UDC 349.2
DOI https://doi.org/10.32782/npnuola.v36.2025.15

I. V. Lagutina

ARTIFICIAL INTELLIGENCE AND OCCUPATION SAFETY AND HEALTH: NEW CHALLENGES AND OPPORTUNITIES

Formulation of the problem. Artificial intelligence (AI) is becoming an increasingly defining factor in the modern world. Its influence permeates various spheres of our lives, from business and medicine to education and entertainment. Thanks to the rapid development of technologies and algorithms, AI opens up new opportunities and transforms traditional approaches to solving problems in various industries.

Nevertheless, in 1955, John McCarthy was the first to create the term «Artificial Intelligence» [1]. Artificial intelligence is transforming our world, creating new opportunities and challenges.

This year's World Day for Safety and Health at Work 2025 focuses on «Revolutionizing health and safety: the role of AI and digitalization at work». This theme will examine various new technologies through an occupational safety and health lens, including: advanced robots; artificial intelligence (AI) and machine learning; exoskeletons; unmanned aerial vehicles (UAVs); internet of things (IoT); virtual and augmented reality. The campaign will also shed light on new work practices, such as automation of tasks, big data analysis, smart digital systems and workers management through AI. New technologies have also given rise to new types of work, such as digital platform work and remote work/hybrid work/telework, which will be further examined [2].

The **purpose** of this article is to study the impacts of AI on the labour market, paying special attention on directions of ensuring of occupational health and safety.

Analysis of recent research and publications. The existing literature mainly addresses the areas of application of AI that already been subjected to such scientists as: D. Acemoglu, J. Adams-Prassl, M. Brancati, S. Broecke, R. Brook, S. Brown, F. Calvino, T. DeStefano, E. Fernandez Macias, G. Graetz, A. Green, L. Herring, A. Hertel-Fernandez, J. Howard, A. Korinek, M. Lane, P. Restrepo, J. Stiglitz, P. Stone, M. Webb, M. Williams, and others.

Presentation of the main material of the study. One of the main impacts of AI on the labour market is the automation of routine tasks. Thanks to machine learning algorithms, many routine processes in manufacturing, logistics, and customer service can be automated. This can lead to changes in labour requirements and job losses in some sectors.

In hazardous work environments like construction, mining, and manufacturing, specialized wearable devices such as smart helmets equipped with sensors can detect harmful gases, monitor environmental conditions, and assess head injuries [3]. These wearables, integrated with AI, trigger

automatic alerts or emergency responses in case of accidents, ensuring timely assistance and preventing severe consequences [4].

Moreover, in a manufacturing facility, AI-powered cameras could monitor workers' adherence to safety protocols, such as wearing helmets or safety glasses. If a worker enters a dangerous area without the proper safety gear, the AI system can instantly alert the worker and the safety manager, preventing potential injuries. In the event of a fire in a factory, AI-powered systems could use data from smoke detectors, cameras, and other sensors to detect the source and scale of the fire. It could then communicate this information to fire crews, helping them plan their response more effectively and ensuring that the appropriate evacuation procedures are followed [5].

Also, AI comprises such subfields, such as robotics, computer vision, natural language processing, machine learning, and expert systems. AI mostly relies on machine learning, which uses algorithms to allow computers to learn from experience, providing «intelligent» outcomes without explicit programming [6].

Particularly, the incorporation of drones and unmanned aerial vehicles (UAVs) represents a stride toward executing a broad array of tasks without direct human intervention. An aerial drone photos shows farmers seeding corns at a field, shows drones working at a canola field, shows farmers picking oranges at a fruit garden [7].

Additionally, wearable devices and sensors in the workplace are pivotal in enhancing workers' well-being, safety, and overall productivity [8].

It should be mentioned that AI can play an important role in preventing workplace violence. Natural language processing (NLP) is a technique from computer science that helps to analyze large bodies of text. Using NLP, AI can scan emails and files for inappropriate language, alerting managers when such phrases are detected [9]. With voice recognition, AI can recognize spoken phrases in meetings, generating detailed reports to address instances of harassment.

