ENHANCING WORKER HEALTH AND SAFETY THROUGH AI-DRIVEN SYSTEMS: IMPLICATIONS OF THE ARTIFICIAL INTELLIGENCE ACT

1 Introduction

This Future of Work expert article explores the opportunities and challenges that the adoption of the Artificial Intelligence Act (hereinafter 'the AI Act') ([1]) may pose for the development and use of both existing and emerging AI-driven occupational safety and health (OSH) systems. It offers a forward-looking perspective on how this new piece of legislation, together with its risk-based approach, might halt, impede or have no impact on current and potential future applications of these technologies.

The adoption of the AI Act marks a significant milestone in the regulation of AI systems and practices within the European Union (EU) by establishing harmonised rules for the development, marketing, deployment and use of AI systems. Specifically, with this legislation, the European legislator aims to strike a balance between the opportunities and benefits of AI-driven technological innovation and the need to develop human-centric, ethical and trustworthy AI, where safety, health and the fundamental values and rights enshrined in the Charter of Fundamental Rights of the European Union (hereinafter 'the Charter') are strongly protected, including the right to human dignity, physical and mental integrity, data protection, and fair and just working conditions (European Commission 2021) ([2]). To achieve this goal, the AI Act adopts a risk-based approach to categorise AI systems and practices according to the risk they pose.

Box 1: The risk-based approach of the AI Act

The AI Act identifies four categories of risk: unacceptable risk, high risk, transparency risk and minimal or no risk (European Commission 2025c) ([3]). Based on this classification: a) certain AI systems are prohibited because their risks are deemed unacceptable (e.g. some AI systems that perform social scoring) ([4]); b) a range of AI systems are classified as high risk, subject to specific mandatory requirements (e.g. a risk management system) and obligations for the various operators in the AI value chain, including AI providers (technology developers) and AI deployers (such as employers in workplace settings) ([5]); c) for four types of AI systems (e.g. AI emotion recognition technologies that are not prohibited but are considered high-risk systems, chatbots and generative AI), specific transparency and information obligations are imposed on AI providers and/or deployers, including the requirement to inform individuals exposed to the use of such systems ([6]); and d) AI systems in the minimal or no risk category (e.g. spam filters) are not regulated, but AI providers and developers can draw up codes of conduct ([7]) (European Parliament 2024).

This legislative development raises the question of how the AI Act might influence the ongoing and future development and use of AI-driven systems aimed at safeguarding and improving occupational safety and health (hereinafter 'AI-driven OSH systems'), specifically OSH smart digital systems such as

[1] Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, 168/2013, 2018/858, 2018/1139 and 2019/2144 and Directives 2014/90/EU, 2016/797 and 2020/1828 (AI Act) (Text with EEA relevance), OJ L, 2024/1689, 12.7.2024.
[2] These rights are laid down, respectively, in Articles 1, 3, 8 and 31 of the Charter.
[3] See, for example, Recital 26 and Article 1 of the AI Act.
[4] Chapter II, Article 5 of the AI Act.
[5] Chapter III of the AI Act.
[6] Chapter IV of the AI Act.
[7] Article 95 of the AI Act.

wearables, smart robots, exoskeletons and collaborative robots (cobots) ([8]). Research on these technologies is rapidly advancing, with studies exploring new device types that could enter the market for workplace applications (e.g. ingestible sensors for monitoring occupational heat stress, Callihan et al. 2023) or are already commercially available (e.g. Moore, Barnard et al. 2024; Patel et al. 2022). At the same time, some of these systems are gradually being adopted in the workplace (EU-OSHA 2025a). For example, data from the fourth European Survey of Enterprises on New and Emerging Risks (ESENER 4) shows that 13% of the establishments surveyed reported using wearable devices, up from just 4.8% in 2019 (EU-OSHA 2025c; EU-OSHA 2019). Additionally, data from OSH Pulse 2025 indicates that 32% of workers across the EU are using one or more advanced digital technologies, a category that includes wearables, smart robots and cobots (EU-OSHA 2025d).

These technologies present opportunities to enhance workplace safety and health. However, they may also pose serious risks not only to workers' health and safety but also to the protection of other fundamental rights, including those relating to personal integrity and data protection. Several recent studies have highlighted this dual nature. For instance, wearables can identify – and at times predict – real-time OSH risks, provide early warnings to workers, and trigger alerts to site supervisors when safety thresholds are exceeded. Smart robots, cobots and assistive technologies such as exoskeletons can replace or support workers in dangerous and physically demanding jobs and tasks (ILO 2025; European Commission 2025b; OECD 2024; EU-OSHA 2023a; EU-OSHA 2022a; Patel et al. 2022). At the same time, however, these technologies may introduce physical safety and health risks (e.g. injuries due to human-robot interactions or exoskeletons) and psychosocial risks (e.g. stress and anxiety) due to factors such as constant monitoring and reduced or loss of autonomy (ILO 2025; European Commission 2025b; European Parliament 2025b; EU-OSHA 2023a).

To explore the opportunities and challenges that the AI Act poses for AI-driven OSH systems, this article is divided into four main parts. Section 2 examines a practice that is prohibited in the AI Act and is relevant to the topic of this piece: AI-driven emotion recognition. It provides practical examples of technologies that are subject to this prohibition (Section 2), those that are not classified as such (Section 2.1) and those classified as exceptions 'for medical or safety reasons' (Section 2.2). Section 3 investigates how the AI Act's high-risk category applies to AI-driven OSH systems. Section 4 considers the interplay between the AI Act and existing EU legislation, such as Framework Directive 89/391/EEC and the General Data Protection Regulation (GDPR). Finally, Section 5 identifies gaps and key takeaways on the practical application of the AI Act to AI-driven OSH systems and offers insights for relevant stakeholders, including employers, workers and their representatives. The paper ends with some concluding remarks and open questions intended to guide further debate on the topic.

