

Workforce management in the digital era

Implications for occupational safety & health

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Digital technologies are transforming the world of work. For workers and employers, digital technologies offer increased opportunities but also present greater risks in terms of occupational safety and health. Based on recent EU-OSHA research on the topic, this article analyses the relationship between the work-related use of digital technologies and psychosocial risks, especially in the area of algorithmic management of workers – a feature of platform work that is becoming increasingly common in conventional workplaces – and discusses the measures to mitigate such risks.

Le tecnologie digitali stanno trasformando il mondo del lavoro. Per lavoratori e datori di lavoro, le tecnologie digitali offrono maggiori opportunità ma presentano anche maggiori rischi in termini di salute e sicurezza sul lavoro. Basandosi sulla recente attività di ricerca dell'EU-OSHA, l'articolo analizza la relazione tra l'uso delle tecnologie digitali e i rischi psicosociali, soprattutto in riferimento alla gestione algoritmica dei lavoratori, una caratteristica del lavoro su piattaforma sempre più comune nei luoghi di lavoro convenzionali, e discute le misure per mitigare tali rischi.

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Introduction

Advancing faster than any innovation in our history, digital technologies are transforming our society and our daily lives, including the way we work, where and how. For workers and employers in many workplaces and in all economic sectors, digital technologies offer increased opportunities but also present greater challenges and risks in terms of occupational safety and health (OSH).

Based on findings from recent research on the OSH implications of the digitalisation of work, the aim of this article is to present findings from the European Agency for Safety and Health at Work (EU-OSHA) research activities, corroborated by results of the EU-OSHA OSH Pulse survey. The article focuses in particular on the relationship between the work-related use of digital technologies and psychosocial risks/mental health issues, especially when it

comes to worker management enabled by digital technologies and systems relying on algorithms and artificial intelligence (AI), a specific feature of digital platform work that is becoming increasingly common in other more 'traditional' working contexts.

The article is structured as follows. Section 1 provides the theoretical background to this article based on an extensive literature review. Section 2 presents briefly the data used for the analysis reported in the subsequent sections. Section 3 discusses the uses of specific types of digital technologies at work. Section 4 analyses the purposes for which those technologies are used. Section 5 presents the implications of the use of digital technologies for the occupational safety and health (OSH) of workers, and section 6 offers a specific focus on digital platform work. Section 7 of the article discusses the solutions to mitigate the OSH risks related to the digitalisation of the workplace, specifically regarding the use of digital technologies for the management of workers. More in detail, section 7 discusses the regulatory framework at the EU and national levels, lists the key principles, formulates recommendations for risk mitigation, and presents some examples of prevention practices in EU workplaces and in digital labour platforms. The last section concludes the article.

1. Theoretical framework and main findings: literature review

In 2020 EU-OSHA initiated a major research programme¹ to investigate the implications of the digitalisation of work and the workplace for the occupational safety and health (OSH) of workers.

One of the main topics under investigation was the use of digital technologies and systems based on algorithms or artificial intelligence (AI) to manage the workforce and their impact in terms of OSH, in particular on the mental health of workers.

The literature on the topic displays that the new forms of worker management resulting from the use of digital technologies (including AI and algorithms)

are a specific feature of digital labour platforms. Digital platform work can be defined as "All paid labour provided through, on or mediated by an online platform" (Lenaerts *et al.* 2021). The demand and the offer of service provision happen always virtually, through the platform, while the service is provided on-location or online, depending on the type of task. The platforms use algorithms to allocate, monitor and evaluate work tasks and/or to monitor and evaluate workers' behaviour and performance. Based on the data collected, automated or semi-automated decisions, including the termination of the worker, are made (EU-OSHA 2023). This form of worker management is commonly known as 'algorithmic management' and characterises digital platform work since its very inception.

Nevertheless, more recently, more sophisticated and intelligent forms of algorithmic management, involving AI (algorithmic or AI-based worker management, AIWM in short) are being increasingly implemented in a range of 'conventional' workplaces across a number of economic sectors, beyond digital labour platforms.

The literature identifies several reasons why organisations decide to introduce AIWM systems to manage their workforce (Christenko *et al.* 2022a and 2022b), although the most common and predominant one is to improve the productivity and efficiency of workers (Kellogg *et al.* 2020; Mateescu and Nguyen 2019).

Unlike earlier forms of management relying on human supervisors, digital technologies allow for new, pervasive and lower-cost forms of worker management, using large amounts of workers' data processed in unprecedented ways (Christenko *et al.* 2022a and 2022b; Reinhold *et al.* 2022).

AIWM refers in particular to a worker management system that collects data, often in real time, from the workplace, workers and the work they do, which is then fed into an AI-based or algorithmic-based system that makes automated or semi-automated decisions, or provides information

1 EU-OSHA has undertaken a number of research activities on the OSH implications of the digital transformation of work and the workplace including literature reviews, a survey of policies and initiatives in the EU, and fieldwork investigating the design, development and implementation of digital technologies for work. For more information, see: <https://osha.europa.eu/en/themes/digitalisation-work>. In this article findings from the OSH Pulse survey, carried out by EU-OSHA in 2022 to investigate psychosocial risk factors and OSH management in post-pandemic workplaces, also in relation to the use of digital technologies, will be presented. For more information, see: <https://osha.europa.eu/en/facts-and-figures/osh-pulse-occupational-safety-and-health-post-pandemic-workplaces>.

for decision-makers (for example, human resources managers or employers and occasionally workers), on questions related to worker management (EU-OSHA 2019; European Commission 2021; European Parliamentary Research Service 2020; High-Level Expert Group on Artificial Intelligence 2019).

These data may be collected by such technologies in a variety of workplaces and economic sectors, as well as outside the workplace, sometimes beyond what is necessary or legal (Christenko *et al.* 2022c).

The AIWM systems allow employers to increase control and surveillance over their workers (Albano *et al.* 2021; Kellogg *et al.* 2020), through, for example, performance, safety, and emotion monitoring (Ball 2021; Eurofound 2020). They can incorporate worker rating systems based on customer satisfaction (Wood 2021), or other metrics to exercise performance pressure on workers, by embedding them into performance evaluation (Frey and Osborne 2013; Lee *et al.* 2015).

