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SAFETY STUDY ON STATE SHIPS AND COMMERCIAL SHIPS ACCORDING TO THE REQUIREMENTS OF SOLAS 1974

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ABSTRACT

The purpose of this study is to analyze the safety performance of state ships and commercial ships according to the requirements of Solas 1974. The requirements of Solas 1974 in the context of international shipping are mainly related to safety and security issues related to the tools and types of shipping safety. Application of the 1974 Solas Convention and the 2018 Solas Consolidation with the scope of discussion on international shipping is especially related to maritime protection. This study uses the Plan, Do, Check and Action (PDCA) evaluation model. The data was collected through the interview survey method and continued with statistical testing with the factor analysis technique. Respondents consisted of crews of commercial ships with a weight of over 500 GT and crews of pioneer ships as state ships anchored at the Port of Tanjung Priok. Research respondents totaled 57 crew members, consisting of 23 crew members of state ships and 34 crew members of commercial ships. The results of this research can be used as reference material in terms of safety and security as well as protection against environmental damage, in accordance with the transportation management system policy which includes; manuals, implementation policies, supporting implementation procedures, and work instructions for all stakeholders. The research output can be used as a basis for providing recommendations related to corrective actions to improve the marine transportation management system through the implementation of Solas 1974.

Keyword: Commercial ships; state ships; pioneer ship; Solas 1974 convention; international shipping

1. INTRODUCTION

Indonesia, as a member of the International Maritime Organization (IMO), has ratified several rules or protocols issued by the IMO. The ratification of the 1988 Protocol relating to Solas 1974 was outlined in Presidential Regulation Number 57 of 2017 while the ratification of the 1988 Protocol relating to Loadlines 1966 was outlined in Presidential Regulation Number 84 of 2017

The 1974 Solas Convention in the context of international shipping is related to several important aspects such as; (1) reports on the validity of ship certificates and documents to the company, (2) procedures to ensure a safe working environment, (3) procedures to ensure a safe working environment, (4) policies regarding safety and environmental protection, (5) audits of the system. onboard safety management, (6)

recruitment of qualified crew, (7) introduction of tools and tasks for crew, (8) documentation of crew performance, (9) safety management training, (10) crew communication skills, (11) Standard Operation Procedure for ship maintenance (12) ship maintenance planning, (13) implementation of ship equipment maintenance audit, (14) documentation of inspection and maintenance results, (15) equipment maintenance report, (16) Standard Operation Procedure for document audit, (17)) safety management guidelines, (18) storage of ship documents, (19) separation of expired documents, and (20) storage of ship safety management guidelines.

Fulfillment of all the ship's marine eligibility requirements is proven by the issuance of certificates and / or documents issued by a party authorized by the government. Broadly speaking, maritime affairs of ships in Indonesia are carried out by two bodies, namely a government agency handled by the Directorate General of Sea Transportation Organizing Unit and a non-government agency handled by the Indonesian Classification Agency (Badan Klasifikasi Indonesia). As for the problems that often arise regarding the law of ship safety enforcement, is when the certificate has been issued, but it turns out that the ship does not meet the ship's maritime requirements so that it does not meet the ship safety requirements according to the statutory regulations concerning shipping. In fact, when the certificate has been obtained, the authorized official is obliged to continue to carry out surveillance until the ship is no longer used, in order to re-confirm the truth of the facts of the ship's maritime condition. Not only officials, all crew members as well as owners and ship operators are required to support the implementation and certainty of the ship's marine condition in accordance with the regulations described above.

