STUDY

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# Improving working conditions using Artificial Intelligence

Policy Department for Economic, Scientific and Quality of Life Policies
Directorate-General for Internal Policies
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# Improving working conditions using Artificial Intelligence

**Abstract**

The analysis considers evidence on the expected impact of Artificial Intelligence (AI) on jobs, discusses the potential of AI to create decent jobs and explores the extent to which AI offers opportunities and poses risks to working conditions. The analysis examines current policies at the European Union (EU) and Member State level and recommends some areas for action at the EU level.

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## LIST OF BOXES

## LIST OF ABBREVIATIONS

| | |
|---|---|
| **AIDA** | Special Committee on Artificial Intelligence in the Digital Age |
| **AI** | Artificial Intelligence |
| **EP** | European Parliament |
| **EU** | European Union |
| **EU-OSHA** | European Agency for Safety and Health at Work |
| **Eurofound** | European Foundation for the Improvement of Living and Working Conditions |
| **GDPR** | General Data Protection Regulation |
| **OECD** | Organisation for Economic Co-operation and Development |
| **OSH** | Occupational safety and health |
| **WEF** | World Economic Forum |

# EXECUTIVE SUMMARY

## Background

Artificial Intelligence (AI) is a key area for European Union research and development, with approximately EUR 1.1 billion invested in AI-related research between 2014 and 2017 under Horizon 2020. The EU is taking a variety of actions to support the adoption of AI, including the ***White Paper on Artificial Intelligence***[1] and the upcoming regulatory framework.

## Aims and method

This study aims to support the work of the Special Committee on Artificial Intelligence in a Digital Age (AIDA) by considering the evidence about whether and how AI can be used to enhance quality work and good working conditions.

To do so, the study investigates the following research questions:

- What is the nature of evidence available on the expected impact of AI on jobs in the EU?
- What is the potential of AI to create decent jobs in the EU?
- To what extent does AI (a) offer opportunities to improve working conditions and (b) pose risks associated with the use of AI in a working environment?
- What is the current evidence on national and EU policies and practices on the use of AI for improving working conditions?

The study uses the findings of a targeted literature review (including 25 sources) and five semi-structured interviews with key informants to map out the current landscape of research.

## Key findings

- What is the nature of evidence available on the expected impact of AI on jobs in the EU?

The current evidence and forecasts on the impact of AI on jobs present a mixed picture of job losses and gains. The impact of AI on the future of jobs foresees the displacement of tasks by AI-based technologies, rather than the replacement of jobs. Despite the limits of forecasts in anticipating large-scale disruptions, AI is expected to disproportionately displace low-skill and low-wage jobs. Member States with existing high levels of technology adoption may experience minimal or positive net employment effects, depending on the role that sectors affected by AI play in the labour market. Member States with low levels of technology adoption and a high proportion of jobs with well-defined task routines are expected to experience negative net employment effects.

- What is the potential of AI to create decent jobs in the EU?

The extent to which AI can create decent jobs is as yet underexplored and is likely to depend on the institutional and societal factors, which are prevalent in individual EU Member States. Job displacement effects due to AI may contribute to a rise in platform work, adding multiple risks to job quality. EU Member States with low levels of labour market segregation and strong collective bargaining frameworks will more likely benefit from AI in terms of decent jobs. The way AI will be incorporated into the legal frameworks regulating labour markets will play a large part in determining the ultimate impact of AI on decent jobs.

[1] See the communication 'White paper on Artificial Intelligence - A European approach to excellence and trust' (COM(2020) 65 final).

- To what extent does AI (a) offer opportunities to improve working conditions and (b) pose risks associated with the use of AI in a working environment?

AI has the potential to bring both risks and opportunities to working conditions. On the one hand, it can reduce the risk of dangerous or unhealthy working conditions, encourage the development of specialist or soft skills, and improve accessibility to certain jobs. On the other hand, the application of automated technologies to the job market brings physical and psychosocial risks. The use of AI software to monitor and manage employees may reduce bias in decision-making and identify skills needs, but also reinforce existing biases, increase psychological risks and result in unprecedented amounts of personal data being held by employers. Future policy-making and technological development will be important in determining the extent of the realisation of the potential benefits and risks of AI.

- What is the current evidence on national and EU policies and practices on the use of AI for improving working conditions?

A range of EU legislation addressing health and safety, data protection and workers' rights plays a role in regulating the impact of AI on working conditions. Recent EU strategies and white papers examining AI are considered an important step towards a cohesive policy. Although Member States are increasingly developing national AI policies, these usually tend to focus more on the economic benefits that automation and software could bring to the country. Few have policies in place that explicitly address how AI can be used to improve working conditions, or consider how to mitigate risks brought by AI to working conditions.

### Recommendations

This study identified four key areas where the EU and its Member States could take new or additional actions to optimise the impact of AI on working conditions:

- Increasing investment in technology and computer literacy as part of education and training to create a more economically resilient workforce.
- Addressing evidence and knowledge gaps highlighted in this report by conducting more granular and empirical research capturing the impact of AI in the workplace and on job quality across Member States, industry sectors, occupations and demographic groups.
- Updating the existing ethical and legal frameworks that govern employment lifecycles to explicitly address the emerging role that AI plays in hiring, promoting and firing decisions.
- Examining the role of the General Data Protection Regulation in protecting privacy risks posed by AI and mitigating high-risk activities.

# 1. BACKGROUND

## 1.1. AI is an increasingly common feature of modern working life

AI has been a key area for EU research and development since 2004 (see section 1.3 for a definition). Under the Horizon 2020 programme, about EUR 1.1 billion was invested in AI-related research between 2014 and 2017[2]. The EU has taken a variety of actions in order to support adoption of AI and the consequent changes in the world of work. The **Communication from the Commission on Artificial Intelligence for Europe** aims to boost the EU's technological and industrial capacity while also proposing ethical and legal frameworks based on EU values[3]. The ***White Paper on Artificial Intelligence*** highlights the importance of ensuring trust and security in AI, matching digital competencies to job market needs and providing inclusive employment opportunities[4]. The European Parliament established a **Special Committee on Artificial Intelligence in a Digital Age (AIDA)** with a mandate to analyse the future impact of AI on the EU economy, including on skills and employment[5]. Member States are also taking the initiative to develop their own capacities in AI, including through training and education, adaptation of existing labour regulations, and enhancing research[6].

Identifying the impact of AI on the future of work and working conditions is inherently challenging, since the jobs of tomorrow do not yet exist. This makes it difficult to define the contribution of AI to improving working conditions in precise detail. AI therefore comes with risks and opportunities for the EU, bringing both the possibility of improving working conditions and various associated challenges for working populations. Given that AI is a rapidly evolving feature of modern working life, further research is needed to understand its potential beneficial and challenging impacts on jobs, job markets and working conditions.

## 1.2. Objectives, research questions and methods

The objectives of the analysis are (i) to examine the extent of use of AI as an opportunity to reduce human exposure to harmful and hazardous conditions and to create more quality and decent jobs before improving productivity and (ii) to critically assess key research and data published on the subject, highlighting any points of contention in the public debate and stakeholders' positions, and outline policy options.

Based on the above objectives, we investigate the following research questions:

- What is the nature of evidence available on the expected impact of AI on jobs in the EU?
- What is the potential of AI to create decent jobs in the EU?
- To what extent does AI (a) offer opportunities to improve working conditions and (b) pose risks associated with the use of AI in a working environment?
- What is the current evidence on national and EU policies and practices on the use of AI for improving working conditions?

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2 European Commission (2018).

3 European Commission (2018).

4 European Commission (2020a).

5 European Parliament (2020a); European Parliament (2020b).

6 Cedefop (n.d.).

This analysis uses the findings of a targeted literature review and five semi-structured interviews with key informants to map out the current landscape of research.

## 1.3. Key concepts and definitions

This analysis uses the European Commission's definition of the term **artificial intelligence**: it "refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals"[7]. The literature reviewed considers the broader implications of automation and digitalisation, rather than being focused solely on AI as a software. However, we make specific references to AI-based technologies (including robotics)[8] where these references are supported by the evidence. Job quality and **decent work** are generally difficult concepts to define and measure. For the purposes of defining *decent work* for this analysis, we use the aspects of job quality identified by Eurofound[9]: earnings, prospects (for example, employment security and growth), intrinsic quality (for example, work intensity, environment, autonomy), and working time quality (for example, hours, flexibility). The **working conditions** examined through this analysis consider the findings of EU-OSHA[10] on the main occupational safety and health risks and on the opportunities associated with digitalisation (work equipment and tools; skills, knowledge and information requirements; work organisation and management; employment status, hierarchies and relationships; characteristics of the workforce; responsibilities for managing occupational health and safety).

