Safety and health at work is everyone's concern. It's good for you. It's good for business.

Healthy Workplaces
SAFE AND HEALTHY WORK IN THE DIGITAL AGE

European Agency for Safety and Health at Work

Healthy Workplaces

Smart digital systems for better safety and health at work

iStock - Natnan Srisuwan

Key points

- Smart digital systems improve workplace safety by providing insights into working conditions in a proactive way that has only recently become possible.
- Transparent use of technology is essential to maintain and build workers' trust and to address concerns about privacy, data handling and over-reliance on technology.
- Involving workers and their representatives in the design, use and sound data management of smart digital systems is important, as it increases their acceptance and buy-in to on the technologies. This promotes workers' health and well-being.
- Smart digital systems should complement other occupational safety and health (OSH) measures, such as workplace adaptations, worker training and fostering trust, rather than being relied upon as the sole solution.
- Legislation and labour inspections must evolve to keep pace with smart digital systems to promote their integration into an effective OSH management system, based on employer responsibility and in the context of the hierarchy of controls.
- Smart digital tools and technologies like wearables can support inclusion and diversity by addressing the needs of specific worker groups.

Safe and healthy work in the digital age

The European Agency for Safety and Health at Work (EU-OSHA) is running the 2023–2025 Europe-wide Healthy Workplaces Campaign to raise awareness of the implications of digital technologies for safety and health at work. If designed, implemented, managed and used in line with a human-centred approach, digital technologies can be safe and productive. As the use of these technologies at work continues to increase and their impact on work and workplaces is still not fully understood, it is important to understand how to fine-tune strategies that promote and protect workers' safety and health.

Smart digital systems for improving safety and health

Smart digital systems are increasingly used across sectors and workplaces to monitor and improve workers' safety and health by identifying and assessing a range of occupational risks, such as physical, ergonomic, psychosocial, chemical, biological and accident-related risks. Examples include smart personal protective equipment (PPE) that detects gases, toxins, noise and high-risk temperatures and wearables designed to interact with workers, such as sensors embedded in hard hats or safety glasses, along with mobile or fixed systems like drones, to monitor hazardous areas in construction and mining. Other systems include monitoring software, digital applications for emergency response and virtual reality (VR) or augmented reality (AR) tools for training. Smartphone apps can also be used to promote safer and healthier behaviours among workers.

These new systems use digital technologies to collect and analyse data or signals to identify and assess OSH risks, thereby preventing or minimising harm and promoting OSH.

Trends in uptake

While data suggest that new smart digital systems for OSH are still in their infancy in some cases, the trend is moving towards increased adoption due to greater awareness of both existing and emerging OSH needs, along with improved opportunities provided by technological advancements.

At the company level, ESENER 2019 data[1] show that 4.8 % of the surveyed establishments reported they use wearable devices and 3.7 % used collaborative robots (cobots), along with a strong correlation between the size of an establishment and the uptake of digital technologies. Larger establishments tend to have more financial resources for long-term R & D and digitalisation, as well as the technical capacity to integrate monitoring technologies across their operations. They also have the human resources to assess needs, install and deploy the technology, and provide the necessary staff training and manuals.

Data from the 2022 OSH Pulse survey[2] show that 11 % of workers report to use wearables at work and 3 % work with cobots. Digital devices are reported to be used in the workplace to monitor noise, chemicals, dust, gases and other hazardous substances for 19 % of workers, and to monitor heart rate, blood pressure, posture, etc. of workers for 7 % of survey respondents.

Proactive and reactive approaches

There are two key overarching approaches to smart digital tools and systems: a proactive approach, which aims to prevent harm and promote health, and a reactive approach, focused on responding to accidents and emergencies. The proactive approach facilitates preventive risk assessment by making it quicker, easier, cheaper and sometimes continuous (i.e. 24/7). The reactive approach minimises the consequences of accidents and emergencies that have already occurred, such as improving accident reporting by making it quicker, automated, cheaper, easier and less stigmatising, while also improving accident investigation.

1 EU-OSHA, *Third European Survey of Enterprises on New and Emerging Risks (ESENER 3)*, Publications Office of the European Union, Luxembourg, 2019.
2 EU-OSHA, *OSH Pulse – Occupational safety and health in post-pandemic workplaces*, Publications Office of the European Union, Luxembourg, 2022.