The AIWM systems are employed to rationalise the organisation of work, allocate tasks, schedules or shifts, reduce the cost of surveillance, reward or penalise workers, influence their behaviours or improve HR management (Kellogg *et al.* 2020). The AIWM technologies allow the appearance as well of functions such as 'people analytics' and 'gamification'. The former consists of the use of worker data to measure, report and understand worker performance and other aspects of work, for example to identify if a worker left their assigned working route (e.g., in a warehouse) or to identify the workers who are planning to quit (Collins *et al.* 2017; Kellogg *et al.* 2020). Gamification refers to bringing ideas and concepts from games, such as rewards for milestones, into the work environment to nudge workers into desired behaviours and improve their efficiency and productivity (Savignac 2017).

These new forms of managing workers enabled by AIWM systems may give rise to legal, regulatory and ethical questions (Stacey *et al.* 2018; Fernández-Martínez and Fernández 2020), as well as concerns for workers' OSH, in particular in terms of psychosocial risks and mental health (Reinhold *et al.* 2022; Bérastégui 2021). Some of the psychosocial risks associated with the use of AIWM most frequently reported in the literature are reported here below.

The *intensification of work* is one of the risks related to the use of AIWM systems most frequently reported

in the literature. To increase productivity, organisations implement AIWM systems that direct workers to work without taking breaks when needed, minimise the time for certain procedures and force them to work at high speed (Reinhold *et al.* 2022). This may cause stress and exhaustion as well as accidents, and musculoskeletal and cardiovascular disorders.

Loss of job control and autonomy are also commonly reported psychosocial risks related to the use of AIWM systems. These systems can direct workers in how to perform their work or assigned tasks, thus potentially taking control over aspects of work (e.g., content, pace, schedule) leaving little to be decided by the worker (Curchod *et al.* 2020; Kellogg *et al.* 2020; Saithibvongsa and Yu 2018). Generally speaking, the use of AIWM – either in the platform economy or in the traditional economy – would have, according to the Job-Demand-Control model developed by Karasek, a detrimental impact on workers' mental health as it drastically reduces the degree of control of the workers over their work and their autonomy, while also increasing demands and at the same time it might lead to a lack of support from peers and line managers (which would have a mitigating impact) (Urzi Brancati and Curtarelli 2021).

The use of AIWM can also lead to *social isolation* among workers, as it compels them to focus on work and productivity, consequently reducing opportunities for communication with peers. The lack of communication between workers (and related lack of support from peers), as well as the *lack of support from line managers* in cases where AIWM systems replace social support, result in a work environment that discourages the cultivation of good relationships and a cohesive work community, which might lead to increased stress, anxiety and, in some cases, burnout in workers (Bérastégui 2021).

The *constant monitoring and evaluation of worker performance*, coupled with the pressure to improve productivity enabled by AIWM systems, have been consistently linked in the literature to increased worker exhaustion, stress, anxiety and fear of job loss and, therefore, are associated with the probability of developing mental health disorders (EU-OSHA 2019; Jarota 2021; Neagu and Vieriu 2019). Another area of concern regards *collecting workers' private and sensitive data* (Ravid *et al.* 2020), which can be used to make automated or semi-automated decisions about the worker. This can result in favouring certain

workers and discriminating against others based on various worker characteristics, for example, during hiring or when appraising/promoting workers. While discrimination is recognised *per se* as a main stress factor at work, which is related to mental health issues, privacy concerns about what data are collected by the AIWM systems and how they are used can also lead to stress, anxiety, performance pressure and other OSH-related issues if ignored (Gal *et al.* 2020).

As the key operational components of AI and algorithms often remain a 'black box', workers may lack information about the rationale behind the decisions made. This *lack of transparency* regarding the deployment of AIWM systems in the workplace, coupled with the lack of transparency about how the technologies work and how decisions are made, "might, in turn, endanger good relations between employers and workers, reduce workers' trust in the manager, and consequently discourage the acceptance and proper use of AIWM systems" (Reinhold *et al.* 2022, 13). This lack of transparency can therefore be seen as a psychosocial risk that can result in increased stress, lack of motivation and other mental health issues (Reinhold *et al.* 2022).

In conclusion, as pointed out by the Health and Safety Executive (HSE), psychosocial risks like those related to the use of AIWM in the workplace are frequently associated with higher levels of stress, and can also lead to reduced productivity, poor performance and higher levels of sickness absence (HSE 2017), the exact opposite result that the deployment of AIWM technologies want to pursue in the first place.

On a final note, it is worth mentioning that AIWM may provide an opportunity to improve OSH monitoring, reduce exposure to various risks, support evidence-based prevention, advanced workplace risk assessment and more efficient OSH inspections (Reinhold *et al.* 2022).

Nevertheless, the ethical use of AIWM and more in general of digital technologies at work requires effective strategies and transparency. The need to collect workers' data should be balanced against their rights to privacy, safety and health, as it will be discussed more in detail in section 7 of this article.

2. Data and methods

In this article we employ information from the 'Flash Eurobarometer – OSH Pulse survey', carried out in 2022². The survey was commissioned by EU-OSHA to get insights into a range of impacts the Covid-19 pandemic has had on workers' health and wellbeing, along with related workplace measures, also in combination with the increasing work-related use of digital technologies. A representative sample of 27,250 employed individuals aged 16 and over was interviewed over the phone in Spring 2022 across the European Union Member States (EU27) (25,683 respondents) and in Iceland (562 respondents) and Norway (1,005 respondents). The survey covers all the economic sectors and focuses on the following thematic areas: psychosocial risk factors, stress and mental health; other health outcomes; OSH preventive measures with a focus on mental health; opinions and experience of OSH in the workplace; digitalisation and use of digital technologies.

