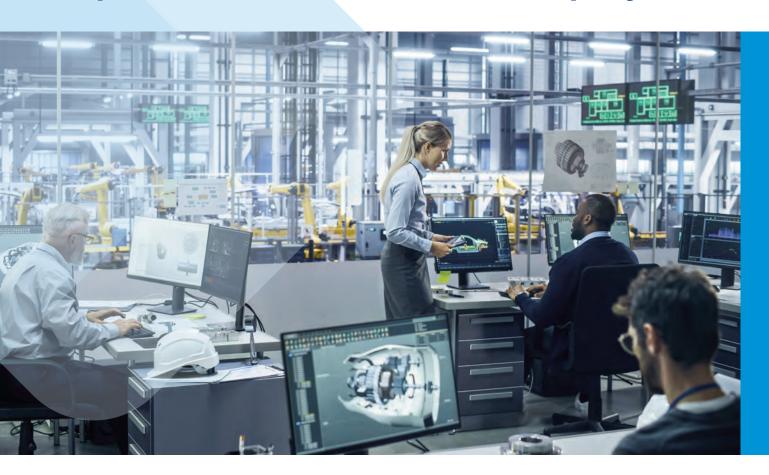Eurofound

Challenges and prospects in the EU

The digital age: Implications of automation, digitisation and platforms for work and employment

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Eurofound

Research carried out prior to the UK's withdrawal from the European Union on 31 January 2020, and published subsequently, may include data relating to the 28 EU Member States. Following this date, research only takes into account the 27 EU Member States (EU28 minus the UK), unless specified otherwise.

The European Foundation for the Improvement of Living and Working Conditions (Eurofound) is a tripartite European Union Agency established in 1975. Its role is to provide knowledge in the area of social, employment and work-related policies according to Regulation (EU) 2019/127.

European Foundation for the Improvement of Living and Working Conditions

Contents

Executive summary

The economy and labour markets of the EU and beyond are in the midst of a digital revolution. While the transition to a digitalised society has been happening for several decades, technological change is accelerating due to the expanding capacity of electronic devices to store, process and communicate information. The recent COVID-19 pandemic has further contributed to increasing the pace of digitalisation.

Digitalisation is a wide field, and its impact differs depending on the technology, country, sector and type of business as well as the workers in the digital environment. To capture this complexity, Eurofound has developed a conceptual framework that structures its research according to three vectors of change: the automation of tasks, the digitisation of processes and coordination through platforms. In practice, these vectors tend to be deployed in combination, together with general purpose technologies such as artificial intelligence (AI).

This report provides a snapshot of how these vectors influence employment, work and social dialogue. It concentrates on key emerging issues and derives policy pointers from them. The report summarises the content of Eurofound's online resource The digital age: Automation, digitisation and platforms, which is planned to be regularly updated and extended.

Key findings

Progress

- While digital technologies are extending into economic activity across the EU, just 28% of establishments (single company sites) with at least 10 employees are highly digitalised, according to data from the European Company Survey (ECS) 2019. At the same time, digitalisation is limited in 27% of establishments. Digitalisation intensity tends to increase with establishment size.

- While it is not possible to establish causality, the available data show that digitalisation in EU establishments coincides with innovation, internationalisation and job creation. Earlier discussions about digitalisation leading to massive job loss are now more nuanced, recognising that changes to task profiles within jobs may be the more important employment impact.

- Digital technologies are reaching a high level of sophistication and affordability, and are therefore becoming more and more central to work management systems. That said, data from the ECS

2019 show that only 5% of EU establishments used data analytics for employee monitoring before the COVID-19 crisis. Since then, however, and related to the extraordinary rise in digitally enabled remote working, the market for surveillance technologies has been expanding.

- Digital technology has enabled people to work from anywhere and at any time, meaning that there is potential for work organisation to be much more flexible, which can be beneficial for companies as well as workers.