## 1.4. Structure of the analysis

This analysis covers the expected impact of AI on jobs in the EU (section 2.1), the potential of AI to create decent jobs in the EU (section 2.2), the opportunities and risks that AI brings to working conditions (section 2.3), and the current EU and Member State policies and practices that consider the issue (section 2.4). Conclusions and recommendations for future action are included in section 3.

[7] EU-OSHA (2019, p. 2). Unless otherwise specified in this analysis, AI is identified as a software, AI-based decisions and AI data processing.

[8] Further information on the challenges and methodological limitations can be found in the annex.

[9] Eurofound (2016).

[10] EU-OSHA (2018).

# 2. FINDINGS

## 2.1. The expected impact of AI on jobs in the EU

This section examines the available evidence on (i) the forecasted and predicted impact of AI on jobs in the EU and (ii) the impact of AI on jobs in the EU.

### 2.1.1. There are multiple and differing forecasts and predictions regarding the impact of AI on job losses and job creation

This analysis is focused on forecasts on job losses and creation where AI is an enabler of software-based, autonomous decision-making. Forecasts typically use forms of quantitative, economic-based modelling [11]; surveys to present the prevailing sentiments about job displacement [12]; or estimates based on research intensities and research and development expenditure in industry and academia [13]. We can discern the following types of forecasts: country-specific forecasts not focused on the EU; country-specific forecasts focused on EU Member States; forecasts of types of jobs, tasks and skills; sector-specific forecasts; and socioeconomic forecasts. We discuss relevant findings from each of these types of forecasts below.

#### a. High-income countries will be better positioned to adapt to the requirements of AI-led automation

Thanks to the availability of robust, long-term employment and labour market data, more evidence on the impact of AI is available for high-income countries, which include Organisation for Economic Co-operation and Development (OECD) countries and many EU Member States. Cross-analysis of forecasts, including those provided by OECD and McKinsey & Company on AI and job losses [14], suggests that up to one third of work activities could be displaced by 2030 due to automation [15]. High-income economies are expected to be better positioned to adapt to the changes required by AI-led automation than middle- to low-income ones [16]. A study considering tasks (rather than jobs) across 32 countries found that about one in two jobs could be significantly transformed by automation, given the tasks they involve [17]. About 14% of jobs in OECD countries are estimated to be highly automatable (i.e. to be at least 70% likely to be automated).

Among high-income Asian countries (with high levels of investment in science, technology, engineering, and mathematics (STEM) education), Singapore, Hong Kong, Taiwan and South Korea are expected to economically prosper despite the risks of AI-led automation [18]. In middle-income countries, such as Thailand and India, 70% of total employment is deemed to be at risk due to AI-based automation.[19] Middle- to low-income countries (such as Central and South American countries and North African countries) may not be equipped to address the challenges posed by automation and

[11] Acemoglu & Restrepo (2018); Braganza et al. (2020); Frey & Osborne (2013).

[12] World Economic Forum (2020).

[13] Fernandez-Macias et al. (2020).

[14] Servoz (2019).

[15] McKinsey (2017) in Servoz (2019).

[16] Servoz (2019).

[17] OECD (2018) in Servoz (2019).

[18] Wisskirchen et al. (2017).

[19] Wisskirchen et al. (2017).

digitalisation, due to lack of universal education, lack of investment in (digital) infrastructure, and absence of a robust legal framework[20].

### b. EU Member States with high levels of technology adoption are expected to see minimal or positive net employment effects due to adoption of AI technologies

Among EU countries, **Nordic countries** are expected to manage the risks of AI-led automation without significant loss of economic activity or social disruption[21]. Similarly, the net employment effects of AI technologies in "digital forerunner" countries in **northern Europe** are expected to be minimal or even positive[22]. **EU countries that are not technology rich** (for example, Bulgaria, Romania and Croatia) are more likely to experience negative effects of AI-based automation[23]. Evidence from France suggests that such sectors as **transport, retail banking**, and **health** are likely to adapt well to the risks posed by AI and AI-led automation[24]. **Manufacturing**, **utilities** and **communication** in the EU are projected to have the highest proportional job losses in all scenarios. Growth in employment is projected for only a few occupations, such as **information and communication technology (ICT)**, **legal**, **social**, and **cultural** (and related associate) professionals, **science and engineering** associates, and professional and customer services **clerks**[25].

### c. Jobs that rely on well-defined task routines are at risk of being replaced due to adoption of AI

Based on current empirical evidence on AI adopted from 2011 to 2020, only a few occupations can be expected to be either eliminated or unaffected[26].

Occupations that rely on well-defined routines and occupations involving physical work/manual work that rely solely on physical strength are at the most risk of loss of demand[27]. This includes jobs in **agriculture** (due to the development of remotely controlled, self-driving tractors); in call centres (which can be replaced by speech recognition software); in **postal services** (mail sorters, processors, carriers); in clerical work (data entry, legal); and in **retail** (shop assistants)[28]. Jobs in **unpredictable environments** (such as gardening, plumbing, childcare and care of the elderly) are considered technically difficult to automate and so are projected to be at lower risk of automation by 2030[29]. Occupations involving **non-routine cognitive tasks** (such as lab technicians, engineers and actuaries) are often judged to be most exposed to AI[30]. Forecasts highlight that jobs requiring social and cognitive intelligence[31] and empathy, as well as jobs in unpredictable environments, are expected to be at low risk from AI[32]. From this perspective, those with jobs in IT, management, science, teaching, humanities, social science, media science or artistic professions or as lawyers, doctors and nursing staff are likely to

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20 Wissikirchen et al. (2017).

21 Wisskirchen et al. (2017).

22 Bughin et al. (2017) in Dølvik & Steen (2018).

23 Servoz (2019). In particular, interviewees 1 and 3 highlighted Romania, Bulgaria and Slovenia as the EU member states most likely to see significant job displacement.

24 Benhamou et al. (2018).

25 Eurofound (2019) in Eurofound (2020).

26 Eurofound (2019) in Eurofound (2020).

27 Servoz (2019); Wisskirchen et al. (2017).

28 Servoz (2019).

29 Servoz (2019); Wisskirchen et al. (2017).

30 Lane & Saint-Martin (2021).

31 Social intelligence is defined as the ability to negotiate complex social relationships, e.g. caring for others or managing cultural sensitivities. Cognitive intelligence is defined as creativity and complex reasoning in an artistic context. See Servoz (2019).

32 Servoz (2019); Wisskirchen et al. (2017).

remain in demand[33]. The World Economic Forum (WEF)'s 2020 Future of Jobs report suggests that algorithms and machines are likely to replace tasks of information and data processing and retrieval, administrative tasks, and some aspects of traditional manual labour. Humans will, however, retain a comparative advantage in such tasks as managing, advising, decision-making, reasoning, communicating and interacting[34].

### d. Different sectors (and therefore different Member States) will be affected to different degrees by AI

The varying levels of impact on sectors may also result in differing levels of impact on Member States due to the varying size of sectors within each. **Agriculture** is identified as an area in which the impact of AI on jobs is expected to differ significantly across the Member States[35]. Countries such as **Germany** and the **Netherlands** (which rely on large economies of scale through industrial farming) may be likely to be the first adopters of AI-led technologies[36]. Countries such as **Bulgaria** and **Romania**, with their predominance of individual farmers, are likely to lag behind in automation[37]. There is a need for differentiated policy measures depending on the type of sector to which AI is being deployed and the stage of AI deployment and adoption in the sector[38].

### e. Predictions of how AI will impact employment are highly dependent on the underlying datasets

The WEF 2020 Future of Jobs survey respondents estimated that by 2025, 85 million jobs may be displaced by a shift in the division of labour between humans and machines[39]. Other forecasts suggest that women are likely to be affected disproportionately by increased uptake of AI, with estimates that women will be over 57% of the workers who will be affected by these job market disruptions[40]. One of the explanations is that women are more likely to be employed in jobs facing a high risk of automation[41].

