European Agency for Safety and Health at Work

Smart digital systems: comparative case study report

Summary

European Agency for Safety and Health at Work

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1 Introduction

This is a summary report of the final comparative comprehensive report conducted under EU-OSHA's 'Smart digital systems for improving worker safety and health - overview of research and practices'[1] and reflects on the findings.

Smart digital systems and technologies are entering EU workplaces and reshape work environments for workers and employers alike. Innovations like smart wearables, exoskeletons, artificial intelligence (AI), machine learning (ML), internet of things (IoT), virtual and augmented reality (VR and AR), among others, are giving new opportunities for preventing and responding to workplace risks.

As part of EU-OSHA's occupational safety and health (OSH) overview programme (2020-2023)[2], EU-OSHA has examined the challenges and opportunities of smart digital tools and monitoring systems for improving workers' safety and health. These systems, leverage digital technology to collect and analyse data in order to identify and assess risks, prevent and/or minimise harm and promote OSH.[3] EU-OSHA has categorised such systems into two categories: proactive (preventive) and reactive, albeit acknowledging the potential overlap between the two.[4] EU-OSHA further provided an overview of the risks and opportunities associated with these systems[5] and explored the workplace resources that could ensure their safe and healthy use.[6]

In order to investigate the practical implementation of smart digital tools and new OSH monitoring systems for improving workers' safety and health, EU-OSHA has developed a number of case studies.

The case studies accordingly investigate aspects related to the development stage and to the deployment[7] stage. OSH aspects including worker's involvement was considered in all case studies taking into account the type of case study. Further, all case studies look at possible drivers, barriers and success factors for safe and effective deployment.

For each of the case studies, a tailored research protocol was developed in cooperation with the company in focus, to ensure that all relevant information was collected. The data collection methods included desk research, individual interviews, focus group discussions and contextualisation interviews.

Detailed findings of the case studies are presented separately, in stand-alone case study reports. The complete comparative perspective is available in the (separate) comparative comprehensive report.

2 Overview of case studies

The case studies show examples of use of **smart digital systems** and use of **OSH monitoring systems**[8]**.** The definition of OSH monitoring systems (see below) has been adopted for this study, drawing on existing definitions of OSH and other monitoring systems, and the evidence gathered on their types and purposes.

[1] Available at: https://osha.europa.eu/en/publications/smart-digital-systems-improving-worker-safety-and-health-overview-research-and-practices
[2] For more information, see: osha.europa.eu (n.d.) Digitalisation of work. https://osha.europa.eu/en/themes/digitalisation-work
[3] EU-OSHA (2023). Smart digital monitoring systems for occupational safety and health: uses and challenges. https://osha.europa.eu/en/publications/smart-digital-monitoring-systems-occupational-safety-and-health-uses-and-challenges
[4] Ibid.
[5] Ibid.
[6] EU-OSHA (2023). Smart digital monitoring systems for occupational safety and health: workplace resources for design, implementation and use. https://osha.europa.eu/en/publications/smart-digital-monitoring-systems-occupational-safety-and-health-workplace-resources-design-implementation-and-use
[7] In previous EU-OSHA's publications, the terms "designer", "implementer" and "system user" were used. That is because at the time those publications were prepared (2021), the AI Act (Regulation (EU) 2024/1689) was not adopted by the European Parliament. Since the AI Act is now officially adopted, in this report the terms "developer" and "deployer" will be used for clarity and consistency.
[8] The term is used interchangeably with 'smart monitoring systems' and 'smart digital systems'.

'New OSH monitoring systems use 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.'[9]

The above definition captures a diversity of **technologies** that are incorporated into the monitoring systems to help improve OSH in the contemporary workplace. From the 9 case studies developed, it is worth noting how the different technologies can be combined and integrated to improve the detection, assessment and management of risks for OSH purposes. In all cases, new technologies are used for specific functions — resulting in integrated, smart digital systems.

Moreover, the case studies show the use of two approaches of smart digital OSH systems, as mentioned earlier:

- a **proactive** approach that seeks to prevent harm and, more broadly, promote health; and
- a **reactive** one that focuses on the response to accidents and emergencies.