- Several initiatives at EU level aim to ensure that as digitalisation spreads there remains a 'human in the loop' so that task assignment, management and surveillance are not left entirely to algorithms. Examples include the *Ethics guidelines for trustworthy AI* (which are linked to the EU Digital Strategy), the General Data Protection Regulation (GDPR), the Digital Skills Agenda, the Digital Markets Act, the Digital Services Act and the autonomous framework agreement on digitalisation by the EU-level social partners.

Challenges

- Limited access to financial resources and lack of the required skills are significant bottlenecks hindering digitalisation in companies, particularly smaller enterprises.

- As digitalisation tends to result in higher demand for high-skilled white-collar workers, polarisation and shortages in the labour market are expected.

- There are increasing concerns about quality of employment because digitalisation disrupts continuity in employment relationships.

- Digitalisation has the potential to raise employee monitoring and data-driven work management to a new dimension by enabling the collection of more data more rapidly and potentially capturing more personal data, including outside the employer's premises. If not designed with workers' interests in mind, digitalisation can also increase their exposure to physical and psychosocial risks arising from long and unsocial working hours; constant connectivity and overlap of private and working time; and increased work intensity and stress.

- Social dialogue and collective bargaining in the digital age face increasing challenges in representing and mobilising workers and anticipating the wider implications of deploying advanced technologies in the workplace.

Policy pointers

- To ensure that Europe keeps pace with other world regions and reaps the benefits of digitalisation, policymakers should explore ways to further support the digitalisation of European businesses. They should consider financial support, exchange of use cases on digital deployment, and facilitating cooperation on the development and implementation of technologies. An opportunity for doing so is the state support linked to the European Commission's Recovery and Resilience Facility. Special attention should be paid to supporting small and medium-sized enterprises (in line with the vision for Europe's Digital Decade) and specific sectors and countries that need to increase the pace of digitalisation.

- Tools to anticipate skills needs, such as the Skills Panorama developed by the European Centre for the Development of Vocational Training (Cedefop) at EU level or similar instruments in the Member States, should be maintained and if necessary further developed to focus more specifically on skills needs in the digital age. Pathways to equip vulnerable groups (such as older workers or those with low formal educational attainment) with relevant skills should be explored, in line with the European Pillar of Social Rights Action Plan and the European Skills Agenda. At the same time, managers need to be trained for the particularities of work organisation and people management in the digital age. They must also learn to use the data generated by digital technologies for the mutual benefit of the company and staff. For those workers affected by redundancies, the European Globalisation Adjustment Fund for Displaced Workers can play a role in supporting reskilling and upskilling.

- Early warning tools could be used to alert policymakers to any slide toward decreasing employment quality, including potential misclassification of employment status. Policymakers should explore the causes of such developments and their impact on businesses and workers as a basis for informed policymaking.

- The opportunities for working time flexibility and improved work–life balance related to digitisation and platform work could be used strategically to support the labour market integration of specific groups, such as those with care responsibilities or health issues. At the same time, the danger of working hours being too short, too long, unpredictable or antisocial and the expectation that workers be constantly available should be addressed, for example through the implementation of the Directive on Transparent and Predictable Working Conditions.

- Building upon the GDPR and the EU legal framework on AI, policy needs to ensure transparency about what data are generated for what purposes and that they are used in a human and ethical way.

- Existing health and safety regulations should be reviewed for their coverage of psychosocial harm, and monitoring bodies (such as labour inspectorates) could be encouraged to pay additional attention to psychosocial risks and impacts.

Introduction

The economy and labour markets in the EU and beyond are being transformed by the digital revolution. While this technological transformation has been under way for several decades, it is accelerating due to the expanding capacity of electronic devices to store, process and communicate information (Eurofound, 2018a). The recent COVID-19 pandemic has further contributed to increasing the pace of digitalisation. The digital transition – both on its own and in combination with the other megatrends of climate change and greening, demographic and societal change, and globalisation – is changing the nature of economic activity, work and employment. A wealth of research is emerging to assist policymakers in anticipating and managing the impact of these changes, including how to foster opportunities while reducing or mitigating risks. This research explores the deployment of digital technologies and the impact it has on work and employment, as well as on social partnership.

