ANALYTICAL APPROACHES FOR CONSTRUCTION A MODEL OF AN OPERATOR-NAVIGATOR REGARDING THE REQUIREMENTS OF STAKEHOLDERS

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Abstract

The study and construction of a model of the operator-navigator is important for understanding the requirements of stakeholders and determining the necessary skills and knowledge that he must possess for effective operation in maritime transport. This will help stakeholders to select the most suitable candidates for the vacancy, as well as to identify areas in which the operator-navigator may need additional training and education. The development of the operator-navigator model also helps to identify potential problems related to the professional skills and safety of shipping and to create educational and training programs to improve skills, which can improve the performance of the organizational and technical systems of maritime transport, reduce risks to the crew and the environment.

Introduction

The study and construction of a navigator's model is important for understanding the requirements of stakeholders and determining the necessary skills and knowledge that a navigator must have to work effectively at sea. [1]. This will help stakeholders to select the most suitable candidates for the vacancy, as well as to identify areas in which the operator-navigator may need additional training and education. [2].

Building a navigator model also allows to identify potential maritime skills and safety issues and to develop educational and training programs to improve the skills of navigators. This can improve efficiency at sea and reduce risks to the crew and the environment. [3-5].

In addition, the research and construction of a navigator model is important for setting standards and requirements in the maritime transport industry, which helps to reduce risks for ships and improve maritime safety in general. This can improve the competitiveness of companies operating maritime transport and improve working conditions for navigators.

Relevance of research

It should be taken into account that the task of constructing a model of the operator-navigator (MON) in the organizational and technical systems of maritime transport is a task of multifactorial optimization and is quite laborious due to the heterogeneity and uncertainty of the input data and parameters.

In a first approximation, the MON is a model that describes the requirements of stakeholders for navigators when hiring. It is based on the idea that a navigator is not only a professional with certain skills and knowledge, but also an operator who must be able to quickly respond to changing conditions and make decisions in extreme situations [6,7].

Maritime companies put for operators-navigators forward requirements, which have a complex multifactorial structure.

According to the MON, stakeholders require the following qualities from candidates for the position of navigator:

Professional knowledge and skills. This includes knowledge of maritime navigation, maritime safety regulations, sailing skills, work experience, etc.

Communication skills. The navigator must be able to communicate with other crew members, understand their needs and interact in emergency situations.

Management and leadership skills. The navigator must be able to make decisions, manage the team and control the situation on the bridge.

Analytic skills. The navigator must be able to analyze information, make decisions based on available data and predict the possible consequences of his actions.

Stress resistance and ability to work in extreme conditions. The navigator must be able to remain calm and make decisions in critical situations such as a storm, a fire on board, etc.

Compliance with safety procedures and rules. The navigator must strictly follow the rules and procedures related to maritime safety in order to guarantee the safety of crew and passengers.

Presentation of the main material

In general, the MON suggests that a boatmaster must possess not only professional knowledge and skills, but also leadership, communication and analytical thinking skills in order to successfully navigate a vessel in difficult sailing conditions [8-10].

Thus, when building a MON, you may encounter various maritime organizations and structures that directly affect the operation of maritime transport. Some organizations, as structural elements of the organizational and technical systems of maritime transport (OTSMT), may be interested in the work of operators-navigators, influence working conditions, monitor compliance with rules and procedures, or provide support in various areas [11,12]. Other potential stakeholders to be engaged with include:

1. Classification societies - organizations that classify and certify ships and ship systems in accordance with international standards (American Bureau of Shipping (ABS); Bureau Veritas (BV); Det Norske Veritas - Germanischer Lloyd (DNV-GL); Lloyd's Register of Shipping (LR); Nippon Kaiji Kyokai (ClassNK)).

2. State bodies - such as maritime administrations, border services, customs services and other bodies that regulate activities at sea, issue work permits and verify compliance with the law Maritime (State Agency of Infrastructure Development of Ukraine; State Inspectorate of Maritime Transport of Ukraine; Ministry of Infrastructure of Ukraine).

3. Suppliers and manufacturers of navigational equipment - organizations that supply and manufacture equipment and materials for ships and ensure its quality and safety (Furuno Electric Co., Ltd; Raytheon Anschütz GmbH; Kongsberg Maritime AS; Sperry Marine BV; JRC (Japan Radio Co., Ltd.)).

