UDC 629.047 DOI https://doi.org/10.33082/td.2021.1-8.06

SAFETY OF NAVIGATION AS A FACTOR OF INCREASING THE EFFICIENCY OF THE COMMERCIAL OPERATION OF THE SHIP

Y.V. Zagorodnia[1], V.V. Pozdniakova[2], O.M. Marukhnenko[3]
[1]Ph.D. in Economics, Assistant Professor at the Department of Navigation and Handling Ship,
Azov Maritime Institute
of the National University "Odessa Maritime Academy",
Mariupol, Donetsk region, Ukraine,
ORCID ID: 0000-0003-0320-540X
[2]Senior Lecturer at the Department of Navigation and Handling Ship,
Azov Maritime Institute
of the National University "Odessa Maritime Academy",
Mariupol, Donetsk region, Ukraine,
ORCID ID: 0000-0002-1968-9915
[3]Senior Lecturer at the Department of Navigation and Handling Ship,
Deep Sea Captain,
Azov Maritime Institute
of the National University "Odessa Maritime Academy",
Mariupol, Donetsk region, Ukraine,
ORCID ID: 0000-0002-0583-3752

Summary

Introduction. *The article deals with modern problems of the safety of navigation, as well as the reasons for the increased accident rate of ships, taking into account the influence of the human factor, the influence of these processes on the commercial component of sea transportation.* ***Purpose.*** *This article is aimed at a comprehensive analysis of the causes of emergencies at sea and finding effective ways to reduce them, minimize the commercial risks of transportation by improving the management of marine resources. A positive trend was revealed in terms of improving the safety of all types of ships, a decrease in the number of lost ships, casualties and wounded crew members in the period from 2014 to 2019. The main causes of emergencies are analyzed on the basis of EMSA statistical data and it is established that the main cause of increased accidents is the human factor. The classification of accidents caused by the human factor is considered. Established international organizations dealing with the safety of navigation and international conventions under which merchant vessels are currently being inspected.* ***Conclusions.*** *In this article we show the dependence of the safety of navigation on the competent management of marine resources, since the influence of the human factor is undoubtedly the main reason for the creation of emergency situations in the fleet, which leads to inevitable losses from the commercial operation of ships. Advanced training of ship officers and coastal operators involved in the ship's propulsion operations is a prerequisite for reducing accidents and increasing the financial efficiency of the fleet.*

Key words: *safety of navigation, management of marine resources, human factor, commercial operation of the vessel.*

БЕЗПЕКА СУДНОВОДІННЯ ЯК ЧИННИК ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ КОМЕРЦІЙНОЇ ЕКСПЛУАТАЦІЇ СУДНА

Ю.В. Загородня[1], В.В. Позднякова[2], О.М. Марухненко[3]
[1]к.е.н., доцент кафедри навігації та управління судном,
Азовський морський інститут
Національного університету «Одеська морська академія»,
Маріуполь, Донецька область, Україна,
ORCID ID: 0000-0003-0320-540X
[2]старший викладач кафедри навігації та управління судном,
Азовський морський інститут
Національного університету «Одеська морська академія»,
Маріуполь, Донецька область, Україна,
ORCID ID: 0000-0002-1968-9915
[3] старший викладач кафедри навігації та управління судном,
капітан далекого плавання,
Азовський морський інститут
Національного університету «Одеська морська академія»,
Маріуполь, Донецька область, Україна,
ORCID ID: 0000-0002-0583-3752

Анотація

Вступ. *Стаття присвячена сучасним проблемам організації безпеки мореплавства, а також основним причинам підвищеної аварійності суден з урахуванням впливу людського фактору та його впливу на комерційну складову частину морських перевезень.* ***Мета.*** *Ця стаття націлена на всебічний аналіз причин виникнення аварійних ситуацій на морі і пошук дієвих засобів щодо їх зменшення, мінімізуючи комерційні ризики морських перевезень, шляхом удосконалення менеджменту морських ресурсів.* ***Результати.*** *Було виявлено позитивну динаміку стосовно підвищення безпеки усіх видів суден, зменшення кількісних показників зниклих суден, загиблих та поранених членів екіпажу в період із 2014 по 2019 рр. Проаналізовано основні причини виникнення аварійних ситуацій на основі статистичних даних, представлених міжнародним агентством European Maritime Safety Agency, та встановлено, що основною причиною підвищеної аварійності є людський фактор. Розглянуто класифікацію аварій, які спричинені людським фактором, та виявлено їх взаємозв'язок. Установлено міжнародні організації, які займаються питаннями забезпечення безпеки судноплавства та міжнародні конвенції, відповідно до яких нині проводиться інспектування торгівельних суден.* ***Висновки.*** *У цій статті ми показуємо залежність безпеки судноплавства від грамотного менеджменту морських ресурсів, тому що вплив людського фактору, безумовно, є основною причиною створення аварійних ситуацій на флоті, що призводить до неминучих втрат із боку комерційної експлуатації судна. Підвищення кваліфікації суднових офіцерів та берегових операторів, які задіяні в рухомих операціях суден, є необхідною умовою скорочень аварій та підвищення фінансової ефективності роботи флоту.*