First, a long list of 15 potential case examples (potential case studies) was identified, which led to the development of 9 case studies. Most of the case studies are European (France, Germany, Ireland, Spain and the United Kingdom) and some are outside of Europe (Australia, United Kingdom, United States). Among them are developers (also referred as: providers) as well as users (also referenced to as: deployers) of the systems. Technologies/uses are wearables designed for better ergonomics, for example, smart insoles for (lone) worker protection, real-time data gathering for effective safety management or for monitoring of environmental risks and worker fatigue, artificial intelligence (AI) and computer vision to predict workers' risks and improve safety reporting, portable gas detectors, and a smart-glass-type device for the purposes of conducting remote OSH assessments and audits.

The range of risks covered by the case studies encompasses:

- individual and collective harmful exposures and environmental levels,
- exposure to ergonomic risks,
- plant and premise-related risks,
- hazardous worker behaviour,
- individual wellbeing and fatigue risks
- psychosocial risks.

3 Implementation process: barriers and facilitators

Based on the practical experiences in the case studies, a number of motivators and goals for implementation of the systems as well as learnings from the systems' implementation - barriers and facilitators - have been identified.

The primary driver for implementing smart digital systems is the desire to increase health and safety in the workplace and by this the systems can help reduce worker turnover and worker compensation costs. The systems can have flexibility and adaptability, and meet the demand to implement ergonomic and innovative OSH solutions. The COVID-19 pandemic has led to a rise in the use of OSH 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.

The smart digital systems 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. One of the main barriers is related to workers' concerns regarding data privacy and the potential misuse of data, which can be sensitive in nature, and raises the need for full anonymisation of data. The adoption of smart digital systems is also linked to company size and sector of operation, with the more cutting-edge technologies having a lower adoption rate. The collected information suggests

[9] EU-OSHA – European Agency for Safety and Health at Work, *Smart digital monitoring systems for occupational safety and health: uses and challenges*, 2022. https://osha.europa.eu/sites/default/files/Smart-digital-monitoring-systems-uses-challenges_en.pdf

that some companies are reluctant to use wearables, AI and other cutting-edge technologies in their workplace, as a consequence of e.g., lack of information, short-term investment costs, or fear of its impact on the workplace. The third barrier to OSH implementation relates to the lack of digital skills among workers and inadequate ICT infrastructure — especially in SMEs — needed to implement new systems.

The studies highlight that close interaction between the designing and implementing companies - providers and deployers- and a common understanding of the workers' needs and priorities are vital to guarantee the successful implementation of the smart system. Such cooperation is most evident during the on-site implementation of the solution. The cooperation at the design and development phase is less visible, and if it occurs, it usually comes in the form of investment and commitment to the first innovation idea of the providing/designing company. The cooperation is generally composed of key steps that are similar for companies: solution tailoring and customisation to deployers/implementers' needs and trial and training opportunities.

4 OSH impacts: opportunities and challenges

In terms of OSH impacts of the smart digital systems, a number of opportunities and challenges have been identified.

Opportunities

- OSH technologies have opened up new **opportunities** for the prevention of accidents, collisions, falls and other events that may put workers or any other parties in immediate danger (i.e. the proactive approach to OSH), often through providing real-time monitoring and immediate alerts.
- Innovative technologies have been shown to have a preventive function regarding a wide range of OSH risks. In particular, predictive functions greatly strengthen the proactive approach to OSH risks. Smart digital systems facilitate timely reactions to any events that could not be predicted by any monitoring tool before. From the system point of view, adaptation of innovative OSH technologies has strengthened proactive accident prevention by enabling generation of very specific insights on risks related to the workplace and workers — enhancing data collection and analysis. Data-driven insights can lead to better workplace design, improved ergonomics, enhanced training programmes and better resource allocation. The aggregated data from multiple sources provide a comprehensive view of workplace safety and health, facilitating informed decision-making and trend analysis.
- Furthermore, the technologies described in the case studies show a significant broadening in the understanding of OSH. Instead of focusing purely on accident prevention, designers move towards a much broader category of workers' wellbeing. Thanks to such systems, workplaces may benefit not only from increased safety but also from increased job satisfaction or better work efficiency. Case studies also indicate that the line between reactive and proactive OSH technologies is very fluid.
- In terms of opportunities for OSH management, one of the most significant benefits is the ability to improve health and safety in a more effective and efficient way. The possibility to conduct remote assessments and inspections is an excellent example of this. Several technologies create the opportunity to perform them remotely without needing to travel to a workplace every single time, which saves time and costs.
- Additionally, data gathered via OSH technologies allow organisation of the OSH process based on 'hard indicators', which are usually unavailable in traditional OSH monitoring technologies. These data also allow OSH professionals to enhance compliance with any legal, including health and safety, requirements. Smart digital systems can enhance compliance management by providing accurate records and simplifying the audit process by providing comprehensive and organised data. Consequently, transparency and accountability can be improved. Extensive use of data, supported with AI and machine learning, helps OSH professionals better

