



DIGITALIZATION IN THE MARITIME INDUSTRY – SOCIAL AND PSYCHOLOGICAL CHALLENGES IN BULGARIA

**Kamelia Narleva, Yana Gancheva*,
Anna Karadencheva**

Abstract. Maritime industry, as an important component of the global trade and logistics, is undergoing a profound transformation driven by technological advances (blockchain, IoT, AI, automation) and changing social, psychological, cultural and ethical challenges. The paper focuses on the synergy between the technological innovations and the human factor in the maritime sector. It argues that this correlation requires careful study, strategic planning and proactive management. It proves that the synergistic effect, achieved through training and investment, leads to increased organizational effectiveness. Empirically, in-depth interviews and subsequent factor analyses have been conducted with managers of companies in the maritime industry. This method demonstrated the key social and psychological challenges resulting from the digitalization of the maritime industry such as change in traditional roles, job rotation, risks of new professions, and mental health. Dependencies between socio-psychological factors and the management impacts of the environment are established through regression and correlation analyses. Factor analysis reveals the leading challenges of the digital era in the maritime industry, stress (56%), information overload (84%), and uncertainty and risk (75%). Investment policies and management strategies in response to digitalization are established including training, communications and innovation. Optimization of the management practices in the maritime organizations is proposed comprising psychological counseling and social programs. In conclusion, the need for developing new competencies by identifying new values is demonstrated. Innovative, systematic training and development programs are presented in response to subsequent technological challenges in the maritime industry.

Keywords: Digitalization; Maritime Industry; Workforce Transformation; Learning Skills; Psychological Challenges.

Nikola Vaptsarov Naval
Academy, Varna, 73 Vasil
Drumev Str., Bulgaria

* **Corresponding author:**
y.gancheva@naval-acad.bg

<https://doi.org/10.7225/imla30.04>

1. INTRODUCTION

Modern global changes, triggered or catalyzed by economic, financial, climate and military crises, represent a challenge to the effective management of the maritime industry. Therefore, a new way of thinking is required to help overcome the negative effects of global changes, in which digitalization is of paramount importance. Globally, maritime organizations are open to the digital revolution. The reasons for this are that digitalization and innovative technologies are the key to standardization, increasing efficiency in shipping and logistics, promoting economic development and sustainable prosperity (Gavalas et al., 2022). At the same time, it is realized that economic progress should be in sync with safety, environmental protection and cybersecurity. An important condition is that the digital transition also reflects the synergy between technological innovations and the human factor with a strong emphasis on social and psychological challenges.

In the context of digitalization in the maritime industry, employees increasingly perceive the new organizational values as part of their own identity through a process of identification with the transformed work environment (Kalinov, 2016). It is characterized by the introduction of new technologies, flexible roles, electronic resources and lifelong learning aimed at addressing professional risks, psychosocial challenges and the need for sustainable adaptation. Within the framework of the presented arguments, the article aims to substantiate the social and psychological challenges of the digitalization of the maritime industry of the Republic of Bulgaria, therefore to propose optimization of skills, competencies and management practices in the maritime industry. In view of the above, the following major tasks are addressed in the article:

- To analyze the new role, tasks and trends in the development of the maritime organizations in the context of digitalization and innovation;
- To examine the systemic challenges facing human resources which arise as a result of the development of new technologies and digitalization processes;
- To analyze management practices and technologies for improving the organizational environment and culture for the effective application of digitalization processes in maritime organizations;
- To demonstrate the need for education, training and continuous investments in psychological and social competence in order to increase the organizational efficiency and digitalization of the maritime industry.

To achieve the latter, pilot in-depth interviews have been conducted with the management of 32 maritime organizations located in the Northeastern region of the Republic of Bulgaria. The subsequent analyses of the empirical research determine guidelines, generalizations and conclusions regarding social and psychological values and practices which resonate with the contemporary innovations and subsequent technological challenges in the maritime industry.

