

NAVIGATING THE INTERSECTION OF MANAGEMENT AND AI: ADVANCING OCCUPATIONAL HEALTH AND SAFETY

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Mariya Sira^{1,2} – *orcid id: 0000-0002-9970-1549, mariya.sira@polsl.pl*

¹Department of Applied Social Sciences, Faculty of Organization and Management, Silesian University of Technology, **Poland**

²Joint Doctoral School, Silesian University of Technology, **Poland**

Abstract: This article provides an exploration of the intersection between management, artificial intelligence (AI), and occupational health and safety (OHS), delving into the evolution of safety systems and the integration of advanced technologies. To address the barriers to AI adoption in OHS and maximize the benefits of AI integration, the article proposes an AI Adoption Roadmap for OHS, delineating phases for assessment, planning, implementation, monitoring, continuous improvement, and the establishment of a data-driven safety culture. By embracing AI-driven solutions and fostering a culture of innovation and collaboration, organizations can proactively address safety challenges and cultivate safer, healthier work environments.

Keywords: occupational health and safety (OHS), OHS management, artificial intelligence (AI), roadmap

1. INTRODUCTION

The convergence of technological management and AI has garnered notable attention in the field of OHS in recent times. In the realm of OHS, this intersection holds particular significance, offering unprecedented opportunities to revolutionize traditional approaches to risk management, accident prevention, and workplace well-being (Shah and Mishra, 2024; Setapa et al., 2020; Klimecka-Tatar et al. 2023). There is a need to provide a framework for understanding the complex nature of workplace safety in the changing environment. The contemporary work environment is a complex and ever-changing system marked by a variety of challenges, evolving dangers, and a diverse employee population. The rapid progress of technology (Kuzior et al., 2019; Kuzior and Kwilinski, 2022), the increasing interconnectedness of the global economy, and shifting regulatory environments have altered the field of occupational health and safety, requiring flexible and responsive tactics to protect workers and maintain the viability of businesses. In this context, conventional methods of occupational health and safety, based on reacting to compliance requirements, have shown to be insufficient in managing new risks, avoiding incidents, and promoting a culture of safety excellence (Hudáková et al., 2021; Greeff, and Van Staden, 2023, Suchacka et al. 2023).



The rapid progression of technology and AI presents a distinct prospect for transforming conventional methods of OHS management. This paper seeks to examine the consequences of incorporating technological management and AI within the realm of occupational health and safety, emphasizing the possible advantages and obstacles as well as to structure for the integration of AI into OHS practices with the aim of attaining notable improvements in safety results.

2. METHODOLOGY OF RESEARCH

The main research methodologies utilized in this investigation consist of conducting literature reviews, performing content analysis, and synthesizing the findings. The purpose of these literature reviews was to summarize a comprehension of the present research landscape within the convergence of AI and OHS. The process of content analysis consisted of identifying crucial ideas and recurring patterns within the body of literature pertaining to the convergence of AI and OHS. The comprehensive understanding of the implications of integrating AI into OHS was developed based on the synthesized findings derived from literature reviews and content analysis.

3. RESULTS

The results obtained from our study emphasize the significant impact of incorporating technological management and artificial intelligence in enhancing occupational health and safety procedures. Companies in different sectors that utilized AI-powered tools noted noticeable enhancements in identifying hazards, conducting risk assessments, and preventing accidents. Through utilizing the analytical capabilities of AI algorithms, these organizations were able to analyse large amounts of data to identify practical insights, allowing for proactive measures to be taken and resources to be optimized (Fisher et al., 2023). In addition, the utilization of wearable technologies and Internet of Things (IoT) devices has been identified as crucial in facilitating the immediate observation of environmental circumstances and the well-being of employees. By engaging in ongoing data gathering and analysis, businesses have the capability to identify possible safety deficiencies beforehand, subsequently preventing unfavourable incidents and reducing interruptions in operations (European Agency for Safety and Health at Work (EU-OSHA), 2021). Additionally, the smooth integration of digital platforms has supported improved communication and cooperation among those involved, thus encouraging a shared dedication to achieving exemplary levels of safety.

To present a comprehensive analysis of the incorporation of technology in OHS practices, it is essential to classify adopters into specific categories. Based on the diffusion of innovation model proposed by Rogers (1962/2003), AI adopters can be classified into various categories, namely innovators, early adopters, early majority, late majority, and laggards. Phrase “early adopters” often occurs in the works of scientists while phrase “late adopters” is relatively rare (Wendler, 2019; Deloitte, 2018; Mcelheran et al., 2021). Therefore, organizations can be classified into three separate groups according to the level of artificial AI adoption and utilization.