Indeed in 2025, mental health is firmly at the forefront of workplace safety. Employers are increasingly recognizing that mental well-being is just as critical as physical safety, and new technologies are emerging to help identify, monitor, and address mental health risks. Mental health and wellness platforms, like apps for stress monitoring or digital counseling, combined with wearable technology for fatigue detection, offer a comprehensive solution for mental health support in the workplace [10].

However, AI also opens up new opportunities for job creation in new industries. The development of AI technologies creates demand for specialists in the fields of artificial intelligence, data analysis, programming, and engineering. In addition, the growing demand for innovative technology developers and data analysts creates new opportunities for career growth and development in these areas. Another important aspect of the impact of AI on the labour market is the need to learn new skills and adapt to change. The growth of AI requires employees to learn new technologies and skills, such as data analytics, machine learning, and robotics. In addition, it is important to develop soft skills such as communication, creativity, and problem-solving

thinking, which remain an integral part of the future of work in the context of rapid technological change.

Digital platform work is a relatively new form of work in which simple forms of AI algorithms match demand and supply of labour through a platform. Think of an app connecting someone ordering food with a delivery driver, or a website matching a person needing help fixing a leaking tap with someone offering their plumbing services. These connections are facilitated by AI-based algorithms, which are sets of instructions guiding computers' software to solve specific problems, such as pairing labour supply and need. For instance, in the food delivery situation, the algorithm allocates the job considering factors like location, but also others like the rating and previous reviews of the worker. This reliance on AI algorithms presents a significant risk: the lack of transparency. Workers and employers often have little insight into all the factors influencing algorithmic functioning and the outcomes they generate, which can lead to undetected biased decisions, dangerous situations for workers and ethical issues. While platform work also offers potential benefits for workers such as a high degree of flexibility and the opportunity to develop different skills and acquire work experience, this opacity poses challenges to platform workers' OSH. Their precarious employment status, coupled with job insecurity and unpredictable income, and factors such as high work intensity and long working hours further add to the bill [13].

AI health and safety training tools offer personalized and interactive learning, ensuring better retention and preparedness. Effective AI tools for health and safety training come equipped with features that streamline and enhance the entire training process: 1) Robust AI Tools: These tools can create dynamic and interactive course content that adapts in real-time to the learner's progress, ensuring a more tailored and effective training experience; 2) Personalized Learning: These platforms tailor training programs to meet individual learning needs, enhancing engagement and retention by providing content that adapts to each learner's progress and abilities. Their platform offers a comprehensive suite of virtual reality (VR) and 3D simulations designed to create immersive learning environments for various industries, including HVAC, electrical, plumbing, and facility maintenance; 3) Adaptive Learning Platforms: Leverage AI to adjust the difficulty and content based on the learner's progress, ensuring an effective learning curve; 4) Virtual Reality and Augmented Reality (VR/AI): Implement immersive technologies to provide realistic training scenarios, improving practical skills and knowledge retention; 5) Multi-Language Support and Translation for Global Training: By offering multi-language capabilities, you can facilitate training across diverse regions and ensure the accessibility and inclusivity of health training protocols; 6) Automation Capabilities: Automating operations streamlines processes and reduces administrative burdens, enabling organizations to focus on strategic initiatives and enhance overall efficiency; 7) Enhanced Decision-Making: Utilize AI to improve safety protocols by reducing errors and enhancing decision-making processes; 9) Comprehensive Integration: Combine automation, personalization, and data-driven insights to create a holistic approach to modern health and safety training programs; 10) Data Security and Privacy:

Prioritize safeguarding sensitive information by integrating advanced security measures, ensuring compliance with privacy regulations [14].