2. RELEVANCE OF THE STUDY

The maritime industry, serving over 80% of the world's goods, is a complex sector characterized by the interconnectedness of various participants in transport, logistics, regulatory and social activities and processes. Maritime organizations are a key factor in the global economy and require innovative and managerial approaches to address the challenges of the modern world, including technological requirements and dynamic global transformations. This requires the widespread application of technologies such as artificial intelligence (AI), the Internet of Things (IoT), blockchain and autonomous systems, which are factors that change the industry and the world as a whole (Vărzaru & Bocean, 2024). These, in turn, are accompanied by many challenges and require a clear definition of leadership positions and responsibilities in management decision-making (Stoyanova & Stefanova, 2025). These include technological constraints and policies and regulations as well as ethical issues that together create formidable resistance to the diffusion of digitalization practices (Verma & Sharma, 2025). In response to the growing pressure to increase efficiency, sustainability and adaptability, the maritime industry is increasingly integrating intelligent information systems which automate key processes such as data collection, processing and archiving. These systems, often built as intelligent agents or personal assistants of the technical manager, contribute to optimizing resource management and increasing the overall efficiency of operations (Sivkov et al., 2019). Digitalization, in this context, not only modernizes traditional practices, but also creates the prerequisites for sustainable development through the implementation of innovative technological solutions. Digitalization is an innovative, technological, but also a social and psychological issue, closely related to human capital (Qureshi, 2023). Maritime organizations are successfully implementing digital technologies to meet the challenges of the fourth industrial revolution. However, the social and psychological aspects that facilitate the transition to the new era are often overlooked (Bayrak, 2025). In a knowledge-based economy,

where value is generated mainly from intangible assets, digital transformation depends and will depend on both technology and human resources – their effective and proactive management (KPMG, 2022).

3. METHODOLOGY OF THE STUDY

The subject of the empirical study are managers of 32 expert companies in the maritime business on the territory of the North-Eastern planning region of the Republic of Bulgaria. The pilot study – in the form of structured, in-depth interviews, was conducted within two years (2022 – 2024) and included two research structural parts. The first part established and analyzed the social and psychological effects of digitalization on the human factor. The second part aimed to identify the management impacts as a response to the studied challenges – practices and technologies for improving the organizational environment and culture. The statistical software product XLSTAT 2024 was used to identify and analyze dependencies between the factors of interest. This product was chosen due to its objective capabilities such as correlation and regression analyses which help to establish the need for education, training and continuous investments in psychological and social competence in order to increase the organizational efficiency and digitalization of the maritime industry.

The limitations of the empirical study were mainly related to its subject. Maritime industry involves a number of counterparties – shipping companies, ports, logistics operators and others, whose digital transformation is characterized by different paces, management methods and efficiency. Moreover, stakeholders identified various deterrent factors, risks and opportunities for a successful socio-technological transition. This fact, as well as a more global

context of the problem, will be the subject of future research studies on the topic.

4. RESULTS FROM THE STUDY

The results of the survey show that the most serious challenge for 97% of the managers (31 people) is the technological pressure on employees. According to the analyses, the need for continuous and systematic acquisition of new skills as a result of the rapid pace of digitalization is perceived more as a threat than as an opportunity. A correlation analysis also proves that, according to the management, the feeling of threat is more pronounced in employees with less experience in using new technologies. The second most significant difficulty, indicated by 84% of the respondents, is cognitive fatigue and information overload. Such fatigue can lead to errors, reduced efficiency and a general deterioration of the psycho-emotional state. The feeling of uncertainty about the future of maritime jobs and the fear of technological displacement also occupy a central place in the responses of the managers – 75% of the participants (24 people). This shows that digitalization is also perceived as a barrier to professional identity and a challenge to the future role of maritime jobs (Figure 1).

A subsequent and complementary analysis of social and psychological factors revealed that the main difficulties in the process of digitalization were mainly related to the lack of sufficient training and stress. On the other hand, insufficient prior preparation is a prerequisite for uncertainty, errors and increased workload, i.e. leading to subsequent social and psychological effects. The next main challenge was the stress caused by the need for adaptation and constant connectivity, noted by 56% of the respondents