However, other forecasts do not predict large-scale unemployment and social disruption in the wake of increased adoption of AI and robotics technologies. Other authors assert that the share of jobs lost to technology is at a historic low and that, therefore, fears of technologically driven unemployment are often overstated[42]. Based on the analysis of job task descriptions and the text of patents, a recent study highlights that, unlike software and robots, AI is directed at high-skilled tasks[43]. Therefore, provided that historical patterns of job and task substitution continue, AI will reduce wage inequality, but will not affect the top 1% of earners[44]. For example, the WEF 2020 Future of Jobs survey estimates that by

33 Wisskirchen et al. (2017). This is also echoed by interviewee 2.

34 World Economic Forum (2020).

35 Interviewees 1 and 4.

36 Interviewee 1.

37 Interviewee 1.

38 Ernst & Mishra (2021).

39 World Economic Forum (2020).

40 World Economic Forum (2018) in Servoz (2019).

41 Servoz (2019).

42 Atkinson & Wu (2017).

43 Webb (2020).

44 Webb (2020).

2025, 97 million new roles may emerge that are more adapted to the new division of labour between humans, machines and algorithms[45].

### 2.1.2. Current evidence on the impact of AI on jobs presents a mixed picture of job losses and gains

AI is expected to play a role in automating complicated but repetitive or regularly performed tasks in the period 2020–2040[46]. The **banking**, **transport** and **health** sectors are identified as examples of sectors which have adapted to such a transformation by modifying job requirements, reskilling workers and developing new services. The **agricultural** sector faces job losses in high-income countries. Due to the use of automatic irrigation systems and intelligent harvesting and transporting machines, the demand for seasonal, temporary labour (which is often employed through foreign harvest hands and helpers) is expected to decrease[47]. In large agricultural businesses, the demand for technically versed employees to check and repair the machines will grow as the dependence of high-income countries on low-wage workers from abroad decreases. This is likely to result in an oversupply of manual labour in agriculture in medium- and low-income countries[48].

#### a. New, high-productivity tasks and jobs need to be created in response to increased adoption of AI

To produce positive outcomes for workers, new, high-productivity tasks need to be created by AI to boost productivity sufficiently to raise consumer demand and therefore increase the demand for human labour[49]. As the use of AI displaces well-defined, routinised tasks, the remaining tasks, which require human input, will be highly skilled, leading to the potential for greater responsibility and/or pressures on workers[50]. However, the evidence of increased polarisation of work between highly skilled and low-skilled workers (affecting the medium-skilled middle-income jobs) is linked with trade liberalisation and the digital technologies landscape, rather than being a specific outcome of AI-based technologies[51]. The estimates on income losses and job displacement vary, with a shift from manufacturing to services cited as a significant influencing factor in job displacement by some sources[52].

When considering the shift from humans to machines, one interviewee cautioned against assuming that automation is inevitable for low-wage jobs[53]. This interviewee posited that such a transition will be highly dependent on whether the use of machines is cost effective. This interviewee argued that as long as there is a supply of low-income human labour for low-paid jobs and no demonstrable cost advantages to using machines, automation is not a certain outcome[54]. Such a scenario suggests that a further examination of different types of work, and whether AI complements it or substitutes it, is required.

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45 World Economic Forum (2020).

46 Benhamou et al. (2018); Bloom et al. (2019).

47 Wisskirchen et al. (2017).

48 Wisskirchen et al. (2017).

49 Lane & Saint-Martin (2021).

50 Cabrelli & Graveling (2019).

51 Frontier Economics (2018).

52 Frontier Economics (2018); Wissikirchen et al. (2017).

53 Interviewee 1.

54 Interviewee 1.

### b. AI-based technologies are expected to displace tasks rather than completely replace jobs

Although there have been notable forecasts identifying large-scale disruption of current job markets[55], AI is expected to displace parts of the activities within jobs over the long term, rather than replace entire jobs. Very few occupations consist primarily of performing automatable tasks, although nearly all occupations include automatable components[56]. This view of AI and robotics displacing tasks rather than jobs in their entirety was also echoed by some interviewees[57]. One of the interviewees highlighted that when considering labour market history, the role of technologies is more likely to be evolutionary than revolutionary[58].

Thanks to AI-based technologies, certain segments of the job market may experience growth in better-paying occupations[59]. Provided that workers are able to gain access to such occupations through reskilling or upskilling, markets may witness productivity gains[60]. However, to ensure this, policy mechanisms to support such a change in occupational demand will be needed to ensure competitive market structures that enable equitable diffusion of innovation[61].

However, these estimates often consider the broader landscape of digital technologies, rather than the impact of specific technologies, such as AI. One of the estimates suggests that current technology could automate 45% of the activities people are paid to perform, with 60% of all occupations potentially seeing 30% or more of their constituent activities automated[62]. An OECD report estimates that only 9% of jobs are at high risk of being fully automated[63]. A McKinsey report also estimates that only 5% of jobs could be totally substituted by technology[64]. In this context, such sectors as accounting, sales, logistics and trading are likely to see some tasks being replaced by specialised software and AI[65].

### c. The impact of AI will depend on institutional investment and ownership patterns of the technology

The impact of AI will depend on the policies and the public and private investment in and ownership of the technological research that underpins it[66]. The impact of AI on workers will depend on organisational incentives to retain and retrain staff and also on the general infrastructure for training and job-search available in the country, direct government funding, tax incentives and the reach of social benefit systems in the country[67]. Workers will need to acquire not only AI-related skills, but also skills in areas that AI cannot perform well, such as creative and social intelligence, reasoning skills, and dealing with uncertainty[68]. This suggests that the impact of AI will differ across EU Member States due to the different structures governing their labour markets and the level of dependence upon jobs at increased risk of AI-led displacement.

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55 Frey & Osborne (2013); Brynjolfsson & McAfee (2017).

56 Brynjolfsson et al. (2018) in Frontier Economics (2018).

57 Interviewees 1, 2 and 3.

58 Interviewee 3.

59 Ernst et al. (2019).

60 Ernst et al. (2019).

61 Ernst et al. (2019).

62 Chui et al. (2015) in Dølvik & Steen (2018).

63 Lane & Saint-Martin (2021).

64 Chui et al. (2015) in Dølvik & Steen (2018).

65 Acemoglu & Retrespo (2019).

66 Lane & Saint-Martin (2021); Mazzucato (2013) in Ernst et al. (2019). See also Fossen & Sorgner (2019).

67 Lane & Saint-Martin (2021).

68 Lane & Saint-Martin (2021).

## 2.2. The potential of AI to create decent jobs in the EU

There is very limited direct evidence on the potential of AI to create decent jobs in the EU. Although there has been some exploration of potential ways in which decent jobs may be manifested in the context of AI, this is not in the context of EU-specific information. We therefore additionally draw on interview testimonies to identify trends that are relevant to the impact AI could have in terms of creating and maintaining decent jobs.

### 2.2.1. AI brings both risks and opportunities in terms of creating and maintaining decent jobs

The evidence suggests that there are important divergences between the development and implementation of AI technologies and the maintenance and improvement of the availability of "decent work"[69]. The increased adoption of AI could result in decent jobs being replaced with ad hoc or temporary, gig-economy work. This could result in the certainty of regular income in a decent job being replaced with income volatility or no income, due to the workers being shifted to contingency work, which could disrupt family and social cohesion[70]. Although not specific to AI, some evidence indicates that automation can play a role in reducing the availability of decent jobs. There may be additionally demographic and geographical barriers to the creation of decent jobs[71]: 90% of the new jobs brought about by automation need to be generated in low- and lower middle-income countries, where traditions of "decent jobs" are not well established[72].

The study commissioned by the Nordic Council of Ministers offers a useful counterpoint. This source suggests that digitalisation can be an enabler in delivering flexibility in staffing and work organisation by matching local labour supply and demand, and by online crowd work matching tasks and workers regardless of geographical constraints[73]. In addition, the shift towards gig-economy work can have benefits for some workers: the potential de-bundling of jobs into smaller tasks can create opportunities for workers to freelance or top up their income and for organisations to gain "on-demand" access to external labour[74]. The evidence identifies that digital platforms enable non-standard employment and work environment patterns[75].

The extent to which AI can contribute to a decent salary for work is unclear. Some studies suggest that AI may have a positive impact on wage growth for workers who are in higher-wage occupations, have highly specialist skills and/or have higher educational attainment[76,77]. One study found that the relative wages across skill groups (high, medium and low) were unchanged after the introduction of AI[78]. However, other evidence suggests that for those in middle- or lower-skilled jobs, AI-based automation could lead to salary reduction despite the employee experiencing no significant change in working hours[79].