Digitalisation is a wide field, and its impact differs depending on the technology, country, sector, type of business and workers, and so on. Eurofound has developed a conceptual framework to take account of this multidimensionality, structuring its research based on three vectors of change, on the assumption that these vectors affect the economy and the labour market differently (Eurofound, 2018a). These three vectors are the automation of tasks, the digitisation of processes and coordination through platforms (defined in the box below). While Eurofound isolates these three vectors to analyse the different impacts of digitalisation on work and employment, in practice they tend to be deployed in combination, together with general purpose technologies such as artificial intelligence (AI).

Eurofound, in its concept paper on digitalisation (2018a), presents hypotheses on the direction of the impacts of the three vectors on work and employment (Figure 1). Automation is expected to transform the types of tasks required of humans in production and service provision, which in turn will affect the structure of employment and skills levels needed, as well as working conditions and industrial relations. Digitisation is assumed to have a more direct impact on working conditions due to altered work environments and work processes. Changes in tasks and occupations, employment conditions and industrial relations are likely to follow. Platforms are expected to have their greatest impact on the social organisation of work, and hence on employment conditions and industrial relations, which in turn affect working conditions.

Eurofound's vectors of change defined

Automation of work is the replacement of human labour by digitally enabled machine input for some types of tasks within production and distribution processes. The use of digital technologies allows the algorithmic control of machinery and, therefore, many more possibilities for automation than previously.

Digitisation of processes refers to the use of sensors and rendering devices to translate the physical production process, or parts of it, into digital information (and vice versa), thus taking advantage of the greatly enhanced possibilities for processing, storage and communication of digital information.

Coordination by platforms uses digital networks to coordinate economic transactions in an algorithmic way. The most widely discussed aspect of this is platform work, the matching of supply of and demand for paid labour through an online platform or app.

Figure 1: Overview of the expected challenges for work and employment by vector of change

	What is it?	Examples	Challenges for work and employment
Automation	Human tasks **replaced** by machines	Robotics Drones	Job polarisation New work organisation New skills demands
Digitisation	Digital production **processes**	Internet of things Virtual/augmented reality 3D printing	Fragmentation of jobs Unstable contractual arrangements Infringement of privacy
Platforms	**Coordination**: matching of supply and demand	Transport Delivery Online services	New work organisation Fragmentation of jobs Ambiguous employment status

Source: *Author, based on Eurofound, 2018a*

This report aims to provide a first response to the issues highlighted by Eurofound's conceptual and analytical framework to assess the implications of the digital age on work and employment. It does not claim comprehensiveness in discussing all relevant topics but gives a snapshot of selected research findings exploring the impact of digitalisation on businesses and workers. The report draws on material compiled for Eurofound's online resource The digital age: Automation, digitisation and platforms.[1] This features short digests summarising key research publications on a specific topic affected by digitalisation. These digests cover the elements that Eurofound's concept paper identifies as potentially most influenced by digitalisation: digitally driven change in production and service provision is expected to affect business models, which in turn have an impact on employment and work organisation, and finally on job quality and working conditions. The social partners and social dialogue can mediate the effects but are at the same time also affected by the transition (Figure 2).

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[1] The web material on which this report is based draws on a large number of research publications by Eurofound and others. As the full references are provided in the web articles, they are omitted in this report for ease of reading.

Figure 2: Analytical framework of the discussion

Source: *Author*

Policy messages have been derived from this discussion of selected impacts of digitalisation on work and employment. Again, this report presents a summary of those messages, while more detailed information can be found in the online resource.

Whereas this report is a static, one-off publication, the web resource will be continuously revised and expanded, to add discussions on additional topics as well as to take the latest developments and research findings into account.

