

PRINCIPLES FOR IMPLEMENTATION AND USE SMART DIGITAL SYSTEMS TO IMPROVE WORKERS' SAFETY AND HEALTH

Smart digital systems for improving workers' safety and health¹ are systems using digital technologies to collect and analyse data in order to identify and assess risks, prevent and/or minimise harm, and promote occupational safety and health (OSH).²

Often, these systems are based on data collection devices, such as sensors, cameras, microphones, etc., which transmits data via Bluetooth, radio-frequency identification or the Internet of things to a cloud platform. In the case of the latter, artificial intelligence (AI) and machine learning (ML) algorithms process data and translate it to information that employers can use to prevent or react to risks. Of course, there are other options too: from smart monitoring systems using augmented reality, virtual reality or mixed reality to train workers in high-risk sectors, to drones conducting remote inspections in the real estate, construction, oil and gas³ or rail sector, these systems are increasingly entering the workplace.

European Agency for Safety and Health at Work's (EU-OSHA) research on smart digital systems shows that companies and organisations can improve the safety and health of their workers using these systems.⁴ However, certain conditions should be met. These include embedding the smart digital systems in existing OSH framework instead of using them to replace it, and understanding that together with benefits, these smart digital systems can come with limitations.

Further, EU-OSHA research highlight as an important condition for the effective implementation of smart digital systems is to ensure workers are fully involved when their employer introduces new monitoring technology.⁵ It is vital that employers address workers' concerns around the potential use of these systems 'from the outset'. The concerns typically revolve around the potential transfer of responsibility for safety and health from employers to workers, as well as the possibility of the use of the data collected for performance measurement, and the resulting potential negative implications for workers.

About this policy brief

Based on research including studies of real-world applications and interviews with OSH professionals, workers, employers, trade union representatives, as well as product developers and deployers⁶, this policy brief outlines eight key principles for the deployment – the implementation – of the systems. Six principles are proposed, intended to bring such systems closer to the needs of workers and workplaces, and therefore increase overall adoption, with the prospect of creating safer working environments.

¹ The term is used interchangeably with 'smart monitoring systems' and 'smart monitoring systems'.

² EU-OSHA – European Agency for Safety and Health at Work, *Smart digital monitoring systems for occupational safety and health: uses and challenges*, 2023. Available at: <https://osha.europa.eu/en/publications/smart-digital-monitoring-systems-occupational-safety-and-health-uses-and-challenges>

³ EU-OSHA, Drones inspecting worksites of gas infrastructure operator (ID16) Available at: <https://healthy-workplaces.osha.europa.eu/en/publications/drones-inspecting-worksites-gas-infrastructure-operator-id16>

⁴ Ibid.

⁵ Ibid.

⁶ In EU-OSHA's publications, the terms "designer", "implementer" and "system user" are used. These publications were prepared before the AI Act ([Regulation \(EU\) 2024/1689](https://eur-lex.europa.eu/eli/reg/2024/1689)) was adopted. With the AI Act new terms such as "developer" and "deployer" have been introduced.

Barriers and drivers for the implementation of smart digital systems

The conducted research identified a number of **drivers for implementing** smart digital systems for monitoring of OSH. The primary one is the **desire for increasing health and safety in the workplace**. In addition, OSH monitoring systems can help **reduce worker turnover and worker compensation costs**, provide **system flexibility and adaptability**, and meet the demand **to implement ergonomic and innovative OSH solutions**. The pandemic has also been a driver, as it led to a rise in the use of smart monitoring systems and a rise in interest in OSH topics in general. Finally, the proliferation of technology among companies and in workers' daily lives has also contributed to the increased adoption of smart digital systems for OSH.

