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Human–robot interaction: What changes in the workplace?

Introduction

Advanced robotic systems and applications disrupt workplaces; they transform the way work is carried out, often resulting in changes to business models and redefining roles, tasks and methods of work. Artificial intelligence (AI) has played a pivotal role in enhancing these systems, giving them greater capabilities, functionalities and flexibility than more conventional robots. AI has also facilitated seamless collaboration and interaction between humans and robots in various industries. This is most prominently illustrated by collaborative robotic applications, through which AI enables closer worker–robot interaction in shared workspaces.

As advanced robots become more complex and prevalent in modern work environments, understanding how workers and robots interact and the implications for work organisation and working conditions is crucial for robots' successful integration into the workplace. The changes brought about by autonomous or semi-autonomous advanced robotics require thoughtful consideration and proactive management to ensure a positive impact on businesses and workers.

Drawing on survey data and case studies investigating advanced robotic systems and applications for task automation, this report contributes to the policy debate on work automation, highlighting new forms of interaction between workers and robots and the changes to work organisation and working conditions that they entail.

Policy context

Unlike conventional robots, usually confined to cages and positioned at a safe distance from humans, advanced robots equipped with sensors and enhanced functionalities ensure greater safety when in proximity to humans. They enable closer human–robot interaction and collaboration characterised by shared goals and more synchronised tasks. Despite these benefits, the forms of interaction arising from the use of increasingly advanced robotic systems, especially those with embedded AI capabilities, may pose new policy and regulatory challenges. The notion of human centricity is more relevant than ever in ensuring safe and effective human–robot interaction.

As part of the EU's digital strategy, several policy initiatives on AI have emphasised a human-centric approach to technology development and use. In the context of advanced robotics, this involves ensuring that systems are designed and deployed in a manner that respects human values and fundamental rights. Furthermore, the European Commission has taken steps to address liability and accountability issues arising from AI use, proposing a revised product liability directive and an AI civil liability directive.

Safety is another important concern in human–robot interaction; with the EU's adoption in 2023 of the new European Machinery Regulation (Regulation (EU) 2023/1230), it sought to update the safety requirements for machinery (and related products) on the EU market. This regulation acknowledges that safety risks extend beyond physical damage to psychological stress. However, the primary legal instrument governing matters of occupational safety and health (OSH) remains the OSH Framework Directive (89/391/EEC).

Other key challenges arising from interaction with advanced robots relate to skills requirements. For some time, the EU has recognised the impact of technological advancements on the labour market and the skills the workforce requires. In this regard, a major policy initiative is the European Skills Agenda for sustainable competitiveness, social fairness and resilience. The agenda encompasses several actions focusing on upskilling and reskilling to ensure individuals have the skills necessary for current and future job markets.

Key findings

- The adoption of robotic technologies is influenced by external and internal factors. According to data gathered by the Eurostat survey on information and communications technology use in enterprises, high labour costs and difficulties in recruiting personnel feature prominently as reasons to invest in robots. Increased competitiveness and productivity gains are key internal factors.
- Industrial and service robots are most prevalent among large enterprises. In 2022, approximately 1 in 5 large EU companies used industrial robots (used for welding, laser cutting, etc.), whereas only 1 in 10 used service robots (used for surveillance, transport, etc.). The adoption rate among small and medium-sized enterprises is notably lower, primarily due to the significant capital investment required to implement robotic technologies and the economies of scale required to fully leverage the resulting efficiency gains.
- When assessing the risks associated with human–robot interactions, establishments tend to focus on physical safety but overlook the psychosocial implications. Involving workers more in the design and deployment of robotic technologies could help reduce certain stressors, particularly uncertainties emerging in the initial stages of technology adoption. Worker involvement is often necessary to adapt or customise systems or applications for the operational environment.
- When integrating robotic solutions into the workplace, as well as emphasising safe technology use, change management programmes can help resolve uncertainties, increase workers' resilience in the face of change and enable them to adapt to new work routines. In most establishments, working with advanced equipment did not require specific qualifications or certifications. Nonetheless, adopting robotic systems required new digital, analytical and soft skills in some establishments in certain sectors (e.g. manufacturing) or certain occupations (e.g. managers and supervisors).
- While data from a European Agency for Safety and Health at Work survey suggest that human–robot interaction is associated with increased work intensity, increased surveillance, deterioration of the social environment and reduced autonomy, evidence from case studies suggests that the negative outcomes stem from organisational factors and management choices, rather than the technology itself.

Policy pointers

- Robotic technologies, particularly when AI-powered, promise to boost productivity, increase workplace safety, alleviate task monotony, reduce physical strain and make work more engaging and rewarding. However, realising these advantages necessitates treating workers as co-creators of technological solutions, rather than merely costs to be minimised. Policy actions are essential to promote human-centric design, including awareness-raising campaigns, public incentives for research and development with a focus on human centricity, and the development of guidelines for ethical and human-centric design.
- The social partners can play a crucial role in shaping policies that prioritise human-centric values and involve participatory approaches to technology design and implementation in workplaces. The European social partners' 2020 framework agreement on digitalisation is an important instrument for coordinating efforts and promoting human centricity in relation to robotics.
- Continued efforts should be directed towards supporting training initiatives that prioritise the development of skills relevant to human–robot collaboration, including digital literacy and adaptability and resilience in the face of automation. It is equally essential to ensure the effective implementation of principle 10 of the European Pillar of Social Rights (on health and safety) and the EU strategic framework on OSH.

Further information

The report *Human–robot interaction: What changes in the workplace?* is available at https://eurofound.link/ef23010

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