1 | Adoption of digital technologies in the EU

Digitalisation

Digitalisation is progressing in the EU, but it is uneven across countries, regions, sectors and types of organisations. The European Company Survey (ECS) 2019, conducted among establishments (single company sites) with at least 10 employees, identified four types of establishments based on their digitalisation intensity.

Highly digitalised (around 28% of establishments in the EU): These establishments have a high share of employees who use computers daily, are likely to have purchased customised software, and are very likely to use data analytics for process improvement. The use of robots is slightly above average, and e-commerce is relatively widespread. This type of establishment is most prevalent in Malta (39%) and Denmark (37%) and least in Latvia and Lithuania (both 12%). From a sectoral perspective, financial services has the highest share of highly digitalised establishments, while this type is least common in construction.

High computer use, limited use of other digital technology (around 26%): While a high share of staff use computers daily in these establishments, use of

customised software, e-commerce and robots is less common. The use of data analytics is marginal. Malta (38%), Germany (38%) and Sweden (33%) have the highest shares of this type of establishment, with it being least prevalent in Lithuania (9%) and Latvia (12%). Financial services shows such high computer use, with industry falling on the other end of the spectrum.

High use of robots and other digital technology, limited computer use (19%): In these establishments, a relatively low share of employees use computers daily, but customised software and the use of robots and data analytics are common. Lithuania (41%) and Cyprus (39%) have the highest shares of such establishments, with Denmark (8%) and Sweden (10%) having the lowest. The use of robots is most significant in industry.

Limited digitalisation (27%): In these establishments, the use of all of the technologies covered by the survey is below average. This type of establishment is most prevalent in Latvia (49%) and least in Malta (11%). As regards sectors, construction has the highest share of establishments with limited digitalisation, while financial services has the lowest share.

There is a tendency for digitalisation intensity to increase with establishment size (Figure 3).
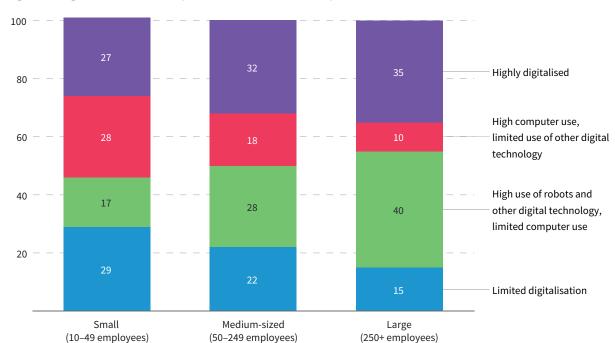
Figure 3: Digitalisation intensity of establishments (%), by establishment size, EU27 and the UK, 2019

Note: *Due to rounding, the values in the bars do not in all cases sum to 100%.*
Source: *ECS 2019 management questionnaire*

Since the onset of the COVID-19 pandemic in early 2020, digitalisation has been observed to be accelerating, with companies and workers seeking digitally enabled solutions such as remote working or automation to keep businesses afloat and maintain employment while adhering to physical distancing requirements. Against this background, it is likely that digitalisation will gain even more importance as a necessary element in enterprises' competitiveness and sustainability rather than something that is 'nice to have'. However, there is evidence that the intensity of digital adoption during the COVID-19 crisis varied across sectors and countries. Productive, economic and market features, as well as the pre-existing level of digital development and technological maturity, are found to influence the take-up of digitalisation.

Automation

While robots have been common in manufacturing for a long time, advanced robots, which are able to perform tasks that go beyond repetitive, discrete motions, are an increasing presence in the economy. They have been adopted in the automotive sector and the food preparation industry, while certain service sectors, notably business logistics, are beginning to employ them too.

In combination with digitisation (see below), advanced robotics is, for example, used in the form of remotely controlled robots. Robotics and AI are jointly deployed as 'cobots' – that is, smaller robots co-working with humans – often to tackle labour shortages. More recently, the combination of automation and AI has been beneficial during the COVID-19 pandemic in the development of vaccines, patient monitoring and the disinfection of hospital wards.

