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Formation and management of safety culture in the railway industry: best practices and strategies

This article examines the current issue of safety culture in the railway industry, in particular, the formation and development of a safety culture on the railways of Ukraine. In the article emphasizes the uniqueness of the European model of railway safety culture. The purpose of the study is to comprehensively study the principles, methods and effectiveness of the formation and management of the safety culture in the railway industry. Recommended strategies include leadership commitment, staff engagement, training, communications, security audits, and technology use. A comparative analysis between the EU and Ukraine's railway system points to structural and regulatory differences, emphasizing the need for Ukraine to adapt European practices in the field of safety. The article also offers a structured approach to incident analysis and implementation of security practices, as well as the application of the Plan-Do-Check-Act cycle for systemic security management. These approaches aim to improve safety practices and ensure efficient transportation systems.

Key words: *Safety Culture, Railway Industry, Risk Management, Employee Education, Awareness, Technology, Safety Improvement, Organizational Safety.*

Introduction. Today, the safety of railways is a very important topic, which focuses a lot of interest in many countries of the world. Current aspects of railway security include the following topics: cyber security of railway transport; countering terrorism and vandalism; safety of passengers and employees; risk management and emergency preparedness; environmental safety and sustainable development. This article deals with the topical topic of the formation and development of safety culture in the railway industry of Ukraine.

To implement this practice in developed railway systems, a number of interrelated issues are resolved, the main aspects of which are shown in the diagram shown in fig. 1. This article examines these aspects and offers conclusions and strategies for the formation and development of a safety culture in the railway industry of Ukrainian railways.

Analysis of recent research and problem statement. A key and necessary condition for the sustainable development of the railway industry is to support and improve the level of safety at each railway transport enterprise and for the railway system as a whole.

Safety culture is a system that encompasses the attitudes of a particular group to risk, safety and threats, indicating the values that are considered key in this area.

Safety culture is the main prerequisite for the effective operation of the railway system. The safety and maintenance management system is based on a safety culture and is an important element in all railway organizations to maintain and improve safety.

A properly understood safety culture is based on a high level of trust and respect between employees and management, so it must be created and maintained by senior management.

The full definition of safety culture is contained in the European Railway Safety Culture Declaration: "Safety culture means the interaction between the requirements of the Safety Management System and

how people understand them based on their attitudes, values and beliefs and what they actually do, as seen from decisions and behaviour. A positive safety culture is characterized by the collective commitment of leaders and individuals to act safely at all times, particularly when faced with competing goals” [1].



Fig 1. Basic aspects of safety culture implementation in railway systems

According to the findings of European national accident investigation bodies, a poor safety culture on the railways has played a role in major rail transport accidents, including those in Great Britain and France. As part of the research conducted in the laboratory of the Lviv Scientific and Research Institute of Forensic Examinations of railway accidents that occurred on the railways of Ukraine, the need to implement an effective safety management system and the formation of a safety culture was also noted.

There are many approaches to assessing and improving safety culture in the railway industry [3-20]. The European Railway Agency (ERA) has defined important standards and developed a key model, taking into account the unique needs of the railway industry [1]. This model acts as a reference basis for evaluating and improving the safety culture, ensuring compliance with the highest standards of reliability and safety.

In turn, the International Union of Railways (UIC) provides guidance on safety culture, emphasizing a global approach to ensuring safety in different regions of the world [2]. These recommendations take into account the challenges and peculiarities faced by the railways of different countries, offering practical strategies and methods for improving the safety culture at all levels of management and interaction of the participants of the railway transport system.

These two influential organizations work together to establish high standards of safety and culture in the rail industry to ensure the efficient and reliable transportation of passengers and freight, reducing risks and improving the overall safety status of the rail system worldwide.

The European Union Agency for Railways (ERA) has introduced its "Safety Culture Model," which serves as a conceptual and evaluative framework for analysing and improving safety culture within railway organizations. The model is divided into three key components [1]:

Cultural Factors: these are levers that determine the development of organizational culture.