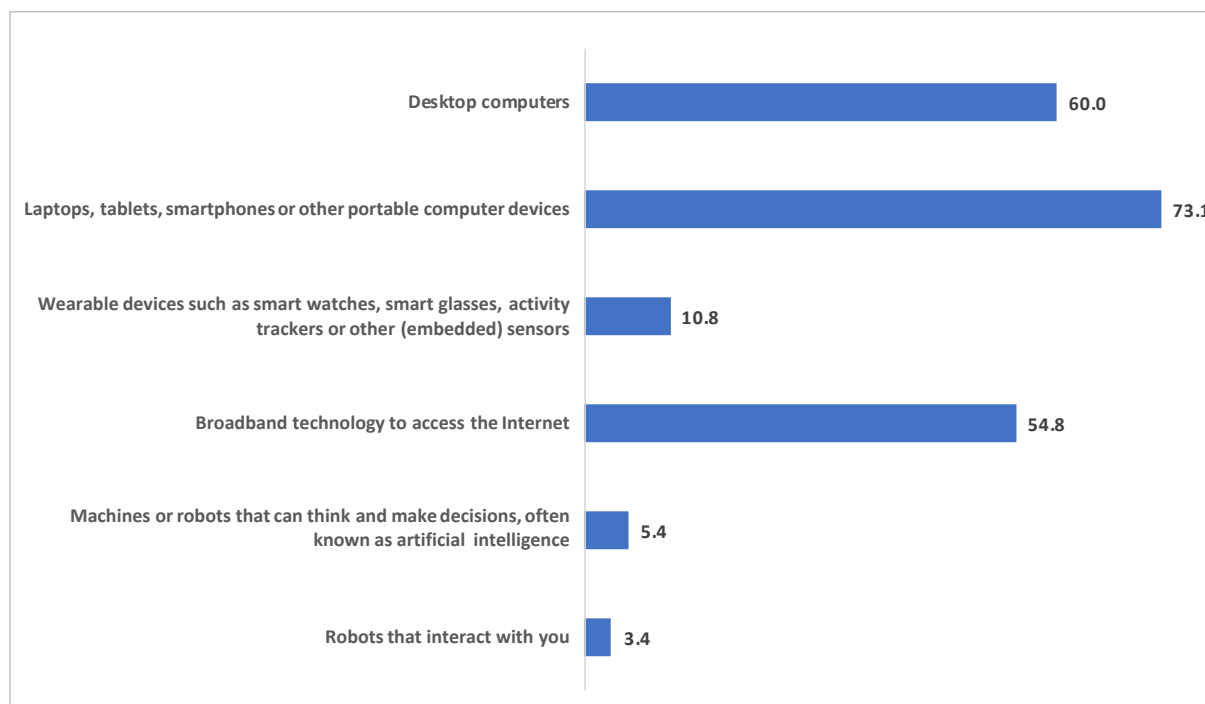
In relation to the latter, survey respondents were asked which type of technology they use at work, and for which purposes the employer introduced it. The questionnaire covers also the practices and initiatives put in place to prevent or address workers' mental health issues in the workplace, with a strong focus on how organisations deal with stress related to the use of digital technology and the organisation of work.

It is worth mentioning that this survey is a unique source of recent data that allows for comparative cross-country analyses on the reported impact of Covid-19 pandemic on workers' health and wellbeing. At the same time, it also offers a unique opportunity to look into the OSH implications of the use of digital technologies. The analysis that follows is based mostly on descriptive analyses of weighted data for the EU27 member states.

3. The use of digital technologies at work

The OSH Pulse survey results (Figure 1) indicate that the vast majority of European (EU27) workers use basic digital technologies at work such as desktop computers, laptops, tablets, smartphones or other portable digital devices, and an internet broadband connection. A share of 60% of workers report using desktop computers, 73% some type of

2 For more information on the survey, including reports and factsheets, see <https://osha.europa.eu/en/facts-and-figures/osh-pulse-occupational-safety-and-health-post-pandemic-workplaces>.

Figure 1. Workers by type of digital technologies used at work by type of technology, EU27, 2022 (%)

Source: Authors' elaboration on EU-OSHA OSH Pulse 2022 data

portable device at work and 55% use the Internet for work.

The use of those basic technologies is widespread across the economic sectors, particularly in services and administration, while it is more common among professionals, technicians, administrators and clerical workers. Smartphones, tablets, and other portable devices are an integral part of many jobs irrespective of the place of work and the workers' skill level: as an example, 60% of farmers and 37.5% of unskilled workers mention using a portable digital device for work.

On the other hand, the use of more advanced technologies appears to be rather limited to specific economic sectors (e.g., manufacturing, construction, logistics, professional and technical services) and is in general more common among professionals, technicians and skilled workers. Wearables devices are used by about 11% of workers, AI-based systems or devices by 5.4% of workers and co-bots (robots interacting with the worker) by 3.4% of workers.

4. Purposes for which digital technologies are used

According to the OSH Pulse data, workers report that digital technologies are used by their employer to supervise or monitor their performance (25.3%),

to allocate tasks or working schedules or shifts (29.9%), or to have their performance rated by third parties such as customers or patients (26.9%).

These specific uses, mostly related to automated or semi-automated workers' management practices or to measure the workers' performance, are quite widespread across all sectors and occupations, but are more commonly reported by some groups of workers. The digital technologies used for worker management practices (monitoring of performance and allocation of tasks and schedules) are reported in particular by service workers and semi-skilled workers, and in construction, commerce, transport and logistics, accommodation and food services, and health and social care.

Technologies used for third-party performance evaluations are reported in particular by sales workers, as expected, and in sectors including commerce, transport and logistics, accommodation and food services, health and social care, and technical services.

These applications of digital technologies are more commonly reported by workers with lower levels of education and appear less prevalent among workers in desk-based and highly qualified jobs.

Digital technologies can also be an opportunity

to protect workers' OSH in the workplace at both collective and individual levels. This is the case of technologies designed to monitor the workplace for hazardous elements such as gases, noises, fumes or other harmful factors in the workplace, or to monitor the worker's vitals (e.g., blood

Table 1. Workers by use of digital technologies at work by type of technology, occupation, sector of activity and level of education, EU27, 2022 (%)

	Desktop computers	Laptops, tablets, smartphones or other portable devices	Wearable devices	Broadband technology to access the internet	Machines or robots with artificial intelligence	Robots that interact with you
<i>Occupation:</i>						
Professional and technical occupations	66.9	82.2	12.1	61.7	7.4	4.3
Higher administrator occupations	71.4	86.2	12.6	67.1	4.8	2.9
Clerical occupations	74.9	75.4	8.4	63.5	3.4	1.7
Sales occupations	62.7	74.5	12.3	57.9	4.8	2.4
Service occupations	52.1	66.5	9.9	43.4	2.9	1.4
Skilled worker	42.4	58.4	10.5	42.8	6.6	5.9
Semi-skilled worker	34.8	56.9	9.5	36.3	3.7	3.9
Unskilled worker	26.5	37.5	7.3	27.7	4.8	3.2
Farm worker	42.9	60.4	10.3	34.7	8.4	4.4
<i>Sector:</i>						
A - Agriculture	49.9	66.3	10.8	42.1	5.4	5.0
BDE - Mining and water, gas, electricity supplies	54.1	74.6	8.6	53.6	11.2	6.7
F - Construction	57.1	69.9	11.5	55.4	9.5	7.9
C - Manufacturing	47.1	67.3	11.1	45.5	5.3	3.4
GHI - Commerce, transport and logistics, accommodation and food services	51.3	69.0	11.6	50.9	3.9	1.9
JKM - ICT, finance, professional and technical services	65.3	88.6	13.6	70.7	8.3	4.2
NO - Administrative and support services and public administration	74.0	73.5	9.9	59.9	4.2	2.1
P - Education	64.2	86.8	8.7	59.7	3.3	1.8
Q - Health and social care activities	67.5	62.5	9.4	48.4	4.3	3.1%
RS + LTU - Other service activities	52.1	71.4	9.6	50.5	3.2	1.9
<i>Level of education:</i>						
Primary education	26.1	37.7	6.2	29.9	3.1	1.9
Secondary education	52.5	62.1	10.2	43.8	5.0	3.1
Tertiary education	66.0	80.6	11.4	62.5	5.6	3.5
TOTAL	60.0	73.1	10.8	54.8	5.4	3.4

