

# 23 Technology, the use of AI and Robotization of Work in Organizations

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## **Introduction**

Innovation and technology have become pivotal in driving the 'fourth' industrial revolution, with Artificial Intelligence (AI) playing a central role in transforming various sectors such as manufacturing, finance, education, healthcare and logistics. This revolution is not only making people's lives more intelligent but is also steering society toward a future defined by automation and smart systems. By 2020, the global AI market was projected to reach US\$47 billion, highlighting the significant investments and strategic focus nations have placed on AI to adapt to an ever-evolving economic landscape.

For instance, in 2016, the Obama administration laid out the groundwork for AI development in the United States through key documents like Preparing for the Future of Artificial Intelligence and The Artificial Intelligence Research and Development Strategic Plan at national level. These initiatives aimed to position AI as a cornerstone of national strategy, culminating in the 2018 establishment of the Selected Committee on Artificial Intelligence to enhance federal investments in this domain.

Similarly, the European Union has also recognized AI's critical role in maintaining global competitiveness. The European Commission's 2018 report, Artificial Intelligence: A European Perspective, outlined an action plan to boost AI research and development (R&D), while also modernizing education and training systems to nurture European talent in this field. Japan, too, has made AI a focal point of its national strategy, as evident in its Report on the 5th Science and Technology Basic Plan (2016-2020), which promotes AI integration across various facets of life to create a super-intelligent society.

China has also emerged as a major player in the AI landscape, making AI a key element in its national strategy to stimulate economic restructuring and industrial development. The 2017 Three-Year Action Plan to Promote the Development of a New Generation of AI Industry emphasized the integration of AI with the real economy, particularly through initiatives like "Made in China 2025." As a result, China has achieved remarkable advancements in applications of AI across various

sectors of its economy, including finance, manufacturing and healthcare. Notably, Chinese companies have gained a competitive edge in technologies like face and speech recognition, with firms such as Baidu and iFlytek leading the way.

Furthermore, China and the United States have outpaced other nations in AI-related patent applications and fundamental research, as reported by the World Intellectual Property Organization (WIPO) in 2019. China's dominance is particularly evident in emerging deep learning technologies and practical AI applications. For instance, AI-powered face recognition systems are revolutionizing customer experiences in retail and travel, while automation in industries like warehousing is dramatically improving efficiency. At JD.com's Shanghai Operation Center, for example, robots now handle 200,000 orders daily, with minimal human oversight. This level of automation reflects the broader trend of increasing industrial automation, underscored by the fact that in 2018, China installed more industrial robots than Europe and the Americas combined, according to the International Federation of Robotics (IFR). This global shift toward AI and robotics underscores the transformative impact of innovation and technology in organizations, as they redefine the future of work and industry.

### **Concept of Artificial Intelligence (AI)**

In various definitions of Artificial Intelligence (AI), a common element is that AI refers to the simulation of human-like intelligence programmed to perform specific tasks within an organization (Russell and Norvig, 2016; Goodfellow et al., 2018). Scholars such as Margaret and Tay (2019) and Coccia (2019) argue that AI possesses the capability to replicate human thought processes, enabling it to take on roles and tasks traditionally performed by employees within the workplace. This ability is rapidly advancing and is increasingly comparable to modern technological innovations, making AI a transformative force in organizational operations and personnel management.

### **Main Applications of AI at the Workplace**

AI-based technologies are revolutionizing the workplace, driving significant changes in how tasks are performed across various sectors. While these technologies are being adopted globally, the rate and extent of AI integration vary across countries and industries (EU-OSHA, 2018; Eurofound, 2020). AI in the workplace manifests in several forms, including algorithmic management systems, wearables that use algorithms to process collected data, and AI-assisted robots, including advanced collaborative robots known as cobots. This section explores the deployment levels and types of AI technologies, with a particular focus on their applications in organizational settings.

### **Use of AI-based technologies in the Workplace**

The European Commission's Advanced Technology Industry (ATI) data dashboard,

which aggregates information from direct company surveys, Eurostat data, and other EU surveys, provides a composite score for each EU Member State regarding advanced technology generation, uptake, and investment.

In terms of adopting AI-based robots, particularly collaborative robots (cobots), the International Federation of Robotics (IFR, 2020) reported an 11% increase in the deployment of robots from 2018 to 2019 compared to other industrial robot units. Additionally, the third European Survey of Enterprises and New Emerging Risks (ESENER) revealed that approximately 3.5% of over 45,000 surveyed enterprises have implemented direct human-robot interaction (HRI) (Wischniweski, Heinold, & Rosen, 2021). The EU Member States with the highest reported percentage of HRI applications were Slovakia (8.7%), Denmark (6.9%), and the Czech Republic (6.7%).