According to Law Number 17 of 2008, ships that will sail must meet ship safety requirements, which consist of regulations and procedures for preventing water pollution from ships, manning, loading lines, loading, crew welfare and passenger health, legal status of ships, safety management and prevention of pollution from ships, as well as ship security management for sailing in certain waters. In 1974, the new Solas 1974 convention was created, which contains several amendments in which each amendment is enforced according to a predetermined time target. This amendment is enforced as a binding rule unless there is a rejection of 1/3 of the number of member countries or 50 percent of ship owners in the world (Suryani, et al., 2018). Mukherjee, (2007) explains that the international safety management of ship facilities and international port facilities, each of which is marked with two codes that function as a center of gravity, namely, the ISM Code and the ISPS Code. The purpose of this code is to provide international standards for the management and safety of ship operations and pollution prevention (Sumarwan et al., 2017). In terms of research regarding onboard safety management system audits, the results of research by Nurdin, (2018), show that the auditor who is concurrently marine supervisors have never received training on ISM Code so they do not have the capacity as a supervisor.

The commercial shipping industry, which dominates the oceans in terms of numbers, puts more emphasis on the safety aspect, while the navy is more concentrated on the security aspect (Cook, 2020). The latest regulatory developments based on the study of Francescutto & Papanikolaou, (2011), point to risk provisions, performance-based stability and safety based on modern scientific developments. Transportation safety and security systems are key factors that must be considered and used as a basis and benchmarks for decision makers (Kadarisman, 2017; Setiono & Mudiyanto, 2010). Several related studies have been carried out, for example research conducted by (Tjahjanto & & Azis, 2016) related to the factors that cause accidents at work, and the consequences that arise due to these accidents, as well as the efforts that must be made to reduce the risk of work accidents for ship crews. Saputra, Yuniarsih & Rianto, (2017) concluded that ships must meet the standards set by IMO and also meet the conditions set by the Indonesian Classification Agency. Safety has always been a top priority in the marine transportation sub-sector (Siswoyo, 2016).

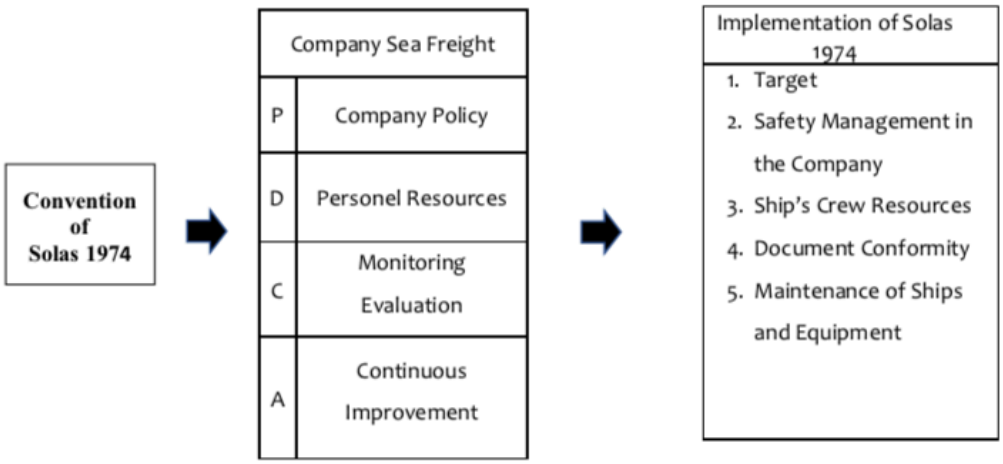
The purpose of this study is to analyze the safety performance of state ships and commercial ships according to the requirements of Solas 1974 and to analyze significant differences in the safety of state ships and commercial ships according to the requirements of Solas 1974. The scope of activities carried out by the authors in this study are the main things that must be carried out. carried out in accordance with the professional corridor of expertise, among others, to analyze and provide recommendations for improvements, especially in relation to the implementation of Solas 1974. Modernization of Solas regulations since 1960 has replaced the 1918 Convention with Solas 1960 where since then regulations regarding design to improve ship

safety have been included such as; (1) Ship construction design; (2) Mechanical and electrical; (3) fire prevention; (4) Safety equipment and (5) Communication and navigation safety devices.