Smart digital systems for OSH are designed to detect unsafe conditions or behaviours in a timely manner, locate workers in distress and improve OSH. However, there are several **barriers to the adoption** of these systems. The most recurrent barrier is related to **data security and privacy and the possibility of data misuse**. Deploying companies (employers) must, on the one hand, comply with legislation that is in place to ensure data protection, and on the other hand, address the concerns of workers on data being used to monitor their performance. The second barrier identified in the research lies in the **lack of maturity of certain sectors, markets or industries**. The systems that use more cutting-edge technology have a lower adoption rate, often because of the associated costs. This factor is especially relevant for SMEs, which also experience a **lack of digital skills among workers and inadequate ICT infrastructure** as a barrier to implementing OSH monitoring systems.

The principles presented below are intended to show how the barriers to implementation can be addressed, and how to bring smart digital systems closer to the needs of workers and workplaces, and therefore increase their overall adoption, with the prospect of creating safer working environments.

Principles for the implementation and use of smart digital systems

Focusing on OSH benefits and worker involvement

First if all, as obvious as it may seem, it is crucial to ensure the smart digital systems and innovations are directed towards improving OSH. As technology advances, product manufacturers offer opportunities to design increasingly sophisticated systems for improvement of OSH, with enhanced accuracy, interoperability, and data analysis and presentation capabilities. Advanced technologies provide powerful tools for monitoring and managing workplace health and safety, but their potential can only be 'net' effective if they are developed with a clear focus on addressing real-world OSH challenges.

This could be fostered by following a demand-driven approach instead of a supply-driven one. This involves product developers working closely with deployers (employers) and their workers to understand the specific risks present in their workplaces as well as the existing OSH management system and co-creating systems to respond to these risks. This collaborative approach can ensure that technology directly addresses the practical needs of users – employers, OSH professionals and workers – and leads to systems that can bring meaningful impact to workplace OSH, and prevent the existence of side effects - sometimes even hindering OSH.

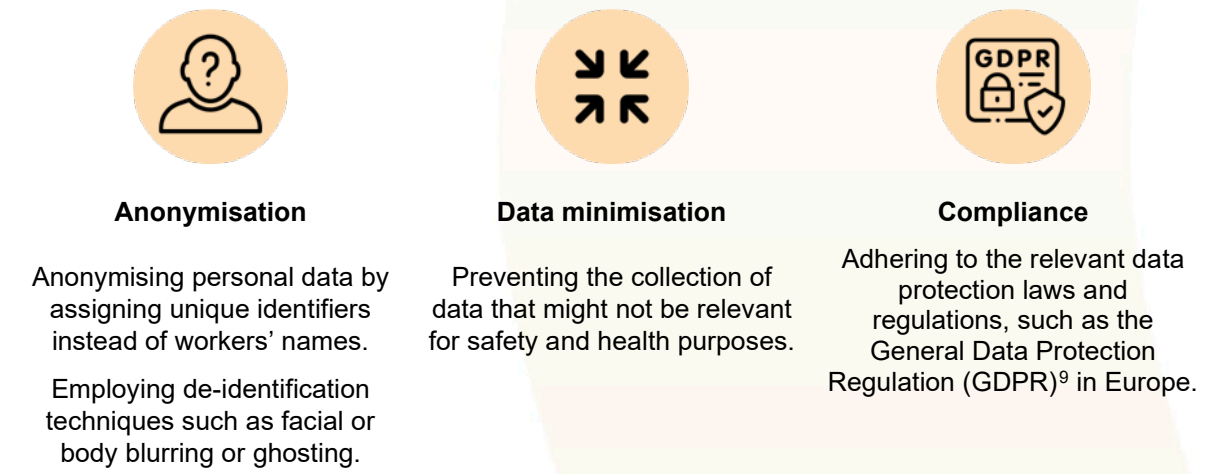
Data security and privacy

The majority of smart digital systems incorporate software and equipment that communicate with a cloud platform, where the data are collected and stored for analysis. This introduces concerns regarding data security for workers, their representatives and employers alike. Cyber security along with data security measures should be put in place to mitigate the risk of potential breaches by externals.

Concerns about data security and data privacy are among the most challenging when introducing a new system at the workplace, but also remain so during the operation and use of the system. In this context, Figure 1 illustrates potential methods to achieve **privacy by design**, which is an approach adopted prior to system implementation. When this is not possible, alternative ways to address data

privacy concerns should be sought between employers and workers or their representatives.⁷ This approach entails **privacy by choice**, focusing on restricting data access for specific positions and users (e.g. OSH professionals).