Regarding investment in AI technologies, the International Data Corporation (IDC) (2020) projected that Europe's total spending on AI would reach EUR 10.64 billion in 2021. IDC's Worldwide AI Spending Guide (2020) also highlighted that in 2020, 24% of Europe's AI spending was in the financial services industry, followed by manufacturing (22%) and the retail and wholesale sectors (14%).

### **Overview of AI Applications in the Workplace**

AI applications in the workplace are diverse but can be categorized into three main groups: algorithmic management applications, emotional AI, and AI-assisted robots. These technologies often overlap, with some applications fitting into multiple categories. Algorithmic management refers to using algorithms to automate, either partially or fully, managerial functions, optimizing business processes and human resource management. This approach relies on data collection and surveillance techniques that enable real-time automated decision-making (Mateescu & Nguyen, 2019). These techniques are often more pervasive and opaquer than traditional management methods (Gillepsie, 2014). According to Kellogg et al. (2020), algorithmic management is primarily used by employers to direct workers by specifying tasks and timelines, evaluate performance through recording and rating, and discipline by replacing or rewarding workers to enforce compliance.

Initially gaining prominence in the platform economy, algorithmic management has since expanded into various industries, including retail, manufacturing, marketing, consultancy, and law enforcement (Adams-Prassl, 2022; McDonnell et al., 2021; Wood, 2021). For example, in some warehouses, AI systems that are embedded in scanners do not only assign tasks and communicate orders, but also monitor worker performance (Delfanti, 2021). AI is also used to schedule workers (Briône, 2020) and screen job applications (Hunkenschroer & Luetge, 2022). Additionally, AI can assist managers by predicting employee performance, identifying deviant behaviors, and measuring engagement (Parent-Rocheleau & Parker, 2021). Various applications

track productivity through keyboard and mouse usage (Heaven, 2020), analyze email content and work patterns (Bales & Stone, 2020), or monitor data collected from workplace communication tools like Slack and Microsoft Teams (De Stefano & Wouters, 2022).

AI is also being used in non-managerial roles, such as assisting healthcare professionals in diagnosing patients and recommending treatments. AI has shown high success rates in reading radiology scans for cancer detection (Reardon, 2019) and assisting in emergency room triage (Soltan et al., 2022).

**Emotional AI:** involves technologies that use affective computing and AI techniques to sense, understand, and interact with human emotions (McStay, 2020). These technologies often include wearables and other tools that measure emotional states through facial expressions, body language, voice tone, and heart rate variability (Mantello et al., 2023). In the workplace, emotional AI is used to measure employee attitudes and engagement passively, often using computer vision (McStay & Urquhart, 2019). A review of patents for emotion recognition technologies in the workplace from 1998 to 2020 revealed their use in customer service, employee monitoring, fraud detection, task assignment, and even manipulating worker emotions (Boyd & Andalibi, 2023). Specific examples of emotional AI include AI software in call centers that alerts workers if they are speaking too fast, sounding sleepy, or lacking empathy (Roose, 2019). AI is also used in recruitment to assess job applicants through video interviews, analyzing facial expressions and voice cues (Ajunwa, 2021). However, emotional AI is still an emerging technology, facing criticism for its accuracy, scientific validity, ethics, societal implications, and legality (Roemmich, Schaub, & Andalibi, 2023). There is also debate over whether AI can genuinely detect emotions (Crawford, 2021).

**Advanced robotics:** leverages AI systems to self-learn and adapt to changing environments. These robots can make decisions autonomously based on a predefined set of instructions (Iphofen & Kritikos, 2019). As robots have become more intelligent and adaptable, the physical barriers between humans and robots in the workplace have been removed, leading to the development of collaborative robots, or robots. Initially, robots were defined as robots designed to interact with humans, but the definition has since expanded to include intelligent machines that collaborate with humans in shared environments, particularly in industrial settings (Bi et al., 2021). According to the International Organization for Standardization (ISO, 2016), robots are intended to combine the repetitive performance of robots with human skills and abilities. In warehouses, for instance, robots complement human workers by performing repetitive tasks like transporting finished orders to depots (Pasparakis, de Vries, & de Koster, 2023). In healthcare, robots assist in surgeries, particularly those requiring detailed precision, such as laparoscopic procedures (Mayor, Coppola, & Challacombe, 2022).