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69 Braganza et al. (2020).

70 Braganza et al. (2020).

71 Bloom et al. (2019).

72 Bloom et al. (2019).

73 Dølvik & Steen (2018).

74 Dølvik & Steen (2018).

75 Dølvik & Steen (2018).

76 Lane & Saint-Martin (2021).

77 Eurofound (2020).

78 Aghion et al. (2020).

79 Eurofound (2020); Graetz & Michaels (2015) in Pham et al. (2018); Lane & Saint-Martin (2021).

### 2.2.2. The impact that AI could have on decent jobs may depend on the broader societal, commercial and industrial frameworks and drivers in place

Interviewees noted key areas that need further investigation when examining the potential for AI to improve decent jobs: the role of institutional factors, the use of AI for conducting hire-and-fire policies, and the operational frameworks within which algorithmically managed platform work is governed[80]. The risks to decent jobs due to platforms which rely on AI-powered algorithms to make real-time decisions was identified as a legislative and regulatory responsibility, rather than an inherently negative characteristic of AI[81]. The legal frameworks in which AI would work with human workers, as well as the business drivers for AI-enabled decent job creation, are not yet clear[82].

One interviewee considered that the impact would be affected by the significant disparities between Member States in terms of the collective bargaining powers vested in workers[83]. The interviewee suggested that the potential of AI to create decent jobs is limited in places where the labour market is quite segregated (including **eastern** and **southern Europe**) compared with those with well-developed collective bargaining power systems (**Nordic countries**). As a result, the benefits accrued due to AI will vary for different workers across Member States[84].

## 2.3. Opportunities and risks associated with AI in a working environment

This section examines the extent to which AI offers opportunities to improve and, conversely, poses risks to the working conditions and the working environment.

### 2.3.1. Using AI in the workplace has the potential to reduce physical risks, encourage skills development and reduce inequality in hiring

#### a. AI-driven automation can reduce the risk of harm to the worker through taking over repetitive or dangerous tasks

AI can facilitate the automation of tasks by allowing machines (including robots) to take over or facilitate repetitive, routine and dangerous tasks that would otherwise be carried out by humans. While some potential risks to harm were also identified (see section 2.3.2), reducing injury was a key potential benefit of AI that was identified in the literature[85] and by interviewees[86]. Such technology can carry out tasks within environments that are dangerous for human workers. Workers may be less likely to be injured by malfunction, as there are fewer mechanical moving parts involved in automated machinery[87] and AI can use data to alert human operators and workers to the risk of injury[88].

[80] Interviewees 4 and 5.

[81] Interviewee 3.

[82] Interviewee 1.

[83] Interviewee 4.

[84] Interviewee 4.

[85] Benhamou et al. (2018); De Stefano (2018); Dølvik & Steen (2018); Eurofound (2020); Frontier Economics (2018); Lane & Saint-Martin (2021).

[86] Interviewees 1, 2 and 3.

[87] Eurofound (2020).

[88] Eurofound (2020).

### b. Automation of repetitive tasks by AI may also encourage interpersonal or specialist skills development

Within more specialist and highly skilled jobs, the use of AI to complement and support job elements may lead to workers being able to focus more on interpersonal or "softer" skills, rather than technical skills. In this way, AI could augment and support workers' "uniquely human" abilities[89,90]. For example, AI's use in **healthcare** may lead clinicians to focus more on the uniquely human skills of holistic diagnosis and empathy[91]. Case studies examining how remote patient-monitoring platforms in hospitals affected the work of nurses and how diagnostic assistance software is used by general medicine practitioners both suggested that the human professionals would be able to spend more time liaising with patients (doctors) or with other healthcare professionals (nurses) when using AI-enabled devices[92]. In **sales**, AI may be used in routine interactions with customers, allowing human workers to focus on complex cases and sophisticated interactions with customers[93]. An example is the Alibaba chatbot, which managed 95% of customer inquiries in 2017[94]. When AI technologies were used to provide **financial** advice to bank advisers through chatbots, the skills required from human financial advisers shifted away from technical knowledge (as this can be gained from the chatbot) and towards the management of customers and risky financial situations, both of which were argued to require human input. As a result, the source reflected on the need for more training in a different direction (such as negotiation)[95].

Examples abound from various **healthcare** specialisms, where the introduction of AI led to medical professionals being required or able to develop more specialist skills in the field (see Box 1). While the use of AI to replace routine tasks may require new skills development and more training, few articles appeared to explicitly address this[96]. Instead, the literature focused on the implications that such uses of AI might have for overall productivity[97] and where AI can improve the accuracy of a task or where AI can make a previously impossible task possible.

[89] Manyika et al. (2017) in Peruffo et al. (2017).

[90] Davenport & Kalakota (2019) in Lane & Saint-Martin (2021).

[91] Davenport & Kalakota (2019) in Lane & Saint-Martin (2021).

[92] Benhamou et al. (2018).

[93] Lacity & Willcocks (2016) in Frontier Economics (2018).

[94] OECD (2019) in Lane & Saint-Martin (2021).

[95] Benhamou et al. (2018).

[96] One example is Peruffo et al. (2017). For example, the need for training is mentioned in the examples given by Benhamou et al. (2018) but not discussed more generally.

[97] Acemoglu & Restrepo (2019); Benhamou et al. (2018); Ernst et al. (2019).

Box 1: AI technologies can support the development of healthcare specialisms

**In radiology**: Software can produce images and semi-automate diagnoses (either entirely or to the extent that non-radiologist physicians can make diagnoses using the AI tool). **Impact on working conditions**: Radiologists will specialise in interpreting complex cases and interventional radiology for diagnostic purposes, making clinical decisions on the imaging data that comes out.

**In cardiology**: AI technologies are used in electrocardiograms (ECGs) in order to interpret ECGs and detect pathologies quickly and to a better extent than cardiologists can. **Impact on working conditions**: Workers have more free time and the ability to focus on complex cases and further training, including further specialisation.

**In patient monitoring**: AI technologies are used in remote patient-monitoring platforms to monitor patients' vital signs (which are usually monitored by nurses). **Impact on working conditions**: Workers have more time to spend analysing data and preparing treatment hypotheses for physicians and can more easily exchange information with other health care professionals, improvement of coordination and collaboration.

Source: Benhamou et al. (2018).

### c. AI could potentially be used to improve equality in hiring staff, manage employees and promote wellbeing

Some sources consider that algorithms, which use AI to make decisions based on existing datasets, may provide more objective and neutral ways of measuring employees' performance and eliminate the possibility of individual biases by supervisors[98]. Similarly, in recruitment decisions, there is potential for tools using AI to reduce bias against groups of applicants, again ensuring more inclusion and diversity in the workplace[99]. Other sources, however, identified more risks than benefits in this regard (see section 2.3.2).

AI may be able to identify new skills and training that are needed among workers. Its ability to process large amounts of data and learn in real time may help in providing continuous feedback[100]. One example given is that of IBM, which experimented using an AI-enabled tool to identify the reasons why employees were underperforming and to suggest training options, before considering redundancy. The trial, in 2017, resulted in 3,500 employees in Europe (out of 80,000) improving their performance and remaining at the company, and it saved the company USD 450 million in retraining and redundancy[101].

Algorithmic management techniques can offer considerable flexibility and autonomy, including by enabling remote working and providing flexibility in working time for workers[102]. However, sources emphasised that such a benefit was not an inevitable result of AI technology being developed, but rather a conscious policy option that depended on regulatory efforts[103].

[98] Bodie et al. (2016) in De Stefano (2018). There is also a risk, however, that AI may be more narrowly focussed on what can be measured.

[99] Frontier Economics (2018).

[100] Kark et al. (2018, p.97) in De Stefano (2018); Nielsen et al. (2016, p.96) in Lane & Saint-Martin (2021).

[101] Servoz (2019).

[102] Dølvik & Steen (2018); Wisskirchen et al. (2017).

[103] Wisskirchen et al. (2017).

AI-enabled monitoring devices can be used to support work wellbeing initiatives. Some interviewees considered that the use of AI to improve the monitoring of employees' activity and wellbeing could be beneficial if introduced well and in a transparent way, as it could provide significant amounts of personal data that may allow for earlier intervention for workers experiencing stress and burn-out[104]. It could also be used, at a meta level, for inspectors and auditors to examine the impact of work–life balance measures at a workplace[105]. In general, interviewees were emphatic that care over implementation, including strict systems and regulations around how such data is collected, is vital to ensure that these benefits come about[106].