The early adopters of AI technology in occupational health and safety showcase a proactive stance in integrating AI-driven solutions for improving workplace safety. By utilizing sophisticated predictive analytics and real-time monitoring tools, these organizations demonstrate an increased ability to identify hazards, assess risks, and prevent accidents.

The moderate adopters category consists of organizations that have taken steps to incorporate AI technologies into their OHS systems, but have not fully harnessed their capabilities. Although they demonstrate a willingness to explore AI-based tools, their implementation is limited by logistical, financial, or organizational obstacles. Organizations classified as late adopters demonstrate a resistance or hesitation to adopt AI-based occupational health and safety solutions. Despite the increasing demand for technological advancement, these organizations maintain a cautious approach, frequently citing apprehensions regarding data protection, ethical considerations, and the complexity of technology. Table 1 presents a comparative examination of important occupational health and safety metrics among organizations grouped according to their degree of artificial intelligence integration.

Table 1. Comparative Analysis of OHS Metrics Across Early, Moderate, and Late Adopters

Hazard Identification	High	Moderate	Low
Risk Assessment	Significant	Moderate	Minimal
Accident Prevention	Effective	Partial	Limited
Employee Engagement	High	Moderate	Low
Compliance Rate	Above Average	Average	Below Average

Individuals who are quick to adopt new technologies show greater effectiveness in identifying hazards, assessing risks, and preventing accidents compared to those who are slower to adopt (Deloitte, 2020). Additionally, organizations that embrace technology early on have higher levels of employee engagement and compliance, highlighting a strong connection between the adoption of artificial intelligence and improved safety outcomes. Reviewed sources highlight the strategic imperatives and operational nuances of applying AI in OHS. Key themes that emerged from the analysis include strategic alignment, data governance and stakeholder engagement.

The successful implementation of AI relies heavily on aligning strategies with the goals and objectives of the organization (Ávila-Gutiérrez et al., 2022). The promotion of a culture of innovation and collaboration is emphasized by early adopters as crucial for achieving sustainable outcomes in occupational health and safety.

Data governance is crucial for maintaining the reliability, confidentiality, and availability of OHS data (Moore, 2019). Organizations place a high degree of importance on implementing security measures and adhering to compliance protocols to mitigate potential risks posed by AI-driven analytics. Effective stakeholder engagement, which involves frontline workers, safety committees, and senior leadership, is essential for gaining support and promoting a feeling of responsibility in occupational health and safety initiatives driven by artificial intelligence (Vilcane et al., 2019). Utilizing communication methods and educational programs helps to facilitate the sharing of information and the enhancement of skills. Although there are clear advantages to incorporating artificial intelligence into occupational health and safety practices, organizations face numerous obstacles that hinder widespread acceptance and utilization. These obstacles span technical, organizational, and socio-economic realms, presenting substantial difficulties in achieving safety excellence through AI implementation.

Table 2 outlines the primary obstacles to the implementation of AI in OHS, including technical, organizational, and regulatory factors. Overcoming these barriers requires a

comprehensive strategy that integrates technological advancements, effective governance, and active involvement of stakeholders to cultivate a favourable climate for AI-driven advancements in safety administration.

Table 2. Barriers to AI Adoption in OHS

Barriers	Description
Technical Complexity	Complexity of AI algorithms, infrastructure requirements, and data integration challenges.
Organizational Resistance	Cultural inertia, resistance to change, fear of job displacement, and lack of stakeholder buy-in.
Regulatory Compliance	Evolving regulatory landscape, data privacy concerns, algorithmic bias, and liability implications.

Source: (Aldoseri et al., 2023; Badhurunnisa and Dass, 2023; Min, 2023)

The intricate nature of AI algorithms and the necessary infrastructure present significant obstacles for organizations, especially those lacking technological knowledge and resources. Consolidating various data sources, verifying algorithm precision, and upholding system compatibility require substantial investments in technology and skilled personnel. The reluctance to adopt AI in OHS is hindered by organizational inertia and resistance to change. The existence of cultural norms, fear of technological unemployment, deep-rooted practices, and concerns about job displacement act as obstacles that deter stakeholders from fully embracing AI-driven solutions (Kuzior, 2022). Consequently, this resistance hampers advancements in safety innovation.