AI applications in the workplace can take various forms although these can be divided into three main groups: algorithmic management applications, emotional AI, and AI-assisted robots. It is important to note that the use of these technologies is intertwined, with some applications falling into more than one of the mentioned groups. Algorithmic management refers to the use of algorithms in the workplace to automate – partially or fully – managerial functions to optimise business processes and human resource management. Algorithmic management relies on the use of data collection and surveillance techniques to enable automated decision-making in real time (Mateescu & Nguyen, 2019), while these techniques tend to be more pervasive and opaque than previous management techniques using algorithms (Gillepsie, 2014). In a review of the literature, Kellogg and co-authors (2020) identified that algorithmic management is used by employers with three main purposes: to direct workers by restricting and recommending (in terms of what needs to be done, in what order and what timeframe), evaluate workers by recording and rating (to review and assess performance), and discipline workers through a system of rewards or replacement. This guarantees cooperation and ensures compliance.

### **Applications and Impact of AI on Work Organization and Working Conditions**

AI-based technologies are changing how organizations manage work, their workers and employment relationships, while the use of these technologies can also have ethical implications. This section provides an overview on how the deployment of AI in the workplace can have implications in three main dimensions: work organisation, working conditions, and ethics. The insights presented are based on a literature review on the topic as well as the findings from exploratory case studies conducted between 2021 and 2023 in specific working environments in four European countries namely; Spain, Italy Denmark and France respective.

#### **Work Organisation**

AI technologies have the potential to reshape work organizations and management models, driven by careful consideration of the role AI plays in each workplace (Ponce Del Castillo, 2018). As discussed earlier, algorithmic management systems directly impact work processes by assisting in directing, evaluating, and disciplining workers (Kellogg, Valentine, & Christin, 2020). This means that nearly all aspects of the employment relationship, from hiring and salary determination to termination, can now be automated (Adams Prassl, 2020). As Jarrahi and colleagues (2021) emphasize, AI applications should be viewed not as autonomous entities within organizations but as tools that reflect and redefine existing relationships between managers and workers. In this sense, both workers and managers actively participate in developing and aligning these systems to meet their needs and interests (Jarrahi et al., 2021). Therefore, AI models will continually evolve alongside changing work practices and relationships (Jarrahi et al., 2023).

The rise of algorithmic management has also led to the creation of new work organizations, especially within the platform economy, where traditional management-worker relationships may not exist. Through offering higher autonomy, flexibility, and independence; numerous companies attract a lot of workers (See Ivanova et al., 2018). Platform workers can choose their work locations and select tasks they wish to perform. However, in platforms like Uber or Amazon Mechanical Turk, workers have less freedom in choosing tasks or clients (Dunn, Munoz, & Jarrahi, 2023). Moreover, this autonomy is somewhat limited, as platforms often exert indirect control over their workforce through algorithms (Rosenblat & Stark, 2016). For example, food delivery platforms recommend routes to drivers, who, although free to choose a different route, are still monitored (Veen, Barratt, & Goods, 2020; Todolí-Signes, 2021).

The use of AI in dictating work processes and pace is evident in warehouses, where AI-based scanners assign tasks and supervise employees as they scan barcodes, acting as intermediaries between workers and management (Delfanti, 2021). Amazon, for instance, holds patents that reflect the future of warehouse operations, including a wristband designed to track workers' hand movements and provide directional feedback through vibrations (Solon, 2018). AI-based technologies are also used to nudge worker behaviors, extending beyond warehouses and logistics to areas like personalized emails aimed at improving organizational effectiveness, preventing burnout, or fostering an engaging workplace culture (Gal, Jensen, & Stein, 2020).

AI technologies are also touted for their ability to free workers from routine and monotonous tasks, allowing them to focus on more valuable work. This can be categorized into two scenarios: tasks taken over entirely by technology, and tasks where human capabilities complement machine abilities in more complex activities (Raisch & Krakowski, 2021). In the first scenario, doctors or teachers, for example, can spend more time with patients or students rather than on data entry (Smids et al., 2020). In the second scenario, the "reinstatement effect" occurs, where technology adoption expands the range of tasks (Acemoglu & Restrepo, 2019). The introduction of AI-based robotics can, in some cases, give human workers greater responsibility for machine operations, requiring them to anticipate robot actions or become more involved in decision-making (Moniz & Krings, 2016).

