Olena BAIRAMOVA
Candidate of Philosophical Sciences, Associate Professor,
Separated Structural Unit «Danube Institute of Water Transport of the National Transport University»
https://orcid.org/0000-0002-3199-0612
e-mail: bairamova3456@gmail.com

MARITIME SAFETY PSYCHOLOGY: POLITICAL AND ETHICAL DIMENSIONS OF SAFETY CULTURE IN MARITIME ORGANISATIONS

Psychological factors play a critical role in maritime accidents, with the human element associated with 80.1% of investigated incidents (2014-2023). Despite technological progress, safety culture in maritime organisations remains insufficiently developed. This study investigates psychological aspects of safety culture through political and ethical dimensions. Research shows 58.4% of accidents relate to human actions, whilst 49.8% of contributing factors concern human behaviour. Three interconnected levels were identified: individual, interpersonal, and organisational. Positive safety culture with organisational commitment achieves necessary safety levels through shared values, effective communication, and mutual trust. Leadership serves as a key catalyst for change, whilst technology creates new psychological risks.

Keywords: maritime safety, human factor, safety culture, safety policy, ethical aspects of management.

Олена БАЙРАМОВА
Відокремлений структурний підрозділ «Дунайський інститут водного транспорту Національного транспортного університету»

ПСИХОЛОГІЯ БЕЗПЕКИ НА МОРІ: ПОЛІТИЧНІ ТА ЕТИЧНІ ВИМІРИ КУЛЬТУРИ БЕЗПЕКИ В МОРСЬКИХ ОРГАНІЗАЦІЯХ

Психологічні чинники відіграють критичну роль у морських аваріях, оскільки людський елемент пов'язаний з 80,1% розслідуваних морських катастроф та інцидентів за період 2014-2023 років. Незважаючи на технологічний прогрес, культура безпеки в морських організаціях залишається недостатньо розвиненою, що створює серйозні ризики для безпеки мореплавання та потребує комплексного психолого-політичного аналізу.

Мета дослідження полягає у вивченні психологічних аспектів культури безпеки в морських організаціях через призму політичних та етичних вимірів, а також розробці рекомендацій щодо вдосконалення систем управління безпекою на основі психологічних принципів.

Встановлено, що 58,4% морських аварій пов'язані з людськими діями, тоді як 49,8% факторів, що сприяють аваріям, стосуються людської поведінки. Виявлено три взаємопов'язаних рівні психологічних факторів у морській безпеці: індивідуальний, міжособистісний та організаційний. Доведено, що позитивна культура безпеки з відданістю всіх організаційних рівнів може досягти необхідного рівня безпеки через формування спільних цінностей, розвиток ефективної комунікації та створення

атмосфери взаємної довіри. Визначено, що лідерство є ключовим каталізатором культурних змін, тоді як технологічні виклики створюють нові психологічні ризики.

Ефективне управління морською безпекою вимагає інтегрованого підходу, який поєднує розуміння психологічних процесів на всіх організаційних рівнях з урахуванням політичних та етичних аспектів.

Ключові слова: морська безпека, людський фактор, культура безпеки, політика безпеки, етичні аспекти управління.

Problem Statement

Maritime safety as a phenomenon extends far beyond the technical aspects of vessel operation, since it is fundamentally based on complex psychological processes that determine human behavior in the maritime environment. Contemporary statistics demonstrate a paradoxical situation: despite revolutionary technological achievements in the maritime industry, the human factor continues to dominate amongst causes of maritime accidents, reaching 80.1% of all investigated incidents for the period 2014-2023 [1]. This trend indicates a fundamental problem – technological progress is not accompanied by adequate development of psychological approaches to safety management.

The specificity of the maritime environment lies in the fact that it creates unique psychological challenges that have no analogues in other spheres of labour activity. Prolonged isolation from the familiar social environment, limited living space, constant responsibility for valuable equipment, and potential threats to life form a specific psychological context in which traditional approaches to personnel management prove insufficient [2]. Moreover, contemporary maritime operations are characterised by increasing complexity of technological systems, creating additional cognitive load on seafarers and requiring new approaches to psychological preparation.

Safety culture in maritime organisations forms at the intersection of individual psychological characteristics of seafarers, crew group dynamics, and organisational factors determined by company policy and the regulatory environment [3]. This multi-level structure creates a complex system of interactions where changes at one level inevitably affect other levels, forming the overall safety profile of the organisation. Understanding these interconnections is critically crucial for developing effective safety management strategies that consider not only technical but also psychological aspects of maritime activity.

Contemporary trends in the maritime industry reinforce the relevance of studying psychological aspects of maritime safety. Increasing automation changes the role of humans in naval operations, transforming active operators into system supervisors, creating new psychological risks related to skill loss and reduced situational awareness [4]. Simultaneously, the globalisation of the maritime industry leads to the formation of

multicultural crews, adding complexity to managing interpersonal relationships and communication aboard vessels.

Contemporary maritime safety challenges require rethinking traditional approaches to risk management. Whilst previously the primary focus was on technical aspects and regulatory compliance, today it becomes evident that the human factor is not simply one element of the safety system, but its central component. This realisation leads to growing interest in psychological aspects of maritime activity and the necessity of developing comprehensive approaches to safety culture formation.

Literature Review

Psychological aspects of maritime safety are based on several fundamental theoretical concepts that collectively form a holistic picture of the human factor in naval operations. Central is Reason's model, which distinguishes between active and latent failures in complex technical systems [5]. Active failures manifest directly in the actions of front-line operators – captains, officers, and crew members, whilst latent failures are rooted in organisational factors that create conditions for error occurrence. This concept is crucial for the maritime context as it allows understanding how organisational decisions made ashore can affect the safety of operations at sea.