Behavioural Models: these are shared ways of thinking and acting that reflect the organizational culture.

Railway Safety Foundations: key principles that must be considered in behavioural models to achieve sustainable safety performance and organizational excellence.

These three components encompass four cultural factors and four fundamental railway safety principles, forming a total of 24 attributes. These attributes serve as a valuable tool for railway organizations to identify their cultural strengths and weaknesses, contributing to the development of a positive safety culture in the railway industry. Figure 2 shows the European Railway Safety Culture Model.

Considering the European integration vector of Ukraine, it is important to implement European practices in the field of security in the railway industry.

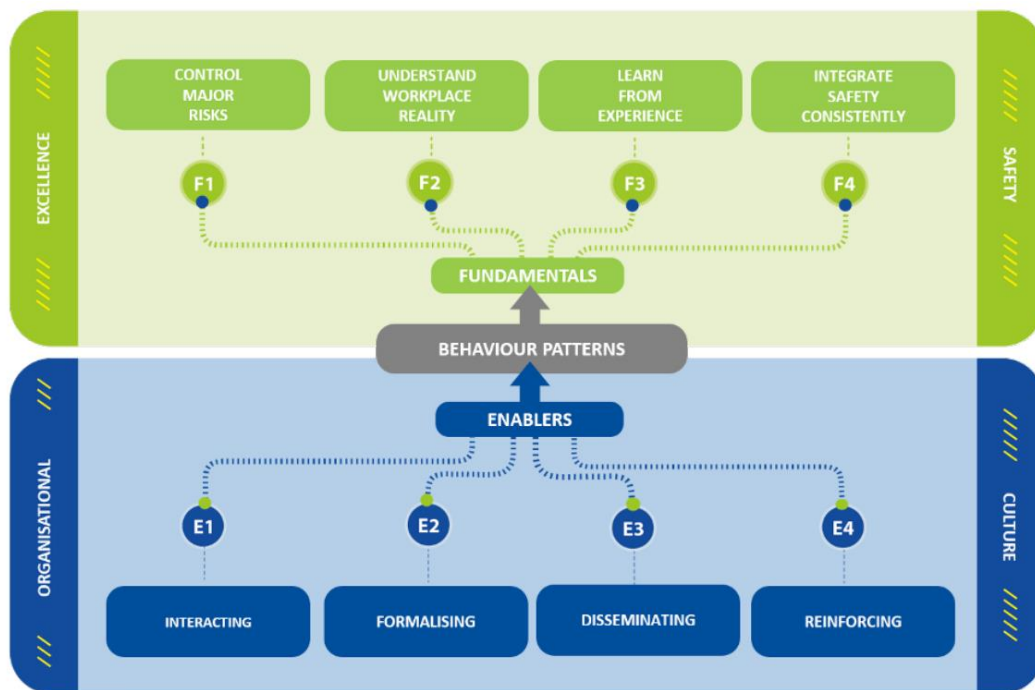


Fig 2. The European Railway Safety Culture Model

In order to ensure the safety and efficiency of operations in the railway industry, the availability of a skilled workforce with relevant competencies is a critical element. Employees of the industry daily perform such operations as inspection, maintenance and modernization of infrastructure and rolling stock. As demands on the rail network continue to grow, it is important that these industry workers receive ongoing training to ensure their skills and competencies are up to date with industry requirements.

The purpose and tasks of the study. The purpose of the study is to comprehensively explore the principles, methods, and effectiveness of forming and managing safety culture in the railway industry, with a focus on identifying best practices and developing strategic approaches. The research aims to contribute valuable insights into enhancing safety measures within railway operations.

The purpose of the study is a comprehensive study of the principles, methods and effectiveness of the formation and management of safety culture in the railway industry with an emphasis on identifying best practices and developing strategic approaches. The study aims to provide valuable information on improving safety measures during railway operations.

