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Implementing the Safety Culture Improves the Autonomous Ships Prosperity

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Abstract: Since that a lot of studies and conventions take a look at the explanations of marine accidents within the maritime sectors, and also the position of the human elements that shoulder the high ratio of accidents reasons. They englobed how we learning and measuring the security culture to the human factors to mitigated the motives of incidents and accidents. the International Safety Management (ISM) Code used to be adopted by the International Maritime Organization (IMO) in order to establish a protection lifestyle inside the global maritime community, the ISM Code states that one of its key goals is to set up a "safety culture" in delivery companies, it does not without a doubt outline the that means and measuring of the term. However, a safety way of life may additionally be described as the values, practices and studying that administration and personnel share to ensure that risks are constantly minimized and mitigated to the best degree possible.

The ship management structures are nearly completely computerized and any automation failure may additionally cause accidents with damages to human life, to the environment, to the ships, to the port facilities and so the products transported, Safety administration in transport pursuits to stay removed from or mitigate the implications of any incidents bemused. The lookup is based on a descriptive approach, the qualitative methodology, as this methodology is the most capable of providing a comprehensive image of the effectivity of getting to know and measuring the protection culture. The lookup aimed to existing the amendment that ought to take area in the ISM code and use a new science for monitoring the performance and effectiveness of the code as a guide line and to create a spirit of credibility amongst the our bodies supervising the implementation of the Code to cope the self sufficient ship technology.

Key words: Autonomous ships, ISM, safety culture.

1. Introductions

Due to the accumulation of disastrous maritime accidents in the Eighties and in the early 1990s, the maritime neighborhood made a serious strive to create an achieved safety subculture for the maritime industry. The IMO adopted the idea of safety way of life profoundly at that time IMO decide to create maritime security tradition due to the accidents amplify (1980s-1990s). Since the beginning of the work of the International Maritime Organization, which is concerned with the field of maritime transport, the issuance of international legislation regulating maritime work to ensure the safety of lives and reduce marine pollution, has issued many regulations and supported technological progress and standardized training for marine Safety. However, marine accidents still occur, and for this reason it is the turn of many international and regional bodies to analyze and search for the causes of those accidents, the main factor of which was human error. Management errors were contributing factors. Hence the urgent need for a safety management system, which in turn led to the implementation and development of the International Safety Management (ISM) Code in 1998.

Through ILO reports, some 340 million occupational accidents and 160 million illnesses are due to work every year worldwide. Also, Approximately 2.3 million people also lose their lives each year as a result of work related accidents or illnesses, accounting for 6000 deaths per day; and the

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international economic system charges an amazing $1.25 trillion or 4% of international GDP yearly [10].

The Maritime Accidents Investigation Department of the Danish Maritime Authority and also Kristensen (2005) indicated that maritime transport is one of the most dangerous industries in the world. Between 2003 and 2012, it was found that the rate of fatal accidents in freight was 21 times that of the British general workforce [13].

The maritime transportation process with all its components, the company, vessels and the workers in the maritime organization, the common factor is the human factor and the persons' life and their dealings are complex especially the life on the vessels. As a result of their different cultures, the safety standards are affected and cause very dangerous accidents [2]. By observing Fig. 1, we find that the very best percentage of accidents is collision 155 cases, grounding147 cases and capsizing 112 cases. Also in Fig. 2, all the vessels types make accidents in different percentages and that ensures that the human factor is the main factor in the accidents. The safety culture should define and implement in the marine sector to reduce the marine accident that it caused by human factors and to cope with the new technology in future that it will be the main aspect to help the technology to achieve it is goals.

2. Terms and Definitions

2.1 Safety Culture

The term of safety culture is appears for the first time in 1986 in a report on the Chernobyl accident (INSAG, 1986). Safety culture is a sub Component of an organizational culture as a whole which affects safety and/or healthy work practices.

It consists of a collection of values, norms, behaviors, opinions, and common practices [21].

