

SMART DIGITAL SYSTEMS FOR MONITORING OF WORKERS' OSH

Hybrid workshop, 28 - 29 June 2023

Introduction

Smart monitoring systems using artificial intelligence, machine learning, and sensing technologies are entering EU workplaces and they are redefining safety and health (OSH).

EU-OSHA, under its [OSH overview](#) project has been looking into the opportunities and challenges of these systems for OSH. Together with Ecorys, the Agency has been working on an overview of research and practices of smart monitoring systems for improving workers' safety and health. Part of this work is already available on EU-OSHA's [website](#).

This two-day hybrid workshop brought all of this work together. On its **first day**, the workshop classified smart monitoring systems, assessed their challenges, risks, and opportunities for different sectors and provided insights into their future prospects. On the **second day**, it presented real-world examples of companies featured in the study that were both manufacturing and using smart monitoring systems. It examined what these companies saw as the greatest challenges and opportunities. The two days have seen wide participation from a diverse group of stakeholders, including OSH specialists, researchers and public officials from all over Europe.

DAY 1

The first day began with introductory remarks from EU-OSHA, the European Commission's Directorate-General for Employment, Social Affairs and Inclusion (EMPL) and the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (GROW).

Introductory words

EU OSHA

EU OSHA's Interim Head of the Prevention and Research Unit, **Malgorata Milczarek**, opened the session. Malgorata started her speech by putting the project into context. She talked about EU-OSHA's foresight work, which served as the foundation for the [OSH Overview](#) umbrella project. This comprehensive initiative explores how digitalisation affects OSH through five distinct sub-projects:

1. Advanced Robotics and AI-based systems for the automation of tasks.
2. New forms of work management through AI-based systems.
3. OSH and digital platform work.
4. Digital systems for monitoring and improving OSH.
5. Teleworking, remote work, and OSH.

Malgorzata noted that EU-OSHA will follow-up on the work of these projects through its [Healthy Workplaces campaign](#), which is scheduled to run from 2023 to 2025. She then introduced **Annick Starren**, the Project Manager of the initiative, who took over the presentation.

Annick kicked-off her presentation by introducing EU-OSHA and its work towards making Europe a safer, healthier and more productive place to work. Annick placed EU-OSHA's work within the context of Europe's digital and green transition and she talked about the Agency's priority areas and activities. She then introduced the project and handed over the floor to **Andrea Broughton**, the Project Director on behalf of Ecorys and moderator of the workshop. Andrea introduced the two speakers from the European Commission, **Jesús Alvarez Hidalgo** from DG EMPL and **Giacomo Mattino** from DG GROW.

European Commission, DG EMPL

Jesús provided DG EMPL's perspective on digitalisation and OSH. Jesús pointed out the European Commission's **Digital Decade policy programme** which sets concrete targets and objectives for 2030, shaping Europe's digital transformation.¹ Furthermore, Jesús drew participants' attention to the role of **EU Act on Artificial Intelligence**² and the **European Declaration on Digital Rights and Principles**³ for the safety and health of workers. He then introduced DG EMPL's recent efforts in assessing the **trends, challenges and opportunities for algorithmic management in the workplace**. Jesús emphasised the role that digitalisation plays within the **EU Strategic Framework for Health and Safety at work 2021-2027**⁴ and indicated the potential update of two relevant directives concerning OSH. In conclusion, he reiterated the importance of the [OSH Overview](#) project, undertaken by EU-OSHA and revealed that a subgroup of the Senior Labour Inspectors Committee (SLIC) was developing practical guidance on OSH enforcement related to digitalisation and the use of machinery and robotics using artificial intelligence. This guidance was expected to be adopted in 2023.

European Commission, DG GROW

Giacomo followed Jesús to offer DG GROW's perspective on the intersection of digitalisation and OSH. He specifically highlighted three areas within DG GROW's purview where integrating the OSH dimension could be advantageous:

- Industrial forum transition pathways and the impact on the digital transformation.
- Single digital gateway.
- Matchmaking events focusing on digitalisation of industry.