The tasks of the research include:

- study of the existing literature on safety culture in the railway industry;
- analysis of case studies, research articles and reports related to security practices;
- research on successful safety initiatives implemented by railway organizations around the world;
- determination of specific practices and strategies that have proven their effectiveness in increasing safety culture;
- assessment of the current state of safety culture in the railway industry;
- studying the effectiveness of existing programs and security policies;
- development of a strategy for the formation and improvement of safety culture based on identified best practices;
- comparison of the practice of safety culture in the railway industry with other highly reliable industries; comparison with international standards and recommendations.

- providing recommendations to railway organizations on strengthening the safety culture and improving the overall safety system.

Materials and methods of research. The formation of a safety culture in the railway industry requires a comprehensive approach, involving the engagement of personnel at all organizational levels and considering the industry's specifics. Best practices include:

1. *Leadership and Management Engagement:*
 - Prioritizing safety and demonstrating leadership commitment.
 - Leaders actively communicating with staff about the importance of safety rules and setting an example in following these rules.
2. *Training and Education:*
 - Regular training and reminders of safety rules.
 - Organizing seminars, training sessions, and other educational events on safety issues.
3. *Employee Involvement:*
 - Involving employees in decision-making processes related to safety.
 - Establishing feedback mechanisms for employees to report potential hazards and safety violations.
4. *Setting Safety Goals and Policies:*
 - Establishing specific safety goals and tracking their achievement.
 - Measuring safety indicators to assess the effectiveness of measures and risk management.
5. *Enhancing Communication:*
 - Ensuring effective safety information exchange across all organizational levels.
 - Encouraging open communication and reporting of incidents, even minor ones.
6. *Safety Audits and Evaluation:*
 - Conducting regular audits and evaluations of the safety management system to identify weaknesses and potential improvements.
7. *Compliance with Regulations and Standards:*
 - Ensuring compliance of all processes and procedures in the railway industry with established standards and regulatory requirements.

These practices contribute to creating a robust safety culture in the railway industry, ensuring the effectiveness and safety of railway transportation systems.

Managing safety culture in the railway industry requires a systematic and comprehensive approach aimed at forming and maintaining a safe working atmosphere. Here are some of the best safety culture management strategies in the railway industry:

1. *Leadership and Exemplification:*
 - Decisive top-down leadership prioritizing safety and actively embodying safety principles in all aspects of operations.
2. *Employee Engagement:*
 - Ensuring active participation of employees in shaping and implementing safety strategies.
 - Considering the opinions and ideas of employees for improving workplace safety.
3. *Training and Development:*
 - Conducting systematic safety training for all staff.
 - Providing opportunities for professional growth and skill development in the safety field.
4. *Communication and Feedback:*
 - Ensuring open and effective communication across all organizational levels regarding safety matters.
 - Establishing mechanisms for collecting and analysing feedback to improve the safety system.
5. *Safety Identification Building:*
 - Creating a specific organizational image where safety is a key component of corporate culture.
6. *Effective Use of Technology:*
 - Implementing modern technologies and innovations to enhance safety systems and operational efficiency.

7. *Monitoring and Analysis:*

- Regular monitoring and analysis of safety conditions, identifying issues, and taking appropriate measures for resolution.

8. *Recognition and Motivation:*

- Establishing a reward and recognition system for achievements in safety, encouraging employees to be more attentive to safety.

These strategies contribute to the creation of an effective safety culture in the railway industry, ensuring optimal protection for both employees and passengers.

Comparing safety culture across rail systems is challenging because of the different contexts, sizes, cultural differences, and management strategies. However, it is possible to highlight the main aspects for comparison, which are shown in Figure 3.