### 2.3.2. Using AI in the workplace is associated with multiple risks to working conditions

#### a. Working with AI-enabled technology may increase the risk of physical or psychosocial injury among workers

Technology that relies on AI may be more limited than human workers in its abilities to calculate risks. AI-assisted technology that is designed to detect specific objects can work less well in low lighting conditions, while the over 90% success rate of technologies used for fruit-picking and other agricultural processes still leaves room for errors that cause harm[107]. Machines' reliance on software and AI algorithms can be problematic, and there are examples of serious injury and death as a result of AI-operated technology in the USA[108]. Ensuring that workers receive sufficient training to operate AI and to avoid accidents will be important[109].

Workers' tasks may also become increasingly fragmented when AI is used to take over some or all aspects. This may result in workers feeling that they do not understand the entire task, feeling less interested[110], or feeling that they are being de-skilled and under-valued[111]. The European Parliament discussed the risks of dehumanisation within those receiving services from AI technologies, but fewer studies have discussed the similar pressure on workers collaborating with automated technology[112]. Workers who increasingly work alongside AI-powered algorithms instead of colleagues or managers may experience a decline in their social interaction[113]. Relationships with colleagues and co-workers are considered to be important for workers' motivation and wellbeing, and the elimination of such interactions from workplaces may lead to dissatisfaction and less motivation[114]. However, much of the evidence reviewed is conceptual, with few direct examples of the precise nature of the psychosocial risks.

[104] Cabrelli & Graveling (2019) and also Interviewee 1.

[105] Interviewees 1 and 4.

[106] Interviewees 1 and 4.

[107] European Commission (2020b).

[108] Wisskirchen et al. (2017).

[109] Servoz (2019). This was also stated by Interviewees 1 and 5.

[110] Interviewee 1.

[111] Cabrelli & Graveling (2019).

[112] De Stefano (2018).

[113] De Stefano (2018); Frontier Economics (2018); Peruffo et al. (2017); Saithibvongsa & Yu (2018).

[114] Barden (2017), Qureshi & Sajjad Syed (2014) in Saithibvongsa & Yu (2018); Eurofound (2018) in De Stefano (2018).

### b. Excessive and opaque uses of AI-enabled monitoring devices lead to privacy concerns and further psychosocial risks

The use of AI to monitor workers is seen as a negative innovation in most of the literature reviewed. Concerns tend to focus on (i) data and privacy concerns and (ii) the perceived loss of autonomy and associated psychosocial risks[115]. Interviewees suggested that remote monitoring in this way may increase further due to the COVID-19 pandemic, as more workers work from home or remotely[116].

AI-enabled devices may have the potential to gather more data than is expected or for the data to be used by the employer in algorithms that are not transparent. Examples include wearable devices that measure if workers are gathering together[117], algorithms that use employees' data to affect their ratings and pay[118], and health-monitoring wearable devices that can also be used to consider the number of hours worked, rest breaks taken and activity levels[119]. The potential risk to data privacy is widely recognised not only in the literature and by interviewees, but also by the European Commission and an increasing number of Member States (as discussed in section 2.4)[120].

Excessive monitoring or surveillance can be facilitated by AI and can have a negative impact on the wellbeing of workers[121]. Many sources suggest that excessive monitoring generates psychosocial risks, including the loss of autonomy[122], increased stress[123], decreased self-esteem, decreased confidence, increased anxiety and paranoia, and decreased levels of creativity and communication[124]. Monitoring can lead to physical risks, with a higher likelihood of repetitive strain injury, nerve disorders and high blood pressure[125]. Workers are also increasingly likely to overwork and thus be at risk of further injury. For example, workers at UPS ignored safety rules in order to meet their targets, and truck drivers skipped legally mandated breaks[126].

AI facilitates monitoring to a greater degree and may increase the existing psychosocial risks by being pre-embedded in tools for workplace management[127]. A lack of transparency in how data are used is likely to exacerbate the effect of monitoring data[128]. Interviewees explained that the privacy concerns brought about by AI-enabled monitoring devices represent significant risks to working conditions, because of the power imbalance that is created between the employer (who gathers a large amount of data) and the worker (who provides data for free without understanding fully how this is used)[129].

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115 Cabrelli & Graveling (2019); De Stefano (2018); Moore (2020); Servoz (2019).

116 Interviewees 4 and 5.

117 Servoz (2019).

118 De Stefano (2018).

119 Servoz (2019).

120 European Commission (2020a); Lane & Saint-Martin (2021).

121 Benhamou et al. (2018) ; Lane & Saint-Martin (2021).

122 Benhamou et al. (2018).

123 Leka & Jain (2010); Van den Broek (2017) in Lane & Saint-Martin (2021); Alder (2001); Henderson et al. (1998); Kizza & Ssanyu (2005); Mujtaba (2003); Sarpong & Rees (2014); Varca (2006) in Moore (2020).

124 Kizza & Ssanyu (2005) in Moore (2020).

125 Schumacher (2010) in Moore (2020).

126 Kaplan (2015) in (Moore 2020).

127 Moore (2019) in Lane & Saint Martin (2021).

128 Varca (2006) in Moore (2020); Moore (2020).

129 Interviewees 2 and 5.

### c. Using AI may contribute to lower employee engagement and feelings of alienation

Using AI-monitoring tools could decrease trust in the employment relationship because of the feeling of being watched and thus feeling inhibited. In some instances, this may lead to workers performing tasks more poorly or to managers focusing on surveillance rather than development and training[130]. Working with AI-powered platforms instead of with colleagues may lead to a decrease in interpersonal skills and social skills (including critical thinking, motivating, negotiating, decision-making)[131].

Using AI-monitoring systems to collect performance data on employees may encourage more coercive supervisory styles and less focus on skills development. Drawing on data from call centre workers, a study found that, although more participatory management styles were anticipated after the introduction of AI, these management styles did not come about; instead, monitoring data tended to be used to validate managers' existing opinions[132]. This contradicts the potential benefit that AI could bring in providing a counter to the potential biases of the individual supervisor (see section 2.3.1).

Adapting a workplace to include AI is likely to bring about wider organisational changes that can be disruptive[133]. Changes in the structure of jobs (for example, working with fewer colleagues) and managing systems (for example, these becoming automated) had significant effects on organisational structure, styles of leadership and management, and general organisational culture[134]. Evidence suggests that changes in organisational identity in this way can have negative impacts on the engagement of existing employees[135]. In a study which used a survey to examine the impact of introducing AI on employees' psychosocial contracts, engagement and trust, employee engagement fell when AI was adopted, regardless of the extent of prior relationships between employer and employee[136]. The study suggests that AI adoption brought about a new type of psychological contract, called "alienational," where there was only ad hoc communication, maintained through technology, with sporadic time periods and limited human interaction[137].

### d. Using algorithmic monitoring and decision-making in human resources and workforce management may entrench bias and inequality

While some sources were hopeful that AI may be able to reduce individual biases in promoting and hiring decisions (see section 2.3.1), others discussed the risk that AI, being dependent on past data, will entrench existing biases. An AI-enabled tool that uses data of past recruitment decisions to train machine-learning algorithms on the use of future applications will be likely to learn to perpetuate any existing racial, gender, ethnic or other biases within the dataset[138]. For example, a recent Amazon AI-enabled recruitment tool downgraded CVs perceived to be from women (for example, which mentioned all-women's colleges or female-indicating phrases) due to the prevalence of men in technical roles[139]. There is also a risk that AI may perpetuate bias due to having been developed in

[130] Aiello & Svec (1993) in Moore (2020).

[131] Doyle (2017); International Bar Association (2017); Lindzon (2017) in Saithibvongsa & Yu (2018).

[132] Ajunwa et al. (2017) in Moore (2020).

[133] Kolbjørnsrud et al. (2016) in Saithibvongsa & Yu (2018).

[134] Ashforth & Mael (1989); Sarangi & Srivastava (2012) in Saithibvongsa & Yu (2018).

[135] McBain (2003); Price & Vandick (2012) in Saithibvongsa & Yu (2018).

[136] Braganza et al. (2020).

[137] Braganza et al. (2020).

[138] Bodie et al. (2016) in De Stefano (2018); Brynjolfsson & McAfee (2017, p.31) in Lane & Saint-Martin (2021); Eurofound (2020); Frontier Economics (2018); Interviewees 4 and 2.