understand a situation in their companies. That helps to adjust company-level systems, training and internal procedures to further improve safety in the workplace.

- Interestingly, OSH monitoring technologies allow the inclusion of a wide range of workers in OSH processes, creating a chance for better inclusiveness of the health and safety procedures accessible to workers of varied genders, body sizes and migrant statuses.
- Finally, smart digital systems provide workers with increased performance *and* awareness of safety and health. Although most of these technologies are still in the early stages of implementation, there is already strong evidence that the number of accidents and injuries has significantly decreased after their implementation. Moreover, workers benefit from a shift in the OSH paradigm supported by these technologies. Since 'worker wellbeing' is perceived as broader than 'preventing accidents', positive impacts on OSH can be seen, especially considering the long-term perspective. Moreover, better OSH awareness translates into better health and safety in the long term. Workers become more engaged in their own safety, leading to a culture of proactive safety behaviour, and real-time feedback increases awareness of proper ergonomics and promotes preventive measures.

Challenges

OSH is a critical aspect of any workplace, and it is essential to address the **challenges** that come with it.

- One of the main challenges identified in the case studies is **privacy and data protection**. Most systems involve monitoring of workers and not just their working environment but also other characteristics such as worker health, presence and proximity to other workers. Therefore, it is crucial to carefully design a data protection system to address two major challenges: legal risks and end-user concerns. The EU's General Data Protection Regulation (GDPR) provides solid legislation on data protection, making legal consequences particularly relevant within the Member States.
- **Cybersecurity** is another related challenge. All the case studies presented require the collection of large amounts of often sensitive data, and devices can be targets for cyberattacks, so these should be carefully protected by the company implementing a new system. Concerns over data privacy or data misuse are among the most important from the perspective of end-users — the workers.
- Challenges for OSH may also relate to **potential technical issues and failures** leading to unmonitored risks or disruptions of the monitoring and feedback process, potential false positives and negatives causing incorrect alerts, and problems with interoperability and data integration. Such issues highlight the need for adequate integration of new systems into existing OSH frameworks to ensure comprehensive workplace safety.
- Smart digital systems have brought about new challenges in OSH management. An often-raised challenge relates to the fact that OSH monitoring systems **may blur OSH responsibility** in practice by making employers increasingly reliant on them at the expense of other -collective- OSH measures. Potentially, employers may omit adequate risk assessments, fail to adopt organisational measures or treat the smart systems as a substitute for other OSH obligations. Workers might also become overly reliant on the system, potentially neglecting basic safety practices and human judgement, or may feel protected and take greater risks. The case studies have shown that system designers and developers (providers) and users and implementing companies (deployers) pay much attention to cooperating to understand the workplace needs, effectively integrate the new solutions into the existing OSH framework and provide adequate training and workplace resources. Proper training of workers is critical, and OSH professionals are often the focal point in system implementation, being at the frontline in case of any worker concerns. In order to fully reach the potential of those solutions, the designer has to have

knowledge of the needs and specifics of a company, which can only be gathered from an everyday practitioner.