The 1974 Solas Convention applies to ships dealing in international shipping except; (1) Warships and ships carrying troops; (2) merchant ships of less than 500 GT; (3) Vessels not driven by mechanical equipment; (4) Traditional wooden vessels; (5) cruise ships that are not related to business, and (6) fishing vessels. Meanwhile, Solas Consolidation 2018 handles security and safety as well as protection of the maritime environment which regulates also the air balance, engine ships and standards as well as handling of the steam pipe system to prevent pollution from ships against the marine and maritime environment. Standard communication systems have also been regulated in the Solas consolidate regulation. 2018 related to the Vessel Traffic Information System (VTIS).

State ships according to Law Number 17 of 2008 are state-owned ships used by certain government agencies that are given the function and authority in accordance with the provisions of laws and regulations to enforce the law and other government duties. The existence of different functions between merchant ships and state ships necessitates laws and regulations that specifically regulate the manning of state ships. Three ministries have operated state ships, namely, the Ministry of Transportation, the Directorate of Customs and Excise at the Ministry of Finance and the Ministry of Human Rights. Some examples of state ships, namely; (1) Pioneer Ship, (2) Container Ship, (3) Livestock Ship, (4) Navigating State Ship, (5) Training Ship and (6) State Patrol Ship. National Navigation Ships consist of the Perambuan Carrier, the Perambuan Auxiliary Ship, and the Perambuan Control Ship. Research conducted by Irwan et al., (2019), concluded that the number of state ships operated by the relevant Ministries only fulfilled 50 percent of the total number of ships needed. This can have an impact on the lower performance of state ship services.The Indonesian Commercial Ship is a sea transportation service facility aimed at fostering the economic unity of the Indonesian archipelago as well as serving and encouraging national economic growth. The provision of sea transportation services is carried out through a system of permanent and regular shipping equipped with sailors. Several studies on commercial ships have been carried out, including by Kuncowati, (2015) which explains that the use of electronic navigation equipment and ship manning requirements affects the workload of ship crews. Other research shows that the marine marine commercial ship has a very strong relationship with shipping safety (Mudiyanto, 2019).

The research approach taken uses the Planning, Do, Check and Action (PDCA) evaluation model as shown in Figure 1.



Picture 1. Research Flowchart Framework

2. METHODS

Combined with the 2018 Solas Consolidation, the research design used an interview survey method with a flexible design so that it could produce quantitative data. The data will then be tested statistically with the factor analysis method. The research approach uses the Planning, Do, Check and Action (PDCA) evaluation model.

According to (Lie, 2012), the PDCA approach is a systematic tool for evaluating the effects of new safety technologies. The application of the Plan-Do-Check-Action model is used to manage processes according to the ISO 9001 quality management standard (Gupta, 2006). The findings of Matsuo & Nakahara (2013) through PDCA, explain that quality management, empowerment, can significantly help improve learning in the workplace. The application of the PDCA model has been carried out in research in the field of transportation in the mode of shipping and railways and is able to show an overview of the implementation of the internal quality assurance system (Bureika et al., 2017; Fuadah, 2019; Reknati, 2019).

In the PDCA context, at the planning stage, a quality planning procedure is needed, at the implementation stage a quality assurance is required, at the evaluation stage a quality control is required, and at the continuous improvement stage quality maintenance and development are required. Researchers conducted a random direct survey by visiting several pioneer shipping as state vessels and commercial shipping as commercial vessels in Tanjung Priok Port. The results of the questionnaire were conducted using the Delphi method for both state and commercial ship crew respondents.