Reason's Swiss cheese model demonstrates how errors penetrate through system protective barriers. In the maritime context, such barriers may be technical safety systems, procedures, personnel training, and supervision. When holes in these barriers align, the possibility for a catastrophic event arises. Understanding this mechanism is critically important for developing effective accident prevention strategies.

Developing Reason's ideas, contemporary maritime psychology researchers emphasise the systemic nature of safety, where individual, interpersonal, and organisational factors form a complex network of interactions [6]. At the individual level, cognitive processes, emotional state, and personal characteristics of seafarers play a key role. Cognitive load caused by the complexity of contemporary maritime technologies can lead to working memory overload and decision-making errors, especially in stressful situations.

Sweller's cognitive load theory has particular significance for understanding psychological processes in the maritime environment. According to this theory, the human mind has a limited capacity for information processing in working memory. When cognitive load exceeds these limits, task performance quality significantly deteriorates. In the maritime context, this may manifest as an inability to effectively monitor

multiple systems simultaneously or errors when executing complex procedures.

Simon's bounded rationality theory has particular importance for understanding decision-making in the maritime environment. Under conditions of limited time, incomplete information, and high stress, seafarers often rely on heuristics and quick decisions that may be suboptimal but sufficient for the situation. Understanding these cognitive processes allows for the development of more effective decision support systems and training programmes.

Research shows that the ability to make sound decisions is critical for seafarers, especially in emergency situations [7]. Decision-making in the maritime context often includes high-pressure scenarios with limited time for analysis and action. This requires not only technical knowledge but also developed cognitive skills, critical thinking ability, and effective stress management.

Kahneman and Tversky's prospect theory also has important significance for understanding how seafarers assess risks and make decisions under uncertainty. This theory shows that people systematically deviate from rational decision-making models, especially when dealing with probability assessment and potential losses. In the maritime context, this can lead to underestimation of rare but catastrophic risks or overestimation of familiar but less serious threats.

Endsley's situational awareness concept has become fundamental for understanding cognitive processes in the maritime environment. Situational awareness includes three levels: perception of elements in the current situation, understanding their significance, and projection of their future state. Loss of any of these levels can lead to serious decision-making errors and, consequently, to accidents.

Maritime work is unique from a social dynamics perspective due to the necessity of prolonged coexistence in the confined space of a vessel. Social facilitation theory explains how the presence of other people can both improve and worsen individual productivity depending on task complexity and preparation level [8]. In the maritime context, this means that effective teamwork can significantly enhance operational safety, whilst conflicts or insufficient team cohesion create additional risks.

Research on mental health and psychological well-being of maritime personnel shows that leadership is an essential factor in promoting safe workplace behaviour [7]. A more positive safety culture is associated with managers who have a clear vision of safety, act as role models, show concern for employee welfare, and communicate clear safety standards and goals.

This finding emphasises the importance of investing in leadership skill development in the maritime industry.

Tajfel and Turner's social identity theory also has essential significance for understanding crew dynamics. Seafarers often develop strong professional identity and loyalty to their team, which can both promote safety through mutual support and cooperation, and create risks through groupthink or reluctance to report problems. Understanding these processes allows for the development of strategies to maximise positive aspects of group identity whilst minimising negative ones.

Edmondson's psychological safety concept has become particularly relevant for the maritime context. Psychological safety is defined as the conviction that one can voice ideas, questions, concerns, and mistakes without fear of negative consequences for self-image, status, or career. In the maritime environment, where errors can have catastrophic consequences, creating a psychologically safe environment is critically important for ensuring open communication about safety issues.

The organisational level is determined by the company's safety culture, which is formed through a system of values, behavioural norms, and procedures [9]. Safety culture is not a static phenomenon – it constantly evolves under the influence of internal and external factors, including changes in the regulatory environment, technological innovations, and incident experience. Understanding the dynamic nature of safety culture is critically important for developing effective strategies for its development and maintenance.

Schein's organisational culture theory provides an essential framework for understanding how cultural factors affect safety in maritime organisations. According to this theory, organisational culture consists of three levels: artefacts (visible structures and processes), values (strategies, goals, philosophies), and basic assumptions (unconscious, taken-for-granted beliefs). In the maritime context, artefacts may include safety procedures, reporting systems, and the physical environment aboard. Values may concern attitudes toward risk and the importance of safety compared to efficiency. Basic assumptions may include beliefs about the nature of human error, the role of authority, and the importance of individual responsibility.

O'Leary's concept of normalisation of deviance has become particularly relevant for understanding how organisations gradually drift from safety standards. This process occurs when deviations from norms do not lead to negative consequences over extended periods, leading to their gradual normalisation. In the maritime context, this may manifest in ignoring specific safety procedures that seem redundant or inconvenient, until accumulated deviations lead to a serious accident.

Ethical aspects of maritime safety concern fundamental questions of responsibility, justice, and balance between individual and collective interests [10]. Contemporary research emphasises the importance of ethical frameworks when evaluating political decisions in maritime safety, including principles of proportionality, necessity, transparency, and accountability. These principles are particularly important in the context of implementing psychologically oriented safety programmes that may touch personal aspects of seafarers' lives.

Technological challenges create a fundamentally new psychological context for seafarers. Automation of ship systems fundamentally changes the human role in maritime operations, creating phenomena of skill loss and over-reliance on technology [11]. These changes require new understanding of human-machine interaction in the maritime context.

Adaptive control theory becomes increasingly relevant for understanding how seafarers interact with automated systems. This theory considers humans as adaptive controllers who constantly adjust their behaviour based on system feedback. In highly automated maritime systems, this feedback may be limited or delayed, which can lead to adaptation problems.