2 Example of a prohibited AI practice: AI emotion recognition technologies in the workplace

The field of AI emotion recognition encompasses a wide range of technologies, including innovative software for speech and facial recognition and analysis, software for keystroke patterns analysis, and wearable devices such as smart earbuds (Moore, Barnard et al. 2024; Dutch Data Protection Authority 2025a). In the workplace, these technologies have a wide range of potential applications across various occupations and sectors (e.g. office environments like customer service and call centres, construction and transportation), including selection of personnel, evaluation of worker engagement levels, performance monitoring and appraisal, coaching and training, improving and personalising workplace learning, and enhancing workers' safety, health and well-being (Abraha 2025; European Commission

[8] This article uses the definition of 'new OSH monitoring systems' in EU-OSHA 2023a to delimit the scope of smart digital systems for OSH improvement that are analysed in light of the AI Act ('New OSH monitoring systems use digital technologies to collect and analyse data in order to identify and assess risks, prevent and/or minimise harm, and promote OSH'). It also considers only those smart digital systems for OSH improvement that are classified as 'AI systems' under Article 3(1) of the AI Act, a term that is broadly defined to encompass a wide range of systems that use machine-learning approaches (e.g. supervised learning) or logic- and knowledge-based approaches to generate, for instance, recommendations or predictions based on the input received (European Commission 2025a).

2025c; Dutch Data Protection Authority 2025a; European Commission 2025b; EPIC 2024; European Parliament 2020; Eurofound 2020).

The AI Act classifies the use of AI emotion recognition technologies in the workplace as a prohibited AI practice ([9]), with the term 'workplace' to be interpreted broadly, encompassing both physical and virtual workplaces and all stages of employment, including recruitment (European Commission 2025c) ([10]). Specifically, the AI Act defines an AI emotion recognition system as one 'for the purpose of identifying and inferring emotions or intentions of natural persons on the basis of their biometric data' ([11]). The concepts of 'emotions or intentions' and 'biometric data' are therefore central to this definition and determine its scope of application, specifying which AI systems classifies as emotion recognition and are therefore prohibited. Both concepts need to be interpreted broadly (European Commission 2025c) to capture a wider spectrum of AI systems that can ostensibly identify workers' affective states.

The AI Act does not define what constitutes an 'emotion or intention', nor does it distinguish between the two terms (Marassi 2025). It does, however, provide a non-exhaustive list of examples (Commission 2025c), which includes happiness, sadness, anger, surprise, disgust, embarrassment, excitement, shame, contempt, satisfaction and amusement ([12]). Other affective states usually considered to be emotions encompass fear, guilt, compassion, relief, hope, love, boredom and anxiety (Dutch Data Protection Authority 2025a; European Commission 2025c). The qualification of stress, whether an emotion or a physical state ([13]), has been the subject of ongoing debate (see, for example, Dutch Data Protection Authority 2025b; Drake 2025). Although not legally binding (Commission 2025c), the European Commission's guidelines on prohibited practices offer some clarity on the issue by specifying that AI systems used for general stress monitoring are not covered by the exception to the prohibition for 'medical or safety reasons' ([14]), thereby indirectly qualifying stress as an emotion (European Commission 2025c; Marassi 2025a). Similarly, the Dutch Data Protection Authority also includes AI systems that monitor stress levels in the category of AI emotion recognition (Dutch Data Protection Authority 2025a).

Moreover, the identification and inference of workers' emotions are prohibited only when based on the processing of biometric data, including personal data resulting from the analysis of a person's physical attributes (e.g. fingerprints, facial contours and iris patterns), physiological characteristics (e.g. heart rate and brain waves) and behavioural traits (e.g. gait, head posture, keystroke patterns and eye movements) (European Commission 2025c; Moore, Barnard, et al. 2024; European Parliament 2021).

Box 2: Examples of AI-driven OSH systems that could qualify as AI emotion recognition systems under the AI Act

- Neurotechnologies, i.e. technologies that record the wearer's brain activity, when used to track a worker's cognitive stress. Examples include wearable devices such as electroencephalogram (EEG) headphones or earbuds and EEG-based smart glasses (Moore, Barnard, et al. 2024; Rathenau 2025).
- Technologies that track workers' physiological parameters associated with stress (e.g. heart rate variability) in the context of workplace wellness initiatives, such as smartwatches and smart rings (Dutch Data Protection Authority 2025a).

[9] Article 5(1)(f) of the AI Act. For the full text of the article, see Annex 1 at the end of the document.
[10] Chapter II of the AI Act became applicable on 2 February 2025, in line with Article 113 of the AI Act.
[11] Article 3(39) of the AI Act.
[12] Recital 18 of the AI Act.
[13] If stress is regarded as a physical state rather than an 'emotion or intention', then AI systems that monitor stress levels may fall outside the scope of the prohibition on AI emotion recognition technologies in the workplace under the AI Act. Section 2.1.B examines the distinction between 'emotion or intention' and physical state, and discusses its relevance in determining what AI systems fall under or outside the scope of the prohibition.
[14] Article 5(1)(f) of the AI Act provides for an exception to the prohibition on AI emotion recognition technologies in the workplace, i.e. when they are used for 'medical and safety reasons'. This exception and its scope are examined in Section 2.2.

2.1 AI systems not classified as AI emotion recognition systems under the AI Act and therefore not prohibited

Based on the text of the AI Act and the Commission's guidelines on prohibited practices, three AI system categories fall outside the scope of the prohibition on AI emotion recognition technologies in the workplace (European Commission 2025c): A) AI systems that infer emotions on a basis other than biometric data; B) AI systems that infer physical states; C) AI systems that detect only 'readily apparent expressions, gestures or movements'. These AI systems are therefore not subject to the AI Act's ban on AI emotion recognition at work.

That said, these exclusions do not imply that their use in the workplace is automatically permitted, as other EU and national legislation may still prohibit their use or impose limitations and (pre-) conditions (e.g. data protection law and OSH legislation). Furthermore, these systems may still fall under one of the high-risk cases defined in the AI Act (see Section 3 below).

A) AI systems that infer emotions on a basis other than biometric data

As mentioned above, the AI Act defines AI emotion recognition systems as those based on the analysis of biometric data. This means that AI systems that perform sentiment analysis to infer workers' emotions – for example, by analysing textual information in emails (European Commission 2025c) – are not considered AI emotion recognition systems under the AI Act and are therefore not prohibited by the AI Act's provision banning AI emotion recognition in the workplace.

Box 3: Examples of AI systems that can infer emotions but are not based on biometric data analysis

- AI systems that can infer emotions by analysing text in emails, Microsoft Teams messages and other communications to measure employee engagement and satisfaction levels (Rathenau 2020).
- AI systems such as mental health chatbots that perform sentiment analysis on workplace written communications to prevent psychosocial risks (e.g. burnout) and to safeguard psychosocial safety (e.g. harassment) (ILO 2025; European Commission 2025b; EU-OSHA 2022a; EU-OSHA 2022b).