Case studies from a JRC study offer additional insights into the impact of advanced technology on work organization. In an Italian logistics warehouse, for example, the introduction of new technology led to the creation of a specific role for supervising and interacting with robots, requiring specialized training. In contrast, another Italian warehouse saw no need to adapt personnel numbers or activities due to the new technology. In two French healthcare facilities, automation of triage activities allowed workers to focus more on their medical roles, reducing administrative

duties. Similarly, advanced technology adoption in an Italian healthcare facility led to the creation of new roles, such as technology specialists and data managers (JRC, forthcoming). Eurofound case studies also show that AI deployment in a French technology manufacturer and a Danish unemployment fund reduced time spent on repetitive tasks, allowing workers to focus on more fulfilling tasks aligned with their qualifications (Eurofound, forthcoming).

The introduction of AI-based robotics has also increased workplace flexibility, as workers can choose how much manual work to delegate to automation technology (Gajšek, Stradovnik, & Hace, 2020). However, this flexibility presents a challenge for managers, who must determine the optimal division of tasks between robots and humans (Liu et al., 2022). AI applications also create new levels of human-machine interaction, which can involve collaboration, cooperation, or coexistence (EU-OSHA, 2022). Consequently, work processes and task design may need to be restructured to accommodate these new technological needs.

To fully realize the benefits of AI in the workplace, the design of technology deployment is crucial. In the case of algorithmic management, Gal and colleagues (2020) suggest that to address ethical challenges, organizations should view these technologies as fallible and introduce new roles and practices focused on human oversight and increased transparency in algorithmic decision-making. For collaborative robots, trust is a key factor for successful implementation (Kopp, Baumgartner, & Kinkel, 2021). Trust in robots is tied to the reliability and predictability of their performance (Paliga, 2023). To address concerns about robots taking over jobs or dehumanizing the workplace, it is essential to involve workers in the design and deployment of these technologies.

### **Working Conditions**

AI technologies have had a significant impact on workplace ergonomics, though their effects are mixed. On one hand, digital technologies have led to more sedentary work and reduced physical activity (Eurofound, 2021). On the other hand, advancements in robotics are beginning to address ergonomic challenges by improving workers' postures and minimizing related risks. For instance, assistive surgical robots have been shown to reduce surgeons' physical workload and decrease the risk of musculoskeletal disorders (Hotton et al., 2023). Similarly, the introduction of collaborative robots on assembly lines has been proven to enhance physical ergonomics in repetitive tasks (Gervasi et al., 2023). Preliminary findings from case studies in warehouses in Italy and France, conducted for the JRC, also indicate that employees experienced a lower physical workload due to reduced walking distances and less need to maneuver trolleys (JRC, forthcoming). Therefore, collaborative robots hold potential to improve workers' physical well-being, provided their design considers workers' needs and limitations (Lorenzini et al., 2023).

AI-driven job automation has also reduced the risk of injuries by taking over repetitive or dangerous tasks. For example, AI-based robots now perform hazardous activities such as handling toxic substances and supporting emergency rescue services (Eurofound, 2020). However, the increased integration of robotics in the workplace has also intensified human-robot interactions, which introduces safety risks. To protect human workers in these environments, global guidelines have been developed to promote safer human-robot interactions, minimizing harm (De Simone et al., 2022).

Despite efficiency gains, the introduction of AI technologies has contributed to the broader trend of work intensification. It is widely accepted that advancements in digital technology are increasing the workload, as new jobs are created to leverage the available digital capacity (Willcocks, 2020). An EU-OSHA foresight study (2018) identified work intensification as a major emerging occupational safety and health concern associated with advanced technologies, including AI-based systems. In the context of AI, work intensification occurs because employees must keep pace with algorithms or machines, raising performance standards. For example, new technologies in warehouses have increased the speed requirements for handling items (Parent-Rochelleau & Parker, 2021). As a result, workers are expected to increase their output based on the perceived productivity gains from these technologies.

For platform workers, performance is closely monitored by the speed at which they complete assigned tasks. This places additional pressure on workers to meet the AI application's standards, which often influences decisions about their employment status. Platform workers have also been shown to work longer hours at a faster pace, driven by concerns over unfavorable customer reviews (Wood, 2021). Delivery workers have even skipped legally mandated breaks or ignored safety protocols to meet targets (Deshpande et al., 2021). The combination of higher performance expectations and increased work intensity has led to greater job dissatisfaction, prompting some employees to quit their jobs (Pasparakis, de Vries, & de Koster, 2023).