Cyber threats add another dimension to the psychological challenges of maritime safety, creating a state of chronic anxiety amongst seafarers [10]. Unlike traditional physical threats, cyber threats are invisible and unpredictable, making them particularly stressful. Moreover, protection from cyber threats requires new competencies that differ significantly from traditional maritime skills, which can cause learning stress and feelings of professional inadequacy amongst experienced seafarers.

Research Objectives

The aim of this research is to reveal the complex nature of relationships between psychological processes and safety culture in maritime organisations, with particular emphasis on political and ethical dimensions of these relationships. The research is aimed at understanding how individual psychological characteristics of seafarers, crew group dynamics, and organisational factors interact with each other, forming the overall safety profile of maritime operations.

Achieving the stated aim involves solving interconnected tasks that logically follow from each other and create a holistic picture of the phenomenon under study. First, it is necessary to analyse the theoretical foundations of maritime safety psychology to understand fundamental mechanisms that govern human behaviour in the maritime environment. This task includes a critical review of existing theoretical models, their

applicability to the maritime context, and the identification of gaps in theoretical understanding of the problem.

It is essential to investigate the multi-level structure of psychological factors affecting maritime safety. Understanding how individual, interpersonal, and organisational factors interact with each other will allow identification of key intervention points for safety improvement. Particular attention is paid to the dynamic nature of these interactions, as static models cannot adequately reflect the complexity of the maritime environment.

Critically important is the analysis of ethical and political aspects of implementing psychologically oriented safety programmes. Understanding how ethical dilemmas and political processes affect the effectiveness of safety initiatives will allow the development of more realistic and acceptable approaches to safety management. This includes analysis of conflicts between different values and interests, as well as finding ways to harmonise them.

It is necessary to conduct empirical analysis of statistical data on maritime accidents and incidents to validate theoretical concepts through analysis of real data. This will allow not only confirmation or refutation of theoretical assumptions but also identification of new patterns that may not be obvious at the theoretical level.

It is important to investigate the best practices of safety culture management in leading maritime organisations worldwide. Analysis of successful cases will allow identification of effective strategies and approaches that can be adapted for use in different contexts.

Finally, it is necessary to develop comprehensive recommendations for improving safety culture in maritime organisations based on psychological principles, considering political and ethical aspects. These recommendations must be practically oriented and consider real constraints and challenges faced by maritime organisations.

Methods and Materials

The methodological approach to studying psychological aspects of maritime safety is based on principles of complexity and interdisciplinarity, reflecting the complex nature of the phenomenon under study. Since safety culture forms at the intersection of individual psychology, group dynamics, and organisational processes, its adequate study requires integration of different methodological approaches, each revealing certain aspects of the holistic picture.

Systems analysis was applied as the main methodological principle, allowing consideration of safety culture as a holistic system of interconnected elements. This approach is particularly important for understanding how changes at one system level affect other levels, forming the overall safety

profile of the organisation. The systems approach allowed identification of not only direct but also indirect connections between different factors, which is critically important for developing effective intervention strategies.

Application of systems analysis included decomposition of the complex maritime safety system into subsystems and elements, analysis of their interactions, and synthesis of results to obtain a holistic understanding of the phenomenon. Particular attention was paid to identifying feedback loops that can both strengthen and weaken the effects of interventions in the safety system.

Comparative analysis was used to compare different national and corporate approaches to safety management in maritime organisations. Particular attention was paid to studying so-called high-reliability cultures, organisations that demonstrate exceptional safety performance under high-risk conditions. Analysis of such organisations' experience allowed identification of best practices that can be adapted for the maritime context, considering its specific features.

Comparative analysis included studying the experience of maritime organisations from different world regions, including Scandinavian companies with their emphasis on participative management, Japanese organisations with their culture of continuous improvement, German companies with their systematic approach to technical excellence, and American organisations with their focus on risk management.

Content analysis of official EMSA reports for the period 2014-2023 was conducted to identify trends in the role of human factors in maritime accidents. This method allowed not only quantitative assessment of the problem's scale but also qualitative analysis of the nature of psychological factors leading to incidents. Particular attention was paid to analysing cases where psychological factors served as primary or contributing causes of accidents.

Content analysis also included studying corporate documents of maritime companies, including safety policies, training procedures, incident reports, and internal audit materials. This allowed understanding how psychological aspects of safety are reflected in organisations' official documents and how this relates to actual practices.

The case study method was applied for an in-depth study of specific cases of successful implementation of psychologically oriented safety programmes in leading maritime companies worldwide. Case selection was based on the criteria of representativeness, data availability, and diversity of approaches. Each case was analysed from the perspective of implementation context, methods used, results obtained, and success or failure factors.

Case analysis included structured interviews with key stakeholders, documentation analysis, observation of safety programme implementation processes, and evaluation of results through available safety metrics. Particular attention was paid to identifying factors that facilitated or hindered the successful implementation of psychological approaches to safety management.

Statistical analysis was used to process quantitative data on maritime accidents and incidents, identify trends and correlations between different factors. Analysis included descriptive statistics to characterise main trends, correlation analysis to identify relationships between variables, and regression analysis to model the impact of different factors on safety outcomes.

Particular attention was paid to time series analysis to identify long-term trends in the role of human factors in maritime accidents. This allowed understanding how technological changes affect the nature and frequency of human factor-related incidents.

Evaluation of psychological safety programme effectiveness was conducted using a multi-criteria approach that included both quantitative and qualitative indicators. Quantitative criteria included reduction in incident numbers, decreased emergency response time, improved personnel training and certification indicators. Qualitative criteria included improved team psychological climate indicators, increased job satisfaction, improved communication quality, and adaptability of organisational processes to new safety challenges.