B) AI systems that infer physical states

The AI Act indicates that physical states are excluded from the notion of emotion recognition. Therefore, AI technologies that infer physical states are not subject to the prohibition on AI emotion recognition systems in the workplace ([15]). Pain and fatigue are cited as examples of physical states, illustrated with an example of an AI system used to detect fatigue in professional pilots or drivers to help prevent accidents ([16]).

The distinction drawn between emotions and physical states in the AI Act has been criticised, as the boundaries between the two concepts can be blurred. For example, stress – which the European Commission's guidelines on prohibited practices appear to classify as an emotion (see Section 2 above) – and fatigue, identified as a physical state under the AI Act, can both manifest through mental and emotional signs, as well as physiological changes in the body (Charmeil 2025; Dutch Data Protection Authority 2025b).

While further clarity and guidance on this issue are needed, the explicit recognition of fatigue as a physical state in the AI Act and in the European Commission's recently adopted guidelines on prohibited practices could provide a basis for the further development and use of AI-driven OSH systems designed to monitor workers' real-time alertness and drowsiness and to detect and predict work-related physical

[15] Recital 18 of the AI Act. Also noteworthy is the fact that, according to the European Commission's guidelines on prohibited practices, AI systems that detect drowsiness and fatigue in drivers and prompt them to rest in accordance with safety laws are beneficial and do not qualify as exploitation of vulnerabilities. Therefore, they are not prohibited under Article 5(1)(b), which bans AI systems that exploit individuals' vulnerabilities, such as those related to age, and that cause, or are likely to cause, significant harm (European Commission 2025c).

[16] Recital 18 of the AI Act.

fatigue in high-risk working environments. Examples include industries where workers operate heavy machinery (e.g. mining), work at height (e.g. construction), or transport people or goods (e.g. truck and bus drivers, high-speed train drivers, and pilots) (Moore, Barnard et al. 2024; EU-OSHA 2023a).

In this regard, research on – and the early commercialisation of – AI-based fatigue monitoring systems is already under way (EU-OSHA 2024a). These technologies usually analyse a wide range of physiological parameters that studies have linked to fatigue, such as heart rate and heart rate variability, respiratory rate, skin temperature, brain waves/activity, eye blinks (e.g. frequency and duration) and changes in head movements (Moshawrab et al. 2022; EU-OSHA 2023a; Bustos 2021).

Box 4: Examples of AI systems that monitor fatigue

- Neurotechnologies for the early detection and prediction of individual fatigue levels in high-risk sectors such as transportation, mining and construction (see, for example, European Data Protection Supervisor 2024; Steindl 2025). These technologies record the wearer's brainwave activity in real time, as changes in the brain's electrical patterns can indicate increasing drowsiness and signal that alertness levels are approaching a critical threshold. Examples of such technologies include EEG-based wearables such as smart safety headwear (e.g. helmets and caps) with integrated headbands that measure the wearer's brain activity (Rathenau 2025; Muhl 2024; Rasouli et al. 2024; EU-OSHA 2024a; Patel 2022; Moshawrab et al. 2022).
- AI-powered camera systems (e.g. dual-facing onboard cameras) that can detect signs of drowsiness by monitoring changes in eye and head movements, as well as driving behaviour such as inconsistent steering (ILO 2025; Moshawrab et al. 2022).
- Wearables, including smartwatches, and smart textiles (e.g. smart vests, smart footwear and insoles, and smart glasses) that measure workers' vital signs (e.g. heart rate) or other fatigue indicators (e.g. gait changes, eye blinks, eyelid movements and head movements) to detect signs of physical exertion or fatigue (Moore, Barnard et al. 2024; Rasouli et al. 2024; Moshawrab et al. 2022; Patel 2022).

C) AI systems that detect only 'readily apparent expressions, gestures or movements'

AI systems that detect only a person's expressions, gestures or movements – such as a facial expression like a smile, hand or arm movements, or a raised voice – without further identifying or inferring an emotion or intention, are excluded from the notion of emotion recognition systems under the AI Act (European Commission 2025c) ([17]). In this regard, the European Commission's guidelines on prohibited practices cite an example of an AI system that tracks how often a worker smiles, noting that this system does not perform emotion recognition (European Commission 2025c).

This exclusion has faced criticism, as the boundary between emotion recognition and expression recognition is not clear cut (Dutch Data Protection Authority 2025b). In practice, even AI systems that claim to detect only observable expressions, such as a person's smile, may still infer information about inner emotional states, such as happiness associated with a smile or anger associated with a raised voice (McStay and Bakir 2025). This creates a potential (and undesirable) loophole that could allow tech developers to circumvent the prohibition on AI emotion recognition in the workplace by qualifying an AI system as merely detecting workers' cues and expressions, such as AI coaching tools for sales employees that provide AI-generated feedback based on workers' facial expressions (e.g. smiling) or voice characteristics (e.g. speaking speed) (EPIC 2024; McStay and Bakir 2025).

[17] Recital 18 of the AI Act.

2.2 The 'medical or safety reasons' exception: when AI emotion recognition in the workplace is permitted

The AI Act provides an exception to the prohibition on AI emotion recognition in the workplace that may be utilised by tech developers and AI deployers (i.e. employers in this context) to support the further development and use of AI-driven OSH systems. Specifically, emotion recognition is allowed when such technologies are used for medical or safety reasons. Unfortunately, the AI Act offers just one example that might be subject to this exception: AI systems intended for therapeutical use ([18]). The lack of further clarification has raised significant questions about the scope of the exception, particularly regarding how it should be interpreted and applied in practice (see, for instance, Dutch Data Protection 2025b; Drake 2025).

The European Commission's guidelines on prohibited practices provide some practical guidance on the key factors to consider when deciding, on a case-by-case basis ([19]), whether the exception applies, along with some examples. Notably, the 'medical or safety reasons' exception should be interpreted narrowly (European Commission 2025c). This means that several factors must be considered when determining whether the exception applies. For example:

1. Is the use of AI emotion recognition **necessary** to protect workers' health and safety, rather than serving other employer needs such as performance monitoring?
2. Are there **less intrusive** means of achieving the same purpose (i.e. OSH protection)?
3. What (technical) **safeguards** have been put in place regarding, for instance, how much time the technology is used, who has access to the data and how much data is being processed?