Autonomous vehicles, such as self-driving vehicles, drones and automated guided vehicles, are at the testing stage rather than being fully deployed for economic purposes, because they lack technical maturity and because of legal concerns (for example, liability issues in the event of accidents).

Digitisation

3D printing, augmented and virtual reality (AR/VR) and the internet of things (IoT) are not yet widely deployed in the economy, mainly because of cost and skills requirements. Accordingly, digitisation technologies, for the time being, are more prevalent in larger enterprises than in smaller ones. Nevertheless, they have good potential for future use across the economy owing to

their versatility, particularly if different digitisation technologies are combined. For example, companies could use IoT devices to collect data that are visualised through AR and automatically sent to a 3D printer, to make production processes more efficient.

According to Eurostat data, in 2020, 5% of enterprises with at least 10 employees in the EU27 used 3D printing. It is most prevalent in manufacturing (12%, for rapid prototyping, for example) and ICT (10%). 3D printing gained attention during the COVID-19 crisis, when it was used to print devices such as replacement respiratory valves and protective equipment such as face shields.

The same data source indicates that 18% of enterprises used IoT, with an above-average prevalence in utilities (38%), telecommunications (32%) and transport and storage (27%). As regards Member States, IoT is most used in Czechia (44%) and least in Romania (7%), and significant uptake is expected by 2025 in western Europe, notably Germany. IoT is mainly deployed – often in combination with AI and algorithm-based systems – to monitor production processes, workflows and supply chains, but also for employee monitoring. As regards the latter, several initiatives at EU level aim to ensure that there remains a 'human in the loop', rather than leaving task assignment, management and surveillance entirely to algorithms. Examples include the *Ethics guidelines for trustworthy AI* (which are linked to the EU Digital Strategy), the General Data Protection Regulation (GDPR), the Digital Skills Agenda, the Digital Markets Act and the Digital Services Act.

As of mid-2021, AR/VR is more commonly used among private consumers for entertainment than in enterprises. The latter mainly use it for training purposes and in logistics, such as for the optimisation of routes and picking processes in warehouses. As a response to COVID-19, VR has been used for telemedicine and drug research, and AR in healthcare, marketing, universities and schools.

As regards the combination of digitisation and AI, the most cited examples are remote-control solutions for cyberfactories, and online retail, where the use of algorithms to identify customers' behaviour and buying patterns and to suggest products is already an established practice.

Platforms

In 2013–2014, platform work was a new or emerging form of work in about two-fifths of EU Member States. By 2020, it was prevalent in almost all of them (Figure 4). That indicates its dynamic growth, even though its overall scale is still rather small.
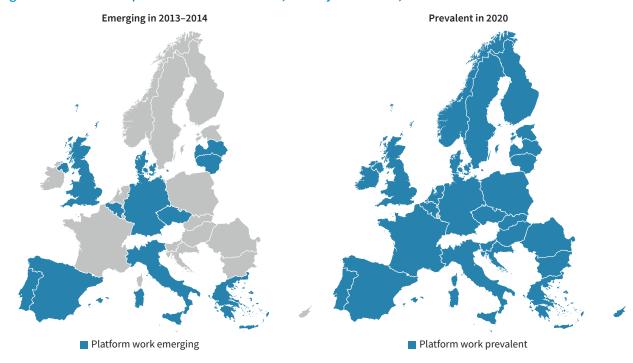
Figure 4: Prevalence of platform work in the EU27, Norway and the UK, 2013–2014 and 2020

Emerging in 2013–2014

Prevalent in 2020

■ Platform work emerging

■ Platform work prevalent

Source: *Eurofound, 2020a*

While no cross-EU harmonised data on the scale of platform work exist, most research finds that 1–2% of the workforce is engaged in platform work as a main job, and around 10% does it occasionally. It is expected that a prolonged economic crisis resulting from the COVID-19 pandemic would lead to a rise in platform work and increased recognition of the possibility to perform work remotely.