Giacomo highlighted that matchmaking events, bringing together digital solution providers with SMEs, represent an excellent occasion for integrating the OSH aspect. In his concluding remarks, Giacomo also appraised the joint work of EU-OSHA, DG GROW and the Enterprise Europe Network in raising awareness of the importance of OSH to SMEs through the Communication Partnership Project.⁵

Icebreaker

Before presenting the project's findings, the research team sought to break the ice and motivate the discussions through a polling exercise. This exercise involved finding out participants' backgrounds, professions, and their immediate associations when encountering the term 'smart monitoring systems for monitoring'. As shown below, the workshop brought together a diverse audience from across Europe, with different perspectives on OSH monitoring systems. This diversity contributed to enriching both days of the workshop with a wide array of valuable viewpoints.

¹ For more information, see: [commission.europa.eu](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en) (n.d.). Europe's Digital Decade: digital targets for 2030, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en. Date of last access: 7 September 2023

² For more information, see [europarl.europa.eu](https://www.europarl.europa.eu/news/en/headlines/society/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence) (2023). EU AI ACT : first regulation on artificial intelligence, <https://www.europarl.europa.eu/news/en/headlines/society/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence>. Date of last access: 7 September 2023

³ For more information, see [digital-strategy.ec.europa.eu](https://digital-strategy.ec.europa.eu/en/library/european-declaration-digital-rights-and-principles) (2022). European Declaration on Digital Rights and Principles, <https://digital-strategy.ec.europa.eu/en/library/european-declaration-digital-rights-and-principles>. Date of last access: 7 September 2023

⁴ For more information, see [osha.europa.eu](https://osha.europa.eu/en/safety-and-health-legislation/eu-strategic-framework-health-and-safety-work-2021-2027) (n.d.) EU Strategic Framework on Health and Safety at Work 2021-2027, <https://osha.europa.eu/en/safety-and-health-legislation/eu-strategic-framework-health-and-safety-work-2021-2027>. Date of last access: 7 September 2023

⁵ For more information [osha.europa.eu](https://osha.europa.eu/en/enterprise-europe-network) (n.d.) Cooperation with other Agencies, European Enterprise Network, <https://osha.europa.eu/en/enterprise-europe-network>. Date of last access: 7 September 2023

Mentimeter

Where are you joining us from today?

46 responses



46

Mentimeter

What is your profession?

46 responses



46



What comes to your mind when you hear the word 'smart digital systems' for monitoring OSH?

46 responses



Findings from EU-OSHA research

Kyriillos Spyridopoulos, the Project Manager on behalf of Ecorys set the scene by elucidating the relevance of exploring smart monitoring systems for enhancing OSH. He then presented the project's main areas of investigation and shared their corresponding findings.

A definition & taxonomy of smart monitoring systems

The first area of investigation focused on establishing a definition and a taxonomy for smart monitoring systems, along with offering an overview of the technologies employed by these systems.

- Following an extensive review of the literature, the project defined smart monitoring systems as those **"using digital technology to collect and analyse data in order to identify and assess risks, prevent and / or minimise harm, and promote occupational safety and health"**.
- New OSH monitoring systems leverage a **broad spectrum of digital technologies, encompassing both well-established and emerging ones**. Among the more established technologies are Bluetooth and Radio Frequency Identification (RFID), while the newer technologies include Artificial Intelligence, Machine Learning, Internet of Things (IoT), Virtual Reality/Augmented Reality (VR/AR), and sensing technology.
- The distinction between **proactive** and **reactive** OSH monitoring systems, based on their utilization of digital technologies, offers a valuable analytical framework for researching these new systems. However, it's important to note that this distinction is not always clear-cut in practice, as these systems often serve multiple purposes, encompassing both proactive and reactive functions.

Challenges and opportunities of smart monitoring systems

The second area of investigation focused on finding out the challenges and opportunities of smart monitoring systems, using the **proactive / reactive** analytical framework.

Proactive smart monitoring systems:

- can **prevent or reduce risks**. In particular, technologies embedded in these systems can help identify a wide cast of workplace risks, including **physical, chemical, ergonomic, psycho-social, safety, etc**. This is possible through:
 - **monitoring individual or plant-related risks**. An example here is a camera-system that monitors the workplace to detect unsafe events such as near misses.
 - **alerting workers and OSH managers and providing on-the-job and often bespoke training**. An example here is a wearable system that can alert workers about ergonomic risks through

vibration alerts and provide them with bespoke training based on their height, weight and age profile.