Ключові слова: *безпека судноводіння, менеджмент морських ресурсів, людський фактор, комерційна експлуатація судна.*

Introduction. Over the past decade international trade has been incessantly increasing. At the same time the shipping is growing constantly intensifying human activity at sea. Scientific achievement in the development of the shipping industry, in particular the technical operation of modern ships, is aimed at reducing accidents and increasing the commercial operation of the fleet. However, the issue of safety and trouble-free operation of navigators is still actual today, since the number of accidents at sea is practically not reduced, annually taking human lives, causing significant damage to the global economy and harm to the environment.

Formulation of the problem. Every year there is an intensive increase in the tonnage and operating speed of ships in the competition to improve the quality of transport and logistics services. Ship management, primarily navigators, have to work in difficult, sometimes extreme conditions, unquestioningly observing the conditions of the charter, without violating the terms of delivery of the cargo and ensuring the proper quality of the cargo transported on board the ship, and at the same time observing the conditions for ensuring the safety of navigation in difficult meteorological conditions, as well as being in dangerous navigation areas. All this affects the quality of the work carried out by navigators. Fatigue, stress, conditions of deprivation, long-term contracts without the possibility of a timely sign-off and other factors lead to inattention, loss of control and, as a consequence, to emergency situations that affect the efficiency of the commercial operation of the vessel.

Analysis of recent research and publications. Analyzing the information data of Ukrainian and foreign scientists, as well as industry experts regarding the safety of navigation and its influence on the commercial operation of the vessel, it is noted that the main reason for the increased accident rate of ships is the human factor. Such scientists and specialists as V. Topalov, V. Snopkov, V. Prus, A. Malcev [4; 6–9], specialists of international organizations for ensuring the safety of navigation were engaged in the study of this issue in detail [1–3; 5; 10].

Formulation of the purposes of the article. The purpose of the article is to analyze the safety of navigation and its impact on increasing the commercial operation of the vessel, identifying the reasons for the increased accident rate of ships, the influence of the human factor on the safety of navigation, the role of marine resource management in minimizing the accident rate on ships.

Presentation of the main material. EMSA (European Maritime Safety Agency) is dedicated to the prevention of maritime accidents, water pollution from ships and loss of life at sea by promoting the implementation of relevant the European Union (EU) legislation. The main purposes and objectives of the agency are providing scientific and technical support to the Member States and the European Commission for the development of the EU legislation relating to safety at sea, protection, prevention of pollution on ships and maritime transport; monitoring the implementation of the EU legislation through controls and audits; improved cooperation with member states; increasing the control of national competent authorities; rendering operational assistance such as the development, management and maintenance of integrated maritime services related to ships, monitoring and control of ships; performance of tasks of operational readiness, detection and response in relation to pollution caused by ships and pollution of the marine environment by oil and gas installations; at the request of the European Commission, rendering of technical operational assistance to non-EU countries around the corresponding sea basins [1].

The European Marine Casualty Information Platform (EMCIP) is a centralized database for the EU member states to store and analyze information on marine casualties and incidents. EMCIP data is completed by the competent national authorities. It is this data that forms the basis of the annual survey of marine accidents and incidents.

According to EMSA 2019 showed a positive trend in terms of improving the safety of all types of vessels, with a decrease in the number of ships lost, casualties and injured crew members. In 2019 3062 accidents were registered, the number of casualties decreased by 200 people and 21 ships were wrecked. In total, during the period from 2014 to 2019, 320 accidents occurred, as a result of which 496 people died, of which 88.3% of the victims were crew members. Analyzing the issue of the accident rate of cargo ships, it was revealed that during the period of 2019, 1,382 cargo ships were involved in accidents or other incidents, as a result of which only one cargo ship was lost [2].