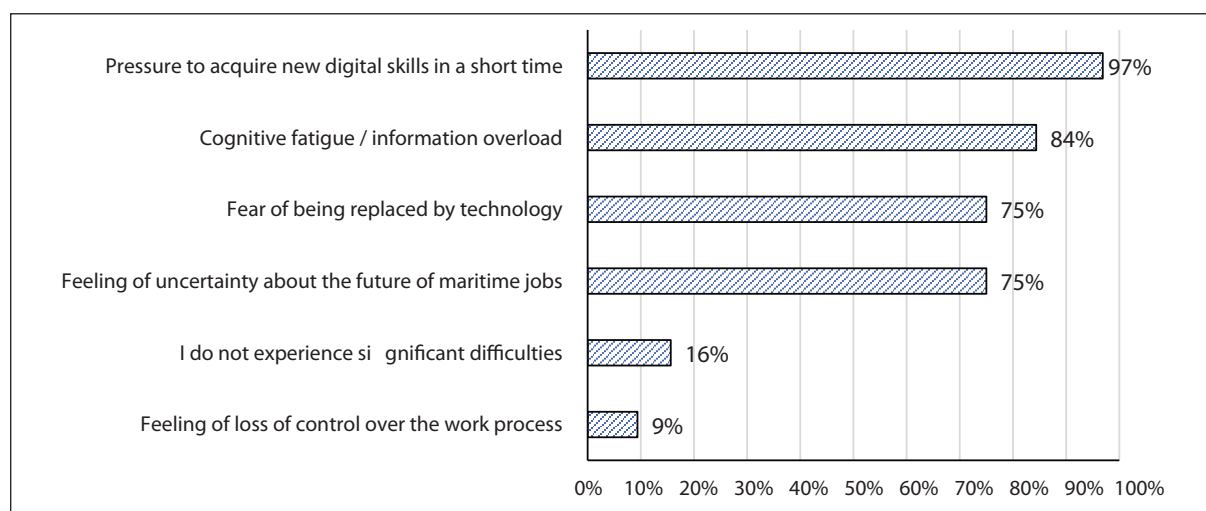


Figure 1. Social and psychological challenges in the digitalization of the maritime organizations.

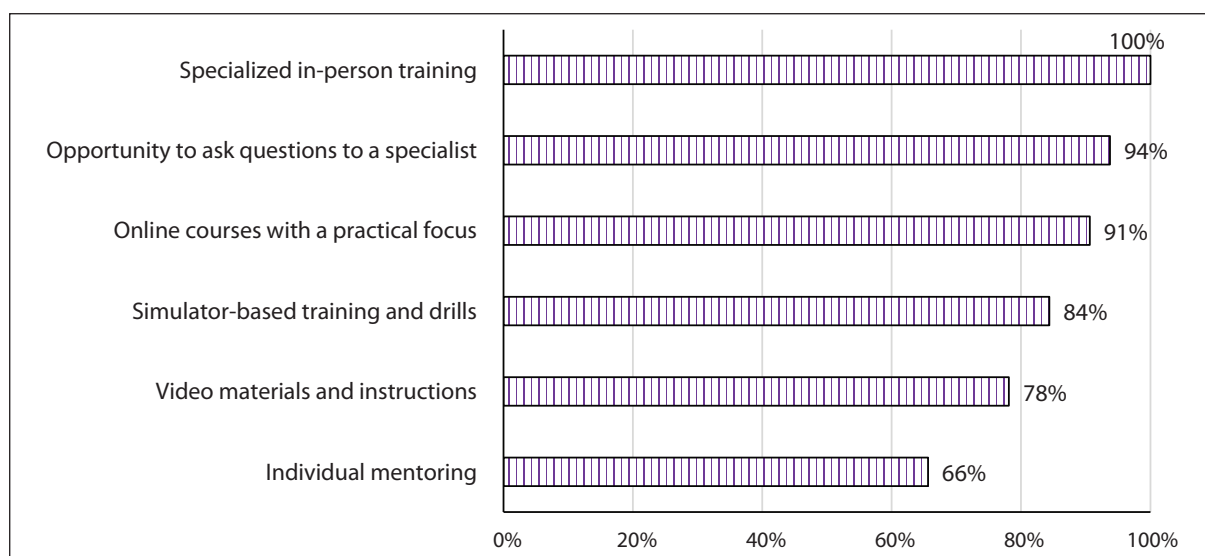


Figure 2. Management impacts for overcoming social and psychological challenges in the digitalization of maritime organizations.