[139] Dastin (2018, p.114) in Lane & Saint-Martin (2021).

largely homogenous environments (including, for example, a high proportion of white men)[140]. To mitigate these risks, the data used needs to be as unbiased as possible[141], and also varied[142], to ensure that AI software can make balanced decisions[143].

### e. AI may weaken workers' bargaining power and privacy rights

Some literature and interviewees suggest that the extensive amount of data gathered by AI-enabled monitoring devices gave employers a stronger position than employees[144]. This had the potential to undermine worker rights and hinder improvements in working conditions[145].

The lack of transparency about how AI technologies are being used to monitor in the workplace and how they are used in decisions about hiring, firing and promoting means that there are fewer opportunities for workers to challenge the decisions[146]. There is the potential for highly personal data to be gathered from workers and used for performance management without this being transparent to the worker[147]. In some instances, location-tracking data has been used to prevent unionisation and meeting of workers by employers, including in McDonald's in the USA[148] and by Amazon warehouse operatives[149]. A recent study indicated that worker representatives in call centres in **Germany** and **Poland** were frequently blocked from accessing information about the data collected on employees and to find ways in which unions could have a presence in bargaining around call centre rights.[150] Interviewees considered that this was more likely to be the case in **Member States where there were fewer regulations around workers' rights**[151].

The monitoring of workers' progress may also push for more performance-driven remuneration, which can risk workers exceeding maximum working hours as a result. More long-term considerations are the potential eroding effect of AI technology on workers' holidays, sick leave and other protections, given that such protections will not be required by the AI-enabled algorithms and robots[152]. Potential solutions suggested include ensuring that there is a minimum wage set for workers[153] and adapting legislation and regulations around working time to encompass and consider these risks[154].

[140] De Stefano (2018).

[141] Interviewee 2.

[142] Li et al. (2020, p.115) in Lane & Saint-Martin (2021).

[143] Interviewees 3 and 4.

[144] European Commission (2020b); De Stefano (2018); Ernst et al. (2019); Knack et al. (2019). This was also echoed by interviewees 4 and 5.

[145] Interviewees 4 and 5.

[146] Eurofound (2020).

[147] Eurofound (2020).

[148] Olivier (2021) as cited by Interviewee 4.

[149] De Stefano (2016) in De Stefano (2018).

[150] Bronowicka et al. (2020) in Moore (2020).

[151] Interviewee 4.

[152] Kolbjørnsrud et al. (2016); Sirkin (2016) in Saithibvongsa & Yu (2018).

[153] Wisskirchen et al. (2017).

[154] Interviewee 5.

### 2.3.3. Regulation and policy-making play important roles in determining the extent of the impact that AI may have on working conditions

AI and other developing technologies are likely to have an impact on working conditions (including time, work intensity, autonomy, flexibility, control, health and safety). However, it is not yet always possible to tell whether these changes will bring improvements or increased risks to the worker[155].

While AI could bring opportunities for skills development, it will be important to ensure that there are funds and mechanisms available for such skills development to take place[156]. Although AI could bring potential benefits for workers in terms of wellbeing, flexibility and reduced hours, the actual benefit is dependent on the actions of institutions and government to ensure that legislation relating to workers is sufficiently updated to protect those working with AI[157]. Interviewees considered that the EU would be important in future regulation of AI to ensure a united and cohesive approach[158], but they also emphasised the need to ensure suitable flexibility to allow for Member States to take actions appropriate to their context and labour market[159].

This highlights the need to have regulation and legislation to ensure that AI is developed in a "human-centred way": encompassing research and consideration of human supervisors, users, and collaborators[160]; addressing the potential for information asymmetry (where employers hold more information and knowledge about the information than the employees do)[161]; and considering how AI can be used to protect and enhance workers' rights[162].

## 2.4. Policies and practices in EU and Member States relating to AI and working conditions

This section covers the current state of play on policies and practices (including legislation) at the EU and Member State level that consider AI in relation to working conditions and aim to use AI to improve working conditions.

### 2.4.1. Recent EU strategies on AI were considered important in setting future policy

When considering the direction of future policies and practice, the European Commission's 2020 **Data Strategy** and ***White Paper on Artificial Intelligence*** were cited as important[163]. These set out a strategic approach to AI and identified key principles with implications for the use of AI in the workforce. These key principles include putting people before technology (including in developing technology and regulating use) and ensuring a coordinated European approach to AI[164]. The White Paper lays out a risk-based approach to AI regulation, where the level of risk is dependent on the impact of AI on citizens' lives. In this model, high-risk cases (including using AI for recruitment processes and for situations impacting human rights) would require transparent, traceable and overseen AI systems, with algorithms tested and certified. Interviewees considered the **upcoming regulatory framework**

155 Eurofound (2020).

156 Interviewee 2.

157 Interviewee 2.

158 Interviewees 2, 3 and 4.

159 Interviewee 4.

160 Wisskirchen et al. (2017). This was also stated by interviewee 5.

161 Interviewee 1.

162 Interviewees 4 and 5.

163 AlgorithmWatch (2020); Lane & Saint-Martin (2021). This was also stated by interviewees 2, 3 and 5.

164 AlgorithmWatch (2020).

**from the European Commission on AI** to be vital to ensure that there will be cohesive policy across the EU[165] and that Member States develop comprehensive national strategies on AI[166].

The **Opinion on Artificial Intelligence from the European Economic and Social Committee**[167] recommends that the EU, national governments and social partners identify the job sectors likely to be affected by AI and consider solutions that consider the impact on the nature of work, employment, social systems and inequality[168]. It states that national governments should consider how AI systems could be "co-created" in the workplace to ensure that AI complements and improves upon humans' work, and it states that ethical guidelines on AI should include principles of transparency in the use of AI systems to manage and hire employees[169].

### 2.4.2. A broad range of existing EU legislation already plays a part in regulating the impact of AI on working conditions

While EU action that specifically covered AI was limited to strategies, in practice, the impact of AI on working conditions was governed by a broad range of EU legislation. This included those focusing on data privacy, health and safety, working time and workers' rights.

#### a. The General Data Protection Regulation (GDPR) regulated use of workers' personal data as gathered through AI tools

The **GDPR** was considered of key importance when considering how AI and its use in the workplace was and could be sufficiently regulated by Member States[170]. The GDPR requires Member States to set out specific rules to ensure that the rights and freedoms of employees regarding their personal data being processed in an employment context are being protected. This has implications for data collected by monitoring devices of all kinds, including those using AI. Member States have addressed this issue in various ways when transposing GDPR into national legislation[171]. Some Member States have national regulations or agreements that explicitly address surveillance devices and require employers to inform both the workforce and trade union/worker representative groups, following a strict procedure (including **Belgium**[172] and **France**[173]). Other countries have fewer procedures that monitor the use of surveillance, which may not include trade unions or may give more power to the employer (examples include **Germany**[174], the **Netherlands**[175] and **Sweden**[176]). Building on GDPR, **Opinion 2/2017 on Data Processing at Work** focused on nine scenarios where modern technology has increased the ability of the employer to monitor employees and sets out good practice in ensuring workers' privacy rights are maintained[177]. One interviewee suggested that potential refinements – such

[165] Interviewees 1 and 5.

[166] Interviewees 4 and 5.

[167] European Economic and Social Committee (2019).

[168] De Stefano (2018).

[169] European Economic and Social Committee (2019).

[170] Hendrickx (2018) in De Stefano (2018); Moore (2020). This was also stated by interviewees 2, 4 and 5.

[171] Mapping of some Member States is contained in Moore (2020).

[172] Art. 5, §1(4)) Belgian National Collective Agreement in Moore (2020).

[173] République Française. Code du Travail (as of 22 April 2021) in Moore (2020).

[174] Moore (2020).

[175] Moore (2020).

[176] Moore (2020).

[177] European Commission (2017a); Moore (2020).

as ensuring that all workers are covered and that processes are in place to ensure informed consent is made possible – are necessary given the imbalance of power[178].

### b. Legislation around informing and consulting employees about changes in the workplace may also be relevant

The **EU Directive 2002/14EC**[179] requires employers to engage in social dialogue when considering the impact of technological innovation. The Directive mandates both ad hoc and regular information and consultation duties on the part of the employer and is an important regulation that ensures workers are consulted about the introduction of AI technology[180]. This is transposed in different ways in Member States. In some, the introduction of automated machinery or the use of AI technology may require consultation or permission from the employer (often, again, to trade unions or collective bodies). For example, in **Sweden**, employers are required to regularly inform an employee organisation about how their business is developing in terms of production and personnel policy (including those in AI)[181]. In **Italy**, a 2017 national collective agreement for the manufacturing sector includes a specific individual right for workers to receive training, to be better prepared for the introduction of new automated machinery, and to move to other tasks (if their roles are replaced by machinery)[182].