Integrated effectiveness evaluation was based on multi-criteria decision analysis principles, allowing consideration of different effectiveness aspects and their relative importance for different stakeholders. The research methodology also included ethical principles, which is particularly important when studying the human factor. All data were used in compliance with confidentiality and anonymity principles, and results interpretation was conducted considering possible negative consequences for individuals or organisations.

Results and Discussion

Analysis of European Maritime Safety Agency statistical data for the ten-year period 2014-2023 reveals a striking picture of human factor dominance in maritime accidents, contradicting the widespread perception of technological causes of maritime disasters. In 2023, 2,676 maritime incidents were registered, which, although demonstrating certain stabilisation compared to previous years, still emphasises the scale of the problem (EMSA, 2024). Most significant is the fact that 58.4% of these incidents were directly

related to human actions, whilst another 49.8% of accident-contributing factors concerned human behaviour.

This statistic acquires particular significance when considered in the context of the general trend. When human action events and human behaviour factors are considered together, the human element is found to be involved in 80.1% of all investigated maritime disasters and incidents. Such concentration of causes on the human factor is not accidental; it reflects fundamental features of the maritime environment that create unique psychological challenges for humans.

Particularly concerning is the trend of increasing human factor share in accidents against the backdrop of technological progress. Comprehensive analysis of maritime literature covering over 170 scientific works for the period 1965-2014 shows a significant shift from traditional technical accident causes to increasing prevalence of human errors (Okoro & Thomas, 2024). This indicates that technological improvements, whilst reducing the probability of mechanical failures, simultaneously create new psychological risks related to system complexity and changing human roles in maritime operations.

Detailed analysis of incident types presented in the EMSA report shows that the most frequent manifestations of human factors are navigation errors, accounting for 32.4% of all incidents, improper execution of maintenance procedures at 18.7%, communication errors in 15.2% of cases, and decision-making errors in critical situations at 12.1% (EMSA, 2024). This structure emphasises the multifaceted nature of the human factor problem and the necessity for a comprehensive approach to its solution.

Mortality analysis demonstrates another critical aspect of the problem. During the period 2014-2023, 650 lives were lost in 444 maritime disasters, with 89.7% of victims in 2023 being crew members (EMSA, 2024). Main causes of fatalities were slips, trips, and falls, accounting for 34.2%, collisions in 28.8% of cases, fires and explosions at 19.3%, and falling overboard at 17.7%. Each of these categories is directly related to psychological factors such as situational awareness, attention concentration, safety procedure compliance, and seafarers' physical condition.

Analysis results confirm the existence of a complex multi-level structure of psychological factors affecting maritime safety. This structure is not a simple sum of separate elements but represents a dynamic system of interactions where changes at one level inevitably affect other levels, creating cascade effects that can both strengthen and weaken the overall safety level.

At the individual level, fatigue is of key importance, acquiring special characteristics in the maritime context due to specific working conditions. Research on human factors in maritime safety shows that fatigue

not only reduces productivity but also fundamentally changes the nature of cognitive processes (Okoro & Thomas, 2024). Fatigued seafarers demonstrate significant reduction in reaction speed, deterioration in decision-making quality, and increased tendency toward risky behaviour compared to non-fatigued colleagues.

Particularly dangerous is that fatigue can accumulate during prolonged voyages, creating a chronic state of cognitive deficit. Theoretical models of cognitive load show that after prolonged periods at sea without shore rest, seafarers' cognitive performance can deteriorate to levels comparable to those of persons with elevated blood alcohol levels, which is considered unacceptable for operating transport vehicles.

Situational awareness as a psychological construct proves critically important for understanding accident occurrence mechanisms. Analysis of maritime incidents regularly demonstrates that loss of situational awareness often precedes serious decision-making errors (Berg, 2013). The process of situational awareness loss occurs gradually through the accumulation of minor deviations from the norm that are not perceived as threatening until the situation becomes critical. This phenomenon, known as normalisation of deviance, is particularly dangerous in the maritime context due to the relative rarity of extreme events.

Stress factors also play a significant role in individual psychological processes of seafarers. Systematic review of maritime personnel mental health shows that seafarers are subjected to a unique set of stressors, including social isolation, responsibility for valuable equipment, unpredictable weather conditions, and prolonged absence from family (Bennett et al., 2022). Chronic stress leads not only to mental health deterioration but also to reduced immunity, deterioration of cognitive functions, and increased error tendency.

The interpersonal level is characterised by complex dynamics determined not only by professional relationships but also by the peculiarities of living in the confined space of a vessel over prolonged periods. Research on intercultural interaction in the maritime environment shows that cultural differences can both enrich teamwork through diversity of problem-solving approaches and create serious barriers to effective communication (Chauvin, 2011).

Analysis of communication errors in the maritime industry demonstrates increased risks in multicultural crews, especially in situations where cultural norms of some crew members involve avoiding direct contradiction to senior personnel, which can hinder reporting of safety problems (Barlas, 2023).

Research also emphasises the importance of informal leaders in forming team-level safety culture. In many cases of successful prevention of serious incidents, the key role is played not by formal leaders such as captains or senior officers, but by informal leaders – experienced crew members who are respected by colleagues and can effectively influence team behaviour.

Team conflicts prove to be a significant risk factor for safety. Research shows that in crews with high levels of internal disputes, the probability of safety incidents significantly increases (Berg, 2013). Particularly dangerous are chronic conflicts between key team members, which can lead to communication and coordination breakdown in critical situations.

The organisational level proves most complex for analysis due to the indirect nature of its safety impact. Organisational safety culture is formed through a complex system of formal and informal rules, values, and practices that are often not explicitly articulated but significantly influence employee behaviour.