The research survey was carried out on commercial ships with a weight of over 500 GT and pioneer ships as state ships. A total of 57 respondents from the crew of state ships and commercial ships have been asked to respond. In making an inventory of the results of the questionnaire, the researcher compiled the characteristics of the respondents based on the age group of the crew, the number of respondents according to the type of ship, the respondent's perception of the implementation of the Solas 1974 provisions. The dominant factors that influence the implementation of Solas 1974 can be grouped into five factors, namely (1) Document Administration, (2) Safety Guidelines, (3) Guard Ship Personnel, (4) Maritime Environmental Security and (5) Safety Equipment Readiness

3. FINDINGS AND DISCUSSION

Respondents Characteristics

Research respondents have various characteristics, seen from their positions, respondents have positions ranging from officer to captain. This allows respondents to have variations in terms of age. Based on the survey results, it can be seen that the age of respondents under 30 years are 13 people or 22.8 percent, 30-35 years old are 18 people or 31.6 percent, ages between 35-40 years are 19 people or 33.3 percent. While the age of the most respondents were in the range between 35-40 years, namely 19 people or 33.3 percent. Furthermore, respondents with age above 40 years were 7 people or 12.3 percent. Of the 57 crew members, 23 respondents came from state ships and 34 respondents came from commercial ships. Respondents were mostly officers from pilot ships or state ships assigned to these voyages. Meanwhile, for commercial ships, the respondents are on the level of a commander-in-chief and captain.

The answers to the questionnaire indicate a fairly good performance on the policy variables of shipping companies, both commercial ships and state ships, with an achievement of 90.11 percent for commercial vessels and 98.434 percent for state ships. Regarding the variable of shipping personnel resources for commercial ships and state ships, the survey results show that there is an achievement of 85.296 percent for commercial ships, while for state ships the achievement is 98.782 percent. In relation to the evaluation and monitoring variables for commercial ships and state ships, the survey shows an achievement of 81.764 percent for commercial ships and 98.26 percent for state ships. Finally, in relation to the variable of continuous improvement, commercial ships show a performance achievement of 80.82 while for State ships, the survey results show a performance achievement of 94.956 percent.

Factors Affecting the Implementation of Solas 74

By using multiple analysis components, the dominant factors that influence the implementation of SOLAS 74 can be grouped into five factors as follows;

Factor 1. Document Administration

Factor 1 contributed 21.69 percent of the variance. Document administration factor consists of eight aspects, namely; (1) Ship document storage, (2) Storage of ship safety management guidelines, (3) Ship maintenance planning, (4) Equipment maintenance report, (5) Ship crew performance documentation, (6) Standard Operation Procedure for ship maintenance, (7) Separation of expired
documents, and (8) Documentation of the results of inspection and maintenance. The contribution of the storage aspect of ship documents to factor 1 was 79.74 percent with the highest loading factor of 0.893, and

the contribution of the documentation aspect of the results of inspection and maintenance was 30.47 percent with the lowest loading factor of 0.552.

Factor 2. Safety Guidelines

Factor 2 contributed 20.71 percent of the variance. The safety guiding factor consists of a component of the ship's equipment maintenance audit with a contribution to factor 2 of 60.84 percent with the highest loading factor of 0.780, and a contribution to the communication ability of crew members with the lowest loading factor of 0.559.

Factor 3. Guard Ship Personnel

Factor 3 contributes 20.13 percent of the variance. The Guard Ship personnel consist of procedures to ensure a safe work environment with the highest loading factor of 0.940, procedures for dealing with and overcoming emergencies, and the recruitment of qualified crew members with the lowest loading factor of 0.752.

Factor 4. Maritime Environmental Safety

Factor 4 contributed 11.11 percent of the variance. The safety factor of the maritime environment consists of policies regarding safety and environmental protection with the highest loading factor of 0.886, an audit of the safety management system on board, the validity of all certificates and documents with the lowest loading factor of 0.569.

Factor 5. Readiness of Safety Equipment

Factor 5 contributes 10.70 percent variance. The safety equipment readiness factor has only one aspect, namely the introduction of tools and duties for crew members with a loading factor of 0.920. The dominant factors that influence the implementation of Solas 1974 provide some of the highest and lowest percentage of contribution and contribution of loading factor (Table 1).