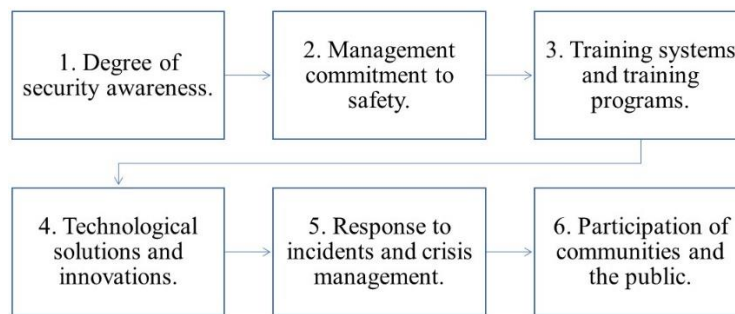


Fig 3. Key aspects for comparing safety culture in different railway systems

A comparison of the safety culture in the railway systems of the European Union (EU) and Ukraine is given in the Table 1.

Table 1. A comparison of the safety culture in the railway systems of the European Union (EU) and Ukraine

No	Indexes	EU	Ukraine
1	Structure and organization	The EU has an extensive rail transport system, including many member states, each of which has its own internal organization and management of railways	The railway system of Ukraine is centralized and owned by the state company JSC Ukrainian Railways (Ukrzaliznytsia), which is a monopoly operator
2	Regulations and standards	The European Commission and the European Railway Agency (ERA) set safety standards and regulations to ensure unity and a high level of safety in the EU rail industry	The Ukrainian State Transport Safety Service is responsible for regulating and overseeing safety in the transport industry, including railways
3	Safety standards and approaches	The European approach to safety includes strict standards and a high level of automation, technology and control over train traffic and infrastructure	Ukrainian safety standards also meet international requirements, but there is a problem of financial constraints and equipment obsolescence
4	Investments and development	European countries are actively investing in the modernization and development of railway infrastructures, in particular high-speed railways, and environmentally friendly vehicles	Ukraine also has plans to modernize its rail infrastructure and improve safety, but limited budget resources may affect the speed and scope of these reforms

Also, in the EU, great emphasis is placed on education and training of personnel in the field of safety and technical aspects of railway transport.

The development of a safety culture in railway transport in Ukraine is crucial to ensure the highest level of safety for both passengers and personnel. Important steps and corresponding actions of the strategy for the development of a safety culture in railway transport in Ukraine are given in Table 2.

Table 2. Important steps and corresponding actions of the strategy for the development of a safety culture in railway transport

№	Important steps	Actions
1	Regulatory Framework Strengthening	Enhance and enforce existing safety regulations and standards, ensuring that they align with international best practices. This includes oversight, monitoring, and audits to verify compliance.
2	Education and Training	Comprehensive training of railway employees at all levels on safety procedures, protocols, and emergency response. Encouraging continuous learning and skill development to keep employees up-to-date on the latest security measures.
3	Safety Communication	Promoting open communication channels where employees can freely report safety concerns, incidents, or potential hazards without fear of retaliation. Encouraging a reporting culture that emphasizes learning from mistakes
4	Safety Leadership	Leaders within the railway industry should set an example by demonstrating a strong commitment to safety. They should actively participate in safety initiatives, emphasize safety as a core value, and communicate safety expectations to all employees.
5	Involvement and Participation	Involvement of employees in safety decision-making processes, hazard identification, risk assessment, and development of safety procedures. Such participation increases a sense of ownership and responsibility for safety.
6	Risk Assessment and Management	Carrying out a thorough risk assessment of all aspects of railway operations. Identifying potential hazards and developing a risk mitigation strategy. Regularly review and update the risk assessment to adapt to changing circumstances.
7	Safety Performance Metrics	Establish clear safety performance indicators and regularly measure, monitor, and evaluate safety performance. Recognize and reward individuals and teams that contribute to maintaining a high level of safety.
8	Investment in Technology	Implement modern safety technologies such as advanced signalling systems, predictive maintenance tools, and automated control systems that can enhance safety and minimize the risk of accidents.
9	Collaboration and Partnerships	Foster collaboration and information sharing among railway companies, industry associations, government bodies, and international organizations. This can facilitate the exchange of best practices and innovative safety solutions.
10	Emergency Response Preparedness	Ensure that railway personnel are well-trained in emergency response procedures and conduct regular drills to enhance preparedness for various emergency scenarios.
11	Public Awareness and Education:	Educate the public about railway safety through campaigns, workshops, and school programs to instill safe behaviors and raise awareness about the risks associated with railway transport.
12	Continuous Improvement	Encourage a culture of continuous improvement by conducting regular safety reviews, learning from incidents, and implementing necessary changes to prevent similar incidents in the future.