It should be emphasized that in May 2018, the European Commission set up an expert group to examine the impact of the digital transformation on the labour markets of the European Union. The final report on the results of the expert group's work was published on the website of the European Commission on 08.04.2019. The report provides recommendations to minimize risks, including: a) creating digital skills personal learning accounts for employees, which will allow reflecting the results of employees' acquisition of relevant skills throughout their career, the number of hours of training per year, the funds allocated for this, etc.; b) adapting employment relations to the new realities in order to prevent risks to occupational safety and health, such as mental health problems and stress, arising from digitalization and the increased volatility of the modern world of work (preventive programs to help employees through informed discourse and the provision of personalized, cost-effective, technology-based solutions); c) equalization of labour regulation in the context of standard and non-standard employment: a «new social contract» as a modernization of the social structure of labour markets through the provision of social protection against unemployment, illness and other life circumstances regardless of employment status, the creation of «underemployment insurance» and the redistribution of the value of digital rights, for example, when data is considered as capital, labour or intellectual property; d) activation of dialogue between social partners, especially in the field of labor based on online platforms [15].

The development of artificial intelligence in the coming years will increase its impact on the world of work. Thus, according to analysts from the leading consulting company McKinsey, the development of artificial intelligence today is one of the defining business opportunities for leaders, those entrepreneurs who can compete in the "data era" will win, those whose employees can effectively use artificial intelligence, ideally, the organization should be completely based on artificial intelligence and constantly develop in order to be a leader in the competitive struggle [16].

Thus, AI-based worker management (AIWM) is an umbrella term that refers to a worker management system that gathers data, often in real time, from the workspace, workers and the work they do, which are then fed into an AI-based system that makes automated or semi-automated decisions, or provides information for decision-makers (for example, HR managers, employers, workers), on worker management-related questions. Organisations implement AIWM systems to reach certain business objectives, such as increasing efficiency and productivity. AIWM involves a number of practices, including, but not limited to, enhancing worker monitoring/surveillance through, for example, performance monitoring, introducing AI-powered automatic scheduling systems to automatically allocate tasks to workers, or introducing people analytics systems in order to, for example, evaluate worker engagement or predict who is likely to leave the organisation. In addition, AIWM systems can also help with worker health, safety and overall wellbeing, if they are implemented in a safe, trustworthy, transparent and

ethical way. For instance, tools that can infer an individual's mood from their facial expressions, body language and speech patterns can make workers feel eerie and uncomfortable, forcing them to behave unnaturally and overenthusiastically. AIWM systems might also exacerbate some discriminatory biases in organisations. For example, if an AIWM system for worker recruitment is based on recruitment patterns that favour a particular race, gender or age, such a system might continue this pattern. In addition, granting autonomy to AIWM systems to make decisions might lead to issues with accountability as it is unclear who is to blame if such a system makes a mistake that leads to a negative OSH consequence [17].

Nowadays, algorithmic management is intensively used. Algorithmic management tools are widespread in the United States (with 90% of firms having adopted at least one tool to instruction, monitor or evaluate workers) and in the European countries covered in the survey (average adoption of 79%). In the United States, the high prevalence of algorithmic management is intensified further by the fact that firms tend to have adopted many tools and tools across different categories (e.g. instruction tools, monitoring tools, and evaluation tools). The intensity of algorithmic management use by French, German, Italian and Spanish firms is more moderate. The picture is different in Japan where, with a less digitalised business sector, algorithmic management appears to be less prevalent (adoption rate of 40%). Even when tools are adopted, adoption is less intense, with most Japanese firms using only one type of algorithmic management tool. The types of algorithmic management tools that firms use also vary across countries, and this is noteworthy because certain tools are more likely to bring about trustworthiness concerns. In the United States, firms commonly use tools of all types (adoption rate of 90% across instruction, monitoring and evaluation tools). However, in European countries, instruction tools (69%) and basic monitoring tools (33%) are more common than tools that could entail more risk. These include monitoring tools that may gather more sensitive data and evaluation tools that could involve more fundamental decisions (e.g. granting bonuses, training, promotion). In Japan, monitoring tools are more common (31%) than instruction and evaluation tools [18].