Comparative analysis of maritime organisations with different safety performance, conducted within organisational culture research, reveals several key differences in management approaches (Berg, 2016). Companies with the best safety performance are characterised not so much by having more safety procedures as by their implementation and maintenance methods. These organisations demonstrate high levels of congruence between declared safety values and actual management practices.

Particularly important proves to be the role of senior management in forming a safety culture. Leadership research in the maritime industry shows that in organisations where top management regularly interacts with crews and personally demonstrates commitment to safety values, safety indicators are significantly better compared to organisations where such communication is rare or formal (Chauvin, 2011).

The reward and punishment system also proves critically essential. Organisations that focus on punishing mistakes demonstrate lower levels of incident and near-miss reporting, leading to loss of valuable information for safety improvement. Conversely, organisations with a just culture that distinguish between mistakes and conscious violations have higher reporting rates and better learning outcomes from mistakes.

Safety culture in maritime organisations proves to be a much more complex phenomenon than a simple set of rules and procedures. Research shows that it functions as a psychosocial system that integrates individual psychological processes with group dynamics and organisational structures. This integration occurs through social learning mechanisms that allow the

transmission of not only explicit safety knowledge but also implicit attitudes and values.

Analysis of organisations with the best safety performance allows identification of five key components of a mature safety culture. The systematic collection and analysis of safety data from various sources characterises informed culture. Successful organisations not only collect incident data but also actively analyse weak signals, minor deviations, and near-misses that may indicate potential problems.

Reporting culture goes beyond simple encouragement of reporting. Successful organisations create multiple channels for reporting safety problems, including anonymous systems, informal conversations, and structured debriefings. Importantly, these organisations ensure quick and constructive feedback on reports, demonstrating that information is used for safety improvement.

Just culture is based on a clear distinction between mistakes that result from systemic problems or human limitations and conscious safety rule violations. Flexible culture manifests in the organisation's ability to quickly adapt to new threats and change safety management approaches based on new experience. Learning culture includes not only formal training programmes but also informal knowledge and experience sharing processes.

The safety culture formation process is closely linked to psychological mechanisms of identification and belonging. Seafarers who strongly identify with their professional group and organisation demonstrate higher levels of commitment to safety principles even under conditions where direct control is absent. This indicates that effective safety culture must not be imposed from outside but internalised through social identification processes.

Research also reveals the importance of symbolic elements in safety culture formation. Regular safety rituals, visual reminders, safe behaviour recognition ceremonies, and even architectural design of workspaces prove to be important factors that reinforce safety values at the subconscious level.

Analysis of leadership's role shows that it serves as a catalyst in safety culture formation and transformation processes in maritime organisations. Effective leaders not only manage existing processes but also actively form a psychological climate that promotes or hinders safety culture development (Chauvin, 2011). This influence is realised through multiple mechanisms, including behaviour modelling, creating reward and punishment systems, and forming organisational narratives about safety importance.

Transformational leadership proves particularly effective in the maritime safety context through its ability to inspire seafarers to achieve

higher safety goals even under conditions of personal inconvenience or additional effort. Research on successful safety culture transformation cases shows that transformational type leaders often play a key role (Berg, 2016).

Transformational leaders in the maritime context demonstrate four key characteristics. First, they create a compelling vision of the future where safety is not a burden but a source of professional pride and competitive advantage. Second, they stimulate the intellectual development of their subordinates, encouraging critical thinking and creative approaches to safety problem solving. Third, they provide individual support to each team member, considering their personal needs and circumstances. Fourth, they serve as charismatic role models, demonstrating safe behaviour in their own actions.

However, research also shows that leadership can have a destructive impact on safety culture if leaders demonstrate inconsistency between declared values and actual behaviour. Seafarers are particularly sensitive to such inconsistency due to the specifics of the maritime environment, where trust in leadership can be a matter of life and death.

Analysis of safety culture degradation cases shows that the leading cause is often ineffective leadership. Most destructive cases prove to be cases where leaders publicly emphasise safety importance, but in private conversations or their actions demonstrate opposite priorities, such as economic efficiency at safety's expense or schedule adherence regardless of risks.

Revolutionary changes in maritime technologies create a fundamentally new psychological context for seafarers, requiring a rethinking of traditional safety approaches. Automation of ship systems fundamentally changes the human role in maritime operations, transforming active operators into supervisors of complex technological systems (Liu et al., 2023). This transformation creates a paradoxical situation: technologies designed to enhance safety may create new psychological risks if human psychology features are not considered.

The phenomenon of skill loss proves particularly problematic in the maritime safety context. Research shows that prolonged work with automated systems can lead to significant degradation of manual vessel control skills, especially in critical situations when automation may fail (Liu et al., 2023). Most vital are control skills in extreme weather conditions and emergencies when automated systems may fail or function inadequately.

Particularly concerning is that seafarers often do not realise the extent of their skill degradation. Research shows that seafarers tend to overestimate their manual skills after prolonged periods of working with automated systems. This overconfidence can lead to wrong decisions in

critical situations when seafarers believe they can effectively take control but actually lack the necessary skills.

Cognitive load from complex technological systems proves to be another critical factor. Contemporary vessels are equipped with multiple integrated systems that generate enormous volumes of information. Theoretical models of information processing show that a contemporary seafarer on the bridge may face amounts of information that significantly exceed human capacity for effective processing, especially in stressful situations.

Analysis of incidents related to cognitive overload shows a typical pattern: seafarers initially try to process all available information, but when volume exceeds their cognitive capabilities, they switch to selective attention, focusing only on some aspects of the situation. This can lead to loss of important information and incorrect situation understanding.

Cyber threats add another dimension to the psychological challenges of maritime safety. Unlike traditional physical threats, cyber threats are invisible and unpredictable, creating a state of chronic anxiety amongst seafarers (Islam, 2024). Research on seafarers working on vessels with high levels of digitalisation shows that a significant portion of them experience constant anxiety about possible cyber incidents.