A safety culture is a collective mindset, values, and behaviours within an organization that prioritize safety and encourage safe practices at all levels. By integrating these strategies and fostering a safety-oriented mindset at all levels of the railway transport sector in Ukraine, a strong safety culture can be developed, leading to safer operations and a reduced risk of accidents or incidents.

Identifying threats to train traffic safety is a critical step in ensuring a safe railway system. Threat identification involves recognizing potential risks, hazards, or factors that could compromise the safety of train operations. The following methods and approaches for determining threats to train traffic safety can be identified:

1. *Risk Assessments*. Conducting a comprehensive risk assessment and hazard analysis to identify potential threats. These assessments should cover various aspects, including infrastructure, equipment, operations, human factors, and environmental conditions.

2. *Safety Audits and Inspections*. Conducting regular safety audits and inspections of railway structures, tracks, stations, signalling systems, rolling stock and other critical components. Identification of any deviations from safety standards and their immediate elimination.

3. *Incident and Accident Analysis*. Analysis of past incidents and accidents in the rail system to identify recurring patterns, root causes and contributing factors. Learning from previous incidents can help in proactively addressing similar threats in the future.

4. *Safety Reporting Systems*. Implementing a robust safety reporting system that will encourage employees and stakeholders to report safety issues, incidents or unsafe conditions. Analysing these reports can help in identifying potential threats and taking preventive measures.

5. *Safety Meetings and Workshops*. Organizing regular safety meetings, seminars and brainstorming sessions with employees and stakeholders. These sessions can provide valuable insights and perspectives on potential threats and safety improvement opportunities.

6. *Job Safety Analysis (JSA)*. Conducting occupational safety analysis for various tasks and operations on the railway. This involves breaking down tasks into individual steps and identifying potential hazards and risks associated with each step.

7. *Human Factors Analysis*. Investigating human factors that may pose a safety risk, such as fatigue, distraction, lack of training or inadequate staffing levels. Addressing human factors is crucial to ensure safe train operations.

8. *Safety Surveys and Feedback*. Collecting feedback and information from employees, passengers, and other stakeholders through safety surveys. These surveys can help identify areas of concern and potential threats that might have been overlooked.

9. *Collaboration with Industry Experts*. Cooperation with safety experts, consultants, or external organizations with expertise in railway safety. Participate in security audits and consultations to identify threats and receive recommendations for improvement.

10. *Utilization of Advanced Technologies*. Implementation of advanced technology such as sensors, cameras, predictive maintenance tools and real-time monitoring systems. These technologies can provide real-time data and alerts to identify potential threats and safety issues promptly.

11. *Close Monitoring of Weather Conditions*. Keep a close eye on weather forecasts and conditions, as adverse weather such as heavy rain, snow or extreme temperatures can affect rail safety. Taking appropriate measures to mitigate the impact of adverse weather conditions on the operation of trains.

12. *Simulation and Scenario Planning*. Using simulation software to model and simulate various scenarios to identify potential threats and assess the safety implications of different operational situations.

By employing a combination of these methods, railway authorities can proactively identify threats to train traffic safety and take appropriate preventive and corrective actions to ensure a safe and reliable railway system.