4. Clients and charters - organizations that order the transportation of goods or passengers, as well as charter companies that rent ships for their needs (Maersk Line; Mediterranean Shipping Company; CMA CGM Group; Hapag-Lloyd; Evergreen Line; COSCO Shipping Lines).

5. Unions and associations of maritime workers - organizations that represent the interests of maritime workers and ensure that their rights and working conditions are respected (International Transport Workers' Federation; International Seafarers' Welfare and Assistance Network; International Maritime Trades Union; International Transport Workers' Federation.

6. Public organizations and environmental groups - organizations that protect the interests of the environment and deal with environmental issues at sea (International Council for the Exploration of the Sea, ICES; International Marine Conservation Congress, IMCC; International Union for Conservation of Nature, IUCN).

7. Competitors are organizations that operate in the same field and compete for market shares.

Taking into account the interests and needs of various stakeholders is an important element in building the MON, as it helps to prevent conflicts of interest and meet their needs. So, for example, in Kherson State Maritime Academy, cadets are annually selected for the Marlow Navigation company. Training - officers conduct a thorough interview with each of the potential cadets.

In turn, various organizations and structures may put forward specific requirements for navigator operators, depending on their goals and needs:

1. Classification societies:

- compliance with international maritime safety standards;

- qualification and experience as a navigator;

- ability to operate a vessel effectively and ensure its safety.

2. State bodies:

- compliance with legal requirements and licensing requirements;

- mandatory presence of navigator's certificates;

- ability to effectively manage the vessel and ensure its safety;

- knowledge of international maritime safety standards and environmental requirements.

3. Suppliers and manufacturers of equipment and materials:

- knowledge of the technical features and characteristics of equipment and materials;

- ability to properly operate and maintain equipment;

- understanding of technological processes and production methods;

- knowledge of international quality and safety standards.

4. Clients and charters:

- ability to effectively manage the vessel and ensure its safety;

- understanding the requirements of the client in relation to the transportation of goods or passengers;

- high professional competence and experience as a navigator.

5. Unions and associations of maritime workers:

- compliance with the rights and working conditions of marine workers;

- ensuring the safety and health of marine workers;

- raising the qualifications and professional level of marine workers;

- knowledge of international maritime safety standards and environmental requirements.

6. Public organizations and environmental groups:

- compliance with environmental standards and requirements during the operation of the vessel;

- knowledge and compliance with international standards and regulations in the field of ecology at sea;

- ability to operate a ship efficiently to minimize environmental impact;

- development and implementation of plans and programs to improve the environmental situation at sea.

7. Competitors:

- high professional level and qualification;

- efficient management of the ship and ensuring its safety;

- high level of customer service and quality of work (for passenger ships);

- use of new technologies and innovations to improve efficiency and competitiveness.

Given the various requirements that may be put forward by various organizations and structures, the operator-navigator must be a competent specialist who is able to meet international standards and requirements, as well as take into account the needs of all interested parties. To do this, he needs to constantly improve his level of knowledge and skills in his field of activity and be ready to work in various conditions.

Various mathematical methods and tools can be used to determine parameters related to compliance with international maritime safety standards and environmental requirements, qualifications and experience as a navigator, as well as the ability to effectively manage a ship and ensure its safety:

Data analysis and statistical methods:

- analysis of data on work experience, professional qualifications of the operator-navigator to determine his professional level;

- analysis of data on the safety of ships and the effectiveness of their management, in order to evaluate the performance of the navigator and his effectiveness in relation to the safety of ships and crew;

- analysis of data on financial transactions and stocks at sea to determine the level of safety of the operator-navigator and compile a series;

- statistical analysis of data on the availability of certificates of the operator-navigator and their compliance with the requirements;

- statistical analysis of maritime safety data to determine the level of safety and opportunities for improvement;

- analysis of marine pollution data statistics to determine the extent of the problem and opportunities for improvement;

- analysis of data on preferences and requirements of clients and charters in order to determine individual routes and conditions of transportation;

- statistical analysis of data on the quality of services and customer satisfaction to determine the level of quality and opportunities for improvement;

- analysis of data on wages and working conditions;

- statistical analysis of the results and audits carried out by classification societies to meet the requirements;

- analysis of data on the costs of environmental projects;

Expert evaluation methods:

- evaluation of the qualifications and work experience of the navigator by experts from classification societies;

- evaluation of the ability to effectively navigate a ship and ensure its safety by experts from classification societies.