- Another challenge for OSH professionals stems from having to **balance between monitoring safety and not worker performance**. With technologies monitoring various aspects of worker characteristics, OSH professionals and companies can have access to data that significantly go beyond what is necessary for health and safety at the workplace. As a consequence, for both legal and trust reasons, OSH professionals have to pay much more attention to their work, to **ensure that workers' personal data are safe and used only for the purpose of safety**. In the long run, there exists a chance that a technology supported by AI will replace OSH professionals in conducting such tasks.
- Labour inspection authorities also face challenges related to OSH technologies. The immediate one is that they create an entry barrier for inspectors. Inspectors should also be aware of the risk of over-reliance on technology, data inaccuracy and manipulation. Therefore, smart digital systems should be used as a support to inspection rather than as its replacement.
- Workers' concerns have been voiced in several case studies, indicating reservations towards the daily use of OSH technologies. Across companies, workers express concerns over monitoring their productivity and possible data misuse. They are concerned about **sharing their data on productivity and location with their managers and worry about 'getting tired and getting fired'**. Workers fear that the workload may increase due to the belief of being better protected, for example, asking one worker to do a job usually done by two. Other end-user concerns were related to worker comfort, which can adversely impact their performance. Another common concern for workers is data privacy. Technology can capture their surroundings, and it might track them. Workers fear sharing their data on health issues. There have been concerns over potential security dangers associated with large-scale operations.
- The collected data foreshadow possible challenges around **protecting workers' voices in decision-making** and their agency more generally. *Over-reliance* on (largely quantitative) data generated from smart digital systems, without seeking direct feedback from workers, may lead to *misinterpretations and decisions that are not optimal and even harmful*, both from an OSH but also a business perspective. The implementation of such systems should thus come alongside procedures for workers engagement beyond the induction phase; and the more intrusive the data collection and possible implications of the system's use for company operations, the higher **worker engagement** should be. Engaging workers may also **ensure that responsibility for OSH does not shift from the collective to the individual level**.

Several measures to address worker concerns regarding OSH technologies have been identified. These measures focus on what data are gathered and how they are stored. In some case studies, data monitoring is related to the device, not the person using the device, putting in another safety layer for worker anonymity. Other measures include encouraging the company leadership to commit in writing that technology will not be misused for any purposes other than OSH.

The reported worker concerns centre around a **fundamental issue of trust** between workers and employers. To truly address concerns, smart digital systems should incorporate solutions that guarantee trust. This includes building in functionalities that give the workers the power to see specific employers' actions on their data and control data processing (including discontinuation) when processing does not have a legitimate basis or exceeds its stated purpose. Given the **power imbalance**, the legal systems should also be prepared to protect workers who assert their rights in this way.

Besides legislation, there is also a clear role to play for **labour inspections** in how smart digital systems are implemented and used. However, for labour inspections to play this role, they need to be equipped with expertise and resources. In this sense, legislation and labour inspections need to keep pace with the fast development of smart digital systems and their use in the workplace, so as to ensure their integration in an effective OSH management system, based on collective employer responsibility and in the context of the hierarchy of controls.

5 General conclusions and considerations

Taking into account the information gathered in the case studies, several conclusions and recommendations have been drawn.

Proactive and reactive functions of smart digital systems

Considering the broad implications, one should note that, overall, the driving force behind implementing smart digital systems is the **desire to enhance health and safety within workplaces** — a goal that in itself is not new but can be achieved by leveraging cutting-edge technologies.

By providing real-time data, predictive insights and even actionable recommendations, the new **monitoring systems can greatly contribute to the proactive approach to OSH**. Rather than merely reacting to incidents, companies can anticipate risks, prevent accidents and safeguard their workforce. The case studies exemplify how technology empowers risk identification and early detection, which leads to the prevention or avoidance of harm. The range of risks covered by the case studies are broad and vary from individual and collective harmful exposures and environmental levels to exposure to ergonomic risks, to psychosocial risks.

Because of the technological developments, accurate and fast insights can be generated when certain parameters exceed specific thresholds or norms. As shown in some of the case studies, risk detection can further be strengthened by **predictive algorithms, which can analyse complex, large-volume or historical data patterns to forecast potential risks and provide behavioural insights**.