As regards the scope of platform work, Eurofound found that in 2017 in Europe there were 10 distinctive types of platform work with a critical mass of active platforms and workers, which differed as regards:

- ◉ the scale of tasks (ranging from microtasks to larger projects)

- ◉ the format of service provision (whether the tasks are delivered on location or online)

- ◉ the level of skills required for particular tasks (routine tasks requiring little complex skill or background knowledge or specialist work requiring a higher level of skill and presumably experience or training)

- ◉ the party that determines the work allocation (client, worker or platform)

- ◉ the matching process (an offer or a contest structure)

'On-location platform-determined routine work' (which includes, for example, provision of ride-hailing and food-delivery services) seems to be the most prevalent type of platform work, followed by 'on-location client-determined moderately skilled work' (for example, provision of household services such as cleaning, gardening or maintenance work). However, a wide variety of tasks are mediated through platforms and delivered online. Examples range from microtasks, such as validating or tagging photos, to high-skilled large projects, such as in the creative industries or professional business services. During the lockdowns, platforms in economic areas requiring little or no physical proximity for product and service delivery (such as mobile payments, consumer marketplaces, professional services and restaurant delivery) tended to see increased demand, while those in economic areas requiring physical proximity (such as accommodation or personal transport) faced a decline in demand.

As the central mechanism of platforms is to algorithmically match supply and demand, AI is strongly linked to this vector of change.

2 | Impact of digitalisation on work and employment: A selective overview
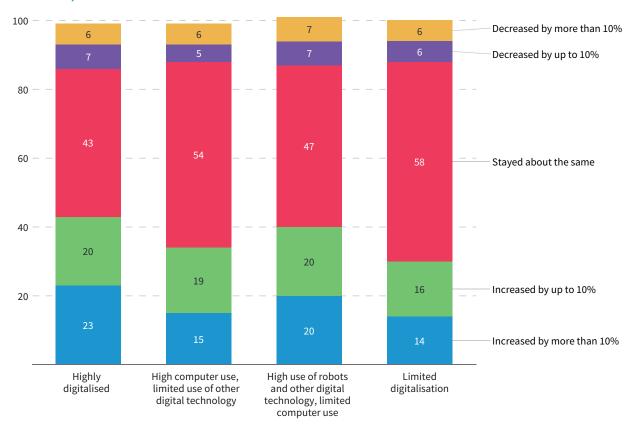
Employment

The employment impact of digitalisation can be quantitative (job creation or job loss), qualitative (understood here as affecting employment quality related to the type of contract and employment relationship) or a combination of both. Furthermore, employment may be affected in terms of changing task profiles within jobs and occupations, and the related skills requirements. All of these aspects are at least partly linked to the business models used, understood as the way in which private and public sector employers structure and organise their activities, including innovation, internationalisation and cooperation/supply chain activities. For that reason, this section also briefly discusses such developments.

Digitalisation

Data from the ECS 2019 show that a higher share of digitalised establishments in the EU than of those with limited digitalisation engages in innovation and international business. As such activities are generally related to higher competitiveness, it can therefore be assumed that digitalisation goes hand in hand with the sustainability of the enterprise, and hence job security. This is supported by findings that highly digitalised establishments score best in terms of business performance and workplace well-being. Indeed, while it cannot establish causality as regards digitalisation intensity and employment levels, the ECS 2019 finds that a higher share of establishments with a high degree of digitalisation (40–45%) increased staff numbers in the three years preceding the survey than those with more limited adoption of digital technologies (30–35%) (Figure 5).