### c. Legislation around product safety, worker protection and occupational health and safety regulates the potential impacts of AI on physical and psychosocial risks

There are several important pieces of legislation from international and EU sources that regulate product safety, occupational health and safety, and worker protections and that implicitly guard against some effects of AI. These include:

- **EU Machinery Directive**[183]: While not explicitly covering robotics and AI[184], this Directive ensures that risk assessments must be carried out by companies before employees work with robots and that there is a minimum standard for all machine products[185].
- **General Product Safety Directive**[186] and **Radio Equipment Directive**[187]: These ensure that only safe products are sold on the market and that users are informed of associated risks[188].

[178] Interviewee 5.

[179] Council and European Parliament Directive of 11 March 2002 establishing a general framework for informing and consulting employees in the European Community - Joint declaration of the European Parliament, the Council and the Commission on employee representation (2002/14/EC).

[180] De Stefano (2018).

[181] De Stefano (2018).

[182] Poglietti (2016) in De Stefano (2018).

[183] Council and European Parliament Directive of 17 May 2006 on machinery, and amending Directive 95/16/EC. 157 (2006/42/EC).

[184] Interviewee 3.

[185] European Commission (2020b).

[186] Council and European Parliament Directive of 3 December 2001 on general product safety (2001/95/EC).

[187] Council and European Parliament Directive of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC. 153 (2014/53/EU).

[188] European Commission (2020b).

- **Multiple occupational health and safety (OSH) directives**[189], including the Directives on Working Time[190], Work Equipment[191] and the Workplace[192], are organised in a common Framework Directive[193] and lay down minimum protection levels[194].

While psychosocial risks were covered in the OSH directives, there is some evidence that these are not yet substantially used in practice: a 2017 evaluation of the OSH directives found that the type and nature of measures to address these risks in the workplace were not yet clear[195].

The **2018 Council recommendation on access to social protection for workers and the self-employed** and the **2019 Commission proposal on transparent and predictable working conditions** propose rights to transparent and predictable working conditions for those working in non-standard and new forms of work. These principles could be the basis for any future adaptations of employment conditions legislation to AI (including robotics)[196]. The **January 2021 legislative initiative set out by the European Parliament**[197] proposes a law enabling digital workers to disconnect outside their working hours; setting out minimum requirements for remote working; and clarifying working conditions, hours and rest periods. One interviewee considered it an important development in terms of regulating the use of AI to monitor workers[198].

### 2.4.3. Few Member States have policies or strategies that explicitly consider AI in relation to labour markets or working conditions

Evidence reviewed suggests that although most Member States have considered the future of work in light of digitalisation (e.g. the platform economy), few Member States have policies or strategies that explicitly consider AI in relation to working conditions.

Some Member States' AI strategies have not considered or addressed the labour market (including **Austria, Portugal, Denmark** and **Estonia**)[199]. Some Member States (**Germany** and **Poland**) have considered AI in relation to the labour market to focus on the potential positive impacts that AI could have on the country's international standing in the global economy, rather than on any potential risks (see Box 2 for examples).

[189] EU-OSHA (n.d.).

[190] Council and European Parliament Directive of 4 November 2003 concerning certain aspects of the organisation of working time (2003/88/EC).

[191] Council and European Parliament Directive of 16 September 2009 concerning the minimum safety and health requirements for the use of work equipment by workers at work (second individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC), 260 (2009/104/EC).

[192] Council Directive of 30 November 1989 concerning the minimum safety and health requirements for the workplace (first individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC) (89/654/EEC).

[193] Council Directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (89/391/EEC).

[194] Mateescu & Elish (2019).

[195] European Commission (2017b); IOM et al. (2015).

[196] Servoz (2019).

[197] European Parliament (2021).

[198] Interviewee 5.

[199] AlgorithmWatch (2020).

Box 2: Member States' AI strategies frequently focus on the productivity potential of AI

In **Germany,** the strategy on AI includes the aims of keeping Germany competitive internationally, ensuring that AI is deployed and developed for the common good, and ensuring that AI is embedded ethically into society. Although the economic working group advising the strategy considered the risks of AI relating to social injustice and labour market participation, this was not addressed in the resulting strategy.

In **Poland**, the national AI strategy being developed (as of 2020) was expected to focus on the role that AI can play in providing Poland with an important place in the global economy and to build a strong internal market. This involves little focus on the potential effects of AI on working conditions or on the risks that AI may bring.

Source: AlgorithmWatch (2020).

One exception is **France,** where the 2019 AI strategy includes key proposals that directly speak to the impact of AI on labour and working conditions. The strategy was based on a research report that examined specifically the impact of AI on jobs and employment and sets out plans to consider the impact of AI on labour, namely, setting up a research think-tank to consider the transformation of work and how humans and machines can complement each other in work and developing schemes to ensure that vocational training is provided to those in jobs at high risk of automation[200]. Similarly, in **Flanders, Belgium**, recent use of an algorithmic service by the Flanders public employment service to predict jobseekers' likelihood of unemployment and motivation[201], and the suggestions by the leaders of the service that further use of artificial intelligence would be beneficial[202], has led to increased debate in the regional parliament over the transparency of the algorithms and the potential for biased data[203].

[200] Villani (2018).

[201] AlgorithmWatch (2020).

[202] De Cort (2019) in AlgorithmWatch (2020).

[203] El Kaouakibi (2020) in AlgorithmWatch (2020).

# 3. CONCLUSIONS AND RECOMMENDATIONS

## 3.1. Overall conclusions

This analysis provides a complex picture of the benefits and drawbacks associated with the increased adoption of AI in the workplace and its impact on working conditions. Managing the impact of AI while minimising disruption to the prevailing social and economic fabric will require careful consideration of the balance of different skills, wages and levels of productivity in an AI-enabled workplace, as well as effective regulation and legislation at a regional and national level.

### 3.1.1. Estimates on the impact of AI indicate trends but lack granularity and empirical evidence

There is significant variance in the current estimates on the impact of AI, due to differences in underlying assumptions, datasets used, and (perhaps most importantly) the regional and national settings in which the models on job displacement were created. This variance indicates the need for a more consistent analytical framework and the selection of robust datasets to examine the impacts of AI and to enable evidence-based planning. Similarly, the benefits and risks of AI to working conditions and the overall impact on job quality remain hypothetical and not yet supported by empirical evidence. Ongoing monitoring and research examining the state of working conditions in tasks that are exposed to the increased use of AI are needed. This would open up opportunities for policy experimentation and for robust studies examining how AI can improve specific tasks, what the empirical impact is of AI in the workplace, and what strategies can both minimise AI's negative effect on working conditions and support AI's positive influence on working conditions or.

### 3.1.2. The potential of AI to create decent jobs in the EU will depend on institutional factors in the Member States

The introduction of AI and automation may have a detrimental effect on the quality of jobs for displaced workers, pushing them to platform or ad hoc work, which presents challenges in terms of lack of job security, income volatility and non-standard working conditions (see section 2.2.1). Ultimately, the potential for AI to create decent jobs is likely to depend on institutional and societal factors prevalent in the Member States. Member States with low levels of labour market segregation and strong collective bargaining frameworks (typically, northern and western EU Member States) are more likely to see decent jobs as a result of AI. However, the legal frameworks within which AI will work with humans and by which labour markets will be regulated will also play a large part, and these are not yet established.

### 3.1.3. AI is likely to disproportionately affect low-skill and low-pay jobs, thereby increasing inequalities in the job market and in working conditions

Widespread use of AI may exacerbate existing inequalities if it is run in the absence of regulatory oversight. The evidence highlights that the adoption of AI disproportionately affects well-defined and highly routinised low- and middle-skilled and -paid jobs in specific sectors. These are also the workers who face the potential risks that AI may bring to working conditions. This will contribute to the ongoing polarisation (or "hollowing out") of the labour market. While this process brings potential benefits for skilled workers, it puts some populations (including women and older workers) at a disadvantage.