The key point is that implementing AI emotion recognition must be necessary and proportionate to protecting workplace health and safety, and the information derived from such data processing must not be misused by employers – for instance, for performance monitoring (European Commission 2025c).

Box 5: Examples of the 'medical or safety reasons' exception in practice

A. When the exception is not applicable

In line with the European Commission's guidelines on prohibited systems, this exception does not apply to AI emotion recognition systems intended for general monitoring of stress levels and for the detection of general aspects of well-being and mental health issues like burnout and depression (European Commission 2025c). Research in these fields has expanded rapidly in recent years (see, for example, Moore, Barnard, et al., 2024; Barac et al. 2024; Herold et al. 2024; EU OSHA 2023a; Khakurel et al. 2017), alongside the commercialisation and early application of these technologies.

Examples include AI-powered facial recognition technologies to measure workers' stress levels (e.g. in office jobs) and wearables such as smartwatches, wristbands and smart rings used in the context of corporate wellness initiatives (Moore, Barnard, et al. 2024; Ajunwa 2023). Although the European Commission's guidelines on prohibited practices do not specify the underlying reason for this exclusion, one could argue that such AI systems may not be deemed necessary to protect workers' health and/or that there are less intrusive ways to achieve the same goal without monitoring workers at such a granular level.

B. When the exception is likely applicable

The exception may apply to AI emotion recognition in high-risk working environments, where early detection of stress, cognitive overload or emotions such as anger and anxiety could help prevent serious or fatal accidents. The crucial point here is that an AI emotion recognition system must be used solely for safety reasons, with 'safety' understood as the protection of life and health, rather

[18] Recital 44 of the AI Act.

[19] The European Commission's guidelines on prohibited practices stress that the application of Article 5 (Prohibited AI practices) of the AI Act requires a case-by-case assessment, 'which takes due account of the specific situation at issue in an individual case' (European Commission 2025c).

than the protection of other employer interests (European Commission 2025c). The example provided in the European Commission's guidelines on prohibited practices is a system used to monitor the stress levels of workers who operate dangerous machinery or handle hazardous chemicals (European Commission 2025c).

By extension, although a case-by-case assessment is required, one could also include AI-driven OSH systems that monitor stress levels in sectors and occupations where workers are exposed to stressful working conditions and where accidents can be fatal not only for the workers concerned but also – in light of the broad phrasing 'protection of life and health' in the European Commission's guidelines on prohibited practices – for others in the working environment (e.g. co-workers, passengers and road users). Examples could include transportation workers (e.g. pilots, road-transport drivers and high-speed train drivers), construction workers and first responders (e.g. firefighters). In this regard, research has been carried out on the use of wearable physiological monitoring to detect stress levels in occupations like firefighters and construction workers (see, for instance, Bustos 2021; Meina et al. 2020).

As a final note, the safety-reasons exception does not apply to AI systems used for occupational fatigue monitoring, even when such systems are intended to enhance workplace safety. As mentioned in Section 2.1, these systems do not qualify as emotion recognition technologies and therefore fall outside the scope of the prohibition on AI emotion recognition systems in the workplace under the AI Act (European Commission 2025c).

3 High-risk AI systems in the AI Act and AI-driven OSH systems

In addition to listing prohibited AI practices and systems, the AI Act also classifies a number of AI systems as high risk, as they pose a significant risk of harm to safety and health or to people's fundamental rights, including workers' rights ([20]). Specifically, the AI Act identifies two main categories of high-risk AI systems: 1) AI systems that are intended to be used as safety components of a product or are themselves products (e.g. personal protective equipment, PPE) (Section 3.1) ([21]); and 2) stand-alone systems included in a predefined list in the AI Act (Section 3.2) ([22]). Both are relevant for applications of AI-driven OSH systems.

3.1 AI systems that are intended to be used as safety components of a product or are themselves products

The AI Act sets out rules for AI systems that are embedded in products such as PPE (e.g. helmets), machinery (e.g. industrial robots), medical devices and toys, and that perform a safety-related function for the product (e.g. an AI system serving as a safety component of a lift) or that are products in their own right (e.g. an AI system that is itself a medical device) (Dutch Ministry of Economic Affairs 2025) ([23]).

With respect to AI systems that constitute safety components of a product such as PPE or that are products in their own right, two conditions must be met for them to be classified as high-risk AI: first, the product must fall under one of the EU's product safety regulations listed in the AI Act (e.g. the Machinery

[20] See Recitals 46-48 of the AI Act.

[21] Article 6(1), in combination with Annex I. These rules will be applicable from 2 August 2027 (Article 113(c) of the AI Act). However, on 19 November 2025, the European Commission published the Digital Omnibus proposal, which, inter alia, provides for a 12-month postponement of the application of these provisions following a Commission decision confirming that adequate measures supporting compliance with Chapter III are available (and, in any event, no later than 2 August 2028). See Amendment 31 of the European Commission's Proposal for a Regulation of the European Parliament and of the Council amending Regulations (EU) 2024/1689 and (EU) 2018/1139 as regards the simplification of the implementation of harmonised rules on artificial intelligence (Digital Omnibus on AI).

[22] Article 6(2), in combination with Annex III, (1)(c) and (4)(a) and (b). Article 6(2) and the corresponding obligations in this Regulation will apply from 2 August 2026 (Article 113(b) of the AI Act). However, in the Digital Omnibus proposal, the European Commission proposes a six-month postponement of the application of these provisions following a Commission decision confirming that adequate measures supporting compliance with Chapter III are available (and, in any event, no later than 2 December 2027) (see Amendment 31 of the Digital Omnibus proposal).

[23] See Recitals 50-51 of the AI Act.

Directive 2006/42 or the PPE Regulation 2016/425) ([24]); second, the product must be subject to a third-party conformity assessment by an independent external body (i.e. a notified body) before being placed on the market under the applicable product safety legislation (Dutch Ministry of Economic Affairs 2025). The rationale behind including these AI systems in the high-risk category is to ensure that any health and safety risks associated with the product due to its AI component are addressed before the product is placed on the market ([25]).

