CHAPTER5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This chapter provides a summary of the findings and implication of the study for future research and discussion. The purpose of this study was to determine the ten accident data and accident report in Indonesia from 2005-2010. In addition, it was to develop FMEA database and perform future analysis of navigation accident, especially on marine diesel engines. And finally, to propose new risk system improvement in marine diesel engines initiative to reduce accident occurrence based on future analysis outcome.

5.2 CONCLUSIONS

Based on the objectives of this study, the following conclusion can been derived:

1. From analysed ship accident cause factors occurring in Indonesian from 2005-2010 were 65% caused by human error, 24% caused by natural factor and 11% caused by other factors. Thus caused of accidents was 56 sunk, 49 collision, 34 fired, 26 grounded, and 21 others totaly 186 accidents.
2. The data above were used to develop FMEA database, the potential failure mode for the element of marine diesel engine were failure of the fuel oil system. Failures of the fuel oil valve represented greater than 30% of the recorded failures, while twelve components accounted for roughly 90%. A review of other studies corroborated the high failure rates of the fuel delivery system, cylinder head, valves and cooling system. The review

information clearly indicated that the fuel injection system had been the most prevalent source of problem for diesel engines (Banks, et al., 2001).

3. To propose navigation system improvement in marine diesel engines initiative to reduce accident occurrence based on future analysis income, analysis from the matrix there were items that should have more attention because high risk: Transfer Pump, Service tank, Storage Tank, Drain Tank, and Settling Tank. This high risk would disrupt fuel supply and ultimately may reduce the performance of the Main Engine. The appropriate recommendation for improving the navigation system in marine diesel engine to reduce the occurrence of accident are several treatment strategies like precise scheduling and maintenance planned, allocate maintenance personnel to perform the treatment appropriately for component with high level of risk. Determining the priority of treatment and identifying the need for high level spare parts could hopefully improve the overall navigation system.

5.3. CONTRIBUTIONS OF THE STUDY

The purpose of this study, firstly wants to determine the sea accident data in Indonesia from 2005-2010. From that data, the study continued to develop FMEA database and to perform analysis of navigation accident, especially in marine diesel engines because most ships use the marine diesel engine. From the sea accident data, causes of accidents were found: sinking, grounding, collision and fired. That ship fired causes could be analyzed with the FMEA methods. FMEA are regularly used during operational stage. It can be more advantageous if it is employed during manufacturing and design stage of marine systems and product. FMEA successfully enables evaluation of failures in marine diesel engines in fuel oil system, lubricating oil system, water cooling system and starting air system. Several implications appear as a result of this study. The main contribution of sea accident data and accident report in Indonesia from 2005-201 caused by human factor. There are many causes of common sea accident. From the data of Marine Court, there were four causes of sea accident: sank, collision, grounded and fired. For ship fired the causes were: mentality of ship crew and reliability of the system or the element of the system.

One main difference between FMEA method and other methods of quality is that the FMEA method is active, while the other is passive method (based on reaction) when a failure occurs, the other methods of defining some of the reactions, but the reaction will take a lot of cost, time and resources. While FMEA trying to estimate the potential issues and risks and then decide on measures to reduce or eliminate those risks. This type of action is a precautionary measure that action against what would happen in the future and requires time and cost is lower compared with action reaction (Mousavi Abdi, et al., 2014).

Although in the literature it is possible to find great numbers of study related to FMEA analysis, a few of the current work deals with the application of these tools to marine diesel engine systems. The author just found two researchers. Cicek et al., 2010 conducted research about risk-based preventive maintenance planning using FMEA for marine engine systems and Banks et al., 2001 conducted failure modes and predictive diagnostics considerations for diesel engines. The FMEA methodology is one of the risk analysis recommended by international standards. An application of a FMEA follows series of successive steps: analysis of the process, product or system in every single part, listing of identified potential failures, evaluation of their frequency, severity (in terms of effects of the failure to the process and to surroundings) and detection technique, global evaluation of the problem and identification of the corrective actions and control plans that could eliminate or reduce the chance of the potential failure (Ireson, et al., 1995 and Scipioni, et al., 2002).

5.4 RECOMMENDATIONS FOR FUTURE RESEARCH

From the findings, the result of analysis can be used for guiding in maintenance system especially in marine diesel engines. This is for preventive maintenance and corrective maintenance. The result from the evaluation could be analysed by qualitative and quantitative approach. This research can be continued to develop reliability block diagram and FTA (Fault Tree Analysed) for the qualitative and the quantitative analysis that could be analysed further using simulation technique.

To propose navigation system improvement to marine diesel engines, initiative must be done to reduce accident occurrence built into the Ship Safety Strategy. This strategy can be developed based on four aspects of potential hazard sources namely Software, Hardware

Environment and Live ware. Software included are: organization, management, rules and regulation, and operating system. Hardware included are: designand structure of the ship, including the machinery and equipment of the ship, and all land based supporting facilities. Environment included are: the condition of the weather, wind, wave, current, depth of the sea, traffic condition, and port description. The last is Live ware included are: the ship crews, the passengers, and the people on shore that have influence to the ship safety. The potential hazard of the ship operation can be categorized as follows: sinking, collision, grounding, fired. We could put that potential hazard into the matrix using hazard matrix and could be discussed again using the FMEA methodology (Sunaryo, 2010).

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APPENDIX

LIST OF PUBLICATIONS

Journal Paper

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