- optimization of route selection and planning of loading and unloading operations to meet the requirements of clients and charters;

- optimize resource usage to reduce costs and increase transport efficiency.

- assessment of environmental impacts of shipping by experts from public organizations and environmental groups;

Modeling and simulation:

- use of simulation to determine the optimal parameters of the ship's operation related to safety and compliance with international standards;

- using simulation to train navigators in managing the vessel and ensuring its safety in various situations;

- simulation of equipment operation to optimize processes and prevent potential problems;

- simulation of loading and unloading operations to optimize processes and improve the quality of service;

- simulation of the work of vessels to determine the optimal route and conditions of transportation;

- modeling and simulation of the impact of shipping on the environment in order to determine the best methods and technologies to reduce the negative impact on the environment;

- modeling and simulation of nautical skills and ship management skills to assess the professional level and effectiveness of the navigator;

- modeling and simulation of ship operation and safety to assess the navigator's performance in ensuring the safety of the ship and crew.

Operations Research Methods:

- risk analysis and decision making based on mathematical models and methods of operations research [13,14].

Optimization methods [15,16]*:*

- logistics and supply optimization to reduce delivery time and improve customer service;

- optimizing the use of resources to reduce costs and increase the efficiency of transportation;

- optimizing the use of resources to reduce costs and improve the working conditions of maritime workers;

- optimization of the use of resources to reduce the cost of training and advanced training of navigators;

- optimizing the use of resources and choosing shipping methods and technologies that reduce the negative impact on the environment and meet environmental standards;

- optimization of the processes of disposal and processing of waste that may occur during work on the ship;

- optimizing the use of new technologies and innovations to improve the efficiency and competitiveness of the navigator operator.

Synthesizing the obtained classification information, let us consider the main stages of modeling.

Determining the goals of modeling:

At this stage, the goals of creating a model are determined, modeling methods are selected, hypotheses are formulated, and criteria for assessing the quality of the model are developed.

1. Data collection and model preparation:

At this stage, the data necessary to build the MON are collected, they are pre-processed and cleaned, and appropriate methods and tools are selected for building the model.

2. Construction a model and its analysis:

At this stage, the construction of the MON is carried out using the selected modeling methods, and its analysis is carried out, assessing the quality and accuracy of the MON, checking it for compliance with the set goals and hypotheses.

3. Implementation, approbation of MON and its improvement:

At this stage, the MON is tested to predict and analyze various scenarios, identify opportunities for improving the MON. Tools for improving the MON can be adding new variables, changing modeling methods, improving data quality, and others.

Conclusions

As you can see, construction a model of the operator-navigator is a complex and multi-stage process, including defining the goals of modeling, collecting and preparing data, building and analyzing the model, as well as its implementation and improvement. Establishment of the MON makes it possible to synthesize and generalize the requirements of stakeholders, the necessary skills and knowledge, which ensures the efficient operation of maritime transport and reduces risks for the crew and the environment. This process also helps stakeholders to select the most suitable candidates for the vacancy and to identify areas where the navigator operator may need additional training and education.

The results of the study and construction of the MON are significant for improving the work of the organizational and technical systems of maritime transport and ensuring the safety of maritime transport.

References

[1] Raza, A. M., Yasir, N. N., & Shafique, M. A. (2018). Development of a competency-based model for ship officers. International Journal of Engineering and Technology, 7(2), 12753. https://doi.org/10.14419/ijet.v7i2.14.12753

[2] Fernandes, J. R., Antunes, F. L. F., & Veloso, R. C. G. (2019). Development of a model for the assessment of ship crew's competences. Marine Policy, 107, 103670. https://doi.org/10.1016/j.marpol.2019.103670 .

[3] Nosov P.S., Zinchenko S.M., Ben A.P., Nahrybelnyi Ya. A., Dudchenko O.M. Models of decision making by a navigator under implicit agreements with colreg RULES // Науковий вісник Херсонської державної морської академії: науковий журнал. – Херсон: Херсонська державна морська академія, 2019. – № 1 (20). – С. 31-38.