Box 6: Examples of AI systems that are intended to be used as safety components of a product

Smart personal protective equipment (PPE)

Smart PPE designed to perform functions such as detecting falls from height, hazardous gases and elevated noise levels (ILO 2025) might qualify as high-risk AI systems (for more on smart PPE, see EU-OSHA 2020), provided that it is subject to a third-party conformity assessment under the PPE Regulation 2016/425. Research is currently under way on applications for various types of smart PPE, while some products are already available on the market. Examples include: a) wearable smart textiles, such as smart insoles and smart belts, used in the construction industry to detect loss-of-balance events by measuring indicators like workers' biomechanical parameters (for example, by means of an accelerometer) (EU-OSHA 2024b; Rasouli 2024); and b) smart helmets for the detection of hazardous gases in working environments such as mines (ILO 2025).

Smart 'machinery'

Examples of AI-driven OSH systems that may warrant closer examination, as they could fall into this high-risk AI category, are cobots, unmanned aerial vehicles (i.e. autonomous drones) and robots used to perform worksite inspections and dirty, dangerous and demeaning (3Ds) jobs such as handling radioactive waste and applying pesticides (ILO 2025; EU-OSHA 2023a), provided that these technologies are classified as 'machinery' under the new Machinery Directive 2023/1230 and are subject to a third-party conformity assessment under this regulation (for more on this topic, see Peruzzi 2024 and Mahler 2024).

3.2 Stand-alone high-risk AI systems in the workplace

The AI Act classifies certain stand-alone AI systems as high risk if they are included in a predefined list of eight use cases or areas (e.g. employment, education and vocational training, law enforcement and administration of justice) ([26]) and present a significant risk of harming safety, health or fundamental rights ([27]). Two use cases are relevant for applications of AI-driven OSH systems.

First, the AI Act refers to 'emotion recognition technologies', albeit without specific reference to workplace applications ([28]). Specific AI emotion recognition systems in the workplace covered by the exception to the prohibition 'for medical or safety reasons' (e.g. to monitor workers' stress levels in high-risk occupations – see Section 2.2 above) could be classified as high-risk systems under the AI Act (European Commission 2015c; Drake 2025).

Second, the AI Act includes a specific use case titled 'Employment, workers' management and access to self-employment', which covers high-risk AI systems intended to be used for: a) recruiting or selecting personnel; and b) making decisions that affect the terms of work-related relationships, the promotion or termination of work-related contractual relationships, allocating tasks based on individual behaviour or personal traits or characteristics, or monitoring and evaluating workers' performance and behaviour ([29]). By including such aspects, the AI Act targets AI-driven management systems that are becoming

[24] See Annex I, Section A, points 1 (Machinery Directive) and 9 (PPE Regulation) of the AI Act. It should be noted that the Machinery Directive has been replaced by Regulation (EU) 2023/1230, which will apply from 20 January 2027.
[25] See, for instance, Recital 47 of the AI Act.
[26] Annex III of the AI Act.
[27] See Recital 52 of the AI Act.
[28] Point 1(c) of Annex III of the AI Act.
[29] Article 6(2) in combination with Annex III(4)(a) and (b) of the AI Act.

increasingly prevalent in the workplace to select candidates, give instructions and monitor and evaluate performance (OECD 2025). Examples of such AI systems include, but are not limited to, handheld devices and ring scanners used in warehouses to deliver algorithmic instructions or directions and allocate tasks; algorithms used to monitor and evaluate platform workers; and AI recruitment software and tools that screen and select candidates through, for instance, online games or AI-driven interviews (European Commission 2025b; European Parliament 2022; EU-OSHA 2022b; Wood 2021). Scientific literature in the field of law and policy studies have linked the use of such technologies to potentially serious violations of a broad range of fundamental workers' rights, including those relating to data protection, non-discrimination, and health and safety at work (see, for example, European Commission 2025b; ILO 2025; Warter 2025; Aloisi 2024; Cefaliello, Moore and Donoghue 2023).

Box 7: AI-driven OSH systems and high-risk AI systems in 'Employment, workers' management and access to self-employment'

One key question is whether AI-driven OSH systems can be classified as high-risk systems under the area 'Employment, workers' management and access to self-employment'. To address this point, it is worth noting that the notion of 'intended purpose' is central to determining whether an AI system falls within the high-risk category (European Commission 2025a; Cefaliello and Kullmann 2022). The 'intended purpose' means the 'use for which an AI system is intended by the provider [the developer]' and is specified in the documentation for the AI system (e.g. instructions for use, promotional material or technical documentation) ([30]).

An AI system is classified as high risk if its provider intended it to be used for one of the applications listed in the AI Act. However, if the AI provider did not intend the AI system to be used in one of the areas defined in the AI Act, but the AI deployer (e.g. the employer) nevertheless uses it in such an area, the AI system will still be considered high risk. In this case, the AI deployer is deemed to be the AI provider and assumes all corresponding obligations (Dutch Ministry of Economic Affairs 2025) ([31]).

In the area 'Employment, workers' management and access to self-employment', the AI Act identifies high-risk systems as those 'intended to be used for the recruitment or selection of natural persons (…)' and 'intended to be used to make decisions affecting terms of work-related relationships, the promotion or termination of work-related contractual relationships, to allocate tasks based on individual behaviour or personal traits or characteristics or to monitor and evaluate the performance and behaviour of persons in such relationships'.

The AI Act does not explicitly refer to AI systems intended to be used for OSH-related purposes, thereby creating uncertainty about whether, and under what circumstances, AI-driven OSH systems should be classified as high risk (Marassi 2024; Peruzzi 2024). Further guidance is needed to clarify this point. For instance, a question that arises is whether AI-driven OSH systems could fall under 'Employment, workers' management and access to self-employment' if their intended purpose is to protect workers' health and safety (e.g. by alerting them to hazards) and if this objective is achieved by, for example, allocating workers tasks based on their personal characteristics or monitoring their behaviour, both of which are explicitly mentioned in the AI Act (Marassi 2024; Weerts 2022). Examples of such technologies might include wearables that monitor real-time personal physiological heat strain based on individual characteristics such as heat tolerance and perform functions such as calculating optimal work-rest cycles and adjusting shifts (Notley et al. 2018), and AI-powered cameras that can detect unsafe and risky driving behaviours such as tailgating and using mobile phones or that check whether PPE is being worn correctly (ILO 2025; EU OSHA 2023).