In sum, algorithmic management tools need to comply with existing legislation and standards, where applicable, such as existing labour law and standards on safety and health at work, as well as non-discrimination [19]. This includes compliance with regulation about transparency such as the EU Platform Work Directive, the GDPR, the EU AI Act, and where applicable national specific employee data protection legislation, like the Italian Transparency Decree. The enforcement of existing law and standards needs to be ensured, which means that for instance labour authorities need enough capacity to supervise and enforce compliance.

AI is improving the food industry by making various work processes faster, safer, and more efficient. From checking food quality with smart cameras to helping reduce waste and personalize nutrition, AI is improving the food production and delivery process. Vision AI systems can also help improve the efficiency of food businesses by providing immediate alerts and feedback when

something goes wrong. For example, the system can instantly notify staff if they are not following proper health and safety protocols.

The implementation of AI in the realm of workplace safety is accompanied by a set of challenges that require careful navigation. Among these, the advent of connected technology brings with it a heightened susceptibility to cyber vulnerabilities. As such, the necessity for robust cybersecurity measures becomes paramount. The long-term benefits of AI are undeniable, yet the initial financial outlay can be considerable. This is particularly true when considering the need for high-quality data to power AI algorithms, the procurement of which can be costly. Ethical concerns also emerge as a challenge when implementing AI. The potential for bias and discrimination in AI algorithms can lead to unfair practices, undermining the overall goal of improving workplace safety [20].

Consequently, the artificial intelligence market is rapidly expanding, and with it the need for skilled professionals. Specializing in AI requires deep knowledge in disciplines such as computer science, mathematics, statistics, and engineering. All of these factors highlight the importance of learning and adapting to change in a world where artificial intelligence is becoming an increasingly important part of the economy and society. The rapid development of AI technologies requires us to be constantly prepared to learn and adapt to be successful in the future.

Bibliography

1. Howard J. Algorithms and the future of work. Am J Ind Meds. 2022; 943–952. URL: https://pubmed.ncbi.nlm.nih.gov/36128686/

2. World Day for Safety and Health at Work 2025. URL: https://www.ilo.org/meetings-and-events/world-day-safety-and-health-work-2025

3. Campero-Jurado I, Marquez-Sanchez S, Quintanar-Gomez J, Rodriguez S, Corchado JM. Smart Helmet 5.0 for Industrial Internet of Things Using Artificial Intelligence. Sensors. 2020. URL: https://pubmed.ncbi.nlm.nih.gov/33139608/

4. Greenfield R, Busink E, Wong CP, et al. Truck drivers' perceptions on wearable devices and health promotion: a qualitative study. BMC Public Health. 2016. URL: https://pubmed.ncbi.nlm.nih.gov/27475984/

5. How AI Can Help with Occupational Health and Safety. URL: https://www.kshsafety.com/single-post/ai-health-safety

6. Niehaus S, Hartwig M, Rosen PH, Wischniewski S. An Occupational Safety and Health Perspective on Human in Control and AI. Front Artif Intell. 2022. URL: https://pmc.ncbi.nlm.nih.gov/articles/PMC9298546/

7. Farmers across China busy working at fields ahead of Chunfen. 2025 . URL: https://en.gmw.cn/2025-03/20/content_37916135.htm

8. Moshawrab M, Adda M, Bouzouane A, Ibrahim H, Raad A. Smart Wearables for the Detection of Occupational Physical Fatigue: A Literature Review. Sensors. 2022. URL: https://pubmed.ncbi.nlm.nih.gov/36236570/

9. Banda JM, Seneviratne M, Hernandez-Boussard T, Shah NH. Advances in Electronic Phenotyping: From Rule-Based Definitions to Machine Learning Models. 2018. URL: https://pubmed.ncbi.nlm.nih.gov/3121827

10. New Tech and Trends in Health and Safety in 2025. URL: https://www.spacebands.com/blog-posts/new-trends-in-health-and-safety

11. Brancati M. (2024), Digital technologies at work and psychosocial risks: evidence and implications for occupational safety and health. URL: https://osha.europa.eu/en/publications/digital-technologies-work-and-psychosocial-risks-evidence-and-implications-occupational-safety-and-health.