Source: Authors' elaboration on EU-OSHA OSH Pulse 2022 data

pressure, heart rate, posture). These uses of digital technologies are reported respectively by 19.2% and 7.4% of workers and seem to be more common in sectors with higher OSH risks, such as agriculture, construction, manufacturing and to a lesser extent, commerce, transport and logistics, accommodation, and food services. Manual workers, either skilled or semi-skilled, farm workers and unskilled workers are those more frequently reporting these uses of digital technologies in their workplace.

5. Implications for occupational safety and health

For more than half of EU27 workers, the use of digital technologies determines the speed or pace of their work (52.3%). However, this is not the only risk associated with the use of digital technologies reported by the EU27 workers. About four workers out of ten express concern that the use of digital technologies in the workplace leads to isolation (working alone), a major risk for mental health, or increased surveillance. Workers report also that the use of digital technologies results in increased workload (about 33%), or reduced autonomy at work (about 20%) (Figure 2).

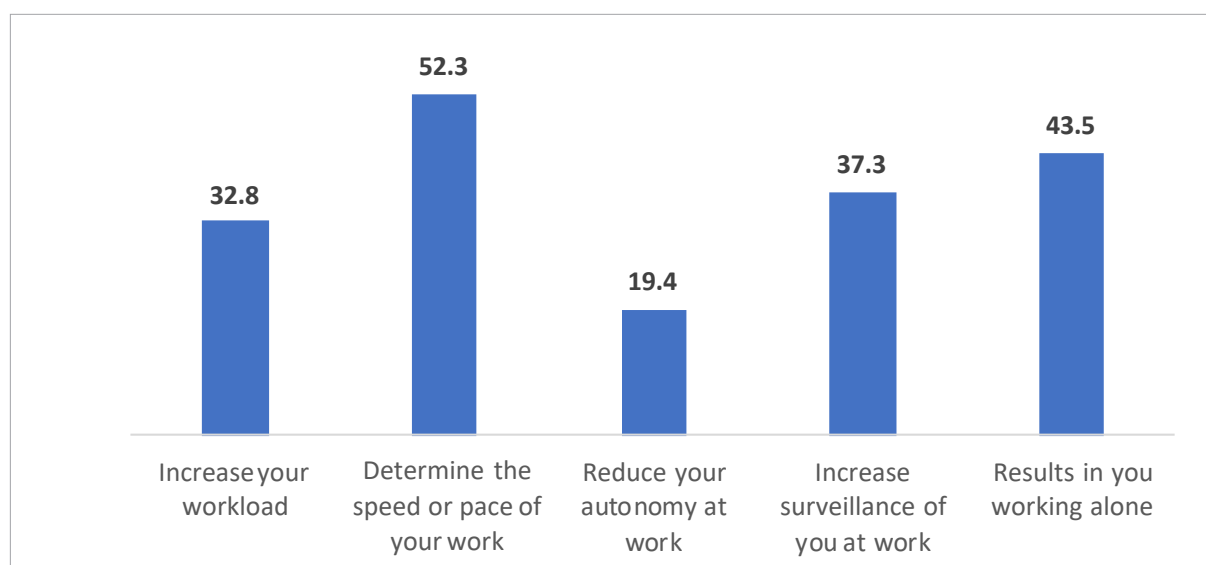
Focusing in particular on uses of the digital technologies related to worker management functions (worker's performance monitoring, allocation of tasks or schedules), the OSH Pulse data indicate that workers

subject to digitally-enabled worker management are consistently more likely to report psychosocial risks in all the areas. When workers report the use of digital technologies to supervise or monitor work and behaviour, they associate it more frequently with an increase in workload (39.6%), speed or pace of work determined by the technology (62.3%), a reduction in autonomy (27.5%), increased surveillance (60.8%) or with work in isolation (48.9%), compared to those not reporting the use of technologies for supervision or monitoring functions (Figure 3).

Similarly, when workers report the use of digital technologies to automatically allocate tasks or schedules, they associate it with an increased workload (39.7%), speed or pace of work determined by the technology (61.7%), lower autonomy (25.6%), increased surveillance (49.3%) or with work carried out in isolation (47.7%), more frequently than workers not reporting the use of technologies for automatic allocation functions (Figure 4).

