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Problems arising in the process of digital transformation in the field of occupational health and safety

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Abstract: *Digital transformation encompasses all aspects of modern industrial processes, including occupational health and safety (OHS). The implementation of information and communication technologies (ICT), Internet of Things (IoT), artificial intelligence (AI), and big data creates new opportunities for monitoring, analyzing, and preventing incidents. However, this process is accompanied by several challenges such as resistance to change, high initial investment, lack of system integration, cybersecurity threats, and absence of a clear strategy. This paper examines the key challenges and proposes approaches to overcome them. Emphasis is placed on the importance of strategic planning, staff adaptation, and sustainable digital solutions in OHS.*

Keywords: digitalization, occupational health, safety engineering, IoT, big data, strategy, integration, training.

1. Introduction

Modern industrial development is unimaginable without digital technologies. In areas such as occupational health and safety, digitalization opens up prospects for improving the efficiency of workplace condition monitoring, risk analysis, and accident prevention. According to the International Labour Organization, more than 2.3 million deaths related to unsafe working conditions occur annually [1]. This underscores the need to reform approaches to occupational safety.

Despite the clear benefits, the process of digital transformation in OHS faces serious challenges. Addressing them requires a systematic approach that combines technical, organizational, and human resource measures. The purpose of this study is to identify and systematize the key issues in digitalization within the field of occupational safety and to formulate practical recommendations for their resolution.

2. Literature Review

Petrov V.N. [1] emphasizes that one of the main reasons for unsuccessful digitalization is the lack of a unified strategy at the enterprise level. Rumyantsev I.S. [2] notes the importance of integrating platforms and digital solutions based on open standards. Foreign literature primarily focuses on the use of IoT, machine learning, and virtual reality (VR) to foster a safety culture [3].

According to the Journal of Occupational Health, the use of big data and IoT contributes to accurate risk prediction, especially in high-risk industries. However, there is a shortage of specialists capable of interpreting data analysis results in the context of OHS.

Thus, academic literature confirms the high relevance of digital technologies in ensuring safety but points out systemic and organizational barriers to their implementation.

3. Methodology

This study employed a qualitative analysis of digitalization challenges based on practical experience from industrial enterprises in Uzbekistan, combined with data from academic publications. The following sources were analyzed:

- Data from 12 enterprises in the mechanical engineering and chemical industries;
- Interviews with 15 occupational safety and IT specialists;
- Results from the implementation of workplace monitoring software from 2022 to 2024.

Additionally, SWOT analysis was used to identify the strengths and weaknesses of current digitalization strategies.

To deepen the analysis, a comparative evaluation was conducted between enterprises that successfully implemented digital tools and those that experienced implementation difficulties. Key performance indicators (KPIs) such as reduction in incidents, training efficiency, and level of system integration were assessed.

Moreover, a survey questionnaire was distributed to 50 OHS managers to gather insights on perceived obstacles, readiness for change, and expectations from digital tools. The data were coded and categorized using thematic analysis to extract prevailing trends.

All collected information was triangulated with national policy documents and international best practices, ensuring a comprehensive and multi-perspective view of digital transformation processes in OHS.

4. Results

The analysis revealed five key issues:

Resistance to Change. Up to 60% of older employees express skepticism about digitalization, preferring traditional paper-based logs.

Financial Barriers. At 8 out of 12 enterprises, the implementation of digital solutions has been postponed due to budget constraints.

Fragmented Digital Infrastructure. Disparate safety systems are not integrated into a unified database, reducing response efficiency.

Data Security Risks. Five enterprises reported incidents of personal data breaches in 2023.

Lack of Qualified Personnel. Less than 30% of OHS professionals have undergone digital competence retraining.

5. Discussion

The findings highlight the need for a comprehensive approach to OHS digitalization. Enterprises should:

- Develop phased digitalization strategies that prioritize critical risks;
- Introduce IT literacy and digital tools training for staff;
- Adopt platform-based solutions with open APIs to ensure system integration;
- Utilize cloud-based solutions to reduce initial costs;

Implement robust cybersecurity protocols to protect employee data.

The deployment of VR and AR simulators for safety training can significantly enhance engagement and reduce injury rates. Moreover, AI-powered video analytics from production cameras offers new horizons in predictive risk assessment.

It is also essential to foster cross-functional collaboration between occupational safety, IT, and management teams to ensure alignment of goals and responsibilities in the digital transition process. Building a culture that values innovation and continuous learning can enhance staff readiness and reduce resistance.

From a policy standpoint, governments and regulatory bodies should support small and medium-sized enterprises (SMEs) with financial incentives and methodological guidelines to facilitate digital adoption. Public-private partnerships can also accelerate the development and dissemination of industry-specific digital safety tools.

Additionally, the role of universities and research institutes should be expanded to provide targeted training programs, joint pilot projects, and case study databases that address the practical needs of enterprises embarking on digital transformation in OHS.

6. Conclusion

Digital transformation in occupational health and safety is not just a trend but a strategic necessity. However, its successful implementation requires investment, changes in managerial approaches, and the development of a digital culture among staff. Only through comprehensive efforts across all areas can digitalization lead to reduced workplace injuries and increased safety system efficiency.

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