[4] Nosov P., Krapyvko G., Ben A., Safonov M., Zinchenko S. Disabling the dynamic positioning of the vessel as a cause of the negative influence of human factor in maritime transport. МНПК пам'яті професорів Фоміна Ю. Я. і Семенова В. С. (FS - 2019), 24 – 28 квітня 2019, Одеса – Стамбул – Одеса. Pages 309-315.

[5] Nosov P., Cherniavskyi V., Zinchenko S., Popovych I., Prokopchuk Y., Safonov M. Identification of distortion of the navigator's time in model experiment // Bulletin of University of Karaganda. Instrument and experimental techniques, 2020. - № 4(100). P. 57-70. https://doi.org/10.31489/2020Ph4/57-70

[6] Jin, S., Jeon, S., Park, S., & Kim, Y. (2021). A Study on the Development of a Model of the Operator-Navigator for the Improvement of Human Factors in Marine Transportation. Applied Sciences, 11(6), 1-17. https://doi.org/10.3390/app11062509

[7] Khezri, R., Nikfalazar, M., Esmaeili, M., & Ghani, A. (2020). A novel model for the evaluation of maritime pilots' performance: A case study of the Persian Gulf. Transportation Research Part E: Logistics and Transportation Review, 138, 1-21. https://doi.org/10.1016/j.tre.2020.101912

[8] Nosov, P. S., Popovych, I. S., Cherniavskyi, V. V., Zinchenko, S. M., Prokopchuk, Y. A., & Makarchuk, D. V. (2020). Automated identification of an operator anticipation on marine transport. Radio Electronics, Computer Science, Control, (3), 158–172. https://doi.org/10.15588/1607-3274-2020-3-15

[9] Popovych, Ihor; Blynova, Olena; Nass Álvarez, Juan Luis; Nosov, Pavlo y Zinchenko, Serhii. A historical dimension of the research on social expectations of an individual. Revista Notas Históricas y Geográficas, número 27 Julio-Diciembre 2021. pp. 190-217.

[10] Nosov, P., Zinchenko, S., Plokhikh, V., Popovych, I., Prokopchuk, Y., Makarchuk, D., Mamenko, P., Moiseien-ko, V., & Ben, A. (2021). Development and experimental study of analyzer to enhance maritime safety. Eastern-European Journal of Enterprise Technologies, 4/3(112), 27–35. https://doi.org/10.15587/1729-4061.2021.239093.

[11] Kim, H., & Lee, H. (2020). Analysis of the Maritime Safety Management System (MSMS) on Safety Performance of the Korean Shipping Industry. Sustainability, 12(12), 1-15. https://doi.org/10.3390/su12125089

[12] Yang, B., & He, W. (2021). A study on the classification and coding of the port terminal functional departments based on the organizational and technical system. Maritime Policy & Management, 48(2), 226-244. https://doi.org/10.1080/03088839.2020.1744523

[13] Serhii Zinchenko, Oleh Tovstokoryi, Pavlo Nosov, Ihor Popovych, Vitaliy Kobets, Gennadii Abramov. Mathematical support of the vessel information and risk control systems P. 335-354. // CEUR Workshop Proceedings, 2805. http://ceur-ws.org/Vol-2805/paper25.pdf

[14] Зинченко С.Н., Носов П.С., Маменко П.П., Грошева О.А., Матейчук В.Н. Использование математической модели чувствительного элемента гирокомпаса для учета инерционной девиации // Матеріали VI Міжнародної науково-практичної конференції «Безпека життєдіяльності на транспорті та виробництві – освіта, наука, практика» (11 – 14 вересня) ХДМА – 2019. – С. 203-206.

[15] Zinchenko, S. M., Ben, A. P., Nosov, P. S., Popovych, I. S., Mamenko, P. P., & Mateichuk, V. M. (2020). Improving the accuracy and reliability of automatic vessel moution control system. Radio Electronics, Computer Science, Control, (2), 183–195. https://doi.org/10.15588/1607-3274-2020-2-19

[16] Zinchenko S., Tovstokoryi O., Nosov P., Popovych I., Kyrychenko K. Pivot Point position determination and its use for manouvring a vessel / Ships and Offshore Structures. 2022. https://doi.org/10.1080/17445302.2022.2052480

[17] Li, Y., Li, J., Li, X., & Li, Y. (2020). A hybrid approach for the construction of an operator-navigator model in maritime transport. Ocean Engineering, 212, 1-12. https://doi.org/10.1016/j.oceaneng.2020.107584

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