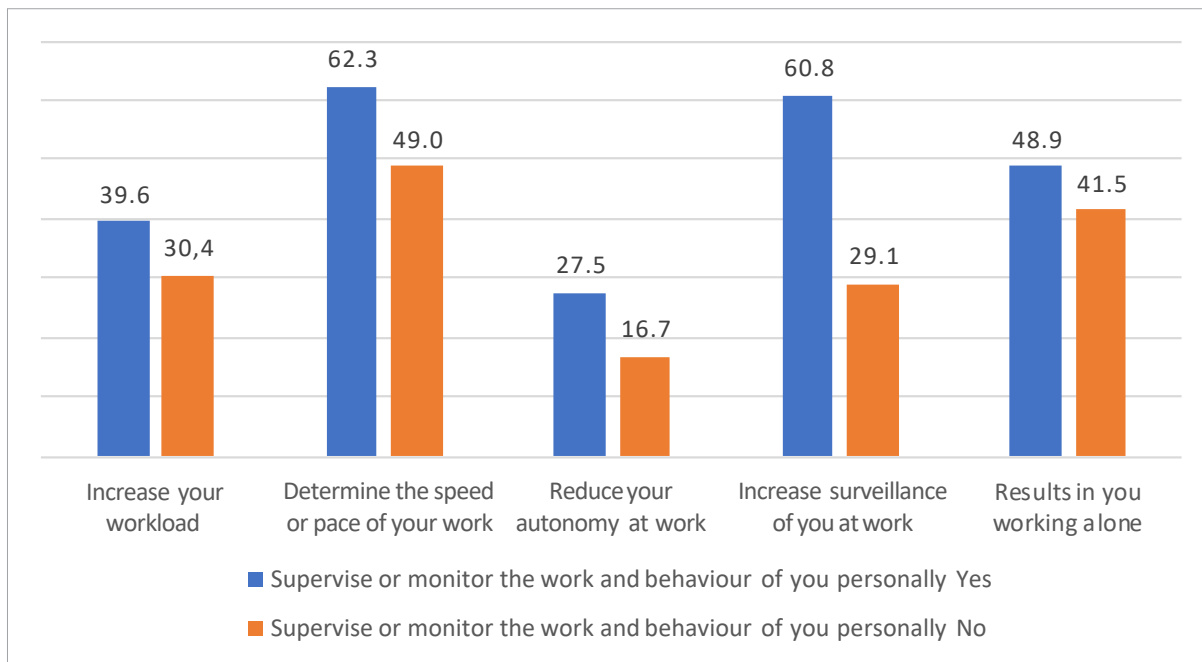
The OSH Pulse survey asked workers also about work-related mental health issues. Looking at the subgroup of workers subject to digitally-enabled worker management, it appears clear that the use of digital technologies in this area is linked to the reporting of mental health issues, as displayed in Figure 5: workers subject to digital management are more likely to report stress, depression or anxiety or

Figure 2. Workers by reported psychosocial risks associated with the use of digital technologies, EU27, 2022 (%)



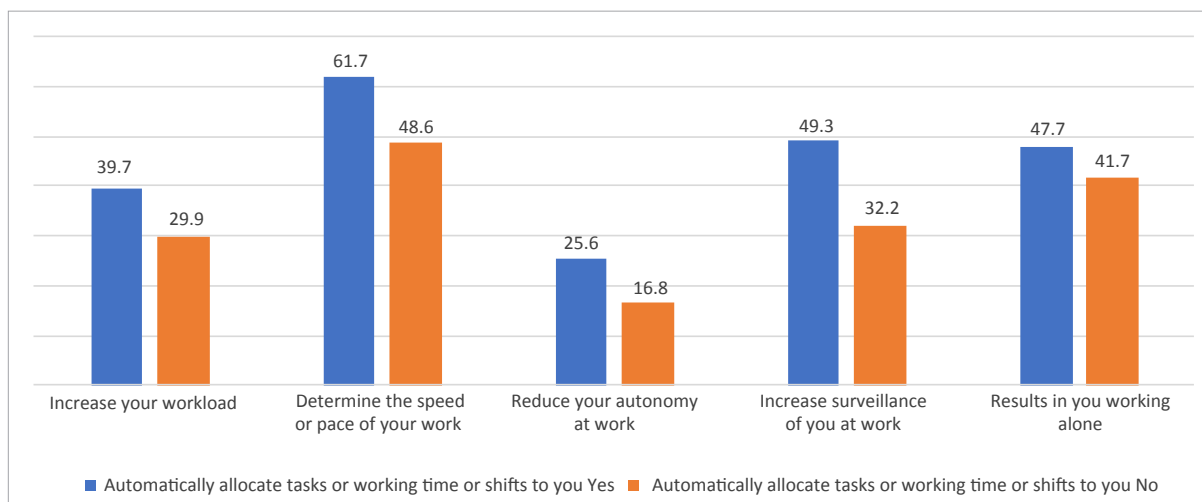
Source: Authors' elaboration on EU-OSHA OSH Pulse 2022 data

Figure 3. Workers by use of digital monitoring technologies (yes/no) and reported psychosocial risks associated with the use of digital technologies in the workplace, EU27, 2022 (%)



Source: Authors' elaboration on EU-OSHA OSH Pulse 2022 data

Figure 4. Workers by automatic allocation of tasks or schedules (yes/no) and reported psychosocial risks associated to the use of digital technologies in the workplace, EU27, 2022 (%)



Source: Authors' elaboration on EU-OSHA OSH Pulse 2022 data

overall fatigue compared with the other workers not subject to digital management.

Workers subject to digital management are also less likely to report being in good health. While on average 96% of EU27 workers perceive themselves to be in very good or good health compared to colleagues of the same age, the proportion of

workers subject to digital management who regard themselves as being in very good or good health is about two percentage points lower.

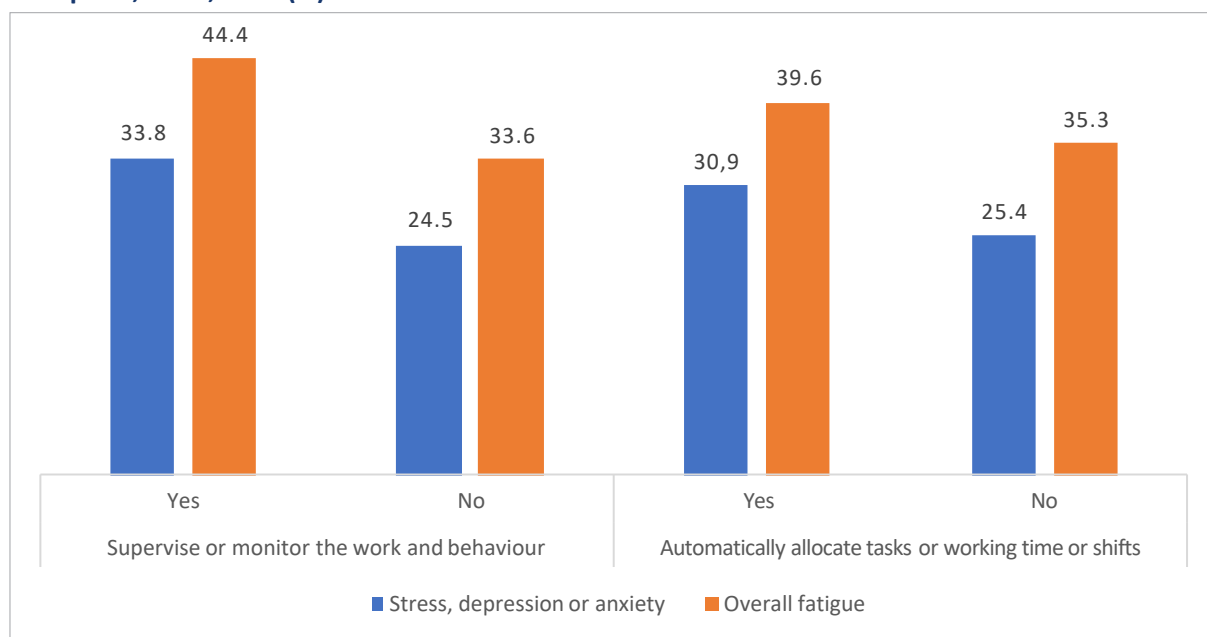
The correlation between psychosocial risk factors on the one hand and health outcomes on the other hand with the use of digital technologies for worker management has been extensively tested and resulted