Table 1. Recapitulation of Factor Analysis

Research Aspects and Factors	Component				
	F1	F2	F3	F4	F5
1. Ship documentation	.893	-.081	-.103	.236	-.022
Ship Document Storage	.819	.190	.297	-.077	.020
Storage of Ship Safety Management Guidelines	.676	.416	.501	-.005	-.080
Ship Maintenance Planning	.655	.464	.205	.040	.301
Equipment Maintenance Result Report	.648	.554	.479	-.028	.089
Documentation of Crew Performance	.614	.404	.125	.025	.516
Standard Operation Procedure for Ship Maintenance	.590	.375	.271	.253	-.009
Expired Documents Separation	.552	.549	.116	-.010	.523
Documentation of Inspection and Maintenance Results					
2. Safety Guidelines	.180	.780	.187	.114	.415
Conducting ship equipment maintenance audits	.364	.757	.138	.266	-.021
Standard Operation Procedure for Document Audit	.018	.699	.609	-.136	.131
Safety Management Guidelines.	.198	.669	.517	.115	.000
Safety management training	.342	.559	.544	-.168	.120
Crew communication capabilities					

3. Guard Ship Personnel	.195	.072	.940	.153	.086
Procedures to ensure a safe working environment	.143	.239	.857	.116	.298
Procedures for dealing with and dealing with emergencies	.179	.456	.752	.168	.212
Recruitment of qualified crew					
4. Maritime Environmental Security	.098	-.076	-.003	.886	.076
Policy regarding safety and environmental protection	-.037	.285	.156	.880	-.198
An audit of the safety management system on board.	.324	.064	.239	.569	.510
Validity of all certificates and documents					
5. Readiness of Safety Equipment	-.093	.089	.220	-.066	.920
Introduction to the Tools and Duties of the Crew	4.338	4.143	4.026	2.224	2.141
Eigenvalue	21.691	20.715	20.130	11.119	10.703
percent variance	21.691	42.406	62.537	73.65	84.359

Table 1 explains that all the factors and aspects in this study contributed 80 percent to shipping safety consisting of factor 1 (Ship Documentation) contributing 21.69 percent; factor 2 (Safety Guidelines) contributed 20.71 percent; factor 3 (Guard Ship Personnel) contributed 20.13 percent; factor 4 (Maritime Environmental Security) contributed 11.11 percent and factor 5 (Safety Equipment Readiness) contributed 10.70 percent. It can be seen from these five factors, the completeness factor of documentation, safety guidance and guarding the ship contributed almost the same, around 21 percent and the other two factors, namely, the Maritime Environmental Security factor and the readiness of the safety equipment contributed an average of 11 percent.

Discussion

Ship Documentation

The Ship Documentation Factor, which consists of many important operational documents on this ship, contributed 21.69 percent of the variance. With a contribution of more than 20 percent of the variance, it can be seen that the importance of ship documentation must be well organized. Several previous studies regarding the importance of ship documentation are in line with this research. Storage of ship documents is very necessary, such as the process of managing ship document extensions as one of the conditions for issuing a Sailing Approval Letter (Setyawan & Aziz, 2020; Sukrisno & Piaratama, 2019). Several previous studies supported the document completeness factor such as that carried out by (Dlugokecki et al., 2010; Ölçer & Lazakis, 2015; Turan & Asar, 2019) that in terms of ship maintenance, preventive maintenance is needed as the best approach that can increase ship system reliability and availability as a whole.

In terms of documentation of crew performance, Mawardi, (2021) explained that in previous studies there were crew performance, especially crew members who lacked discipline and were responsible for guarding their duties. Other studies have introduced short maintenance periods for certain machine groups (Verma et al., 2012). In terms of Standard Operation Procedure, previous research was also in line with this research, such as reports of marine accidents which often mention bad procedures as a factor in the occurrence of marine accidents (Doherty, 2016). Finally, according to Pie-Ya & Chien-Chang, (2019), research, developed standard operating procedures can be offered to several bulk carriers, ship owners and charterers, and ship safety management companies to improve navigation safety and avoid cargo damage.