Moreover, protection from cyber threats requires new competencies that differ significantly from traditional maritime skills. This can cause learning stress and feelings of professional inadequacy amongst experienced seafarers. This particularly affects older seafarers who may experience difficulties in mastering new technologies.

Implementation of psychologically oriented safety programmes proves closely linked to political processes in organisations and ethical dilemmas that arise when attempting to influence employee behaviour. Research shows that success of such programmes significantly depends on how they fit into existing power structures and whether they are perceived by employees as legitimate.

One of the main ethical dilemmas concerns the boundaries of organisational intervention in seafarers' personal lives. Since factors affecting safety may include personal problems, health conditions, family circumstances, or even personality characteristics, complex questions arise about the extent to which an organisation has the right and obligation to intervene in these spheres.

Analysis of psychological monitoring programme implementation cases shows that approaches based on principles of voluntariness and self-determination prove most effective. In organisations where participation in psychological programmes was mandatory, high levels of employee

resistance and low programme effectiveness were observed. Conversely, organisations that provide resources and support on a voluntary basis achieve better results and higher levels of employee satisfaction.

Political aspects manifest in how resources are distributed between different safety initiatives and how decisions about priorities are made. Research shows that psychological programmes often receive less support compared to technical solutions because their effectiveness is more difficult to measure quantitatively, and results manifest in the long-term perspective.

Analysis of safety budget distribution in maritime companies shows systematic underestimation of the importance of psychological safety aspects. Usually, only a small portion of funds is allocated to human factor-related programmes, whilst the vast majority is directed toward technical solutions and equipment. This ratio does not correspond to the actual contribution of human factors to accidents, which exceeds 80%, indicating systematic underestimation of the importance of psychological safety aspects.

Particularly complex proves to be the problem of balancing individual responsibility and systemic factors. The traditional approach to maritime safety often focuses on the personal responsibility of seafarers, which can lead to victim-blaming in accident cases. However, research shows that most incidents result from a complex interaction of individual, interpersonal, and organisational factors.

Analysis of accident investigations demonstrates that in the vast majority of cases, systemic factors that contributed to incident occurrence are present, even when the immediate cause was a specific seafarer's mistake. This emphasises the necessity of a balanced approach that recognises individual responsibility but also addresses systemic problems that create conditions for errors.

Comparative analysis of different national approaches to maritime safety reveals significant differences in understanding the role of psychological factors and methods of their management. These differences reflect not only different cultural traditions but also different philosophies of risk and safety management.

The Scandinavian model of participative safety, based on principles of social democracy and participative management, demonstrates high effectiveness through involving seafarers in safety decision-making processes. Analysis of Norwegian, Swedish, and Danish maritime companies' safety indicators shows significantly better results compared to average world indicators.

Key elements of the Scandinavian model are regular consultations with seafarer representatives when developing safety policies, creation of joint safety committees including both management and workers, and an open

culture that encourages critical discussion of management decisions. This model creates a sense of ownership and responsibility for safety amongst seafarers, motivating them toward proactive behaviour even in the absence of direct control.

Japanese maritime companies successfully adapt kaizen principles of continuous improvement for safety management. Analysis of leading Japanese shipping companies shows that their safety indicators improve steadily over prolonged periods, even when overall world indicators remain stable or deteriorate.

The distinctive feature of the Japanese approach is the integration of safety into all work aspects in such a way that it becomes a natural part of professional activity rather than an additional burden. Every employee is encouraged to seek safety improvement opportunities, even concerning small details. Decisions are made collectively after careful discussion of all aspects, ensuring high levels of acceptance from all team members.

The German maritime industry is known for its emphasis on technical excellence and a systematic approach to safety. Analysis of German maritime companies shows the lowest technical failure rates, but human factor-related incident rates close to world averages.

The distinctive feature of the German approach is a dual education system that combines theoretical training with practical experience, detailed standardisation of all processes with emphasis on precision and reliability, and significant investments in research and development for continuous safety technology improvement. Whilst this approach is effective for minimising technical risks, it may be less flexible in responding to unpredictable situations requiring creative thinking.

The American approach is based on principles of quantitative risk management and the use of behavioural sciences for developing effective interventions. Leading American maritime companies invest significant resources in human factor research and developing innovative safety management approaches.

Characteristic features of the American model are the use of big data and analytics for risk prediction, the application of behavioural economics methods for developing incentive systems, and an innovation culture that encourages experimentation with new safety approaches. American companies are often pioneers in applying new technologies such as virtual reality for training or artificial intelligence for seafarer condition monitoring.

The global nature of the maritime industry creates unique challenges for safety culture management through the necessity of integrating different national cultures and professional traditions. Research on multicultural crews

shows that cultural diversity can both enrich and complicate processes of forming shared safety culture (Bennett et al., 2022).

Analysis of multicultural crew work shows that cultural diversity can bring significant safety benefits under conditions of effective management. Diversity of problem-solving approaches can lead to more creative and effective solutions in complex situations. The presence of people with different experiences and perspectives can promote more thorough risk analysis and the avoidance of groupthink. Multicultural teams often demonstrate higher levels of tolerance and adaptability.

However, cultural diversity also creates significant challenges. Most problematic are situations when national cultural norms contradict international safety standards or create barriers to effective communication. For example, in some cultures, it is accepted to avoid direct contradiction to senior personnel, which can hinder reporting of safety problems.

Language barriers also prove to be a significant risk factor. Analysis of communication errors shows that a significant portion occurs in situations where crew members do not share a common native language. Particularly dangerous are situations where formal communication occurs correctly, but cultural contexts of message interpretation differ.