AI technologies have also been linked to psychological concerns, as highlighted in a literature review by Eurofound (Eurofound, 2022). Work intensification has led to increased stress due to higher work standards and faster work pace, and in some cases, has caused elevated anxiety levels among employees (Bakewell et al., 2018). AI-based performance monitoring has been negatively associated with mental health, contributing to higher stress levels and a greater risk of burnout (Manokha, 2020). Research has also connected AI-based monitoring with a loss of autonomy, diminished self-esteem, reduced creativity, and decreased workplace communication (Deshpande et al., 2021). In some instances, monitoring technologies have pressured workers to hide their emotions or suppress their individuality, preferences, and feelings (Todolí-Signes, 2021).

The adoption of AI technologies may also impair workers' cognitive skills. While AI is expected to take over mundane tasks, allowing workers to focus on more complex and creative tasks, some researchers argue that AI decision-making applications displace human judgment, as people defer to automated decision processes (Bader & Kaiser, 2019). In some cases, AI applications have been cognitively demanding. For example, in an automotive supplier warehouse, the introduction of an AI-based system for product pick-up overwhelmed staff with information through their headsets (Lager et al., 2021). A scoping review also found that advanced robotics in industrial settings increased mental burdens, requiring workers to manage tasks and reallocate their attentional resources (De Simone et al., 2022).

Another concern with AI technology in the workplace is the potential for social isolation, as workers may have less interaction with colleagues. However, AI technologies have sometimes facilitated more social tasks. For instance, case studies in healthcare facilities in France and Italy found that AI technologies allowed healthcare workers more time to engage with patients (JRC, forthcoming).

Ultimately, workers will increasingly interact with machines, and the benefits of AI will depend on how these technologies are implemented. In some cases, workers may view machines as colleagues. For those following algorithmic instructions, algorithms may even be seen as taking on the role of employers or supervisors (Möhlmann et al., 2021; Baird & Maruping, 2021). However, workers may find their relationship with algorithms challenging and unclear, as they may be unsure whether to follow the provided instructions or if they can override them (Tarafdar, Page, & Marabelli, 2022). Additionally, even when workers believe that the algorithm's instructions are incorrect, they may not seek clarification or override the instructions, as speed is often prioritized (Marabelli, Newell, & Handunge, 2021). Given that algorithms often influence decisions about job prospects, workers may also hesitate to challenge the technology.

## **Conclusion**

The integration of AI-based technologies in the workplace significantly impacts work organization, working conditions, and ethical considerations. Algorithmic management, for instance, plays a pivotal role in structuring work and decision-making processes by helping organizations direct, evaluate, and discipline employees. This development has also given rise to new forms of work organizations, particularly within the platform economy, where traditional relationships between management and the workforce may not exist. AI technologies can free workers from routine and mundane tasks, allowing them to focus on more complex, valuable, and creative activities, and can also relieve them from physically demanding or dangerous jobs. This shift necessitates a reorganization of work, with new roles and responsibilities shared between humans and technology. The use of AI-based applications introduces new forms of human-

machine interactions, including collaboration, cooperation, and coexistence. In the case of AI-based robotics, these closer interactions demand robust safety assurance mechanisms. While AI technologies can enhance efficiency and productivity, they can also lead to work intensification as workers are required to keep pace with the technology. This increased pressure, coupled with AI-driven monitoring, can elevate psychosocial risks for employees, contributing to higher levels of anxiety, stress, and negative effects on mental health due to the loss of autonomy and decreased self-confidence. AI's role in the workplace also raises significant ethical concerns. The opacity and the complex nature of algorithms are capable of posing challenges on the question of accountability and taking of responsibilities of success or failure. Furthermore, because algorithms are often trained on historical data, they can perpetuate structural biases, leading to discriminatory or unfair decision-making processes. The use of AI for monitoring and surveillance can also infringe on privacy, and emotional AI may influence worker behavior, making them susceptible to manipulation. Given these varied impacts on work organization, working conditions, and ethics, it is crucial to approach the design and deployment of AI-based technologies with careful consideration. This involves adhering to ethical guidelines, implementing safety procedures, and engaging in consultation and negotiation with employees and their representatives to ensure a shared understanding and acceptance of these technologies. In response to these challenges, several initiatives at the EU, international, and national levels have emerged to regulate and guide the development and use of safe and ethical AI systems.

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