Safety Guide

The second factor, namely the Safety Guidelines, contributed 20.71 percent. Several studies regarding shipping safety guidelines have been carried out and are in line with this research. The government is obliged to carry out the field of law enforcement at sea, both against the threat of violations, utilization of waters, as well as maintaining and creating optimal shipping safety (Kadarisman, 2017). An effective management system can provide clear exposure to the crew and ship managers in an effective, safe and systematic manner. The results of the research by Ahmad et al., (2014) show that human error, stability factors and external factors affect management efficiency.

According to Joseph & Dalaklis, (2021), many Solas 1974 rules and related supporting codes of work have complemented each other and together have contributed positively to the safety of personnel, the environment and Solas 1974 convention and has ratified its implementation in 2013, which accommodates several state ships to comply with the applicable rules in the Solas 1974 convention, the implementation of its implementation is also related to commercial ships. Safety training management training is very important for the safety of ships, crew, and passengers (Dragomir & Simona, 2016). Other studies have concluded that training on the prevention of safety disturbances at every sailing is needed (Astuti & Muladi, 2019; D. Lasse & Fatimah, 2016; Nurhasanah et al., 2015). The aspect of communication skills for crew members is an important aspect in this regard, so it is necessary to make efforts to improve the ability of Indonesian crews to communicate, especially in English (Bunga, 2017).

Guard Ship Personnel

The third factor, namely the Guard of the Ship, has three aspects, namely; (1) Procedures to ensure a safe working environment, (2) Procedures for dealing with and dealing with emergencies and (3) recruitment of qualified crew members. The factor of this ship guard personnel has contributed 20.13 percent. Several previous studies are in line with this research. Empowerment of employees and service quality at shipping companies, recruitment of qualified crew members by paying attention to human resource variables to support shipping safety strongly supports shipping safety factors (Berg et al., 2013; Kadarisman et al., 2016; Ricardianto et al., 2020; Wiweko et al., 2015). Poor working and living conditions on board are key factors that must be avoided to increase retention among seafarers and ensure a safe working environment, this is very significant especially in relation to increased handling of the transport of dangerous goods (D. A. Lasse, 2014; Nguyen et al., 2014). Ershov et al., (2017), add proposals for several important procedures to deal with and overcome emergencies, for example by carrying out maneuvers to prevent damage to the ship's hull. Other research by Astuti & Muladi, (2019) with the application of the ISM Code to optimize ship safety has shown good performance in handling ship operating safety procedures such as procedures in dealing with bad weather, dealing with narrow shipping lanes and emergency steering.

Maritime Environmental Security

The fourth factor, namely Maritime Environmental Security, contributed 11.11 percent. In general, studies on the use of commercial ships and state ships in previous studies also support this research. In terms of policies regarding safety and environmental protection, re-registration and national audits of Indonesian ships that are still operating must be carried out immediately, in accordance with developments in international standardization (Thamrin, 2015). The use of ships must meet the requirements of Solas 1974 set by IMO (Francescutto & Papanikolaou, 2011; Akindehin et al., 2015; Mudiyanto, 2020; Saputra, Yuniarsih & Rianto, 2017). Their findings indicated that the onboard safety measures were proving very effective. Several previous studies also support the Maritime Environmental Security factor in this study. International Safety Management Code (ISM Code) and ISPS Code in previous research conducted by (Mukherjee, 2007; Naily et al., 2019; Nikcevic Grdinic, 2015; Suganjar & Hermawati, 2019; Suhartoyo, 2018) It is hoped that the implementation of the ISM-Code will make ship safety more secure. ISM-Code requires a strong commitment from the level of shipping leadership to executor, both on land and at sea (crew). The relevance of the ISM Code with the ship worthiness assessment indicates that the implementation of the seaworthiness of the company as defined in the ISPS Code needs to be analyzed with respect to security requirements (Anwari, 2005).