- **performing remote inspections.** An example here is a drone system that can prevent workers from getting involved in high-risk tasks in industries such as construction or mining.
- **providing data insights that can help workplaces improve OSH.** As an example, a camera system can direct OSH professionals to locations where unsafe events are happening, prompting them to investigate and potentially reconfigure these areas to enhance safety measures.

Reactive smart monitoring systems:

- can **react to OSH risks through:**
 - **using geolocation data to track workers that are in danger** and reduce the time of rescue operations.
 - **aiding accident investigation and reporting.**

Next to these opportunities, there are some risks:

- **Physical risks that** can result, amongst other reasons, from malfunctions in the technologies, cumbersome design, and other reasons.
- **Psychosocial risks** that can result, amongst other reasons, from workers' alienation.

Simultaneously, there are several challenges around the use of data. There are ongoing uncertainties about the reliability and accuracy of data collected by smart monitoring systems. Do these systems provide dependable data for informed action? Additionally, concerns often arise regarding the potential misuse of data by employers, for purposes unrelated to OSH, such as performance measurement. Lastly, but certainly not least, questions concerning data privacy, ownership, and security persist.

In conclusion, the key take-aways of the session were that smart monitoring systems:

- can have reverse effects for OSH.
- have limitations in terms of their capabilities.
- can only be part of the OSH solution, but not the solution itself.
- come with important issues around the use of personal data.

Workplace resources

The third area of investigation centred on identifying enabling conditions, including workplace resources, that can assist businesses in the successful integration of smart monitoring systems into their workplaces. The main findings in this regard were the following:

- At the international and national levels, workplace resources can offer a broad perspective and assist employers in tailoring their unique approach to OSH. However, it's important to note that the majority of these resources do not specifically address new OSH monitoring systems. Instead, resources from product manufacturers or employers are more likely to encompass guidance on these systems.
- While workplace resources are valuable, they alone cannot help employers effectively integrate smart monitoring systems at the workplace. Therefore, employers should **maintain their OSH competencies based on the hierarchy of controls and nurture close collaboration of workers with OSH professionals on the ground and involve workers in every step of the process**, including testing, selecting, and optimising the new OSH monitoring system.
- Recommendations to effectively integrate new OSH monitoring systems include cross-company or cross-sectoral peer-learning activities, as well as workplace resources that consider workers' needs and provide information around data, limitations, and rights, in an accessible fashion.

Break-out groups: key messages

Following the presentation of the main findings, participants were split into three break-out groups. Two of these groups were held in person, whereas the one was hybrid. The break-out groups motivated discussions around three topics:



Opportunities of smart monitoring systems



Challenges of smart monitoring systems



Integration of smart monitoring systems in workplaces

The main take-aways from the break-out groups were the following:

Opportunities of smart monitoring systems. In this context, the following issues emerged:

- Accessing real-time safety and health data.
- Using data insights to design preventative measures.
- Providing bespoke training for workers and prolonging their career in view of an ageing workforce.
- Making unknown risks known e.g., in the area of chemical risks.
- Triggering positive behaviour change (e.g., some sectors/jobs may become more attractive by the use of technology).
- Helping business get the 'big picture' around safety and health through combining different data.
- Based on aggregated data, trends in health and safety become visible which supports collective responsibility for prevention.
- Improve internal communication in the enterprise.

Challenges of smart monitoring systems. In this context, the following issues emerged:

- Determining who has access to the collected data (privacy).
- Concerns about the potential misuse of those systems for purposes unrelated to OSH, e.g. data being collected containing sensitive, personal information, or related to worker performance, etc.
- Establishing a threshold for psychosocial factors: how much stress is acceptable at the workplace? Drawing the line: do smart monitoring systems monitor performance, OSH, or both?
- The challenge of regulatory frameworks keeping pace with rapid technological advancements.
- The need to better understand the potential psychosocial risks for workers.
- Exacerbating the safety and health disparities between large enterprises, which possess the financial and human resources to implement these systems effectively, and SMEs, which often lack such resources.
- Cybersecurity: what if a smart monitoring system sends a rescue team to a dangerous area during an emergency situation?
- The risk to delegate the workplace risk assessment to smart monitoring systems and to shift employers' responsibility for OSH to individual workers, as well to go against the hierarchy of prevention measures giving priority to collective prevention measures.
- Overloading managers/OSH professionals with data that they do not know what to with or how to interpret.
- Employers could misuse the new transparency, for example an employer could say "We are still below the exposure limit").