We have chosen to adopt the definition proposed by Daniellou et al. (2010), namely: "Safety culture is that the collection of practices developed and applied by the key actors involved to handle their profession's risks" as it focuses on operators' activities.

2.1.1 Accidents:

Accidents are unwanted events which lead to personal injury.

Incident: An unplanned series of events and/or circumstances that results in a loss case, which may possibly have contributed to it.

2.1.2 Safety Climate

The climate of safety sometimes refers to subculture of local groups.

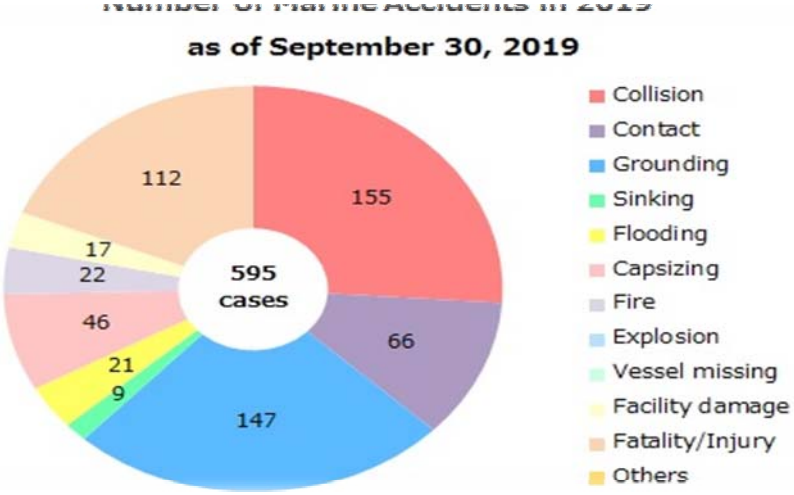

Fig. 1 The number of marine accidents in 2019 [8].

2.1.3 Safety Factors

The facets of a mature protection tradition are referred to as protection factors. These include awareness of protection, safety merchandising, feedback, respect, communication, identification of distress, security of reward, responsibility, empowerment, multi-cultural operations, integrity, unnamed reporting and the hiring of satisfactory people.

3. Measurement of Safety Culture Indicator

Organizational Safety Commitment (OC) Relates to the degree of the governance of an organization prioritizes decision-making safety and allocates appropriate resources for safety mitigation, even if this includes system delays in resolving the problem. In particular, there are three sub-factors that mirror an organization's commitment to safety, together with [25].

Safety Values (SV) — Attitudes and values expressed with the aid of leadership in phrases of protection in words and actions. This reflects the enterprise's dedication to safety at the pinnacle levels. The general overall performance of protection must be actively controlled and monitored with the same systematic oversight attempt and interest to exceeding goals as are the fee variety of businesses.

Safety Fundamentals (SF) — Compliance with managed safety factors which includes standards for education, manuals and processes, restore of facilities, and administration of operations inside and between teams/units. At this point, the organization have to motivate protected practices as a way to do enterprise and grant a stable framework to fulfill positive safety requirements for the organization, its management, and line workers.

Going beyond Compliance (GBC) priority granted to protection in allocating enterprise sources (e.g., facilities, personnel time) even although legal guidelines do now not permit them. This will be pondered in areas which include employee rostering, shift scheduling and relaxation time, advanced technological know-how whilst wanted, fatigue control programs and one-of-a-kind technological know-how-based totally threat management structures.

Operations Interactions (OI) are embodied in operating relationships with middle managers, bosses, and other operations employees, contemplating their 0 presence and security concerns. It includes the offerings personnel's precedence given to security and their appreciation of the authentic risks. OI applies to the diploma to which those especially worried in aiding research and supervising workers are in fact dedicated to protection and verify the safety requirements encouraged via senior administration when these values are optimistic.