highly significant, displaying that increased psychosocial risks and worse health outcomes are positively correlated with the use of digital technologies for worker management in the workplace (Pesole 2023).

6. A focus on platform work

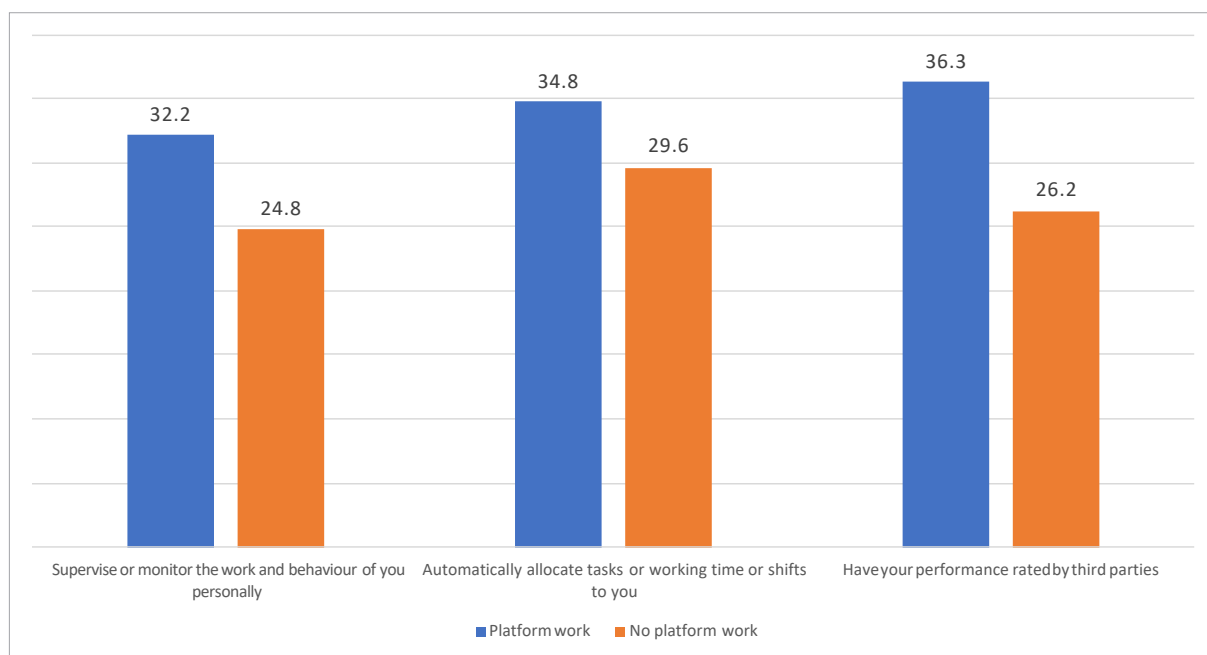
Data from the OSH Pulse allow us to estimate the share of digital platform workers in the EU27. Workers were asked if they earn part or most of their income

Figure 5. Workers by mental health outcomes and specific uses (yes/no) of digital technologies in the workplace, EU27, 2022 (%)



Source: Authors' elaboration on EU-OSHA OSH Pulse 2022 data

Figure 6. Workers by reported psychosocial risk factors associated with the use of digital technologies in the workplace and type of work (platform work/non-platform work), EU27, 2022 (%)



Source: Authors' elaboration on EU-OSHA OSH Pulse 2022 data

working for a digital labour platform, and around 6% of them responded affirmatively. The majority of them are aged up to 44 years old (54.6%), and younger workers (aged between 16 and 34) are 35% of platform workers. Men represent 55% of platform workers. Data display a higher relative prevalence of platform work as well among foreign citizens.

Furthermore, in line with the literature, data from the OSH Pulse confirm a higher prevalence – among platform workers and in comparison with the rest of the workers – of supervision or monitoring of worker performance, automated allocation of tasks or schedules and rating by thirds parties (presumably customers) through digital technologies.

As previously mentioned research shows that platform work is frequently associated with increased psychosocial risks. Findings from the OSH Pulse are in line with research (see Lenaerts *et al.* 2021; Lenaerts *et al.* 2022a): platform workers are more likely than other workers to report that the use of digital technology is associated with increased workload (39.8% versus 32.3%), determines the speed or pace of work (59.6% versus 51.8%), reduces autonomy at work (23.7% versus 19.2%), increase surveillance (41.3% versus 37.1%) and solitary work (54.1% versus 42.8%) (Figure 7).

Platform workers were also more likely than other workers to report infectious diseases (including Covid-19) (22.8% versus 20.3%), or accidents or injuries (6.1% versus 5.2%) in the 12 months preceding the survey. Conversely, mental

health issues are reported in similar proportions by platform workers and other workers.