Analysing the results of investigations into transport incidents on railway transport is crucial for understanding the causes, patterns, and potential impacts on safety. This analysis helps in identifying trends, improving safety measures, and implementing preventive actions. Table 3 provides a

recommended structured approach to rail incident analysis that organizations can use to identify critical safety issues and implement necessary improvements.

Table 3. A recommended structured approach to rail incident analysis

№	Hunting action	Recommended actions
1	Incident Data Collection	Gather detailed incident data including the date, time, location, type of incident, individuals involved, weather conditions, and any other relevant contextual information. Ensure data accuracy and completeness.
2	Root Cause Analysis (RCA)	Conduct a thorough root cause analysis for each incident to determine the underlying factors that contributed to the occurrence. Identify immediate, underlying, and systemic causes.
3	Categorization of Incidents	Categorize incidents based on their nature (e.g., collisions, derailments, signal violations, human error) and severity (e.g., minor, significant, catastrophic) to identify trends and patterns.
4	Frequency and Trend Analysis	Analyse incident data over a specific period to identify trends, patterns, and frequencies. Determine if the number of incidents is increasing, decreasing, or remaining constant, and identify any seasonal variations.
5	Identification of Common Factors:	Identify common factors across multiple incidents, such as equipment malfunctions, human error, maintenance issues, or inadequate training. Highlight recurring issues that need immediate attention.
6	Human Factors Analysis:	Evaluate the role of human factors in incidents, including factors such as fatigue, distractions, communication breakdowns, and inadequate training. Determine the impact of human performance on safety.
7	Equipment and Infrastructure Analysis	Evaluate the role of equipment malfunction, signalling system failures, track conditions, and overall infrastructure in incidents. Understand how these factors affect safety.
8	Regulatory Compliance Assessment	Evaluate incidents in the context of regulatory compliance to identify whether safety regulations and guidelines were followed. Assess the adequacy and effectiveness of existing safety protocols.
9	Safety Culture Assessment	Evaluate if there are indications of a poor safety culture within the organization by analysing incident reports and employee feedback. Consider factors like reporting culture, blame-free environment, and accountability.
10	Impact on Safety Measures	Assess how incidents have influenced safety measures, protocols, and procedures. Evaluate changes made post-incident to enhance safety and prevent future occurrences.
11	Lessons Learned and Recommendations	Summarize the lessons learned from each incident and provide recommendations for preventing similar incidents. Propose corrective actions, procedural changes, training improvements, or equipment upgrades.
12	Data Visualization and Reporting	Present the analysis findings through data visualization techniques such as charts, graphs, and dashboards. Create comprehensive reports summarizing the incident analysis and recommendations.
13	Implementation of Corrective Actions	Ensure that the recommendations are implemented effectively to improve safety. Monitor the progress and effectiveness of corrective actions.
14	Continuous Monitoring and Improvement	Establish a system for continuous monitoring, learning, and improvement based on incident analysis. Regularly revisit incident data, update safety measures, and conduct periodic safety reviews.

The Safety Management System (SMS) is fundamental for ensuring high levels of railway safety. Both railway operators and infrastructure managers share the responsibility for safety within the railway system. The SMS's purpose is to secure business objectives safely and adhere to safety obligations in the dynamic railway environment. Compliance with Directive (EU) 2016/798 is necessary for safety certificates or authorizations, involving a comprehensive Plan, Do, Check, Act (PDCA) cycle. A systematic approach considers individual requirements, their integration, and interfaces with other railway actors, emphasizing hazard identification, risk management, and accident prevention. Effective risk control involves three critical dimensions: technical, human, and organizational components.

The Plan-Do-Check-Act (PDCA) cycle can be applied to manage safety systems in railway transport. Figure 4 shows the application of the Plan-Do-Check-Act (PDCA) method for the management of railway safety systems.