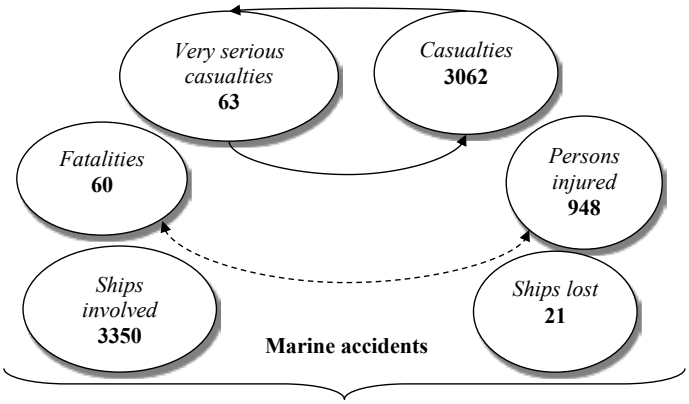

Fig. 1. Number of registered marine casualties and incidents as of 2020

The main causes of emergencies according to investigations by EMSA are erroneous actions of the crew (human factor) (67%), equipment failures (24%), dangerous substances (4%), weather conditions (3%), another ones (3%) (fig. 2).

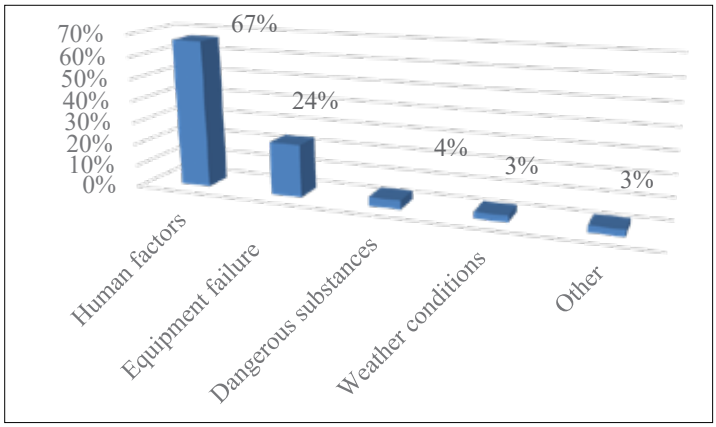

Fig. 2. Reasons for ship accidents according to EMSA data for the period since 2014–2019 [3]

Based on the data in fig. 2, it can be concluded that among the reasons for the accident rate of ships in the prevailing majority, emergencies occur due to the human factor. First of all, this refers to the mistakes of the command staff and port workers involved in organizing the movement of ships, in particular pilot boats, tugs, traffic control services, etc. The P&I Club of mutual insurance record about 73% of accidents due to the human factor due to mistakes of navigators.

The most serious security breaches are considered cases when accidents lead to maritime disasters such as shipwreck, loss of life and environmental problems. Almost security always breaches also affect the commercial component of a vessel's voyage. It causes demurrage, untimely delivery of cargo (as a result the consignee may refuse from the goods), complete or partial loss of the vessel and cargo, damage to cargo, penalties, etc. All these factors, in most cases, are caused by the low qualification of the ship's crew and the inability to quickly and competently make managerial decisions in conditions of increased risks with limited time. Human factor ship accidents can be contingently classified as the following (fig. 3):

- navigational;
- technological;
- technical [4].

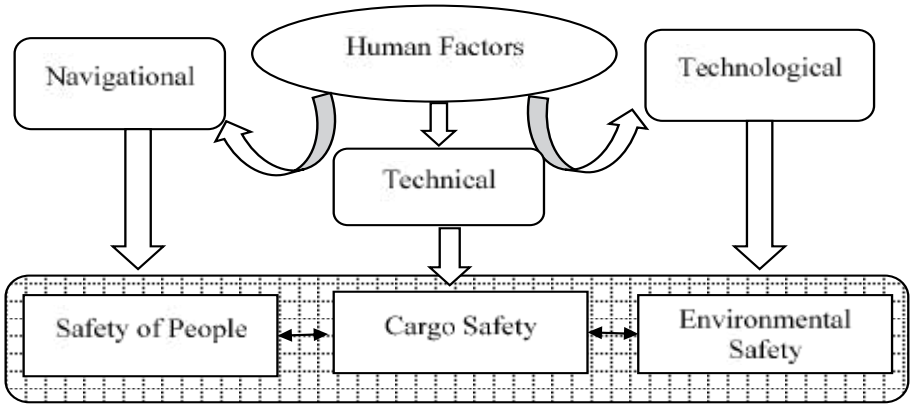

Fig. 3. Classification of factors affecting the accident rate of ships [4]

Navigational accidents occur due to the incompetence of the command staff, lack of appropriate experience and the ability to make quick and correct decisions in difficult situations as the result collisions, groundings, ship hits against underwater obstacles, storm damage are inevitable. All these situations entail large financial losses by shipping companies and inevitably lead to the loss of commercial benefits of transportation. For example, in 2020, a navigators' mistake resulted in a Greek shipowner spending $ 600,000 due to an error in plotting a Second Mate's course, who did not notice fishing farms on the chart in the area of China.