The regulatory environment concerning AI applications in OHS is quickly changing, leading to compliance difficulties for businesses. Issues related to data protection, bias in algorithms, and legal accountability emphasize the importance of strong regulatory structures and ethical standards to ensure responsible AI integration. As technology continues to progress, there is an increasing acknowledgment of the crucial role that AI can have in transforming OHS procedures. By adopting AI-based solutions, organizations have a unique opportunity to proactively tackle OHS challenges, reduce risks, and promote a safety-oriented culture. The Fig. 1 presents a strategic approach for organizations seeking to harness the potential of AI to improve their OHS initiatives and foster a safer work environment. By emphasizing assessment, implementation, monitoring, and continuous improvement, this plan offers a structured framework for integrating AI into OHS practices and achieving significant safety outcomes.

AI Adoption Roadmap for OHS includes such practices and their explanation.

Assessment Phase:

- Identify OHS priorities and challenges within the organization.
- Assess current technological infrastructure and data availability.
- Evaluate readiness for AI integration, including organizational culture and workforce skills.

Planning Phase:

- Establish specific goals for the integration of artificial intelligence in occupational health and safety that are in line with the overall objectives of the organization.
- Create a comprehensive strategy that identifies the specific AI tools to be utilized and the anticipated advantages they will bring.
- Devote appropriate resources, such as funding and staff, to support the successful implementation of AI technologies.

Implementation Phase:

- Obtain or cultivate artificial intelligence tools and technologies customized to meet occupational health and safety requirements.
- Incorporate AI solutions into current occupational health and safety systems and processes.
- Deliver training and assistance to personnel to ensure proficient utilization of AI tools.

Monitoring Phase:

- Develop key performance indicators (KPIs) to assess the efficiency of AI in enhancing OHS results.
- Utilize advanced monitoring technologies to observe OHS data in real-time and identify possible dangers or threats.
- Regularly assess the performance of AI and gather feedback from users to pinpoint opportunities for improvement.

Continuous Improvement Phase:

- Utilize findings from AI analytics to enhance OHS strategies and procedures.
- Promote an environment of creativity and continuous learning, empowering staff to propose enhancements and optimal approaches.
- Continuously enhance AI models and algorithms to respond to evolving OHS standards and emerging hazards.

Establishment of Data-Driven Safety Culture:

- Utilize AI-generated insights to guide decision-making across all organizational levels.
- Promote cross-departmental data sharing and collaboration to improve overall safety outcomes.
- Cultivate a transparent and accountable culture, emphasizing evidence-based practices for ongoing enhancement of occupational health and safety measures.

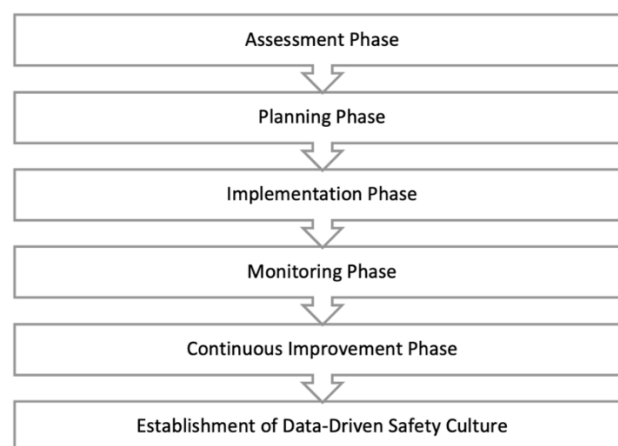


Fig. 1. AI Adoption Roadmap for OHS

4. DISCUSSION

The combination of technological management and AI represents a significant advancement in occupational health and safety, marked using data to inform decision-making, proactive management of risks, and increased awareness of safety. However, this shift in approach is not without its difficulties and factors that must be considered. Organizations face various complexities, such as concerns regarding privacy of data, ethical implications, cybercrime, and the need to enhance the skills of their workforce (Fobel and Kuzior, 2019; Kuzior et al., 2023, Ślusarczyk et al. 2024). Successfully

leveraging AI-driven solutions requires careful navigation of these challenges to ensure responsible implementation.

5. CONCLUSION

In summary, the merging of technological management and artificial intelligence marks a significant turning point in the development of occupational health and safety protocols. Despite existing obstacles, the advantages of utilizing AI-based tools for improving OHS measures are indisputable. To fully harness the transformative capabilities of technology in promoting safer, healthier, and more efficient workspaces, continued research initiatives and collaborative initiatives are essential (Kuzior et al., 2021).

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