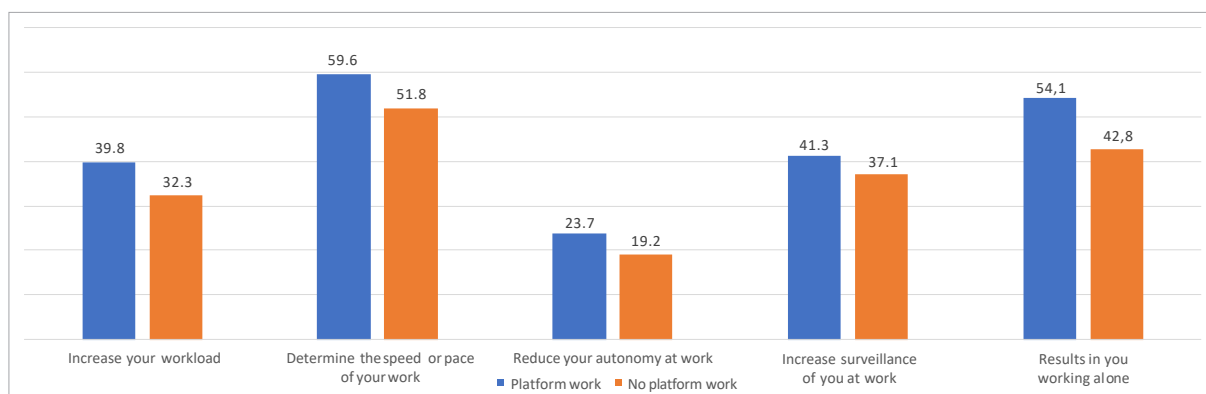
7. How to mitigate the impacts of digital technologies on the workers?

In a nutshell, digital technology in itself is neither good nor bad. Maintaining a balance between the OSH challenges and the opportunities will depend on its proper regulation, development, application and management in workplaces.

Legislation at the EU and national levels

First, it is important to recall that the risks stemming from digitalisation in the workplace, including those associated with AIWM, fall within the scope of Directive 89/391/EEC (the OSH framework directive)³ and the national legislations that transposed it into law. The general principles of prevention should be upheld concerning digitalisation at work and, among others, the legal obligation on employers to take into account the full range of potential risks of any (new) digital technology or digital working process introduced into the workplace as part of the workplace risk assessment, including those associated with AIWM (Jankauskaitė *et al.* 2022a). At the same time, if well designed, used and managed, AIWM may also support the workplace risk assessment with useful data related, for example, to workers' workload or (cyber) bullying and violence. Such systems could even provide real-time alerts of such situations.

Figure 7. Workers by reported psychosocial risk factors associated with the use of digital technologies in the workplace and type of work (platform work/non-platform work), EU27, 2022 (%)



Source: Authors' elaboration on EU-OSHA OSH Pulse 2022 data

³ See: <https://osha.europa.eu/en/legislation/directives/the-osh-framework-directive/1>.

Consultation and participation of workers and their representatives in the decisions taken regarding the development, implementation and use of new technologies, including digital technologies and systems, are also requirements of the OSH Framework Directive.

The EU General Data Protection Regulation (GDPR) provides to some extent some measures to exert control over workers' data and to prevent its misuse that may come from faulty algorithmic decisions (Pesole 2023). Chapter 3 of the GDPR encompasses a right to notification of data subjects, in this case workers, regarding the personal data collected, the purposes for collection and the duration of retention. If such data are processed by automated decision-making, workers have a right to be informed about the 'logic involved' (Articles 13 and 14). Furthermore, Article 22 specifically limits the possibility of being subject to solely automatic decisions resulting in legal effects.

In December 2023, the European Parliament and the Council reached an agreement on the so-called AI Act (Regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence – artificial intelligence act)⁴, approved in May 2024. Some aspects of the proposed regulation are directly related to the workplace, such as the prohibition of emotion recognition in the workplace (⁵). The proposal also includes a list of 'high-risk' systems, some of them used at work, such as AI systems used for recruitment or selection, and AI

systems used for making decisions on promotion and termination of work-related contractual relationships, for task allocation and for monitoring and evaluating the performance and behaviour of workers.

The European Parliament and Council also reached another agreement in December 2023 on a proposed directive to improve working conditions for platform workers⁶ eventually approved in April 2024, which includes measures to correctly determine the employment status of people working through digital labour platforms and to foster a more transparent and fair use of algorithmic systems in the workplace. The agreement ensures that workers are informed about the use of automated monitoring and decision-making systems. It also prevents digital labour platforms from processing certain kinds of personal data by means of automated monitoring or decision-making systems.

Also, in some EU Member States there have been legislative initiatives to regulate some aspects of digital platform work and prevent OSH risks. In Box 1 below, the examples from Italy, France and Spain are reported (Lenaerts *et al.* 2022a; 2022b).

Key principles and recommendations for risk mitigation

Besides the provisions defined in the legislation, a number of key recommendations based on principles that are cornerstones to OSH prevention are important to consider in order to mitigate the impacts of digital technologies on the workers:

Box 1. Examples of policy-level initiatives in the EU Member States

Spanish so-called 'Riders' Law': introduced a right to algorithmic transparency for all digital platform workers and the presumption of a dependent employment relationship for digital platform workers working in the delivery sector.

Italian legislative framework and Bologna's charter: the Bologna Charter of fundamental rights of digital labour in the urban context introduced OSH protections for platform work and inspired similar initiatives in the Lazio region and Milan, and changes to the national legislation, including an obligation of transparency of the algorithms and the extension of the OSH legislation to riders.

French legislative framework: a set of laws ('El Khomri law', the law on the fight against fraud and the Mobility Orientation Law (LOM)) grants a range of rights and protection to platform workers (e.g., right to form and join a trade union, right to disconnect, insurance against work-related accidents).

4 See: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206>.

5 See: <https://www.europarl.europa.eu/news/en/press-room/20231206IPR15699/artificial-intelligence-act-deal-on-comprehensive-rules-for-trustworthy-ai>.

6 See: <https://www.consilium.europa.eu/en/press/press-releases/2023/12/13/rights-for-platform-workers-council-and-parliament-strike-deal/>.

- *OSH aspects must be considered at the design and development stage.* The 'prevention through design' approach should not only consider the design of digital technologies on their own but of the entire working process where digital technologies are introduced. Programmers, designers and developers of digital technologies should work with OSH experts, employers and workers or their representatives from the start. If digital technologies are not designed to contribute to good OSH, they will most likely not do so.
- To make the *consultation and participation of workers and their representatives* possible, employers, managers, workers and their representatives should have equal access to information. This requires guaranteeing transparency about how digital systems operate, and about their main benefits and drawbacks. Equally important is enhancing digital literacy among workers and employers by promoting qualification and skills development for digital applications. This empowers them to better understand the digital systems, and the associated OSH risks and opportunities, and is a pre-requisite to social dialogue and to OSH prevention and management.
- *Workers should also be thoroughly consulted and informed about the data collected* within the working environment and concerning themselves, its purpose and who has access to it. They should retain control over their own data and receive adequate information to consider the positive and negative consequences of sharing it with the employer and/or OSH professionals. The need to collect worker data should be balanced against the rights of workers to privacy and their safety and health, following the principle of minimisation of worker data collection.
- There is a need to *clarify the responsibilities and liabilities* of developers and employers in relation to the design, development and use of digital technologies in the workplace and their potential OSH risks. This is particularly relevant with regard to the level of autonomy of AI-based systems in decision-making.
- An inclusive *human-in-command approach* is key to

digital transformation. AI and digital technologies should support, but not replace, human control and decisions. The design, development and use of digital systems should aim to support workers and preserve their job control and autonomy.