12. Gonzalez Vazquez, I. et al. (2024), “Digitalisation and workers wellbeing: The impact of digital technologies on work-related psychosocial risks”, JRC Working Papers Series on Labour, Education and Technology. URL: https://publications.jrc.ec.europa.eu/repository/handle/JRC138992.

13. EU-OSHA. Artificial intelligence and workplace safety and health: The future of work or a complex challenge? URL: https://healthy-workplaces.osha.europa.eu

14. Top 7 AI Tools for Health and Safety Training to Boost Workplace Safety (2025). URL: https://www.disco.co/blog/ai-tools-for-health-and-safety-training

15. Final report of the High-Level Expert Group on the Impact of the Digital Transformation on EU Labour Markets. 2020. URL: https://ec.europa.eu/digital-single-market/en/news/policy-and-investment-recommendations-trustworthy-artificial-intelligence.

16. Brown, Solly, Darshit Gandhi, Louise Herring, Ankur Puri. 2019. “The analytics academy: Bridging the gap between human and artificial intelligence”. McKinsey Quarterly. 2020. URL: https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/the-analytics-academy-bridging-the-gap-between-human-and-artificial-intelligence

17. EU-OSHA. Artificial intelligence for worker management: an overview. URL: https://osha.europa.eu/en/publications/artificial-intelligence-worker-management-overview

18. Algorithmic management in the workplace. New evidence from an OECD employer survey 2025. URL: https://www.oecd.org/en/publications/algorithmic-management-in-the-workplace_287c13c4-en.htm

19. Adams-Prassl, J. et al. (2023), “Regulating algorithmic management: A blueprint”, European Labour Law Journal. URL: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4373355

20. Grewal S. Artificial intelligence and workplace safety: A new era for the energy and utilities sector. 2024. URL: https://www.huronconsultinggroup.com/insights/ai-workplace-safety#The_transformative_role_of_AI_in_workplace_safety_FE11C5BD572D41AF8A13C462FAA2E93E

Summary

Lagutina I. V. **Artificial intelligence and occupational safety and health: new challenges and opportunities.** – Article.

This article discusses the impact of artificial intelligence on occupational health and safety. Understanding its potential and capabilities will allow us to open new horizons and reach new heights in various fields of activity. AI is affecting the labour market in all its aspects, changing the need for skills and types of work.

In turn, occupational health and safety (OHS) is defined as a multidisciplinary field concerned with safeguarding and promoting the well-being of individuals in the workplace. It encompasses a systematic approach to identifying, assessing, and mitigating risks and hazards that may arise from work-related activities. The primary goals of OHS are to prevent injuries, illnesses, and fatalities among workers and to create and maintain a work environment fostering the workers' physical, mental, and social health.

One important area of application of AI in special equipment is the development of autonomous vehicles (AV). AI allows for the automation of the control and navigation of these vehicles, ensuring their safety and efficiency in various working environments.

AI is used to analyze data from sensors and equipment on special equipment to anticipate and prevent technical problems. This reduces equipment downtime and maintenance costs, increasing overall production efficiency. AI allows developing new features and capabilities for special equipment, increasing its versatility and usefulness. AI can improve safety systems in special equipment by identifying potentially dangerous situations and preventing accidents.

New forms of AI-based monitoring of workers may also provide an opportunity to improve OSH surveillance, reduce exposure to various risk factors, including harassment and violence, and provide early warnings of stress, health problems and fatigue.

Real-time advice tailored to the individual can influence workers' behaviour and improve safety and health. AI-based monitoring could support evidence-based prevention, advanced workplace risk assessment and more efficient, risk-based, targeted OSH inspections. Information could be used by organisations to identify OSH issues, including psychosocial risks, and where OSH interventions are required at organisational level.