Technological accidents are associated with the cargo function of the vessel, in particular: violation of the strength of the vessel's hull, her devices, loss of stability, cargo movement, fire, water flooding into the interior spaces, etc.

Technical accidents occur as a result of improper maintenance and operation of the vessel, for example, the breakdown of ship mechanisms.

For increasing the safety of navigation, international organizations are constantly developing a system of measures to improve the safety and minimize the accident rate of ships. In 1982 14 European countries adopted the Paris Memorandum of Understanding on Port State Control (PSC) which was the first agreement on the control and safety of shipping. In addition to the standard issues of ensuring the safety of navigation, the participating countries have adopted a system for monitoring the safety of ships, through the interaction of port authorities and international organizations, so that foreign merchant ships entering the port or being at anchorage without any flag discrimination they sail.

The task of the PSC is to inspect the vessel in order to detect violations in the fulfilment by the shipowners (operators) of the requirements of international conventions and rules. For 2014–2019 PSC officers carried out about 20 thousand checks on ships in ports of call, as a result of which 187 ships were detained to eliminate comments. The dynamics of changes in the number of detentions of ships shows that the measures taken by shipowners (operators) and crews are insufficient to ensure the safe operation of ships. As a result, the number of detained vessels remains high. Statistics indicate that most of the PSC comments are related to a violation of fire safety and amounts to 32%, violation of the requirements for life-saving appliances – 24%, malfunction of auxiliary machinery and ship engines – 17%, other reasons – 27% [5].

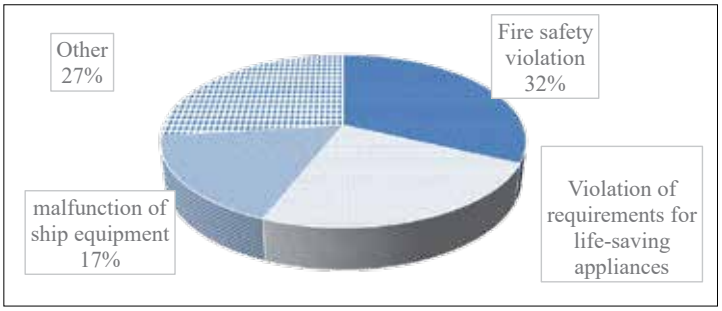

Fig. 4. The main reasons for the detention of ships in ports of call by PSC [5]

The analysis of statistical data made it possible to identify the following causal relationship of factors that led to the detention of ships (fig. 5).

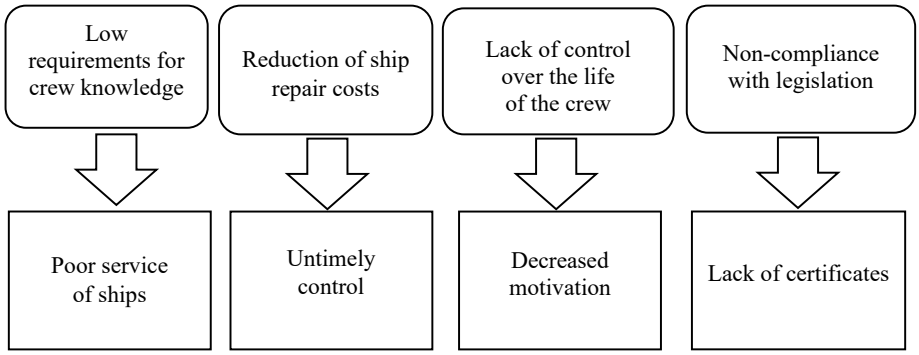

Fig. 5. The causal relationship of factors that led to the detention of ships [6–9]

In order to develop cooperation between countries in the field of technical supervision of ships and to ensure the safety of navigation the International Association of Classification Societies (IACS) was created in 1968. The purpose of the association is to develop standards and rules for ensuring the safety of maritime transport. The Association is the chief technical advisor to the International Maritime Organization (IMO).

Nowadays merchant ships are inspected in accordance with international conventions: the International Convention on Load Lines, 1966 (CLL-66) amended by the 1988 Protocol; the International Convention for the Safety of Life at Sea, 1974 (SOLAS-74); the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL-73/78); the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW-78); Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs -72); the International Convention on Tonnage Measurement of Ships, 1969 (TONNAGE- 69); International Labor Organization Convention No. 147 on Minimum norms on merchant ships, 1976 (ILO-147) [10].