Formal Safety Indicators (FS) refers to tactics and systems which can be organizationally installed to document and address each occupational and technique protection dangers. This sort of formal device.

Reporting System (REP) — Having a gadget to acquire protection-related occasion facts isn't always enough for an organization; it needs to be a non-punitive gadget if it's to encourage incident reporting and danger reporting. Issues target the accessibility, familiarity, and actual use of the safety reporting device of the organization. Is that the device used per its meant reason, and do employees feel secure to apply it? Feedback and response (FR) — Timeliness and adequacy of control responses to recorded safety facts and records dissemination to group of workers. It hs to be processed and exchanged on a habitual basis till records is amassed simply so security training is found out at some stage in the enterprise.

Safety Personnel (PER) Perceived effectiveness and reverence of people in particular protection positions (e.g., safety Officer, vice president for Police). Were they "paper tigers capable and viewed? Do they actively trade statistics in order to promote fantastic

practices in protection should safety personnel song records patterns in a systematic manner to minimize or dispose of rising hassle areas.

Safety Indicators (IS) refer to unwritten safety behavior rules, including safety rewards and punishments and unsafe actions, and the way such rewards and punishments are imposed in a truthful and fair manner informal fitness metrics virtually encompass issues along with:

Accountability (ACC) — The reliability and suitability with which employees were held responsible and answerable for unethical conduct. Is there an expert evaluate of incidents finding shortcomings in institutional protection? Justice and favoritism are the subject of issues.

Authority (AUT) — Authority and participation of staff in the making of safety decisions as workers embody the organization's eyes and ears, they are well-positioned to provide security solutions and evaluate inefficient and hazardous work practices in reengineering.

Employee Professionalism (PRO) — Group guidelines for safe and unsafe conduct for peer community workers. Are there successful application of Standard Operating Procedures (SOPs) [25].

4. Safety Responsibilities in Maritime Industry

The rapid development of the maritime transport system and its impact on upgrading the international trade system, which is concerned with the organizational structure of the maritime industry and the safety of individuals, ships and the marine environment, the place every delivery employer is required to link to this system in the course of daily operations. Which in flip leads to the acquisition and desirable understanding of protection administration inside the transport system, which requires expertise of the legal guidelines and the global regulatory framework. Some historical most important traces and the modern-day reputation of safety administration and the regulatory gadget will be presented. Fig. 2 shows an outline of the global regulatory system, maritime administration and the agreements associated with protection control machine are shown in Fig. 2.

The United Nations has stipulated the obligations of the safety of maritime administrations (flag and coastal states) thru the Convention on the Law of the Sea (UNCLOS). Although the United Nations Convention on the Law of the Sea is greater

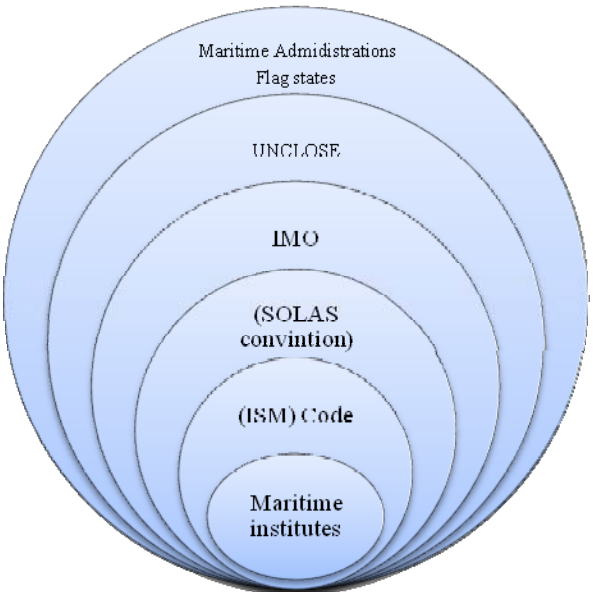

Fig. 2 The maritime international regulatory system.

comprehensive, the task of growing and retaining relevant guidelines on ship safety is delegated to the International Maritime Organization and is now responsible for 35 international conventions and agreements. For the motive of this research, the most necessary is the Safety of Life at Sea Convention (SOLAS 74) Convention for the Safety of Life at Sea (SOLAS 74) chapter IX, management for the safe operation of ships, and the guidelines for SOLAS IX, as shown in Fig. 2.