Regarding the implementation of Designated Person Ashore (DPA), shipping companies are expected to reduce the level of accidents in each of their vessels (Nurdin, 2018; Suganjar & Hermawati, 2019). In terms of shipping safety, this study supports several previous studies conducted by (Hendrawan, 2019; Kadarisman, 2017; Setiono & Mudiyanto, 2010), which explains that ship and shipping safety indicators are two inseparable sides. Talaie & Javidbakht, (2020), added that in order to achieve the objectives of the ISPS Code, all IMO member countries must fully implement the regulations. To achieve a higher standard when it comes

to maintaining maritime security members are advised to take advantage of the experiences and practices of successful countries such as Malaysia and South Korea.

Safety Equipment Readiness

The fifth factor, namely Safety Equipment Readiness, contributed 10.70 percent. Several previous studies support the results of this study. In terms of improving the planning and design of electronic navigation systems, the availability of systems, communication devices and security equipment, this research also supports several previous studies (Malisan, 2013; Mutholib, 2013; An, 2016; Siswoyo, 2016; Astuti & Muladi, 2019). To overcome and prevent safety, Shipping Companies must have procedures, facilities and equipment in accordance with the provisions of the ISM Code (Asalina & Purwantini, 2018; Nurhasanah et al., 2015). Regarding navigation issues, Jensen (2016) offers a new instrument specifically designed to make navigation in arctic waters safer and more environmentally friendly.

Grdinic, (2016) added that in addition to international conventions which are basic international instruments, the codes adopted by various international organizations are very important in improving navigation safety. Several other researchers discussed the recent development of international safety standards for electronic navigation aids on ships. Ships must have safety equipment, including lifeboats, life jackets, fire extinguishers, documents and certificates, ship-worthy conditions (Beattie, 2009; Hendrawan, 2019). Hermawan, Anwar, & Junius, (2020) added about the use of the Electronic Chart Display and Information System which is needed to increase understanding and knowledge in using the system.

Analysis of difference in the implementation of commercial ships and state ships according to SOLAS 1974 requirements

State ships that are guided by the regulations of Ministerial Regulation Number 35 of 2013 have been very strict in fulfilling the rules set by the IMO world body, where one of the instruments is Solas 1974. The principle of implementing Solas 1974 on state ships is guided by the regulations of the Minister of Transportation of the Republic of Indonesia which assigned by the state in serving pioneering routes in areas that are not covered by private shipping with consideration of the risk of costs that are not feasible for shipping operations.

Meanwhile, commercial ships guided by the provisions of Solas 1974 must pay attention to shipping safety instruments against accidents and human errors from the shipping operations. In this case the researcher limits the safety factor which is oriented to ship construction, ship operations and safety equipment available on a voyage that must be fulfilled by commercial shipping companies. The safety factor mandated by the shipping law has been clearly spelled out in fulfilling the implementation criteria which obliges state ships to carry out state duties to serve isolated areas with the condition of ships deemed sail-worthy for the safety function of shipping. The same treatment is applied to commercial ships guided by the provisions of Solas 74 where commercial ships must pay attention to shipping safety instruments in accordance with established rules, both domestic and international shipping.

4. CONCLUSION AND RECOMMENDATION

From the aspect of ship documentation, the results show that state ships are better prepared with an ideal score of 97.39 percent, while commercial ships only score 87.85 percent. In respect to the aspect of crew members' resources, the survey results show that state ships are better prepared with an ideal score of 98269 percent, while commercial ships only get a score of 83.38 percent. In respect to the document suitability aspect, the survey results show that state ships are better prepared, where the scores achieved by commercial ships are below the scores obtained by state ships. Regarding to the aspect of ship maintenance and equipment, the research results show that state ships are more prepared, because the scores obtained by commercial ships are below the scores achieved by state ships.

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