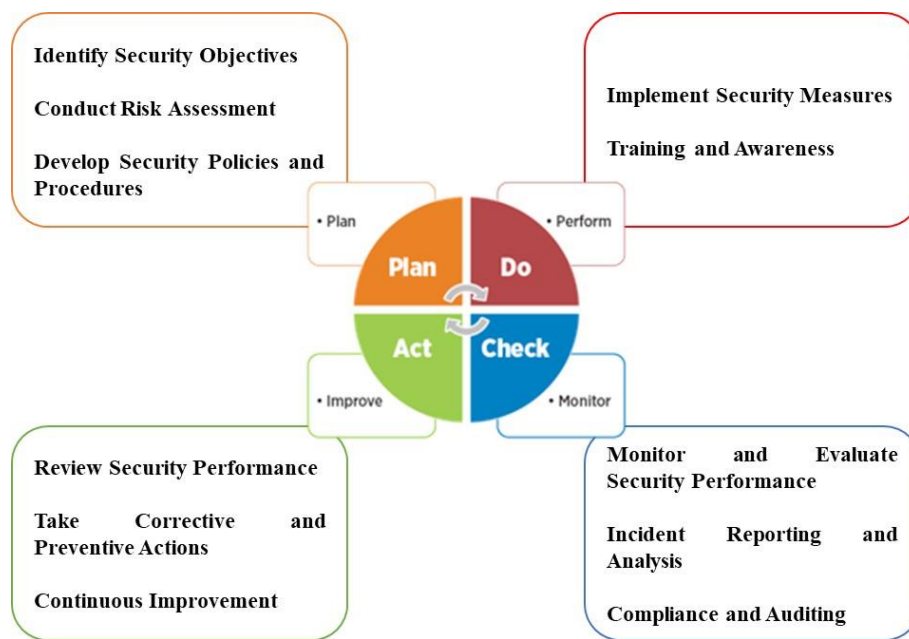


Fig 4. Application of the Plan-Do-Check-Act method to the management of the safety system in railway transport

Application of the Plan-Do-Check-Act method to the management of the safety system in railway transport.

1. Plan:

- *Identify Security Objectives:* Define security objectives, considering the unique security risks and challenges associated with railway transport. Objectives may include preventing sabotage, ensuring passenger safety, protecting critical infrastructure, and cybersecurity.

- *Conduct Risk Assessment:* Perform a thorough risk assessment to identify security risks specific to railway operations. Consider aspects such as potential terrorist threats, cyber-attacks, unauthorized access to tracks or stations, and safety hazards.

- *Develop Security Policies and Procedures:* Establish comprehensive security policies and procedures that address identified risks. Include guidelines for access control, emergency response, cybersecurity measures, employee training, and communication protocols during security incidents.

2. Do:

- *Implement Security Measures:* Put into action the security controls and measures outlined in the security policies. This may involve deploying surveillance systems, access control technologies, cybersecurity measures, security personnel deployment, and safety protocols.

- *Training and Awareness*: Conduct training programs and awareness campaigns for railway staff regarding security policies, emergency response procedures, and the use of security technologies. Raise awareness about the importance of security and reporting any suspicious activities.

3. Check:

- *Monitor and Evaluate Security Performance*: Continuously monitor security measures using a combination of surveillance systems, security audits, and feedback mechanisms. Regularly assess the effectiveness of implemented security controls against predefined key performance indicators (KPIs).

- *Incident Reporting and Analysis*: Establish an incident reporting system to capture security incidents or breaches. Analyse these incidents to understand the root causes, identify vulnerabilities, and develop strategies to prevent similar incidents in the future.

- *Compliance and Auditing*: Conduct regular compliance audits to ensure that security measures and practices align with the established security policies and relevant regulations. Address any non-compliance issues promptly.

4. Act:

- *Review Security Performance*: Review the data and insights obtained from monitoring, incident analysis, and audits. Evaluate the performance of the security system and identify areas for improvement.

- *Take Corrective and Preventive Actions*: Implement corrective actions to address identified security gaps and incidents. Also, proactively introduce preventive measures based on lessons learned and emerging security threats.