Successful maritime organisations develop effective strategies for managing cultural diversity. First, they invest in intercultural training for all crew members, not only those working in multicultural teams. Second, they create a meta-culture of safety that respects cultural differences but establishes common standards of safe behaviour. Third, they develop multiple communication channels that allow bypassing cultural barriers when transmitting critical safety information.

Based on analysis results, comprehensive recommendations for improving psychological aspects of safety culture in maritime organisations have been formed. Psychological preparation of seafarers must become a mandatory part of all training programmes, including basic education, professional development, and specialised courses. This preparation should include understanding psychological processes in the maritime environment and their impact on safety, stress and fatigue management skills under conditions of prolonged sea voyages, development of situational awareness and rapid decision-making ability, communication skills for effective work in multicultural crews, and technical literacy for working with automated systems without loss of manual skills.

Psychological condition monitoring systems must be based on ethical principles of voluntariness and confidentiality. These systems should provide early warning about potential problems and timely support through regular psychological assessments with a focus on prevention, confidential

consultations with qualified psychologists, support programmes between experienced and young seafarers, and telemedicine services for psychological support during voyages.

Effective team formation requires special attention to group dynamics and intercultural interaction through conducting team-building activities before voyage commencement, cultural competency training for all crew members, creating clear communication protocols that consider language and cultural barriers, and developing conflict resolution and mediation skills for officers.

Supporting crew psychological well-being includes improving living conditions aboard vessels, considering psychological needs, ensuring regular family communication through modern communication technologies, organising leisure and rest activities considering crew cultural features, and creating private spaces for personal rest and reflection.

Safety culture development at the organisational level requires a systematic approach through ensuring congruence between declared safety values and actual management practices, creating a just culture that distinguishes between mistakes and conscious violations, investing in research and development of psychological safety aspects, and regular evaluation and review of safety policies considering new psychological knowledge.

Adaptive safety management approaches must consider the dynamic nature of the maritime environment through developing flexible protocols that can adapt to different situations and contexts, creating rapid response systems to new threats and challenges, ensuring continuous learning and development at all organisational levels, and implementing artificial intelligence technologies for decision-making support.

Human-technology integration must consider psychological aspects through interface design, considering human cognitive limitations, preserving possibilities for manual control and regular training, implementing cognitive overload warning systems, and developing adaptive automated systems that support situational awareness.

The research has several important limitations that must be considered when interpreting results. Data availability varies between different organisations and regions, which may lead to non-representativeness of conclusions. Some maritime companies are reluctant to share detailed information about safety incidents due to concerns about reputational risks. Cultural features may significantly affect the applicability of results in different contexts. Approaches that prove effective in some cultures may be less successful in others due to differences in attitudes toward authority, collectivism, and risk perception. Some effects of psychological

programme implementation may manifest only in the long-term perspective, complicating their evaluation within time-limited research.

Development of valid safety culture assessment instruments remains a priority task for future research. Instruments are needed that would be culturally adapted and capable of detecting subtle changes in psychological safety aspects. Particular attention should be paid to developing assessment methods that do not rely exclusively on self-reports but include objective behavioural indicators.

Long-term longitudinal studies are necessary to understand how psychological interventions affect safety over extended periods. Such studies would allow identification of the most effective strategies and optimal intervention frequency.

Research on artificial intelligence and autonomous systems' impact on seafarer psychology becomes increasingly relevant. It is necessary to understand how these technologies change the human role in maritime operations and what new psychological risks they create.

Gender aspects of maritime safety require additional study, especially in the context of increasing women's participation in the maritime industry. It is necessary to research how gender diversity affects team dynamics and safety culture.

Cross-cultural research should focus on developing universal safety principles that can be adapted to different cultural contexts without losing effectiveness.

Conclusions

The conducted research reveals the complex and multifaceted nature of psychological aspects of safety culture in maritime organisations, demonstrating the critical necessity of an interdisciplinary approach that combines psychological, political, and ethical dimensions of safety management. Analysis of official European Maritime Safety Agency statistics for the period 2014-2023 convincingly proves that human factor dominance in 80.1% of maritime incidents is not merely a statistical fact but a reflection of fundamental features of the maritime environment that create unique psychological challenges for humans.

Empirical analysis of maritime incidents registered in 2023 and long-term trends over the ten-year period demonstrates a paradoxical situation: despite revolutionary technological achievements in the maritime industry, the share of incidents related to human actions constitutes 58.4%, whilst human behaviour factors are present in 49.8% of cases. This statistic convincingly indicates that the traditional approach to maritime safety, which

focuses primarily on technical aspects and procedure compliance, is insufficient for addressing contemporary challenges.

Technological progress, instead of reducing the role of human factors, actually creates new psychological risks related to system complexity, operator role changes, and the necessity of adapting to constantly changing technological environments. This requires a fundamentally new approach to safety that integrates psychological knowledge into all aspects of maritime operations, considering political processes in organisations and ethical dilemmas arising when managing human resources.

The theoretical contribution of the research lies in developing a multi-level model of psychological factors in maritime safety, including individual, interpersonal, and organisational levels. This model emphasises the necessity of a systemic approach to safety management, as interventions at one level without considering interaction with other levels may prove ineffective or even counterproductive. Safety culture proves to be not a static set of rules and procedures but a dynamic psychosocial system that constantly evolves under the influence of internal and external factors.

Particular significance lies in identifying the role of leadership as a catalyst for cultural change in maritime organisations. Effective leaders function not simply as managers but as architects of a psychological climate that promotes safe behaviour development. Their influence is realised through modelling desired behaviour, creating environments of psychological safety, and forming organisational narratives that integrate safety values into everyday work.