(17 people). This result highlights the pressure which technological changes exert on the mental health due to the culture of constant digital accessibility and the expectations of immediate response. Increased isolation and reduced human interaction, selected by 44% (14 managers), illustrates how digitalization, in addition to transforming work processes, also changes the social dynamics.

The results obtained prove that digitalization in the maritime industry leads to a strong psychological impact, dominated by a feeling of stress, overload and uncertainty. The data confirm the need for targeted management interventions by the management in the training, psychosocial support and change management. In this context, the principles and approaches to stress management at individual, group and organizational levels acquire particular importance taking into account the causes and consequences of psychological stress in the work environment (Stoyanov, 2023). On this occasion, the second part of the structured in-depth interviews identifies the specific managerial impacts of the management in response to the social and psychological effects of digitalization. A significant result is the fact that all respondents (32 people) prefer specialized training as a response to digital changes. Managers share the opinion that face-to-face training is perceived as more reliable, better structured and more effective for acquiring complex technological skills. 94% of the respondents (30 people) also indicate the importance of the opportunity to ask questions to a specialist. This confirms the need for interactivity and personalized support to compensate for the feeling of uncertainty accompanying digitalization. Employees seek feedback, validation of their knowledge and an opportunity to solve prob-

lems in real time with the help of an expert. Moreover, practical online courses are rated very highly by 91% of the managers. The results prove that online teaching has high potential, as long as it is aligned with real practice, focusing on theory which can provide essential knowledge for building skills, and on the actual application of these skills. Simulation training and simulators are also considered an effective method according to 84% of the respondents (27 people). This result emphasizes the value of experiential and experimental learning which simulates real-world situations and allows for safe testing of knowledge and skills. Video materials and instructions are preferred by 78% of the respondents. Individual mentoring is positioned lower in the training system – by 66% (21 people). The result suggests that mentoring is not applied sufficiently or is not well known/accessible in the present environment, despite its potential to provide long-term social and psychological support (Figure 2).

The results demonstrate the need for practically oriented, interactive and accessible forms of training that combine a hands-on element, the opportunity for dialogue with specialists and realistic simulations. This is particularly important for the effective adaptation of maritime managers and employees to the technological changes and for the reduction of digital stress. The results of the question aimed at identifying the most effective strategies for mitigating the psychological effects of digitalization outline a clear preference for systematic, planned, timely and communicatively supported management technologies and approaches. All participants in the survey – 100% (32 managers) – indicate as key significant the possibility of training that does not follow, but precedes technological changes.