### 3.1.4. Optimal use of AI in improving working conditions will depend on legislation, enforcement and employer awareness

The negative impacts of AI on working conditions are, to some extent, mitigated by current EU legislation, particularly in the field of data privacy and occupational health and safety. However, further action by policymakers and institutions may be required to ensure that the potential improvements that AI could bring to working conditions can be realised. At present, the lack of explicit reference to AI in EU legislation and in many Member States' legislation around working conditions means that this action is not yet sufficient to realise the benefits. The European Commission's horizontal regulatory proposal on artificial intelligence is particularly valuable[204]. However, all existing and any future legislation needs to be implemented and enforced in workplaces. There is a key implementation and enforcement role to play by relevant EU and national authorities, such as labour inspectorates, by trade unions; and by employers. This may pose challenges for sectors and occupations where the use of machinery (and familiarity with the relevant legislation) is not widespread.

### 3.1.5. Member States' policies on the use of AI for improving working conditions are in early stages of development

At present, few Member States have policies in place that explicitly address how AI can be used to improve working conditions or consider how to mitigate risks brought by AI to working conditions. With a few exceptions, national policies tend to focus on AI's potential economic benefits for the job market. Promising practices of AI strategies that directly refer to the impact of AI on working conditions may be taken from some Member States (such as France). However, further exploration of how regional and national governments in EU Member States with different levels of technological development plan to address the impact of AI on working conditions could offer inspiration and learning.

## 3.2. Outline recommendations

This study points to some key recommendations for further investigation and decision-making to optimise the impact of AI on working conditions.

### 3.2.1. More investment in digital skills, technology and computer literacy is needed to create a more economically resilient workforce

Workers who are most at risk of job displacement need to be either upskilled to more complex tasks or reskilled to transition to other in-demand occupations. If historical patterns of task and job displacement continue, workers need to move towards those industries and occupations where their skills are complementary to AI in order to have more secure jobs. Increased investment in technology and computer literacy as part of education and training offers (including continuing education) could enable such workers to acquire the necessary skills to thrive in an era dominated by AI-led technologies. In particular, workers engaged in highly routinised and well-defined low-wage jobs are at high risk of their jobs being displaced. Any such schemes need to provide workers with a resilient skill set which enables them adapt to changing job markets rather than overemphasise specific skills and jobs which may disappear in the long term. The Digital Skills and Jobs Coalition could play a crucial role in disseminating these opportunities and improving the uptake by employers to reach out to those at risk of losing out on the possible benefits of AI.

[204] Proposal for a Regulation laying down harmonised rules on artificial intelligence (Artificial Intelligence Act), https://digital-strategy.ec.europa.eu/en/library/proposal-regulation-laying-down-harmonised-rules-artificial-intelligence-artificial-intelligence.

### 3.2.2. A more granular understanding of AI impact on workplaces and job quality is necessary to better harness its potential to improve working conditions

The potential impacts of AI on working conditions need to be understood and articulated in sufficient detail to reduce the uncertainty, for example, in order to prepare workers for the socioeconomic and behavioural changes necessary to work alongside AI-powered algorithms. This suggests the need for AI-led workplace transformation, introduced in a phased manner and based on substantial and evidence-based decision-making. More granular and empirical data need to be collected on the impact of AI in the workplace across Member States, industry sectors, and tasks and for different demographic groups by Member States and the European Commission and its relevant agencies, such as Eurofound and EU-OSHA.

Furthermore, the ubiquity of AI, combined with its likely influence upon a number of other game-changing technologies, requires a more thorough examination of the role that technological factors play in defining decent jobs. For example, should access to technology and connectivity be a consideration in how decent jobs are conceptualised? Digital inclusion could prove influential in addressing existing social inequities and in the successful execution of the European Commission's digital single market strategy. Given this, EU agencies, such as Eurofound, could investigate how AI software and machinery affect job quality (especially in relation to environment and autonomy of workers) and the role of AI and AI-enabled technologies in helping to improve job quality.

### 3.2.3. Existing rules and regulations across different stages of employment and labour market lifecycles need to be updated for the use of AI in the workplace

AI-based technologies are expected to significantly change a number of aspects of existing job markets, from job advertisement, candidate selection and skill assessments to worker supervision and reporting of work and workplaces. In this context, current legislation at Member State level needs to be reviewed to understand whether the existing rules and regulations are fit-for-purpose to address the challenges posed by AI and robotics. The institutional structures in place for regulatory and legal oversight and consultation (including, for example, statistical authorities which collect data on employment and social wellbeing, national regulatory authorities which govern specific industries, and ombudsperson services) may also need to adapt to anticipate and provide dynamic responses to emerging challenges. To support these changes, the European Commission and its agencies, such as EU-OSHA and Eurofound, will have an important role to play in identifying and promoting good practice and learning among the EU Member States.

### 3.2.4. The role of GDPR in protecting privacy needs to be examined as Member States devise their own strategies to address the impact of AI on work and working conditions

The current provisions of GDPR vis-à-vis the automatic processing of data could be adapted by the European Parliament and the Council of the European Union to explicitly consider the risks posed by the use of AI in surveillance and monitoring to workers' privacy and rights. At present, although several EU Member States are in the process of identifying regulatory frameworks for the use of AI, the role of AI in the workplace and its impact on workers remains insufficiently investigated. In particular, the use of GDPR to mitigate the potential ways in which high-risk AI could limit workers' rights should be assessed to provide a set of good practices to the Member States.

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# ANNEX: DESCRIPTION OF METHODS USED

This analysis relied on information gathered through two methods: a targeted literature review and interviews with key stakeholders.

## Targeted literature review

In order to identify relevant literature and policy documents, the team ran a series of targeted searches in Scopus, Google Scholar and Google to obtain a set of relevant articles. We used combinations of search terms relating to AI ("Artificial intelligence" OR "AI" OR "machine learning" OR "ML" OR "robotics" OR "automation"), the workplace ("working conditions" OR "workplace safety" OR "decent jobs" OR "decent work" OR "harmful and hazardous conditions" OR "occupational safety" OR "work-life balance" OR "HR management"), functions of AI ("surveillance and monitoring" OR "technological delegation" OR "skill obsolescence" OR "mental health stress" OR "information overload" OR "productivity" OR "human bias" OR "digital and AI literacy") and geography ("European union" OR "EU" OR "EU Member States" OR "United Kingdom" OR "United States" OR "US" OR "Australia" OR "OECD countries").

For the articles identified on the basis of these searches, the team prioritised evidence published after 2015, peer-reviewed journal articles and grey literature from well-established national, international agencies, and evidence from high-income countries (including EU Member States) and OECD countries. The team excluded technical evidence on AI and robotics that focus on design and development of the technologies. Only English language sources were considered. We included 25 articles.

## Interviews with key stakeholders

In order to supplement the information and learning gained from the literature review, **we conducted five semi-structured interviews with a broad range of stakeholders** at the EU/international and national level. These interviews aimed at gathering view and inform analysis on topics related to using AI to improve working conditions at a high level. The interviews lasted up to an hour and were conducted virtually using tele- or web-conferencing methods. Data safeguarding measures were put in place to meet the requirements of GDPR. Data were collected on the basis of legitimate interest. The following individuals (organisations identified in parentheses) were consulted as part of the interviews and have consented to being named in this annex: Dragos Adascalitei (Eurofound), William Cockburn (EU-OSHA), Rossana Merola (International Labour Organization), Isabelle Schömann (European Trade Union Confederation), and Sascha Wischniewski (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin).

## Limitations of the methods used

We note a few limitations in the methodology followed in this paper. First, **the scope of the research questions and the research conducted was highly concise** by design of the European Parliament. We consulted five interviewees and focused on literature published in the English language. While we consider that this may mean that valuable inputs and information could be omitted, we carefully selected these to ensure a broad coverage of our proposed research questions. The processes for selecting relevant sources of information are documented above for clarity. Second, **our focus was on AI as a software**. Given that the broader literature focused more heavily on trends in automation, digitalisation and technological development, identifying and distinguishing forecast and impacts of AI was not always possible. Where supported by underlying evidence, we identify the impacts of AI (including robotics) on jobs and working conditions clearly in this analysis. We have used the terms automation and digitalisation trends in the remaining analysis to ensure consistency with the underlying evidence.

The analysis considers evidence on the expected impact of Artificial Intelligence (AI) on jobs, discusses the potential of AI to create decent jobs and explores the extent to which AI offers opportunities and poses risks to working conditions. The study examines current policies at the EU and Member State level and recommends some areas for action at the EU level.

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