Ships operate in difficult meteorological conditions (storms, ice, fog, currents), there are many complex structural elements, devices and instruments on board that can fail for various reasons, the rules and regulations governing the management of ships and their operation are imperfect and have significant limitations. But the most important circumstance is that people work on ships, often not always competent and disciplined enough, who commit rash acts and actions, make mistakes and blunders that entail serious consequences. To eliminate the human factor it is not enough for the ship and crew members to comply with all the norms and rules of international conventions and classification societies. It is necessary that the qualifications of the crew members correspond to the specialization of the vessel; it is advisable to hire a crew on the same vessels all the time that will provide a better knowledge and understanding of the technical condition of the vessel; since in most cases the ship's crew is international, it is necessary to eliminate the language barrier. For all the identified causes of accidents, deeper and more systematic studies should be carried out aimed at reducing the factors causing them.

Reducing emergency situations at sea, therefore, and minimizing the commercial risks of transportation can be achieved with the help of a set of effective measures in relation to the training of marine specialists by improving practical skills on specialized simulators that imitate a workplace on a ship; strict obedience of international and national regulations for the safe navigation of ships and transportation of passengers, prevention and elimination of impacts from direct and concomitant causes of emergencies.

Conclusions. Thus ensuring the safety of navigation directly depends on the competent management of marine resources, since the influence of the human factor is, of course, the main reason for the creation of emergency situations on board that leads to inevitable losses from the commercial operation of ships. Advanced training of ship officers and coastal operators involved in the ship's propulsion operations is a prerequisite for reducing accidents and increasing the financial efficiency of the fleet.

BIBLIOGRAPHY

1. EMSA. URL: http://www.emsa.europa.eu/
2. Annual Overview of Marine Casualties and Incidents. URL: http://www.emsa.europa.eu/tags/85-annual-overview.html
3. ABS AnnualReview 2015. URL: http://ww2.eagle.org/en.
4. Мальцев А.С. Теория и практика безопасного управления судном при маневрировании : дис. … докт. техн. наук: 05.22.16. Одеса, 2007. 395 с.
5. EMCIP. URL: https://portal.emsa.europa.eu/emcip-public/#/dashboard
6. Топалов В.П. Риски в судоходстве / В.П. Топалов, В.Г. Торский. Одесса : Астропринт, 2007. 368 с.
7. Прусс В.М. Международно-правовые аспекты безопасности мореплавания. Одесса : Латстар, 2001. 132 с.
8. Снопков В.И. Безопасность мореплавания / В.И. Снопков, Г.И. Конопелько, В.Б. Васильева. Москва : Транспорт, 1994. 247 с.
9. Торский В.Г., Топалов В.П. Управление судовыми экипажами. 2-е изд., исправленное и дополненное. Одесса : Астропринт, 2011. 244 с.
10. IMO. URL: https://webaccounts.imo.org/Common/weblogin.aspx?ReturnUrl=%2f&error_message=interaction_required

REFERENCES

1. EMSA. URL: http://www.emsa.europa.eu/
2. Annual Overview of Marine Casualties and Incidents. URL: http://www.emsa.europa.eu/tags/85-annual-overview.html
3. ABS AnnualReview 2015. URL: http://ww2.eagle.org/en.
4. Mal'cev A. S. Teoriya i praktika bezopasnogo upravleniya sudnom pri manevrirovanii : dis. … dokt. tekhn. nauk: 05.22.16. Odesa, 2007. 395 s.
5. EMCIP. URL: https://portal.emsa.europa.eu/emcip-public/#/dashboard
6. Topalov V.P. Riski v sudohodstve / V.P. Topalov, V.G. Torskij. Odessa : Astroprint, 2007. 368 s.
7. Pruss V.M. Mezhdunarodno-pravovye aspekty bezopasnosti moreplavaniya. Odessa: Latstar, 2001. 132 s.
8. Snopkov V.I. Bezopasnost moreplavaniya / V.I. Snopkov, G.I. Konopelko, V.B. Vasileva. M.: Transport, 1994. 247 s.
9. Torskij V.G., Topalov V.P. Upravlenie sudovymi ekipazhami. 2-e izd., ispravlennoe i dopolnennoe. Odessa : Astroprint, 2011. 244 s.
10. IMO. URL: https://webaccounts.imo.org/Common/weblogin.aspx?ReturnUrl=%2f&error_message=interaction_required