Positive implications for OSH

By providing real-time data, predictive insights and even actionable recommendations, smart digital systems can help companies to adopt a proactive approach to OSH, anticipating risks, preventing accidents and safeguarding their workforce. They can particularly support companies for:

- Improved compliance with OSH regulations (e.g. through real-time data on the proper use of personal protective equipment (PPE).
- Better-informed decision-making, by generating **accurate and fast OSH information** (parameters) and the use of predictive algorithms.
- More effective enforcement through the identification of risks at an aggregated level.
- Increased training opportunities in virtual reality environments.
- Greater accessibility for workers with specific needs (e.g. ageing workers or those with health conditions) and overall improvements in workforce well-being.

Smart digital systems enable risk identification and early detection, which lead to the prevention or avoidance of harm. The range of risks includes individual and collective harmful exposures and environmental levels, exposure to ergonomic risks, plant- and premise-related risks, hazardous worker behaviour, poor individual health and well-being and psychosocial risks.

In practice, smart digital systems often **serve multiple OSH purposes by combining more than one digital technology and integrating several functions**.

Close cooperation between the designer and the implementer, a mutual understanding of needs and priorities, and dialogue at the workplace between employer and workers are all vital to ensuring the successful implementation of the solution.

Challenges for OSH

Despite the positive aspects, there are risks and challenges that need to be considered.

- The use of collected data may have limitations, such as inaccuracies or difficulties in interpretation, and may fulfil aims that differ from OSH prevention.
- Smart digital systems may also create new hazards or increase existing risks. For instance, physical and safety risks may arise if the systems malfunction, are hacked by cyberattacks, cause explosions or if there is an over-reliance on digital OSH monitoring at the expense of other OSH procedures.
- Also, frustration over equipment malfunctions, solitary, monotonous, or repetitive tasks, the continuous monitoring of workers required by the digital system, the lack of skills or training to use them, and the frequent warnings generated by the digital technologies, are all psychosocial risks that can be associated with increased stress and other mental health issues.

Smart OSH monitoring systems may blur OSH responsibility, particularly if the control hierarchy is not respected. Collective safety measures should not be overtaken by a focus on personal control measures. There is also a need to consider data privacy and protection.

The workplace as a data-rich environment

The more intrusive the data collection, the greater the need for worker engagement. Specific measures will vary depending on the system but must address what data is gathered, and how it is stored and processed. Two key approaches are:

1. **Privacy by design**, which includes data anonymisation, minimisation, GDPR compliance and secure storage.
2. **Privacy by choice**, which restricts data access to specific roles (e.g. OSH professionals).

Smart digital tools, as part of the broader OSH framework, transform the workplace into a data-rich environment, raising concerns about worker data privacy and potential personal data misuse.

Concerns about data privacy or misuse may be seen as workers' resistance to new technologies. However, concerns about employers gaining access to more personal aspects of workers' lives, including mental health, are serious. This highlights the need to involve workers and their representatives to consider their needs and concerns, and take them into account when introducing new smart digital systems. There is also the need to transparently inform workers and their representatives about how these systems function, and what the implications are for them. Employers need to ensure that proper training, coaching and feedback are provided to workers to support the use and management of these systems.

Case study: increasing emergency response and protecting lone workers with smart insoles

Workers in sectors like construction, mining, manufacturing and energy face life-threatening risks such as slipping, stumbling and falling. In the EU, nearly 600 000 work-related accidents occurred in 2019, of which 520 were fatal. In addition to slipping, stumbling and falling from a height, other risks include accidents requiring evacuation and exposure to hostile behaviour.

The smart digital tool that was developed consists of wearable insoles that function without the need for smartphones or additional accessories. These insoles detect falls or loss of vertical position and also allow workers to send an invisible voluntary alert by tapping their right foot against their left three times. A safety supervisor can instigate an evacuation order through a long vibration sent to all workers on the team. The insole complies with standardisation and certification guidelines for insoles and electronics.

Resources

Check out all related content under the priority area 'Smart digital monitoring systems':

https://healthy-workplaces.osha.europa.eu/en/about-topic/priority-area/smart-digital-systems.

Explore all publications on the topic:

https://osha.europa.eu/en/publications-priority-area/smart-digital-systems.

See EU-OSHA's thematic section on the digitalisation of work and its implications for OSH:

https://osha.europa.eu/en/themes/digitalisation-work.

Print: ISBN 978-92-9402-339-1, doi:10.2802/811049, TE-01-24-004-EN-C • PDF: ISBN 978-92-9402-338-4, doi:10.2802/231094, TE-01-24-004-EN-N