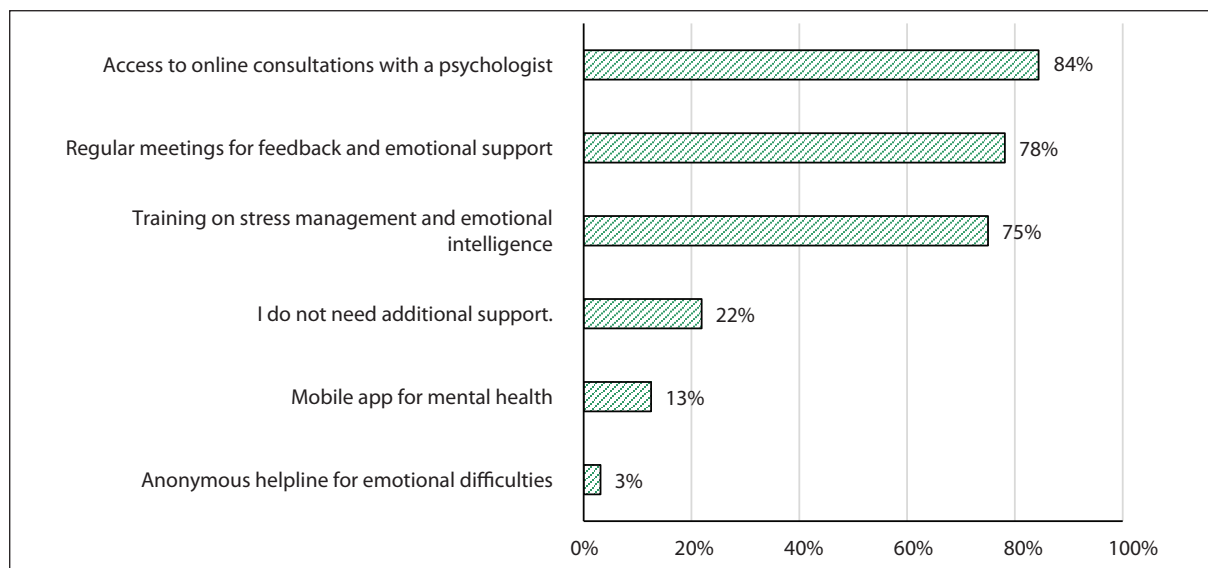


Figure 3. Management support for overcoming social and psychological challenges in the digitalization of maritime organizations.

In addition to the management impacts, the study reveals a strong need for accessible, person-oriented and integrated support to accompany technological advances in the maritime industry. The most highly rated option is the opportunity for online consultations with a psychologist, supported by 84% of the managers. This clearly highlights that digitalization, although a source of stress in itself, can also be used as a tool for providing psychological support. Online access is perceived as a flexible and unobtrusive way to deal with emotional and mental difficulties – especially in an environment like the maritime one, where physical access to experts is often impossible. Regular feedback meetings are second in importance, preferred by 78% of the respondents. Data confirms that managers do not seek instant, individual solutions, but inclusion in a culture of constant communication and care. Investing in mental health and resilience programs can bring significant economic benefits to the maritime industry by reducing absenteeism and staff turnover, while such initiatives reduce the feeling of isolation, build trust and strengthen team spirit – particularly important in conditions of high workload and dynamic technological change. (Vladimirova et al., 2024)

A mobile mental health application (13%) and an anonymous helpline (3%) were suggested by fewer respondents, which may indicate low awareness, engagement, or trust in such digital solutions (Figure 3).

5. PROSPECTS FOR THE DIGITALIZATION OF MARITIME ORGANIZATIONS

The results of the conducted in-depth structured interviews show that the management is willing to

invest additional resources to overcome social and psychological challenges of digitalization of the maritime organizations. However, 70% of the respondents report multiple threats to the implementation of this task. Leading among them are the rapidly growing amount of information generated as a result of the implementation of digitalization and the development of artificial intelligence, as well as the complexity and uncertainty of the environment in which maritime companies operate. The study proves that the lack of proactive knowledge and management of how to prepare for future digital work and jobs makes it difficult to allocate training resources to acquire the necessary knowledge and skills. This slows down technological innovations that can lead to competitive advantages, economic and social contributions. The emergence of the digital workplace and the era of rapid innovation means that existing skills are becoming obsolete much faster than before, making upskilling and retraining of human resources imperative for the maritime organizations. Empirical data suggests that training and development programs are part of the investment strategy of maritime businesses. They should be designed with long-term strategic goals in mind. A key point is to forecast and anticipate the skills that will be critical to the success of maritime organizations in 3-10 years. New competitive advantages and long-term sustainable growth will be realized by the organizations that can create strong drivers for digital talent growth, along with adequate social and psychological management impacts. In today's world of working anytime and anywhere (mostly digitally), soft skills and neurodiversity are becoming increasingly relevant. Empathy, emotional intelligence, and the ability to build international relationships and

collaboration are as important to the success of maritime companies as the technical skills (Pazaver & Kitada, 2025). Organizations expect teams to collaborate, design jointly, and find complex solutions in a rapidly changing world and cultures (Lopes et al., 2025). Maritime organizations would benefit from a broader view of upskilling and technical training completion with programs that increasingly focus on entrepreneurship, cross-functional competencies, and cross-cultural differences. Such an approach will help to engage and collaborate more deeply with maritime organizations and stakeholders socially and psychologically.