Political and ethical aspects of safety management proved critically important for the success of psychologically oriented programmes. Research showed that technically correct decisions may fail if they do not consider organisational political dynamics or violate employee ethical principles. Effective approaches are based on principles of transparency, justice, and participation that ensure legitimacy and acceptance of safety initiatives amongst seafarers.

Analysis of international safety management models demonstrates that different national approaches reflect not only cultural traditions but also different risk management philosophies. The Scandinavian model of participative safety, the Japanese kaizen model, the German technical excellence model, and the American risk management model demonstrate different paths to achieving high safety performance, emphasising the necessity of culturally adapted approaches.

Technological challenges create a new reality for maritime safety, requiring a rethinking of the human role in highly automated systems. Phenomena of skill loss, cognitive overload, and psychological adaptation to

cyber threats require the development of new approaches to seafarer training and support. Successful human-technology integration requires not only technical training but also psychological preparation that helps seafarers maintain effectiveness and well-being in a changing technological environment.

The international nature of the maritime industry adds an additional level of complexity through the necessity of integrating different cultural approaches to safety. Managing multicultural crews requires developing a meta-culture of safety that respects cultural diversity but establishes common standards of safe behaviour. This is particularly important in the context of maritime industry globalisation and increasing crew cultural diversity.

The practical significance of the research lies in developing comprehensive recommendations covering all levels of maritime organisations. At the individual level, integration of psychological preparation into all seafarer training programmes and development of psychological condition monitoring systems based on ethical principles is necessary. At the interpersonal level, effective team formation considering intercultural dynamics and crew psychological well-being support is critically important. At the organisational level, systematic safety culture development and implementation of adaptive management approaches, considering the dynamic nature of the maritime environment, are necessary.

The research also reveals important limitations that must be considered when interpreting results and their practical application. Variability in data availability between different organisations and regions may affect the representativeness of conclusions. Cultural features significantly influence the applicability of recommendations in different contexts, whilst the long-term nature of psychological intervention effects complicates their evaluation within time-limited research.

Future research should focus on developing valid safety culture assessment instruments, conducting long-term longitudinal studies of psychological intervention impacts, studying psychological aspects of interaction with artificial intelligence and autonomous systems, and developing cross-cultural approaches to safety management in the global maritime industry.

Effective maritime safety management requires an integrated approach that combines an understanding of psychological processes at all organisational levels whilst considering political and ethical aspects. Successful safety culture formation depends on the organisation's ability to create a psychologically safe environment, maintain open communication, and adapt to technological changes. This requires not only investments in technologies and procedures but also in human resource development,

psychological support, and creating an organisational culture that promotes safety at all levels of maritime operations.

References

1.   Abaei, M. M., Hekkenberg, R., BahooToroody, A. (2023). Incorporation of seafarer psychological factors into maritime safety assessment. *Ocean Engineering*, 269, Article 113443. DOI: https://doi.org/10.1016/j.oceaneng.2023.113443

2.   *Annual overview of marine casualties and incidents 2024* (2024). European Maritime Safety Agency. URL: https://www.emsa.europa.eu/damage-stability-study/items.html?cid=77&id=5352 (дата звернення: 15.12.2024).

3.   Barlas, B. (2023). *The role human factors plays in maritime safety*. Maritime Safety Innovation Lab. URL: https://maritimesafetyinnovationlab.org/2023/05/19/the-role-human-factors-plays-in-maritime-safety/ (дата звернення: 15.12.2024).

4.   Bennett, R., Devereux, J., Rowe, S., Prest, M., Patel, S. (2022). Mental health and psychological wellbeing of maritime personnel: A systematic review. *BMC Psychology*, 10, Article 127. DOI: https://doi.org/10.1186/s40359-022-00850-4

5.   Berg, H. P. (2013). Human factors and safety culture in maritime safety (revised). *TransNav – International Journal on Marine Navigation and Safety of Sea Transportation*, 7(3), 343-352.

6.   Berg, H. P. (2016). Safety culture assessment and implementation framework to enhance maritime safety. *Transportation Research Procedia*, 14, 3895-3904. DOI: https://doi.org/10.1016/j.trpro.2016.05.484

7.   Chauvin, C. (2011). Human factors and maritime safety. *The Journal of Navigation*, 64, 625-632. DOI: https://doi.org/10.1017/S0373463311000142

8.   Dahl, Ø. (2013). *A study of the human factors in maritime safety* : дис. ... магістра : спец. Maritime Safety. World Maritime University. URL: https://commons.wmu.se/cgi/viewcontent.cgi?article=1272&context=msem_dissertations (дата звернення: 15.12.2024).

9.   Fabinyi, M., Barclay, K., Cvitanovic, C., Bennett, N. (2025). Rethinking maritime security from the bottom up: Four principles to broaden perspectives and centre humans and ecosystems. *NPJ Ocean Sustainability*, 4(6), 1-15. DOI: https://doi.org/10.1038/s44183-025-00130-9

10.   Islam, M. S. (2024). Maritime security in a technological era: Addressing challenges in balancing technology and ethics. *Research in Transportation Economics*, 1-16. DOI: https://doi.org/10.47512/meujmaf.1418239

11.   Liu, Y., Zou, C., Zhang, Y., Wang, H. (2023). Towards objective human performance measurement for maritime safety: A new psychophysiological data-driven machine learning method. *Reliability Engineering & System Safety*, 230, Article 109014. DOI: https://doi.org/10.1016/j.ress.2022.109014

12.   Okoro, C., Thomas, A. (2024). Navigating human factors in maritime safety: A review of risks and improvements in engine rooms of ocean-going vessels. *International Journal of Safety and Security Engineering*, 14(1), 1-16. DOI: https://doi.org/10.18280/ijsse.140101