[30] See Article 3(12) of the AI Act.
[31] See Article 25 of the AI Act.

4 The interplay between the AI Act, EU OSH legislation and the GDPR

4.1 The AI Act as complementary legislation

The AI Act is intended to complement EU and national legislation, including that relating to data protection (e.g. the GDPR), OSH (e.g. Framework Directive 89/391/EEC) and product safety (e.g. the Machinery Directive) (Cristofolini 2024) ([32]). It adds an extra layer of protection for the development, marketing and use of human-centric and trustworthy AI. Notably, it does not affect the application of relevant EU and national legislation to AI systems and practices. In practice, this means that the use of an AI system may be considered unlawful if it violates GDPR provisions or labour legislation, even if it is not prohibited under the AI Act ([33]). For example, an AI emotion recognition system might be covered by the 'medical or safety reasons' exception, yet its use in the workplace could still breach data protection or employment legislation (European Commission 2025c).

With respect to EU OSH legislation, Framework Directive 89/391/EEC establishes that employers have a legal obligation to ensure a safe and healthy working environment by preventing or minimising OSH risks. As the duty of care lies with employers, the legal literature and several EU-OSHA studies have stressed that the implementation of AI-driven technologies in the workplace, including smart OSH systems, must not lead to a shift of OSH responsibilities from employers to workers – or to AI itself (EU-OSHA 2025e; EU-OSHA 2023a; Jarota 2023). This issue is becoming increasingly relevant as technologies evolve and incorporate features such as early warnings, which may 'trigger' questions about potential shifts in OSH responsibility in certain scenarios. In this regard, even when AI-driven OSH systems provide workers with individual real-time feedback and/or coaching (e.g. guidance on posture), which empowers them to take proactive steps to safeguard their health and safety at work, OSH responsibility ultimately remains with the employer.

The importance of maintaining employer responsibility for OSH aligns with the general principle of prevention that lies at the heart of EU and national OSH legislation and under which employers are required to take all necessary measures to prevent and mitigate OSH risks. This principle also applies when AI systems are involved (ILO 2025). In this regard, employers are required to conduct a systematic OSH risk assessment and take the appropriate preventive and protective measures, even when the AI system being introduced is intended to benefit workers' health and safety. As studies have shown, OSH smart digital systems can also pose serious OSH risks that employers must identify, evaluate and address (see, for example, EU-OSHA 2023a).

In this context, the introduction of AI-driven OSH systems must be integrated into companies' existing OSH management and comply with the general principle of 'hierarchy of control' measures. In practice, this has two key implications. First, employers should prioritise AI systems that eliminate hazards (e.g. smart robots) before resorting to solutions like smart PPE, a point underscored by a recent ILO study (ILO 2025). Second, AI systems cannot be viewed as a replacement for 'traditional' preventive and protective measures, but instead should complement them as part of a proactive risk assessment process (EU-OSHA 2024c; EU-OSHA 2023a; EU-OSHA 2023b). For example, employers should not prioritise the implementation of smart helmets that monitor fatigue levels in high-risk industry sectors – which are likely considered high-risk AI systems under the AI Act – without also having a fatigue risk management policy or other organisational measures to prevent fatigue.

Considerations under data protection law must also play a key role both before and during the implementation of AI-driven OSH systems. As the AI Act does not affect the application of the GDPR, employers planning to use such technologies must ensure that they comply with data protection principles, including considering whether processing workers' (sensitive) personal data through the use of such AI systems is necessary for safeguarding workplace health and safety and proportionate (Article 29 Data Protection Working Party 2017). Determining the appropriate legal basis for processing personal data is key, particularly when AI systems process workers' sensitive personal information such as

[32] Recitals 9 and 64 and Article 2(7) and (9) of the AI Act.
[33] Article 5(8) of the AI Act.

biometric data (e.g. brain activity) or health data (e.g. vital signs as a way of measuring stress or heat strain levels) (see, for example, Marassi and Bolte 2025). For example, the Dutch Data Protection Authority ruled that consent cannot be used as a legal basis for processing data collected with wearable technology (in that case, smartwatches used to monitor workers' stress levels) (Moore 2018). Similar concerns arise regarding the application of the principle of purpose limitation, especially when AI-driven OSH systems generate insights that go beyond health and safety and could be used for performance monitoring and appraisal (see, for example, Custers and Ursic 2018). A case in point could be AI-powered dual-facing camera systems for fleet management safety, which, depending on their functionalities, may also provide employers with insights into driver behaviour (e.g. smoking).

4.2 Employers' obligations under the AI Act and information (and consultation) rights

The AI Act sets out several requirements for high-risk AI systems (e.g. in relation to data governance) and obligations for AI providers (i.e. tech developers), including the implementation of a risk management system ([34]). It also outlines a number of obligations with which AI deployers (e.g. employers) of high-risk AI systems must comply. These obligations apply to AI-driven OSH systems classified as high risk. Specifically, in addition to obligations related to the appropriate use of the AI system and human oversight (Cristofolini 2024) ([35]), employers are required to inform workers' representatives and affected workers before using the AI systems ([36]). It stipulates that relevant provisions on 'information or information and consultation obligations' laid down in other national and European legislation remain applicable, including Directive 2002/14/EC and implementing national legislation ([37]).

The obligation to involve workers' representatives and affected workers prior to introducing an AI system underlines the importance of and need for a participatory and collaborative approach in both the design and the integration of such systems in the workplace, including when intended for OSH-related purposes, as recently emphasised by EU-OSHA (EU-OSHA, 2025f). Notably, individual and collective information and consultation rights (and training of workers) are also laid down in Framework Directive 89/391/EEC, which, inter alia, specifically requires employers to consult with workers and/or their representatives on the planning and introduction of new technologies and their potential impact on workers' health and safety (Cristofolini 2024) ([38]). This is especially relevant given that AI systems, even those deployed for OSH purposes, can also pose OSH risks (ILO 2025; EU-OSHA 2023a; EU-OSHA 2022a), and consultation with workers' representatives on the potential impact of digital technologies, such as laptops, wearable devices and systems that automatically allocate tasks, on health and safety remains relatively limited. In this regard, findings from the recent ESENER survey show that, although the percentage has increased since 2019, when it was 24%, only about a third (35%) of establishments using digital technologies consulted employees on this matter in 2024 (EU-OSHA 2025b).