5. Improving Safety Culture in Marine Regulatory System

5.1 International Safety Management ISM Code

The ISM Code requires shipping companies to develop, implement and develop a safety management system, which includes safety policy, informational and methods to guarantee secure operations of ships in agreement with worldwide enactment and the hail state, particular specialist levels as well as lines of communication between shore and transport workers, Accident reporting procedures and anticipation of future risks and prepare an action plan to counter them Reducing its impact, as well as paying attention to internal audit procedures and administrative reviews. Within the guidelines of the blog and how to create an ideal organizational atmosphere that fits with every work environment so that people are willing to report accidents and mismatches by developing a fair culture, which is an essential component of James Rison's theory of safety culture and safety management [22]. The International Maritime Organization identifies three main elements in order to reap the development of a way of life of organizational protection which is the awareness that accidents are preventable by using following the right tactics and growing first-rate practices, constantly thinking about safety, and attempt for continuous improvement. The IMO's approach and perspective to a safety lifestyle seem beneficial, which in turn is mirrored in the integrity of the whole system [17].

Implementing the safety culture via new application forms in this code will enhance the output result of seafarers' behaviors and companies follow up and tracing. The new forms should handle mathematical issues to measure the safety culture first before maintaining a safety management system for companies and ships.

5.2 The Flag State

Each flag state tune the safety tradition behavior for its vessels that can also have a countrywide register, 2nd register, and/or open register. The flag state can monitor the protection culture via a periodical shape survey for measuring the better ships mind-set and issue security culture certificates for each ship and point out the reasons for withdrawing the certificates in case they don't observe the safety subculture margin that the flag kingdom illustrated.

5.3 Education and Training at Maritime Institutes

Powerful education in safety issues needs to be addressed on the earliest viable stage in a seafarers' lifestyles. Environmental schooling ought to be an necessary segment of any curriculum and must be as actual to lifestyles as feasible. It needs to affect imperative know-how such as self-awareness. So that leaders can ascertain the place there are weaknesses. The Philippine service provider Marine Academy so that you can assist new applicants rapidly adjust supply a one month orientation education period in which they're isolated from own family and buddies and prohibited from pleasing web page traffic [18].

This is a clean but tremendous training approach. As opposed to just using maritime institute schooling ships as a floating study room cadets need to enjoy that actual international of transport in all its paperwork. As an instance, the addiction of reporting desires to begin on the institute level where there may be the merchandising of security subculture so that it will now not actually hand out punitive judgements.

Alternatively it will be assist the crew and person see the benefits of reporting with the aid of objectively inspecting what led up to the error the lessons that may be learnt from such enjoy. Environmental training and strain training are device which can be effectively used by the usage of the aviation organization in developing personnel that are equipped in working and performing their responsibilities in all possible situations [6].

Syllabus should be including the meaning and the objective of safety culture the help the cadets to achieve the success in his personality.

6. What Are the Features of Autonomous Ship?

According to the European Waterborne Technology Platform Implementation Plan for 2020, the development of autonomous ships is one of the key exploitation outcomes to strengthen Europe's maritime sector. Defines an autonomous ship as a vessel with:

"The Next generation modular system and technology that will enable wireless monitoring and control functions both on and off board. To bring the idea of autonomous ships to life, the European Commission has established the research project by Intelligence in networks and their exploitation in the safe operation of ships remotely (independent marine navigation by network intelligence, MUNIN). MUNIN investigated the feasibility of autonomous ships, and aims to develop required technology and business concepts [15].

