

## DIGITALIZATION OF MARINE INTERNATIONAL SAFETY MANAGEMENT SYSTEM FOR SHIP OWNERS AND OPERATORS

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### ABSTRACT

A global standard for ship safety and pollution control is set by the ISM Code's international rules. Earlier this year, the Assembly passed resolution A.443 (XI), which asked governments to protect shipmasters in their duties relating to maritime safety and environmental protection. In resolution A.680 (17), the Assembly acknowledged the importance of a management organization in order to meet the needs of ship passengers while maintaining high standards of safety and environmental protection. As a rule, all risks to a company's ships, crew or environment should be assessed and appropriate safety measures should be implemented. A wide variety of terms and expressions are used in the code so that it can be understood by a wide audience. It's clear that different levels of management necessitate different levels of expertise, whether on land or at sea. A commitment from the top down is required for effective safety management. All these factors are important when it comes to protecting the environment and ensuring the safety of workers. A paperless version of the current safety management system used by most ship owners and operators is the goal of this research. Survey questionnaires were used to gather and analyze end-user feedback. It's important to know what the end user expects to get the most out of a product. In order to help the ship's operator, make informed decisions, this research was conducted. There were significant benefits for both shipowners and operators in terms of both time and paper savings as a result of the implementation of the new safety management system.

**Keywords:** *Digitalization, Safety Management System, Ship Owner's, and Ship Operator's*

### 1.0 INTRODUCTION

The International Safety Management Code (ISM code) came into force in July 1998. After the 1987 sinking of the "MS Herald of Free Enterprise" off Zeebrugge, the IMO adopted this code. Goal: Internationalize ship management and pollution prevention. The Code's overall goals are to protect human life, the marine environment, and maritime property (IMO, 2019a). The ISM Code has two parts. Resources and personnel, ship and equipment maintenance, documentation are some of the elements covered in Part A (implementation, certification and

verification). The Code's guidelines and recommendations help ensure ship safety and quality. Many shipping companies use the ISM Code as a quality assurance tool because it is based on the ISO 9002 standards for quality management. The Code promotes ship quality by adhering to existing regulations and conventions MARPOL, SOLAS, STCW etc. The crew interprets the code's principles as safety policies, which are documented and subject to company and external audits. Failure to comply with the Code and its quality management systems may bar a vessel from trading. The ISM code must be implemented by all three parties (shipping companies, maritime regulators, and crew members). These important roles will be impacted by modern digitalization of ships. Technology is increasing industry digitalization.

Maritime digitalization is huge. Ships are now global data hubs. Global data exchanges are now possible at low cost via satellite communications. An industry shift toward process and function automation benefits safety, the environment, and commercial performance. Although not new, digitalization is still evolving in the shipping industry. Complicated technologies are used, and this study examines the relationships between them. The use of digital technologies to transform processes and enable new forms of value creation. Going digital is one way, this paper focuses on how information technology is transforming the ISM Code implementation and the resulting safety and quality assurance pro In other words, how is the ISM Code being implemented on ships as technology advances? As a result, this paper looks at how IT has influenced ISM Code quality assurance systems on ships.

According to new research, cyber-attacks on ships and shipping companies have increased dramatically. A recent maritime cyber security survey by Fair Play and BIMCO revealed that out of 350 respondents, more than a fifth had been attacked [1]. In the last year, 72% of respondents had a cyber-related incident, with 49% experiencing service disruption and 25% financial loss. Weaknesses in the maritime transport industry include high vulnerability to cyber-attacks. So too does protecting the land-based infrastructure that allows it. Cyber-attacks can cause major disruptions. Loss of life or damage to the ship's IT and OT systems. Digital technologies can both jeopardise and complicate maritime security. For example, hackers could hack into ship navigation systems and cause intentional groundings or collisions.