Integration of smart monitoring systems at the workplace. In this context, the following issues emerged:

- Financial incentives might help product manufacturers seek certification of their products, which in turn could give an indication about their reliability.
- Financial incentives might help SMEs implement such systems and bridge the gap with larger companies.
- There is a need to clearly communicate to workers the use of these systems in order to allow worker consultation and participation, and to embed them in the process of testing, selecting and optimising them. It is crucial to embed the implementation and use of such systems in a sound OSH management system, taking them adequately into consideration in the workplace risk assessment.

The experts' perspective: key messages

Following the presentation of the break-out groups' key messages, **Elsbeth de Korte**, Senior Research Scientist, TNO Unit Healthy Living & Working and **Hilde Færevik Senior**, Business Developer and Scientist, SINTEF Digital gave their reflections on the presentation and the discussions that took place.

In her reflections, **Elsbeth** recognised the multitude of opportunities that smart monitoring systems offer for enhancing safety and health. However, she also underscored that their potential negative effects for workers e.g., psychosocial effects, should not be overlooked in view of a balanced assessment.

Hilde, in her remarks, emphasized that while smart monitoring systems can be highly suitable for certain professions, such as measuring heat stress in firefighters, their application in other sectors, like assessing stress levels in healthcare, requires careful consideration. She stressed the importance of adopting a scientific approach, beginning with fundamental questions: why measure, how, at what level, and who will utilize the data? Will the proposed solutions improve the health and wellbeing of workers, or add another stress factor?

Closing remarks

The experts' remarks sparked a discussion among the participants, touching upon various topics covered throughout the day. After this discussion, **Andrea Broughton** summarized some of the key insights mentioned earlier and then handed over the proceedings to **Annick Starren**, who thanked the participants and concluded the first day of the workshop.

DAY 2

The second day centred on showcasing real-world examples of smart monitoring systems. **Annick Starren** initiated the day with a welcoming address. Subsequently, **Pawel Hess**, the Project Manager representing Ecorys, presented the real-world applications discovered during the research. After Pawel's presentation, two product manufacturers elucidated how their systems are addressing workplace risks. These presentations sparked vibrant discussions, which are elaborated upon below.

Applications of smart monitoring systems for OSH: A selection of case studies

Pawel focused his presentation on showcasing Ecorys engagement in the context of developing 10 stand-alone case studies looking into the design, development, and implementation on smart monitoring systems in Europe and overseas. Pawell discussed smart digital solutions employing a broad array of technologies, with applications spanning various sectors. For each solution, he delved into its underlying rationale, the types of risks it aims to mitigate, the industries and applications where these risks are prevalent, the solution's main functions, the technologies it incorporates, and its key advantages. Each case study presented, focused on one of the following issues:

- Preventing hand-arm vibration through smart wristwatch.
- Reacting to emergencies / protecting lone workers through smart insoles.
- Monitoring hazardous gases in high OSH risk sectors.
- Using voice-AI to detect emotions, stress and other vocal biomarkers.
- Analysing real-time health and safety data through wearable technology.
- Preventing risks in the mining sector through electroencephalography.
- Using autonomous drone systems in railroad applications.

A deep dive into case studies: 2 real-world applications of smart monitoring systems for OSH

Following Pawel's presentation, the workshop featured two product manufacturers that engaged in the research, to provide firsthand insights into their solutions, as well as into the opportunities and challenges that these can pose for occupational safety and health.

Matthew Hart, CEO of a UK-based product manufacturer, presented how his company is using artificial intelligence to assess musculoskeletal safety at the workplace and then talked about the opportunities and challenges of implementing their solution at workplaces.

In terms of opportunities, using AI to address MSDs can:

- Increase the awareness of workers about their movement through real-time feedback e.g. through vibration.
- Provide objective data that can help OSH professionals design engineering or substitution solutions for high risks.
- Reduce absenteeism due to MSDs and increase workers' well-being, which is crucial in view of an ageing workforce.
- Reduce costs for traditional training solutions, which are often not scalable.

To tap into these opportunities, Matthew suggested that it is important to:

- Ensure the active participation and education of the managers involved in the programme.
- Ensure buy-in to the new technology's benefits and address concerns around data collection.
- Make sure that the technology is user-friendly, regardless of employee's skill level.