As outlined within the definition of an autonomous ship, the vessel should be able to operate remotely under semi or fully autonomous control. The MUNIN project's core task is to develop and validate the specified technology to realize semi or fully autonomous control [23].

The ship is remotely operated according to the MUNIN project, ensuring that no crew member is expected to complete operations on the ship for parts of a specific voyage.

Japan's Nippon Yusen Kabushiki Gaisha (NYK) has launched first independent ship, Dead weight (DWT) 70,826-tonne pure vehicle truck carriers (PCTC) Iris Leader, sailing from China to Japan. Using the Sherpa System for Real ship (SSR) navigation system, the Maritime Autonomous Surface Ship (MASS) trial used to be carried out from 14-17 September 2019 from China's Xinsha to Japan's Nagoya, and then from Nagoya to Yokohama from 19-20 September 2019.

6.1 Autonomous Level

Table 1 shows the definition of autonomy levels by the Lloyd's Register basing primarily on variations between the methods used and the role of the operator.

Table 1 Lloyd's register's definition of autonomy levels [5].

Autonomy Level	Operator's Role
M-Manual navigation with automated processes and decision support	Crew on board ships to control the vessel that is operated in accordance with modern recruitment standards. Taking into account the technical assistance options and warning systems available, recently the bridge may also sometimes be unmanned with a responsible person ready to intervene to manage and anticipate navigational monitoring.
R-Remote-controlled vessel with crew on board	The vessel is managed and operated from shore or from any different vessel, however a person trained for navigational watch and maneuvering of the ship can be on board on standby geared up to acquire manage and assume the navigational watch, wherein case the autonomy level shifts to level M.
RU-Remote-controlled vessel without crew on board	The vessel is controlled by shore or other vessel, and has no crew on board.
A-Autonomous vessel	The vessel's working system calculates both penalties and risks. The system is capable of making decisions and determining actions with the use of itself. The shore operator is concerned only when the device fails or prompts human intervention, in which case the degree of autonomy shifts to level R or RU, depending on whether the crew is on board or not.

7. What Are The Benefits Of A Safety Culture Approach In Using The Autonomous Ships?

The approach to safety culture includes an overview of how the security priorities communicate with other strategic objectives.

An approach to the safety culture may encourage:

Greater congruence between the strategic decision taking of the organization and the fast ending fact.

Better integration of human and organizational factors (in nature, through modifications and in everyday activities), and hence an increase in the conditions of material and psychosocial work;

Better environmental efficiency, and progress in other corporate social responsibility areas;

An improvement in other aspects (quality of the product, brand identity, adherence to lead time [19].

8. Conclusion

Through this research paper, there is an urgent need to continue developing, implementing, and exerting effort and work to promote a safety culture on board ships and in companies. The safety culture assessment framework requires cooperation and integration among all sectors of the shipping system for successful implementation. The results of this research indicate that the safety culture is very important to implement in the marine sector structure a code to reduce the marine accidents and save the marine environment and also to help the autonomous ships and new revaluations technology to take place and achieve its goals. Since the new technology still depend on the human factor to operate and follow up, its recommended that the IMO should introduce, highlight, measure and implement the safety culture in the marine sector.

In the event the maritime organization adopts a culture of safety and also the application of a compulsory course for the crew that might help sailors to boost the culture of safety and alter their sense of communication and save themselves first and to not save symbols and agreements, which affects a course within the entire system.

The IMO need to take in consideration that the security way of life is the cornerstone of precise protection management.

References

[1] ACSNI Study Group (1991). “Study Group on Human Factors.” *Human Reliability Assessment — A Critical Overview*, Advisory Committee on the Safety of Nuclear Installations.

[2] Anderson P. (2003). “Cracking the Code: The Relevance of the ISM Code and Its Impact on Shipping Practices.” London: Nautical Institute.