### *1.1 Implications of Using IT In Maritime and Shipping Industries*

The implications of using IT in maritime and shipping industries are also discussed. The findings of this paper are meant to educate sailors, shipping companies, and other interested parties. They say a literature review will help future research in this field. International Safety Management Code, which consists of 12 elements for various and most ship owners' safety management systems are currently in hardcopy and will be stored in large files, according to the International Safety Management Code (ISMC). When documents and checklists are stored onboard or in the office, they must be retrieved as quickly as possible. This is especially problematic in today's fast-paced offshore industry, where every second counts. If the completion of the inspection and audit is delayed because of document search time, the ship's owners or charterers will incur additional costs as a result of the delay. It will cost the owner or operator money to set up and maintain the system, and the amount will be determined by the number of vessels owned or operated. Aside from that, their system must be customised to work with the owner's existing hardcopy system. Aside from that, each vessel still requires a hardware system as well as a server system, which must be set up both onboard and ashore, depending on the vessel's requirements. It is also necessary to perform routine maintenance on this arrangement [2].

If there are flaws in the system, it will be vulnerable to cyberattacks. It is necessary to analyse and explain the cyber threat to the maritime and shipping industries by utilising the Confidentiality, Integrity, and Availability (CIA) Model, which combines traditional security and cyber security. Information technology has been implemented on ships in order to protect them from cyber threats and vulnerabilities, and the number of systems on board has increased exponentially as a result of this. Nowadays, ships' operational systems are increasingly frequently connected to the internet. This opens the door to unauthorised access to ships as well as malicious attacks on the ship's systems and infrastructure [3].

### *1.2 Digitalization Technology in Marine Industry*

Everything we do, from work to play, is affected by digital technology. The marine industry is benefiting from technological advancements by increasing its safety, productivity, usability, and long-term viability. As a result of the SMS being in a digital format, all changes to procedures can be accessed from a single location, i.e., the company server. If the ship's manual has not been updated in a physical copy, this ensures that the crew is working according to the most up-to-date procedures. When a company owns a fleet of vessels, these changes can be implemented across the board. For both safety and convenience, crew members who move to other vessels in the fleet can use the same procedure.

When a ship's computers are used to access a company's SMS, crew members can access the SMS quickly and easily. As a result, delays occur in the implementation of SMS updates because they must be posted on each ship individually. However, by converting the ship's SMS to a digital format, the company can make real-time changes to the SMS without delay. The SMS can also be accessed from anywhere in the world by company officials (ship superintendents, fleet superintendents, etc.). It is possible to train and brief seafarers ashore about upcoming SMS changes, and it is also possible to grant them access to the SMS while they are on leave. Over the course of their time away from the office, they can stay up to date on changes to company policies and procedures and new regulations, codes, and guidelines that will go into effect [4].

Using a computer to access a copy of an SMS allows a ship's staff to access the message more quickly, as multiple people can do so at the same time. It is possible to include links to relevant reference documents, such as IMO resolutions and circulars, on the same page where they are required to be attached. For example, searching for information on a ship's SMS using keywords has made it much easier to locate reference documents. For example, many ship operators have purchased or developed their own in-house tool or software for navigating through quality assurance documents in order to convert their company's SMS to a digital format. Each member of the crew has a unique set of log-in information.

It is the purpose of this study to determine the level of customer satisfaction when dealing with the Safety Management System digitally, whether it is through internal or third-party software. Specifically, the objectives of this research are to identify system bottlenecks that can be addressed further in order to assist shore or ship personnel in utilising the system in a much more efficient manner at this fast-paced environment. In order to make improvements to the system, we need to hear from shore and ship personnel, as well as third parties, about the difficulties they have encountered when using the paperless procedure [5].

## **2.0 ANALYSIS OF THE PREVIOUS WORKS**

The International Maritime Organization (IMO) established the International Safety Management Code (ISM Code) as a global standard for ship safety and pollution prevention in the maritime industry. Ship safety and quality assurance are governed by the International Maritime Organization's (IMO) Code, which provides crew members with a set of guidelines and recommendations to follow. The ISM Code, which was previously a paper-based system, aims to increase the efficiency of ship operations in order to improve overall ship performance. An online literature review was conducted in order to identify areas of code that have been impacted by technology, as well as the benefits that have been realised as a result of the technology implementation. As a result of cyberattacks on ships and the maritime industry in general, there has been a debate about the various consequences of ships' increasing reliance on technology and the rapidly evolving digital world. Because of the widespread use of digital technologies, processes can be transformed into new forms of value creation. We have the option of making the transition from digital to analogue [8]. ISM Code implementation and safety are being improved as a result of the evolution of information technology, which is also contributing to digitalization [6].