Figure 1: Data privacy by design⁸



Definition of the purpose of the system

Smart digital systems transform the workplace into a data-rich environment and may raise concerns about the potential misuse of the collected data. The systems provide employers with knowledge, which may be significant to improve OSH, but the insights that they gain on workers deepen the asymmetry inherent in the employment relationship. With some types of systems, such as those collecting biometric data, this asymmetry can reach a level whereby employers potentially know much more about their workers than the latter know about themselves. Moreover, workers may be concerned that the systems will be used not only for OSH purposes but also in order to collect data on productivity for performance monitoring.

The **implementation of such systems should come alongside procedures for worker involvement**; the more intrusive the data collection and possible implications of the system's use for company operations, the higher the worker engagement should be. The specific measures and procedures will always depend on the rationale behind the system's introduction, but they **need to address what data are gathered and for what purpose**.

⁷ For more information, see: EU-OSHA – European Agency for Safety and Health at Work, *New monitoring systems for improving workers safety and health. Empowering safety, respecting privacy. Towards transparent new monitoring systems for improving workers' safety and health*, 2024.

⁸ For more information, see: EU-OSHA – European Agency for Safety and Health at Work, *New monitoring systems for improving workers safety and health. Empowering safety, respecting privacy. Towards transparent new monitoring systems for improving workers' safety and health*, 2024.

⁹ Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA relevance). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02016R0679-20160504&qid=1532348683434>

Figure 2: Addressing concerns about data and system misuse



Procedures and policies

Employers should implement procedures and policies that define the purposes and scope of system use.



Worker engagement

workers need to be engaged during the system's implementation and operation phases.



Safeguarding workers' rights

Employers should comply with data processing regulations and communicate how workers' rights are safeguarded.

Integration with existing infrastructure

Some of the smart digital systems are designed to integrate with existing (OSH) management infrastructure, including software or hardware systems, which can help reduce costs and tap into new opportunities for increasing safety and health. Below are some examples showing how integrating new OSH monitoring systems within existing software or hardware can take place in practice.



A Sweden-based product manufacturer of a smart monitoring system, designed to alert forklift operators about the presence of co-workers in their vicinity, offers the option to connect to a forklift's software, automatically slowing it down in the event of a potential collision.



An Ireland-based product manufacturer of an AI system designed to capture unsafe events integrates this system into organisations' existing camera systems, facilitating seamless integration and more efficient (and less costly) improvement for safety and health.

Indeed, product developers are increasingly working in the direction of cooperating with their clients (i.e. deployers) to integrate the systems in response to specific workplace needs and conditions. For example, a Germany-based product manufacturer of smart gas detection systems has been working together with its clients, the deployer (employer), to explore ways of integrating the data in a cloud-based platform that included a site-wide safety and health information management system. This way the use of safety devices could be monitored in relation to other workplace safety and health information.

Figure 3: Embedding OSH monitoring systems in an existing OSH framework



In another example, a United States-based product manufacturer has reported multiple possibilities of having their software-as-a-service (SaaS) interact with organisations' safety systems or equipment. An illustrative example would be activating an organisation's air handler when the SaaS detects that air quality in the organisation's facilities has reached a hazardous level for workers' safety and health.

Exchange of information between the smart system and existing software, points to the need of the implementing company to work together with the system designer to tailor the solutions to a specific implementation setting.



Smart digital systems can bring OSH benefits to multiple sectors, markets and industries, including SMEs. **When implementing a system, it is important to cooperate with the company that designed it**, so as to ensure effective integration with existing infrastructure. Further worker involvement is important as well as **provision of training to ensure that employees have the skills required to use the system**. Intuitive workplace resources such as guidebooks, videos and posters featuring workers themselves can also contribute to workers' understanding of the respective systems.¹⁰

NB: despite all effective possibilities of integration, all potential for perceived or real interference of use of the data collected for performance measurement should be avoided.