Moreover, in terms of implications for OSH management, the systems bring **operational opportunities for companies and OSH professionals**. For example, some systems allow internal risk assessments, inspections or audits to be performed remotely, saving time and resources that would otherwise be necessary for travel to distant sites of operation. Remote technologies also have the potential for participation of external parties in such assessments and inspections. Other systems can improve the efficiency of compliance monitoring by identifying if protective gear is worn, procedures are followed and equipment is operated correctly.

The extensive use of data, supported by AI and machine learning, can help OSH professionals and the employer better **understand the situation in their workplaces, facilitating continuous improvement** — that is, allowing to adjust company-level systems and internal procedures to further improve safety in the workplace. Together with the enhanced potential to present information tailored to needs of specific workers or groups, digital technologies can strengthen the training functions of OSH systems. The case studies did not directly identify the systems being used for the purposes of labour inspectorates. However, such use is clearly conceivable, and research has mapped examples.[10]

As the case studies exemplify, in practice, the smart digital systems often serve multiple OSH purposes and combine more than one digital technology. Often, this is not limited to monitoring for multiple risk factors within the systems' proactive functions, but also integrating functions that fall into the category of reactive OSH monitoring. By enabling easy signalling and precise localising of emergencies and helping to respond to such events, the systems can minimise the consequences of harm that occurred at the workplace.

New technological capabilities can also enhance how accidents are investigated, reported on and used to support the improvement of OSH. While smart systems bring many opportunities, they also pose challenges to OSH. The analysis of the conducted case studies shows that key to overcoming these challenges is how the systems are integrated into existing OSH frameworks.

Integrating smart digital systems into existing OSH frameworks

By highlighting the multifunctionality of the solutions covered by the case studies, it can be seen that in some cases they are in fact **integrated systems** aimed at offering comprehensive solutions to leverage

[10] EU-OSHA – European Agency for Safety and Health at Work, *Smart digital monitoring systems for occupational safety and health: uses and challenges*, 2022. https://osha.europa.eu/sites/default/files/Smart-digital-monitoring-systems-uses-challenges_en.pdf

new technological advancements and with a combination of technologies solve specific needs of an industry, company or workplace. By providing accurate and detailed monitoring of various parameters, they can greatly enhance OSH practices and contribute to safer work environments. However, OSH is a process or cycle, rather than a compartmentalised intervention, and while able to perform many functions, the systems discussed in this study 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**.

Examining the case studies reveals that these smart digital systems are often **custom designed to address specific purposes or monitor particular parameters**. Whether in specific industries, sectors or individual companies, these systems are tailored to meet unique requirements. Their richness of information allows for targeted interventions and proactive measures. For instance, a system designed to monitor noise levels in a manufacturing facility may differ significantly from one focused on ergonomic assessments in an office setting. This adaptability can potentially **ensure that OSH monitoring aligns with the specific needs of each context**.

While the systems are transferrable to a degree (the more similar the tasks, applications or sector, the higher the transferability), the case studies highlight that implementation at a specific workplace requires some consideration. Close cooperation between the developer and deployer and **a common understanding of the worker's needs and priorities are vital to guarantee the successful implementation of the solution**. System developer and users have to address needs at the company's employer level (high management), at the OSH professionals' level and at worker level. In the examined cases, this was often conducted through iterative interactions between the developer and user companies, which served in assessing the system's effectiveness and identifying room for improvement.

The importance of understanding needs and priorities is linked to the fact that data collected by smart digital systems can potentially be inaccurate, limited or biased, which ultimately can bring risks to safety and health. **Over-reliance on the smartsystems can lead to complacency and a false sense of security**, which can be particularly dangerous in high-risk work environments. Therefore, it is crucial to use these systems as a **supplement to, rather than a replacement** for, traditional safety measures and human judgement that form elements of a broader OSH framework.

The workplace as a data-rich environment

The introduction of digital technologies to the workplace brings multiple opportunities and challenges. The underlying change is that smart digital systems — as an element of broader OSH frameworks — transform the workplace into a data-rich environment, and in consequence, the **primary considerations relate to the privacy of workers' data and potential misuse of such data**.

The case studies show that, often, smart digital systems, while serving to increase workers' safety and broader wellbeing, are seen (and sold) as tools of which the employer is the primary user. Workers can be empowered to contribute at some stages, for example, on the systems' design or implementation at a workplace, and trained to use the systems, yet the decision of introducing a new system lies with the company/employer.