- *Raising awareness of all actors and stakeholders at all levels* (from research and innovation to policy and practice) for the impacts of digitalisation on OSH, in particular on workers' mental health is imperative. Indeed, EU-OSHA's 2019 ESENER survey found that less than one in four workplaces (24%) that use digital technologies in the EU have discussions about the potential impact of such technologies on the safety and health of workers. Raising awareness is the objective of EU-OSHA's Healthy Workplaces Campaign (HWC), 'Safe and healthy work in the digital age', launched in October 2023 and scheduled to run until 2025⁷. It aims to raise awareness of the OSH implications of digitalisation and to promote good practices to prevent the OSH risks associated with the use of digital technologies in the workplace, while maximising their potential benefits.

Prevention of psychosocial risks in EU establishments using digital technologies

According to Urzi Brancati *et al.* (2022), establishments using digital technologies enabling worker management systems tend to introduce relatively fewer measures to prevent psychosocial risks. Among such establishments, the most frequently introduced measure is the action plan to prevent stress, followed by intervention to modify working hours. However, the ESENER-2019 data analysis also shows that OSH measures, such as having an action plan to prevent work-related stress, contribute to reducing psychosocial risks in the workplace but do not mitigate the relationship between psychosocial risks and worker management systems enabled by digital technologies (Urzi Brancati and Curtarelli 2021). Allowing employees greater decision-making authority regarding their job responsibilities is unsurprisingly much less common among establishments using digital technologies to enable worker management systems, as this restricts workers' autonomy, despite being the most

7 All information about EU-OSHA HWC 'Safe and healthy work in the digital age' will be available in all EU languages at: <https://healthy-workplaces.osha.europa.eu/en>.

Box 2. Examples of initiatives by platform and platform associations

Glovo, Lyft, DoorDash, Uber, Waymo, Amazon Flex and other platforms have introduced a number of initiatives to integrate OSH aspects in the functioning of the apps and technologies to improve OSH of platform workers. This shows that platforms can be actively promoting safe and healthy platform work for all workers. Examples of initiatives are hotlines, helpdesks, automated support systems, OSH messaging, tips and advice through app-based notifications and automated OSH-related nudges, corporate group forums, interpersonal safety measures (e.g., emergency assistance or panic buttons), provision of safety nets in the form of sickness, accident and compensation insurance, healthcare and disability insurance, maternity and paternity leave, tailored OSH training and awareness resources, just to name a few examples (Williams Jiménez 2023).

Box 3. Examples of initiatives by trade unions and platform workers

Trade unions have been active across Europe carrying out initiatives aimed at promoting OSH risk prevention in platform work. Examples of that are registers or observatories on key labour law, social dialogue and voluntary schemes relating to the conditions of digital labour platform work, training tools such as 'train-the-trainer' resources for trade union trainers, or collections of good practices for the prevention of OSH risks in platform work. Also, platform workers have been carrying out a number of initiatives such as informal exchanges of information on work-related issues, communication between peers, or self-organising initiatives. Chat forums, social media, and face-to-face interactions are the most frequently used channels. Other initiatives include the provision of services or informal safety measures and precautions to protect themselves from task-specific risks (Williams Jiménez 2023).

Box 4. Examples of initiatives based on social dialogue

Social partners have negotiated and agreed on a number of initiatives. Collective agreements have proven to be an effective tool for securing personal protective equipment for riders in accordance with national jurisdictions and to improve the working conditions of platform workers. For example, Hilfr, a Danish cleaning services platform, and the Danish trade union 3F negotiated a 'world's first' collective agreement promoting decent work and sickness benefits, including an economic welfare supplement (additional compensation somewhat equivalent to hazard pay) (Williams Jiménez 2023).

prevalent measure for European establishments overall (Jankauskaitė *et al.* 2022b).

Risk prevention practices in digital platform work

To prevent the risks associated with digital platform work, Williams Jiménez (2023) compiled a list of initiatives introduced by public decision-makers, digital labour platforms and platform associations, social partners and – although to a much lesser extent – platform workers themselves. Such initiatives are summarised in the Boxes 2, 3 and 4.

Conclusions

Digital technologies are reshaping the landscape of work. This has implications for OSH that have to be carefully considered from the very initial phases

of technology design through to their deployment in the work environment. It is worth noting that the digitalisation of work in itself is neither inherently positive nor negative. However, to strike a balance between OSH risks and the opportunities stemming from digitalisation, it is imperative that digital technologies in the workplace are subject to appropriate regulation, development, application and management.

In this article we have focused mostly on the use of digital technologies and systems (e.g., AI, algorithmic systems) for the management of workers (AIWM). The literature highlights that the use of AIWM technologies in the workplace is associated with a number of psychosocial risks and potential mental health issues. The evidence presented is in line with

the literature, indicating that the adoption of digital technologies in the area of worker management frequently comes with several OSH risks and could result in mental (and physical) health issues.

To address the OSH issues stemming from the use of AIWM and more in general of digital technologies at work, while making the most of them, it is crucial to take into account some general principles in all stages of the digitalisation process.

On a final note, it is worth emphasising that such principles – summarised here below – must underpin all interventions and initiatives (including at the workplace level) with the aim of making the digitalisation processes safe and healthy for all workers:

- *an inclusive human-in-command approach is key to digital transformation*: AI and digital technologies should support, rather than replace, human control and decisions;
- *considering the OSH implications of digital*

technologies already at the design and development stages;

- *consultation and participation of workers and their representatives* in all the decisions related with the introduction of digital technologies, allowing access to information about the rationale behind their introduction and how the technologies function;
- *consultation and information of workers* about the data collected in the working environment and concerning themselves, its purpose and who has access to this data;
- *clarifying responsibilities and liabilities of developers and employers* concerning the design, development and use of digital technologies in the workplace and their potential OSH risks;
- *raising awareness among all actors and stakeholders at all levels* (from research and innovation to policy and practice) about the OSH implications of digitalisation.

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