Operational technology such as the management of physical processes, systems, and machineries are also becoming more sophisticated. In response to the rapid advancement of information technology, quality assurance systems for the ISM Code are constantly evolving. Documentation systems, maintenance systems, certifications, recording and reporting systems, audits, and inspections are all examples of what is covered. Because it can be read simultaneously by multiple people using computers, an SMS that has been converted from hardcopy to digital format allows the crew of a ship to access the message more quickly. It is possible to include hyperlinks to relevant International Maritime Organization (IMO) documents, such as resolutions and circulars, on specific pages. The use of keywords on a computer has made it much easier to locate reference materials in the system. Many ship operators have implemented a web-based documentation tool for navigating quality assurance documents in order to digitise their company's SMS and streamline operations. All members of the crew have access to the navigation system's logs, which can be used to provide feedback and make suggestions to the captain. In part by automating the exchange of information between different parts of the system, digitalization and data sharing contribute to the reduction of transaction costs and the improvement of efficiency. It is critical to be able to trust and verify the information that is being shared in this process [7].

### 3.0 METHODOLOGY

#### 3.1 System Usability Scale (SUS)

It's a quick and easy way to see if the products and designs are usable as shown in Figure1. It is possible to use SUS to determine whether a software system or solution has an overall problem with its design in a practical and reliable way across a wide range of digital products and services [8]. The SUS is a ten-point question or statement:

- i. I found the system unnecessarily complex.
- ii. I thought the system was easy to use.
- iii. I think that I would like to use this system frequently
- iv. I think that I would need the support of a technical person to be able to use this system.
- v. I found the various functions in this system were well integrated.
- vi. I thought there was too much inconsistency in this system.
- vii. I would imagine that most people would learn to use this system very quickly.
- viii. I found the system very cumbersome to use.
- ix. I felt very confident using the system.
- x. I needed to learn a lot of things before I could get going with this system.

Strongly Disagree 1	2	3	4	Strongly Agree 5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 1: SUS format

#### 3.2 Open-Ended Survey Question

Open-ended questions are free-form survey questions that allow respondents to answer in an open-text format so that they can answer based on their complete knowledge, feelings, and understanding of the subject matter at hand. Responses to this question need not be limited to a single set of choices. As opposed to a closed-ended question, an open-ended question allows to delve deeper into the respondent's answers, gaining valuable information about the topic at hand. The answers to these questions can be used to gain a deeper understanding of a topic [9].

#### 3.3 Train-the-Trainer Concept

In the workplace, a common training strategy is to "train the trainer." Subject matter expert trainers teach other employees how to use online system programmes, for example, and teach them how to teach other employees how

to use the system programmes they have learned. Training the trainers is essential because it improves the efficiency and effectiveness of their respective training programmes. As a result, they are able to hone their existing abilities and learn new ones while also providing a service to the end users [10]-[11].

#### 4.0 ANALYSIS OF THE RESULTS

By analyzing data and facts, a systematic review and examination of data or information by dividing it into its component parts in order to reveal their interrelationships, it provides the basis for problem solving and business decision making. As a result, companies can learn what is working well for them and what they need to improve in order to grow. Analyzing statistics

##### 4.1 System Usability Scale (SUS) evaluation

The SUS survey has 10 statements, and it uses a Likert Scale. The user can evaluate at which level the statement is agreeable. The quickest and most simple steps do so:

*Step 1: Convert the scale into number for each of the 10 questions / statements*

Strongly Disagree: 1 point  
 Disagree: 2 points  
 Neutral: 3 points  
 Agree: 4 points  
 Strongly Agree: 5 points

*Step 2: Calculate*

$X = \text{Sum of the points for all odd-numbered questions} - 5$

$Y = 25 - \text{Sum of the points for all even-numbered questions}$

$\text{SUS Score} = (X + Y) \times 2.5$

It's easy to understand the reasoning behind the calculation. It's a 100-point test, and each question is worth a total of 10. Odd-numbered questions tend to have a more positive tone, so if the answer is strongly agreed upon, the 10 points. If zero point of the response is strongly disagreed. To ensure that each question has a maximum score of 10, multiply the answers by 2.5.