The systems provide companies 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 where employers know much more about their workers than the latter know about themselves.

The implementation of such systems should thus come **alongside procedures for worker engagement beyond the induction phase**; and 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 also address what data are gathered and how they are stored and processed. The examined cases highlight two approaches to these issues: **a) privacy by design**, which entails measures such as data anonymisation, data minimisation, compliance with the GDPR and secure storage of data; and **b) privacy by choice**, which focuses on restricting data access for specific positions and users (e.g. OSH professionals).

On a superficial level, concerns about data privacy or misuse brought up by workers may be *perceived as resistance* to new technologies. This perception testifies to a possible implicit acceptance of the inevitability of these systems being implemented by employers. Yet, the concerns around allowing employers access to ever more spheres of workers' lives, including mental, health are serious and lead some to argue against the use of some technologies. This highlights the **need to consider data privacy when introducing digital smart systems at the workplace, and potentially developing guidance or regulations that safeguard workers' rights**. Smart digital systems should incorporate functionalities that give the workers the power to see specific employers' actions on their data and control data processing (including discontinuation) when processing does not have a legitimate basis or exceeds its stated purpose. Given the power imbalance inherent in the worker–employer relationship, the legal systems should also be prepared to protect workers who assert their rights in this way. Besides legislation, there is also a clear role to play for **labour inspections** in how new systems are implemented and used.

6 Takeaways for development and implementation of smart digital OSH systems

Based on the case studies, a number of cross-cutting insights and considerations for the development and implementation of smart digital systems can be formulated. To a degree, these overlap, which highlights that some issues, such as data security and privacy, and cooperation, should be considered both by the system developers (providers) as well as implementers (deployers).

Box 1: Considerations for developers of the smart digital systems

System design and development should ensure the following features where applicable:

INTEGRATION AND CUSTOMISATION

- **Integrated** into organisations' **existing systems to optimise OSH processes** and to form a holistic view of safety and health across all workplaces, prevent migration issues and anticipate (future) scalability needs.
- **Customised** to fit to specific organisational and individual needs.
- **Tailor-made** by embedding **diversity and inclusion principles**.
- **Intrinsically designed to avoid negative consequence** by the use of the smart monitoring systems for performance measurement.
- **Foster proactive safety management** to emphasise mitigation of risks before incidents occur, demonstrating clear advantages over reactive technologies.

DATA SECURITY AND PRIVACY

- **Compliant** with the latest relevant legislation (European and national) on issues such as data privacy, (AI) provisions, etc.
- **Fostering a privacy-centric design** that addresses and alleviates worker privacy concerns, embedding privacy by design where feasible or preferred.
- **Minimising and/or anonymising the collected data**, preventing the collection of data not relevant for OSH and making certain features, such as geolocation data, available only in specific circumstances such as for alerts.
- **Transparent by clearly informing users** about the data privacy and management aspects of the systems, to maintain and build trust among the workforce.
- **Ensure robust data security measures** within the system to address potential cyberattacks and ensure user data confidentiality.

RELIABILITY AND USER FRIENDLINESS

- **Ensuring user comfort** in the design of the wearables and devices.
- **Focused on safe interfaces** by a user-centred, ergonomic and intuitive design for the interfaces to minimise physical and operational hazards.
- **Enhance accuracy** through continuous empirical validation and refinement of algorithms and data sources, ensuring reliable results for clients' needs.
- **Compliant with relevant standards** for effective operation in **challenging environments and remote areas**.
- Adherent to transparent and rigorous processes to ensure **clarity in the journey from data to interpretation and to avoid potential biases, including unintended** ones.

COMMUNICATION AND COOPERATION

- **Clear about limitations** of the systems to potential clients to prevent misunderstandings regarding their usage.
- **Involving the client's representatives**, in particular users and workers, in the development stage.
- **Transparent by implementing measures** to provide clients with **clear insights** into how the systems operate and the **underlying algorithms**, fostering trust and understanding.
- **Establishing a step-by-step cooperation framework** with the deployers, emphasising efficient **change management** and communication.
- **Offering ongoing support** to deployers throughout the implementation phase, such as trial periods, test phases, tutorials, workshops, user guides, on-site visits and so on.