5 Key takeaways on the practical application of the AI Act to AI-driven OSH systems

Scientific research in organisational, OSH and legal fields

Given that this is a novel topic, there is a clear need for scientific evidence (in legal, OSH and organisational fields) on how the AI Act will apply to AI systems designed to improve workers' health

[34] See Chapter III, Sections 2 and 3 of the AI Act.

[35] See Article 26(1) and (2) of the AI Act. Article 26 lists the obligations of deployers of high-risk AI systems. In relation to the human oversight obligations of the deployer (i.e. employer), according to the AI Act, the deployer must assign 'human oversight to natural persons who have the necessary competence [e.g. AI literacy], training and authority, as well as the necessary support'. For instance, human oversight encompasses being able to detect and address anomalies in the use of the AI system, and to disregard the output of the high-risk system (see also Article 14 of the AI Act).

[36] Article 26(7) of the AI Act. See also Recital 92.

[37] Directive 2002/14/EC of the European Parliament and of the Council of 11 March 2002 establishing a general framework for informing and consulting employees in the European Community - Joint declaration of the European Parliament, the Council and the Commission on employee representation, OJ L 80, 23.3.2002, pp. 29-34.

[38] See Articles 6(3), 11 and 12(1).

and safety. Currently, such literature is limited (see, for instance, Charmeil 2024; Marassi 2024). Moreover, since the AI Act complements existing EU and national legislation, it is important to further explore how these different regulatory frameworks interact in practice. For example, more research is needed on how to involve workers and their representatives prior to the introduction of AI-driven OSH systems in light of the requirements set out in both the AI Act and other relevant legislation, such as Framework Directive 89/391/EEC.

EU policy

There is demand for further clarity and guidance on several key points regarding how the AI Act applies to AI systems intended to enhance workplace safety and health. The following areas merit closer attention.

First, the AI Act differentiates between AI systems that infer 'emotions or intentions' and those that monitor physical states such as fatigue and pain. However, this distinction is not always clear cut (Charmeil 2024). For example, while fatigue is explicitly listed as a physical state and excluded from the definition of emotion recognition, further clarification is required as to whether this term also includes 'occupational mental (or cognitive) fatigue', which is relevant in high-risk working environments from an OSH perspective and is distinguished from occupational physical fatigue in the literature (Moshawrab 2022). Moreover, pain is listed as a physical state, but no further clarification is provided by the AI Act or the European Commission's accompanying guidelines on prohibited practices. Similar concerns arise regarding the definition of stress, which the abovementioned guidelines only indirectly include as an emotion, without providing any justification, despite ongoing debate on the matter. Furthermore, it remains unclear whether AI systems designed to detect cyber-bullying and (sexual) harassment could be covered by the 'medical or safety reasons' exception (Dutch Data Protection Authority 2025b).

In addition, for high-risk AI systems, the inclusion of AI-driven OSH systems within the area 'Employment, workers' management and access to self-employment' remains unclear. Challenges also arise when applying the high-risk category 'AI systems that are safety components of products or are themselves products' to smart PPE and smart machinery. For example, concerns have been raised about the limited knowledge about smart PPE among the notified bodies in charge of third-party conformity assessment. Studies also show that testing these devices against the PPE Regulation is complex and costly (EU OSHA 2023a; EU-OSHA 2020). This situation may affect the fulfilment of the third-party conformity assessment requirement under the AI Act. As a way forward, in June 2025 the European Commission launched a public consultation on the implementation of rules for high-risk AI systems, which will lead to the publication of guidelines on their practical implementations and a list of examples ([39]). This could provide a valuable opportunity to offer much-needed clarity regarding these issues.

Employers, workers (and their representatives), and OSH professionals

Employers considering introducing AI-driven OSH systems into the workplace must be aware that there are still several grey areas and ambiguities regarding how the AI Act applies to such technologies. It is often impossible to determine definitively what is permitted and what is prohibited, thus making a case-by-case assessment essential. This includes evaluating whether the AI system is both necessary and proportionate. In addition, even when it is clear that an AI-driven OSH system does not constitute a prohibited AI practice, employers must still carefully examine the multiple layers of regulation that govern the use of such technologies (e.g. is there a legal basis under the GDPR to process the data collected by the AI system?).

Similar considerations apply to workers and their representatives, as well as OSH professionals, who may face questions and challenges related to issues such as the practical implementation of information and consultation rights under different regulatory frameworks, ensuring that the technology serves only its intended OSH purpose and integrating AI-driven OSH systems into existing OSH management.

[39] These guidelines were due to be published no later than 2 February 2026 (Article 6(5) of the AI Act). However, at the time this article was completed on 5 February 2026, the European Commission had not yet published them.

6 Concluding remarks

This article has examined how the adoption of the AI Act may create both opportunities and challenges for AI-driven OSH systems. This new legislation is likely to influence the ongoing and future development and integration of such technologies in the workplace. Based on the analysis conducted in this paper, four key conclusions can be drawn.

First, the AI Act will prohibit the entry into the European market and the use by employers of various AI emotion recognition applications. This applies not only to AI emotion recognition technologies used in algorithmic management practices 'in the strict sense' (e.g. for personnel recruitment), but also to certain technologies designed to infer workers' affective states for OSH-related purposes, such as general stress monitoring in office jobs.

Second, the inclusion of the exception 'for medical or safety reasons' to the prohibition of AI emotion recognition in the workplace and the exclusion of physical states such as fatigue from the notion of emotion recognition may open the door for the further development and application of innovative AI-driven OSH systems, such as neurotechnology for fatigue monitoring and wearable devices for stress monitoring in safety-critical professions. This reflects an important contribution of the AI Act: it acknowledges that certain AI technologies can present OSH benefits for workers, provided that their (OSH) risks are also properly addressed and adequate safeguards are put in place, such as assessing whether the AI system is necessary and proportionate.

Third, ambiguities and a lack of clear-cut boundaries between certain concepts introduced in the AI Act may put the brakes on technological innovation in the field of AI-driven OSH systems, even when the technology is intended for a 'good purpose'. A key example is the extent to which such technologies can qualify as high-risk AI systems under the area 'Employment, workers' management and access to self-employment', which covers AI systems such as those intended to monitor and evaluate workers' performance and behaviour. Faced with compliance risks, tech developers may adopt a more cautious approach, choosing not to make their products available on the EU market or refraining from developing new ones altogether. Similarly, employers may opt for OSH measures and products that are safer from a regulatory standpoint, thereby potentially overlooking AI systems that could offer significant, more individualised, on-the-spot benefits for workers' health and safety.

