents in Indonesia Using 4 M Factors

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1. Introduction
Research has shown that human factors are the main cause of ship accidents around the world. However, it does not seem true in Indonesia. The National Transportation Safety Committee (NTSC) of Indonesia published its maritime report in 2011, which showed that human factors caused 41% of the accidents and the others were attributed to technical factors (1). This means that the human factors were not the main factor contributing to Indonesian maritime accidents. This paper will study the causes of Indonesian accidents by analyzing the most common accidents from the available data then dividing them into 4 M (Man, Machine, Media, and Management) Factors, where human factors are classified as Man Factor.

2. Objectives
There are 2 aims of this study. One is to find the dominant factor of Indonesian accidents, whether Man, Machine, Media or Management. And the second is to isolate the most common failure which caused or contributed to the accidents.

3. Methodologies
The analyses utilize 4 M factors by classifying the causal factors of the accidents into each category. Man Factor is related to knowledge, skills, abilities, memory, motivation, and alertness. Machine Factors includes anthropometry, equipment layout, information display, and maintenance. Media Factor means temperature, noise, sea state, vibration, regulations, and economics. Management Factor is about work schedules, crew complement, training, communication, and safety culture. This 4 M Factors was found by the United States National Transportation Safety Board (NTSB). Related to this 4 M Factors, Prof. M. Furusho designed the IM-Model which has an underlying concept based on the individual (self)-centered properties, as well as relations among these factors (2). The 4 M Factors can be utilized as the first step of risk assessment which is termed hazard identification (3). These factors provide a basic framework for analyzing systems and determining the relationships between composite elements that work together to perform the mission.

The steps are listing all the failure events and classifying them into several causal factors. Those causal factor is divided into 4 M Factor based on their classification. After that, the classification is analyzed.

4. Analysis on Indonesian Accidents
The total number of accident investigations from 2007 to 2011 was 26 accidents. From those data, authors can conclude that the most prevalent 3 accident types in Indonesia were fire, collision, and sinking, where the biggest one is fire with percentage of 38%. For that reason, this paper is analyzing the fire accidents. The analysis finds that there were 52 failure events among 10 fire cases, where 11 (Man), 30 (Machine), 1 (Media), and 10 (Management) failures.

5. Results
The results of the analysis above can be shown from the fig.1 below. The results show that the Machine factor is the main cause, accounting for 58% of all accidents.

![Fig.1 4 M Factors Percentage of Fire Accidents](image)

In general, the most 3 common failures which were happened are incapability of the crew in firefighting, the insufficient car-deck layout, and the lack of CO2 fire-fighting system in equipment failure which were happened 3 times in each failures.

6. Conclusions
The conclusions of this study are:
1. Indonesian ship accidents were dominated by Machine, not Man Factors.
2. The most common accident failure which happened in fire/explosion accidents were the incapability of the crew in fire-fighting, attributable to Management, and the insufficient car-deck layout, along with the lack of CO2 fire-fighting system in equipment failure, both of which belong to the Machine factor.

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References
(1) Indonesian Ministry of Transportation, Transportation Statistics 2011- Book II, Indonesia, 2011