[3] Anderson P. (1998). *ISM Code: A Practical Guide to the Legal and Insurance Implications*. London, Singapore: LLP.

[4] Chauvel A. M. (1997). *Managing Safety and Quality in Shipping*. London: The Nautical Institute.

[5] Danish Maritime Authority (2017). “The Division for Investigation of Maritime Accidents.” Denmark.

[6] Chang-kyunm (2012). “A Study on Educations Role in Establishing Strategies for Improving Safety at Sea the Asian.” *Journal of Shipping and Logistics* 27: 483-500.

[7] Daniellou F., Simard M., and Boissieres I. (2010). *Facteurs humains et organisationnels de la sécurité industrielle, Un état de l’art* (Vol. 2010–02). Toulouse: Institut pour une Culture de Sécurité Industrielle.

[8] Japan Transport Safety board (JTS) (2019). “Statistics of Marine Accident.” http://www.mlit.go.jp/jtsb/ statistics_mar.html.

[9] European Maritime Safety Agency (EMSA, 2016). *Annual Overview of Marine Casualties and Incidents*. 2016, s.l..

[10] International Labour Organization (ILO, 2012). “ILO. Safety Statistics.” http://www.ilo.org/public/english/ region/eurpro/moscow/ areas/safety/statistic.htm.

[11] Management (ISM) Code by Administrations (resolution A.788(19)).

[12] Kristensen, Hans Ottoand Marie Lützen (2013). “Prediction of Resistance and Propulsion Power of Ships.” In: 2.4.

[13] Kristensen, Heinemann and Burlington (2005). “Maritime Transportation.” *Safety Management and Risk Analysis*.

[14] Lappalainen J., Kuronen J., and Tapaninen U. (2012). “Evaluation of the Ism Code in the finish shipping companies”. *Journal of Maritime Research* 9 (1): 23-32.

[15] Lloyds List (2017). “Let Seafarers Light Way Forward on ISM Code.” The effectiveness of the ISM Code requires an urgent review.

[16] Nautical Institute (2004). "Paperwork, What Paperwork?" *Alert* (2): 1-8.

[17] Oltedal H. A. and Engen O. A. (2009). "Local Management and Its Impact on Safety Culture and Safety within Norwegian Shipping." In: Artorel M., Guedes C., Barnett J. (Eds.), *Safety, Reliability and Risk Analysis: Theory, Methods and Applications*, Taylor & Francis Group, London, pp. 1423-1430.

[18] PMMA admission, 2010.

[19] Institute for an Industrial Safety Culture (2018). "Safety Culture from Understanding to Action", p. 39, http://www.icsi-eu.org/.

[20] INSAG (1986). "*Summary report on the post-accident review meeting on the Chernobyl accident"*. Vienna: International Safety Advisory, International Atomic Energy Agency.

[21] Guldenmund F. W. (2000). "The Nature of Safety Culture: A Review of Theory and Research." *Safety Science 34* (1): 215-257.

[22] Reason J. (2001). "Managing the Risks of Organizational Accidents", Ashgate, Aldershot.

[23] Rodseth (2012). "Developments toward the Unmanned Ship." In: *Proceedings of International Symposium Information on Ships – ISIS 2012*, Hamburg, Germany, August 30-31, 2012.

[24] Tokyo MoU (2017). Annual Report on Port State Control in the Asia-Pacific Region 2017, Tokyo. http://www.tokyomou.org/publications/annual_report.php.

[25] Von Thaden T. L. and Li Y. (2008). "Attitudes of Chinese Commercial Pilots Toward Voluntary Reporting Systems." *XXIX International Congress of Psychology*, Berlin, Germany, July 20-25-2008.

[26] Zhang H., Wiegmann D. A., Thaden T. L. V., Sharma G., and Mitchell A. A. (2002). "Safety Culture: A Concept in Chaos?" Paper presented at the *46th Annual Meeting of the Human Factors and Ergonomics Society*, Santa Monica.