Lastly, given that the AI Act complements existing legislation, compliance with the AI Act alone does not guarantee that the use of the technology in the workplace is lawful under other applicable European and national legislation (e.g. data protection laws). The regulation of AI-driven OSH systems is therefore multilayered, thus requiring careful consideration of various legal requirements and obligations before they are deployed in the workplace. The potential adoption of a directive on algorithmic management (or another EU action), as recently proposed by the European Parliament (European Parliament 2025a; European Parliament 2025c), could further reshape the regulatory landscape by, for instance, classifying the use of certain AI systems as prohibited in the workplace. This aligns with the provision in the AI Act stating that it does not prevent the EU (or Member States) from introducing laws that provide stronger protection for workers.

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Annex I. Text of selected relevant articles and recitals ([40]) of the AI Act

Definition of 'AI system'	Article 3(1) (Definitions)	'AI system' means a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments.
Definition of 'intended purpose'	Article 3(12) (Definitions)	'intended purpose' means the use for which an AI system is intended by the provider, including the specific context and conditions of use, as specified in the information supplied by the provider in the instructions for use, promotional or sales materials and statements, as well as in the technical documentation.
AI emotion recognition systems in the workplace	Article 5(1)(f) (Prohibited AI Practices)	The following AI practices shall be prohibited: (…) the placing on the market, the putting into service for this specific purpose, or the use of AI systems to infer emotions of a natural person in the areas of workplace and education institutions, except where the use of the AI system is intended to be put in place or into the market for medical or safety reasons.
	Article 3(39) (Definitions)	'emotion recognition system' means an AI system for the purpose of identifying or inferring emotions or intentions of natural persons on the basis of their biometric data.
	Recital 18	The notion of 'emotion recognition system' referred to in this Regulation should be defined as an AI system for the purpose of identifying or inferring emotions or intentions of natural persons on the basis of their biometric data. The notion refers to emotions or intentions such as happiness, sadness, anger, surprise, disgust, embarrassment, excitement, shame, contempt, satisfaction and amusement. It does not include physical states, such as pain or fatigue, including, for example, systems used in detecting the state of fatigue of professional pilots or drivers for the purpose of preventing accidents. This does also not include the mere detection of readily apparent expressions, gestures or movements, unless they are used for identifying or inferring emotions. Those expressions can be basic facial expressions, such as a frown or a smile, or gestures such as the movement of hands, arms or head, or characteristics of a person's voice, such as a raised voice or whispering.
	Recital 44	There are serious concerns about the scientific basis of AI systems aiming to identify or infer emotions, particularly as expression of emotions vary considerably across cultures and situations, and even within a single individual. Among the key shortcomings of such systems are the limited reliability, the lack of specificity and the limited generalisability. Therefore, AI systems identifying or inferring emotions or intentions of natural persons on the basis of their biometric data may lead to discriminatory outcomes and can be intrusive to the rights and freedoms of the concerned persons. Considering the imbalance of power in the context of work or education, combined with the intrusive nature of these systems, such systems could lead to detrimental or unfavourable treatment of certain natural persons or whole groups thereof. Therefore, the placing on the market, the putting into service, or the use of AI systems intended to be used to detect the emotional state of individuals in situations related to the workplace and education should be prohibited. That prohibition should not cover AI systems placed on the market strictly for medical or safety reasons, such as systems intended for therapeutical use.
High-risk systems in the workplace	Article 6(1) and (2) (Classification rules for high-risk AI systems)	1. Irrespective of whether an AI system is placed on the market or put into service independently of the products referred to in points (a) and (b), that AI system shall be considered to be high-risk where both of the following conditions are fulfilled: (a) the AI system is intended to be used as a safety component of a product, or the AI system is itself a product, covered by the Union harmonisation legislation listed in Annex I; (b) the product whose safety component pursuant to point (a) is the AI system, or the AI system itself as a product, is required to undergo a third-party conformity assessment, with a view to the placing on the market or the putting into service of that product pursuant to the Union harmonisation legislation listed in Annex I. 2. In addition to the high-risk AI systems referred to in paragraph 1, AI systems referred to in Annex III shall be considered to be high-risk.
	Annex III(1)(c) (High-risk AI systems referred to in Article 6(2)	High-risk AI systems pursuant to Article 6(2) are the AI systems listed in any of the following areas: 1. Biometrics, in so far as their use is permitted under relevant Union or national law: (…) (c) AI systems intended to be used for emotion recognition.

[40] Note that recitals are intended to provide guidance on how the text of articles should be applied (McStay and Bakir 2025).

	Annex III(4) (High-risk AI systems referred to in Article 6(2)	4. Employment, workers' management and access to self-employment: (a) AI systems intended to be used for the recruitment or selection of natural persons, in particular to place targeted job advertisements, to analyse and filter job applications, and to evaluate candidates; (b) AI systems intended to be used to make decisions affecting terms of work-related relationships, the promotion or termination of work-related contractual relationships, to allocate tasks based on individual behaviour or personal traits or characteristics or to monitor and evaluate the performance and behaviour of persons in such relationships.
	Recital 57	AI systems used in employment, workers management and access to self-employment, in particular for the recruitment and selection of persons, for making decisions affecting terms of the work-related relationship, promotion and termination of work-related contractual relationships, for allocating tasks on the basis of individual behaviour, personal traits or characteristics and for monitoring or evaluation of persons in work-related contractual relationships, should also be classified as high-risk, since those systems may have an appreciable impact on future career prospects, livelihoods of those persons and workers' rights. Relevant work-related contractual relationships should, in a meaningful manner, involve employees and persons providing services through platforms as referred to in the Commission Work Programme 2021. Throughout the recruitment process and in the evaluation, promotion, or retention of persons in work-related contractual relationships, such systems may perpetuate historical patterns of discrimination, for example against women, certain age groups, persons with disabilities, or persons of certain racial or ethnic origins or sexual orientation. AI systems used to monitor the performance and behaviour of such persons may also undermine their fundamental rights to data protection and privacy.