Box 2: Considerations for users/deployers (employers) of the smart digital systems

System deployment should incorporate the following where appropriate:

DATA SECURITY AND PRIVACY

The deployment of the system should be:

- **Compliant** with the latest European and national legislation on data privacy and relevant (AI) technologies.
- **Minimising and/or anonymising the collected data**, preventing the collection of data not relevant for OSH and making certain features, such as geolocation data, available only in specific circumstances such as for alerts.
- **Ensure robust data security measures** within the system to address potential cyberattacks and ensure user data confidentiality.
- **Engaging workers or their representatives to address concerns** over personal data collection, provide comprehensive information and establish clear policies on data usage and workers monitoring, ensuring transparency and consent.
- **Establishing clear protocols and procedures** for addressing any concerns or issues raised by workers related to privacy, data security or ethical considerations.

PURPOSE OF SYSTEM USE AND PROACTIVE SAFETY CULTURE

- **Safeguarding workers' rights** and clearly inform users about the data privacy and management aspects of the systems, adopt a transparent approach to build trust among the workforce.
- **Supported by procedures and policies** that define the purposes and scope of system use and clarify who **owns the collected data**, and communicate these procedures and policies clearly.
- **Separating the OSH system from other information management systems**, for example, those related to measuring the workers' performance, to ensure transparency and overcome employees' resistance.
- **Providing comprehensive training** to workers on the proper use and interpretation of the system, emphasising its role as a supportive tool rather than a surveillance mechanism.
- **Acting on the data insights to foster a proactive safety culture** in the workplace, effectively offering support and coaching to at-risk workers.
- **Fostering proactive safety management** to emphasise mitigation of risks before incidents occur, demonstrating clear advantages over reactive technologies.
- **Promoting balanced vigilance** — encourage a balance between technological reliance and human vigilance through training and awareness programmes.

INTEGRATION WITH EXISTING OSH FRAMEWORKS AND TECHNICAL INFRASTRUCTURE

- **Acknowledging the main responsibility** to ensure safety in the workplace falls on **employers,** and that it cannot be substituted by system indicators.
- **Highlighting how the new system supports individual wellbeing**, encouraging workers to take precautions for their own safety while reiterating that **the employer maintains the overarching responsibility for OSH**.
- Introducing the new the smart digital systems as an **integral part of a comprehensive OSH framework** rather than as a substitute.
- **Exploring avenues to improve system integration (and interoperability)** to optimise OSH processes and form a **holistic view of safety and health across all workplaces**, prevent migration issues and anticipate (future) scalability needs.

- particularly in life-critical operations. Having clear protocols and procedures in place **for addressing any concerns or issues raised by workers related to privacy, data security and ethical** considerations
- **Conduct regular evaluations and assessments** of the system's effectiveness and impact on workers wellbeing, making adjustments as necessary to ensure its safe and responsible implementation.
- **Allocating sufficient resources** for the proper implementation and regular maintenance of the system and take precautions against potential system malfunctions.

COOPERATING WITH SYSTEM DEVELOPERS

- **Ensuring transparent communication with system developers** to receive clear information on limitations and insights into how the systems operate and the underlying algorithms, fostering trust and understanding.
- **Engaging workers' representatives during system deployment** to ensure customisation and tailoring to their needs, as well as reinforce trust and transparency.
- **Establishing a step-by-step cooperation framework** with the developer, emphasising efficient change management and communication.
- **Requesting ongoing support from the developer** throughout the implementation phase, such as trial periods, test phases, tutorials, workshops, user guides and on-site visits.

The European Agency for Safety and Health at Work (EU-OSHA) contributes to making Europe a safer, healthier and more productive place to work. The Agency researches, develops, and distributes reliable, balanced, and impartial safey and health information and organises pan-European awareness raising campaigns. Set up by the European Union in 1994 and based in Bilbao, Spain, the Agency brings together representatives from the European Commission, Member State governments, and employers' and workers' organisations, as well as leading experts in each of the EU Member States and beyond.

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