6. CONCLUSION

The results obtained from the research conducted in this paper prove that the digitalization introduced in the maritime industry leads to a strong psychological impact, dominated by a feeling of tension, overload and uncertainty. This suggests proactive, systematic and planned management impacts. The analyses of the in-depth interviews demonstrate the aspiration of the maritime organizations management for humane and timely care, integrated with professionalism, accessibility and the emotional connection of support. The systematic introduction of psychosocial care in the process of digitalization can be a determining factor for both the sustainability and the effectiveness of the management in the maritime industry. It can be confirmed that the digitalization of maritime organizations is not a set of technological solutions and products, but the creation of a social and psychological environment with the help of management impacts. The results clearly show that the most serious threat is not the new digital technologies, but the lack of human and professional support during their implementation. Human capital is a leading resource in the digitalization process of the maritime industry, which makes crucial its provision, psychological training, social integration, and systematic proactive management.

REFERENCES

- Bayrak, D. & Muslu, A., 2025. The impact of digitalization on the maritime sector: Analyzing technostress among officer seafarers, *Journal of International Maritime Safety, Environmental Affairs, and Shipping*. DOI: 10.1080/25725084.2025.2478751.
- Gavalas, D. et al., 2022. Digital adoption and efficiency in the maritime industry, *Journal of Shipping and Trade (JST)*, ISSN 2364-4575, SpringerOpen, London, Vol. 7, Iss. 1, pp. 1-22, Available at: <https://doi.org/10.1186/s41072-022-00111-y>
- Kalinov, K., 2016. *Organizatsionna kultura [Organizational culture]*. Dangrafik. ISBN: 978-954-9418-91-0
- Lopes, L., et al., 2025. Essential competencies in maritime and port logistics: A study on the current needs of the sector. *Sustainability*, [online] 17(6), p.2378. Available at: <https://doi.org/10.3390/su17062378>
- KPMG, 2022. The Future of Higher Education in the Knowledge Economy, World Government Summit, pp. 1–62, Available at: <https://assets.kpmg.com/content/dam/kpmg/ae/pdf-2022/04/future-of-work-and-education.pdf>
- Pazaver, A. & Kitada, M., 2025. Integrating twenty-first century skills into STCW competences: Implications for maritime education and training. *WMU Journal of Maritime Affairs*, [online] pp. 1–22. Available at: <https://doi.org/10.1007/s13437-025-00368-7>
- Sivkov, Y.A., Alexandrov, Ch.I., Tsvetkov, M.Y., Atanasov, V.E. & Petrova, M.I., 2019. Opportunities for application of the personal assistant to the technical manager in the marine industry. In: *Maritime Scientific Conference*, Varna, Bulgaria, 10–11 October 2019. Varna: Nikola Vaptsarov Naval Academy, pp. 61–67. ISBN 978-619-7428-46-9
- Stoyanov, V., 2023. Principles and approaches for stress management in organizations. *Bulgarian Journal of Psychology*, 51(1–4), pp. 133–146. Available at: <https://www.ceeol.com/search/article-detail?id=1169051>
- Stoyanova, A. & Stefanova, M., 2025. Implementing artificial intelligence in public administration: Managing challenges, risks, and opportunities in the contemporary context. In: *AI driven tools for sustainable public administration*. IGI Global Scientific Publishing, pp. 153–188. Available at: <https://doi.org/10.4018/979-8-3693-8372-8.ch006>
- Qureshi, S., 2023. Digital transformation for development: a human capital key or system of oppression? *Information Technology for Development*, Vol. 29, Iss. 4, 423–434. Available at: <https://doi.org/10.1080/02681102.2023.2282269>
- Verma, Shiv & Sharma, M., 2025. Role of Digitalization in a Sustainable Blue Economy. *International Journal of Teaching, Learning and Education*, 4(3), May 2025. Available at: <https://doi.org/10.22161/ijtle.4.3.5>
- Vladimirova, N., Nedeva, R., Stavrev, D., Mednikarov, B., Doncheva, D. & Stefanova, M., 2024. The maritime profession and the physical and mental health of the crew: A study of anthropometrical and psychological alterations after the first transatlantic voyage to the Antarctic. *Journal of IMAB – Annual Proceeding (Scientific Papers)*, 29(no), pp. 6–12. Available at: <https://doi.org/10.5272/jimab.2023v29Supplement1>
- Värzaru, A. & Bocean, C., 2024. Digital Transformation and Innovation: The Influence of Digital Technologies on Turnover from Innovation Activities and Types of Innovation. *Systems*, 12(9), 359. Available at: <https://doi.org/10.3390/systems12090359>