Integration with existing OSH frameworks

OSH is a process of continual improvement or cycle, rather than a compartmentalised intervention, and while able to perform many functions, the systems identified in the research are not able (nor do they aim to) provide all-in-one solutions. An OSH framework should be viewed as a means of continuous learning, which involves a number of dependencies, processes and practices. Thus, it is a framework that encompasses a wider range of elements than a single smart monitoring system.

Indeed, OSH management requires that preventive measures be implemented to eliminate hazards and/or reduce risks, according to the so-called *hierarchy of controls*.¹¹ In this context, the smart digital systems can be seen as tools in a broader OSH management system, which is 'used to achieve the OSH policy to prevent work-related injury and ill-health to worker(s) and to provide a safe and healthy workplace. In this context you can think of existing workplace measures (tool box training and risk assessment), as well as - more external - ISO requirements.¹²



Smart digital systems may potentially blur OSH responsibility in practice by making employers increasingly reliant on them at the expense of other OSH measures. It must be avoided that employers may omit adequate risk assessments, fail to adopt corrective measures or treat the smart systems as a substitute for other OSH obligations. **Over-reliance** on the new systems can lead to complacency and a false sense of security. It is crucial to **use these systems as tools to enhance specific elements of a broader OSH management system, rather than as a replacement for traditional safety measures**.

Implementation as a cooperative process with worker involvement

Continued cooperation of the deploying company with the developer of the smart digital system during the implementation and use of the smart system has been found as a common practice to tailor the system to specific needs of the workplace and workers, address potential challenges and discover

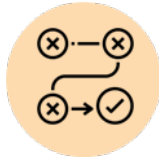
¹⁰ EU-OSHA – European Agency for Safety and Health at Work, *Smart digital monitoring systems for occupational safety and health: workplace resources for design, implementation and use*, 2023. Available at: <https://osha.europa.eu/en/publications/smart-digital-monitoring-systems-occupational-safety-and-health-workplace-resources-design-implementation-and-use>

¹¹ The hierarchy of controls includes: 1. elimination; 2. substitution; 3. engineering controls (e.g. ventilation, scaffolding, safety nets); 4. administrative controls (e.g. task rotation, risk assessments); and 5. PPE.

¹² ISO 45001:2018 Occupational health and safety management systems — Requirements with guidance for use.

improvements. Figure 4 shows potential ways of cooperation between the two parties, used to ensure the successful implementation of the new system.

Figure 4: Cooperating with the system manufacturer



Trial periods

Trial periods can help in understanding the specific needs of the workplace and workers, and adapt the new OSH monitoring system.



Continuous support

Implementing companies should choose product developers that offer continuous customer support and are open to addressing potential questions.



Trainings and workplace resources

On-site or online trainings for OSH professionals and workers and workplace resources should be developed to address questions on the spot.



A Germany-based product manufacturer of smart gas detectors conducts 'discovery technology workshops'. In these, OSH professionals from the implementing company and representatives of the product manufacturer discuss ways in which technology can tap into opportunities for increased health and safety.

Conclusions

This policy brief is based on EU-OSHA's research into real-world applications of smart digital systems for OSH in workplaces. In the course of the research, the team conducted interviews with a self-selected group of OSH professionals, governmental, worker, employer and trade union representatives, as well as developers of smart digital (OSH monitoring) systems and their clients (i.e. deployers). These discussions, along with insights gathered from a high-level seminar held in Bilbao, Spain, in 2023,¹³ form the basis of this policy brief.

The policy brief has provided an overview of six principles that deployers of smart digital systems can leverage, to bring them closer to the needs of workers and their working environment and enhance their overall uptake. These include the need to **respect data security and privacy, define and communicate the purpose of the system, ensure integration with existing infrastructure and with OSH frameworks, and cooperate with the product developers** during the deployment and use of the system.

¹³ For more information, see: euosha-events.eu (2023). High-level Workshop Smart Monitoring Systems. <https://www.euosha-events.eu/smart-digital-systems/>

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