Figure 2: Sample of the SUS score / result

#### 4.2 Statistical Package for the Social Sciences (SPSS) Text Analytics

Automated and manual techniques are used to extract and classify key concepts from open-ended survey responses using SPSS Text Analytics. In order to categories the survey responses, the robust category building algorithms and simple drag-and-drop functionality to create categories, or "codes." Studies that use the same or similar categories will have more reliable results. No two projects will be the same because the open-ended response data can vary so widely from one survey to the next. As a rule, an expect to follow the same steps to conduct the analysis.

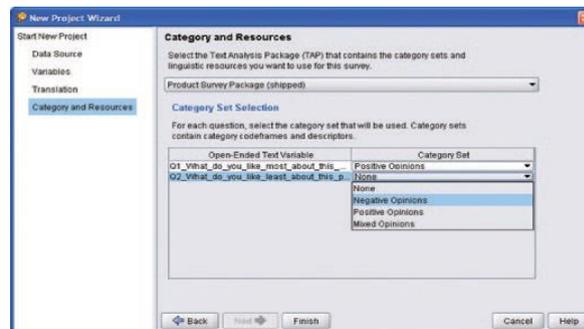


Figure 3: Variables and Text Analysis Packages (TAPs) containing pre-built categories and linguistic resources.

#### 4.3 Learning Management System (LMS) Analytics

Whether the offer a self-paced eLearning course or host a live online class, an LMS is a great way to update the classroom for the digital age. For face-to-face instruction, instructors and trainers can set up real-time webinars. To get a faster return on investment, the course up and running in minutes instead of hours or days (return of investment). Among other things, it gives students unlimited access to e-learning materials and the information they need.

Analysing the learners' data with LMS analytics can help the make better decisions about the training strategy and deliver better training experiences. It's capable of producing reports with examples, such as:

- Learner Activity, Progress & Competencies
- Department Progress
- Course & Curricula Activity
- Course Evaluations
- Certificates & Other Training

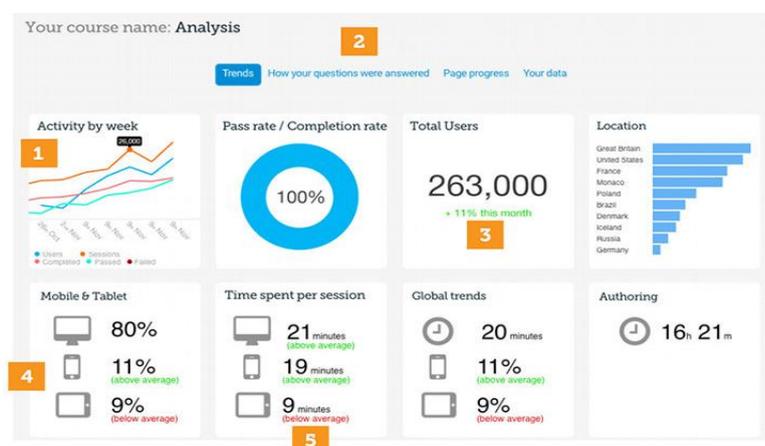


Figure 4 demonstrates sample of LMS Analytics statics

1. **Sessions vs. total users.**
2. **Completion rate.**
3. **User stats.**
4. **Device type.**
5. **Session times.**

## 5.0 CONCLUSION

Based on the results from this study, most passengers were satisfied with the facilities at the ferry terminal. The ferry terminal management should provide more data information for customers. On the other hand, it can be concluded that consumer loyalty and efficiency are closely linked. This can be seen from the table on paired sample t-Test for analysis objective 1. This can be seen from the table correlation analysis findings for dependent variable by using Pearson correlation for analysis objective 2. This research introduces the customer satisfaction concept, and the importance of measuring it.

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