Dan Hobbs, CEO of an Irish product manufacturer, took his turn from Matthew to show how his company is leveraging artificial intelligence to capture unsafe events, as well about the opportunities and challenges this creates for different workplaces.

In terms of opportunities, integrating AI into camera systems to detect unsafe events can:

- Transform proactive safety decision making through giving visibility to unsafe events that might lead to accidents.
- Support employee behavioural change.
- Help to reduce accidents on-site.
- Help to reduce insurance costs.

To tap into these opportunities, Dan suggested that it is important to:

- Embed privacy of workers by design.
- Have the necessary infrastructure to implement the solution.
- Increase openness to adoption of solutions leveraging new technologies.

Break-out groups: key messages

Following a quick Q&A session, similar to the first day, participants were divided into three break-out groups, which focused on discussing the challenges and opportunities of the aforementioned real-world applications. As shown below, the discussions very much confirmed those of the first day.

Opportunities of smart monitoring systems presented:

- Integrating smart monitoring systems into existing OSH structure to get a more holistic approach on OSH and to fulfil the requirements of the OSH legislation in terms of workplace risk assessment, hierarchy of control measures etc.
- Increase of collective responsibility for prevention, based on monitoring of trends in health and safety.
- Identifying new and more complex risks that are not typically captured in traditional risk assessments.
- Using the wealth of data to inform safety and health policies at EU-, national- or sectoral level.
- Using AI to aid decision making – but not replace it.
- Removing workers from dangerous situations through remote monitoring.

Challenges of smart monitoring systems presented:

- Overreliance on data that might not be correctly interpreted might lead to wrong conclusions.
- Challenges in establishing ('auditing') whether the data analysis and interpretation processes are rigorous
- Systems measuring non-OSH related parts e.g., work performance.
- Increasing workers' acceptance of the systems: is the market driven by suppliers or product manufacturers?
- AI systems & decision-making: can a drone system take the decision to stop a train if something is on the racks? Can an AI-system measuring physiological parameters account for the fact that a worker might just be having a bad day?
- Generational considerations: young people developing the software that older workers are wearing without being aware of their need and skills/capacity to work with such systems.

- Need to think about how workers might manipulate their own data. Technology can be bypassed or jammed, e.g., taxi drivers disabling seat belt monitors, or workers taking paracetamol to lower their temperature during COVID-19 to continue working.

The experts' perspectives: key messages

Following the presentation of the break-out groups key messages, **John Bolte, Director, Centre of Expertise Digital Operations and Finance, The Hague University of Applied Sciences** and **Elsbeth de Korte, Senior Research Scientist, TNO**, gave their reflections on the presentation and the discussions that took place.

In his reflections, **John** highlighted that while it is true that the hardware of sensors can be affected by environmental circumstances, sensors can still give a wealth of important information that can help workplaces improve their safety protocols and detect early-on risks. John then raised an important question: what happens when combining different data allows people to see new structures? In this regard, he highlighted that there is a conscious decision to be made on whether safety information should be used for performance measurement. Should we introduce ethical standards and legislations to guide this use?

In her turn, **Elsbeth** highlighted the importance of having solutions that are bespoke to a specific context. She further emphasised that involving all important stakeholders (end users, employers, physicians, health and safety experts, but also labour inspectorates and insurance companies) early-on in the design of these systems, and making the most out of their expertise, could help in their effective implementation. Last, but not least, **Elsbeth** reiterated that these systems should be a part of, and not a substitute of an existing OSH framework.

Closing remarks

The experts' remarks sparked a lively discussion among the participants, touching upon different topics covered throughout the day. After this discussion, **Andrea Broughton** stressed the importance to continue looking into the potential uses, challenges, and opportunities of these systems in view of a very changing fast-moving world, and then handed over to **Annick Starren**. Annick emphasized the importance of discussing the impact of digitalisation on OSH in dialogue and stressed the importance of the present project in terms of informing the Healthy Workplaces Campaign 2023-2025 on digitisation. She then gave the floor to **William Cockburn, Interim Executive Director of EU-OSHA** for the closing remarks. William highlighted the prominent role of digitalisation within the work of the Agency and forthcoming campaign. He then emphasised that the correct design and implementation of these systems, along with worker consultation, are pivotal elements for their successful integration into the workplace. In this context, he highlighted a significant opportunity for worker representatives to assume a central role and contribute their expertise in addressing this complex issue. Following this, he thanked all participants for their inputs and closed the session.