But ethical decisions and effective strategies and systems are needed for handling the large quantity of sensitive personal data that can be generated. Adequate legal provisions giving

national labour inspectorates access to anonymised data could, provide an opportunity for evidence-based prevention and policy-making. The need to collect data about workers should be balanced against the rights of workers to privacy and their safety and health. It is important to ensure transparency in collecting and using such data, and workers and their representatives should be empowered through the same access to information.

Key words: Artificial Intelligence, Occupational Health, Safety, Mental Health, Rights, Employer, Employee.

Анотація

Лагутіна І. В. **Штучний інтелект і охорона праці: нові виклики та можливості.** – Стаття.

У цій статті обговорюється вплив штучного інтелекту на здоров'я та безпеку праці. Розуміння його потенціалу та можливостей дозволить нам відкрити нові горизонти та досягти нових висот у різних сферах діяльності. ШІ впливає на ринок праці в усіх його аспектах, змінюючи потреби в навичках і види роботи.

У свою чергу, гігієна та безпека праці визначається як багатодисциплінарна сфера, пов'язана із захистом і сприянням добробуту людей на робочому місці. Він охоплює системний підхід до виявлення, оцінки та пом'якшення ризиків і небезпек, які можуть виникнути в результаті пов'язаної з роботою діяльності. Основними цілями гігієни праці є запобігання травмам, хворобам і смертельним випадкам серед працівників, а також створення та підтримка робочого середовища, яке сприяє фізичному, психічному та соціальному здоров'ю працівників.

Однією з важливих сфер застосування ШІ в спеціальному обладнанні є розробка автономних транспортних засобів. ШІ дозволяє автоматизувати керування та навігацію цими транспортними засобами, забезпечуючи їх безпеку та ефективність у різних робочих середовищах.

ШІ використовується для аналізу даних від датчиків і обладнання на спеціальному обладнанні, щоб передбачити та запобігти технічним проблемам. Це зменшує час простою обладнання та витрати на обслуговування, підвищуючи загальну ефективність виробництва. ШІ дозволяє розробляти нові функції та можливості спеціального обладнання, підвищуючи його універсальність і корисність. ШІ може покращити системи безпеки в спеціальному обладнанні, визначаючи потенційно небезпечні ситуації та запобігаючи нещасним випадкам.

Нові форми моніторингу працівників на основі штучного інтелекту можуть також надати можливість покращити нагляд за БГП, зменшити вплив різноманітних факторів ризику, зокрема переслідування та насильство, і забезпечити раннє попередження про стрес, проблеми зі здоров'ям і втому.

Поради в режимі реального часу, адаптовані до конкретної особи, можуть вплинути на поведінку працівників і покращити безпеку та здоров'я. Моніторинг на основі штучного інтелекту міг би підтримувати запобігання, засноване на фактичних даних, розширену оцінку ризиків на робочому місці та більш ефективні, засновані на ризиках, цілеспрямовані перевірки БГП. Інформація може бути використана організаціями для виявлення проблем з БГП, включно з психосоціальними ризиками, і там, де необхідні заходи з БГП на рівні організації.

Але для роботи з великою кількістю конфіденційних персональних даних, які можуть бути створені, потрібні етичні рішення та ефективні стратегії та системи. Адекватні законодавчі положення, що надають національним інспекціям праці доступ до анонімних даних, можуть надати можливість для запобігання та розробки політики на основі доказів. Необхідність збору даних про працівників має бути збалансована з правами працівників на недоторканність приватного життя та їхню безпеку та здоров'я. Важливо забезпечити прозорість у зборі та використанні таких даних, а працівники та їхні представники повинні мати однаковий доступ до інформації.

Ключові слова: штучний інтелект, охорона праці, безпека, психічне здоров'я, права, роботодавець, працівник.