- *Continuous Improvement*: Integrate the lessons learned and recommended improvements into the security policies and procedures. Continuously update and adapt security measures to enhance the security posture of the railway transport system.

Conclusions. The article underscores the critical importance of safety culture in the railway industry, emphasizing its role in ensuring the safety of passengers, employees, and the overall railway system.

Drawing from global best practices, the article highlights the European Railway Safety Culture Model as a comprehensive framework. It discusses the role of influential organizations like the European Railway Agency (ERA) and the International Union of Railways (UIC) in shaping safety standards and promoting a positive safety culture worldwide.

The article identifies leadership, employee engagement, training, communication, safety audits, compliance, and technological advancements as key components of an effective safety culture. It emphasizes the need for a dynamic safety culture that adapts to changes over time.

A comparative analysis between the European Union (EU) and Ukraine's railway systems reveals distinctions in structure, regulations, safety standards, investments, and cultural emphasis on education and training. The article recognizes the need for Ukraine to align with European practices in enhancing railway security.

The article provides a set of comprehensive strategies for managing safety culture in the railway industry. These strategies encompass leadership commitment, employee engagement, continuous training, effective communication, safety audits, compliance with regulations, and utilization of technology.

The article outlines methods for identifying threats to train traffic safety, including risk assessments, safety audits, incident analysis, safety reporting systems, and collaboration with industry experts. It emphasizes the importance of proactive measures to ensure a safe and reliable railway system.

A recommended structured approach to rail incident analysis is presented, involving incident data collection, root cause analysis, categorization, frequency and trend analysis, human factors analysis, and continuous improvement. This approach aims to learn from incidents, improve safety measures, and implement necessary corrective actions.

The application of the Plan-Do-Check-Act (PDCA) cycle to the management of railway safety systems is illustrated. This cyclical approach involves planning security objectives, implementing

security measures, monitoring and evaluating performance, and taking corrective and preventive actions. The PDCA cycle is presented as a systematic method for continuous improvement in railway safety.

The suggested approaches and frameworks aim to guide the railway industry towards enhanced safety practices, ultimately ensuring the well-being of passengers and personnel while maintaining efficient and reliable transportation systems.

All organizations have their own security culture, regardless of whether they pay attention to it or explicitly manage this process. Various events and accidents that have occurred in various industries demonstrate that a low level of safety culture can lead to catastrophic consequences. Thus, companies and regulators in various fields recognize the urgent need to actively build a positive safety culture. This culture must not only be static, but also dynamic, constantly monitored, and ready to change or improve over time. Ensuring a high level of security requires organizations to be aware of and implement security principles and practices, thereby contributing to the safe and stable operation that is important to all participants in the process.

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Формування та управління культурою безпеки в залізничній галузі: найкращі практики та стратегії

У статті розглядається актуальне питання культури безпеки в залізничній галузі, зокрема, формування та розвитку культури безпеки на залізницях України. У статті підкреслюється унікальність європейської моделі культури безпеки на залізниці. Мета дослідження полягає в комплексному дослідженні принципів, методів та ефективності формування та управління культурою безпеки в залізничній галузі. Рекомендовані стратегії включають відданість керівництва, залучення персоналу, навчання, комунікації, перевірки безпеки та використання технологій. Порівняльний аналіз між залізничною системою ЄС та України вказує на структурні та нормативні відмінності, наголошуючи на необхідності для України адаптувати європейську практику у сфері безпеки. У статті також пропонується структурований підхід до аналізу інцидентів і впровадження практик безпеки, а також застосування циклу «План-Виконання-Перевірка-Дія» для системного управління безпекою. Ці підходи спрямовані на покращення практики безпеки та забезпечення ефективності транспортних систем.

Ключові слова: культура безпеки, залізнична галузь, управління ризиками, навчання працівників, обізнаність, технологія, підвищення безпеки, організаційна безпека.