Figure 5: Change in number of employees since 2016 (%), by digitalisation intensity of establishments, EU27 and the UK, 2019

Note: *Due to rounding, the values in the bars do not in all cases sum to 100%.*
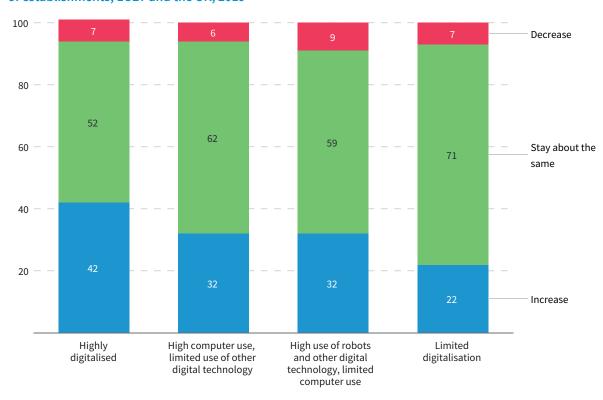**Source:** *ECS 2019 management questionnaire*

Figure 6: Expected change in number of employees in the coming three years (%), by digitalisation intensity of establishments, EU27 and the UK, 2019

Note: *Due to rounding, the values in the bars do not in all cases sum to 100%.*
Source: *ECS 2019 management questionnaire*

Furthermore, a higher share of highly digitalised establishments (42%) planned to increase employment numbers in the three years following the survey than of establishments where digitalisation was limited (22%) (Figure 6).

To move forward with digitalisation, however, companies need to be equipped with the financial resources required to develop or purchase and maintain digital solutions. They also require staff capable of designing and working with those digital solutions. Both might be a challenge for smaller enterprises and young enterprises with limited resources.

The skills requirements in digitalised establishments suggest there are good labour market prospects particularly for high-skilled white-collar workers, while those in occupations with a high level of routine tasks, particularly in sectors such as automotive, machinery and consumer goods manufacturing, are likely to face employment challenges. This gives rise to concerns about increasing labour market polarisation. The European Centre for the Development of Vocational Training (Cedefop) has found, for example, that more than 70% of employees in the EU need at least basic ICT skills to satisfy job demands, but about 30% of them are at risk of falling into the digital skills gap.

At the same time, the increasing demand for higher-skilled and specialised staff, in combination with expected shortfalls in the education and training sector, poses the risk of increased labour shortages in areas such as science, technology, engineering and mathematics or among workers with an advanced or multidisciplinary skill set.

As digitalisation often accompanies employment flexibilisation, it may contribute to an increase in involuntary atypical forms of employment, including less secure employment relationships (such as shorter fixed-term contracts or part-time employment with fewer hours), subcontracting and outsourcing.

Automation

Automation is generally discussed in relation to job loss, as the key feature of this technology is that it replaces human input. Early sky-high estimates warning of 'robots stealing our jobs' have been corrected downwards over time, with the increasing recognition that there is less potential to automate jobs completely than to automate individual tasks within jobs.

Cedefop has found that the highest shares of employees in the EU27 at high risk of job automation are among trades workers, specifically those classified as 'other manufacturing workers' and handicraft and printing workers, as well as subsistence farmworkers, machine and plant operators, assemblers and construction workers (more than 15% at risk). In contrast, the lowest shares (less than 5%) are among managers, street services workers, and care workers (Figure 7).

Figure 7: Shares of employees whose jobs have high automation risk (%), by occupation, EU27, 2020

Managers
Business managers	3
CEOs, officials and legislators	2
Hospitality and retail managers	4
Technical managers	3

Professionals
Health professionals	5
ICT professionals	6
Legal and social professionals	5
Office professionals	7
Researchers and engineers	8
Teaching professionals	8

Associate professionals
Health associate professionals	7
ICT technicians	6
Legal and social associate professionals	5
Office associate professionals	5
Science and engineering technicians	8

Clerks
Accounting clerks	6
Customer clerks	5
Office clerks	6
Other support clerks	5

Service and sales workers
Care workers	4
Personal service workers	8
Protection workers	10
Sales workers	9

Farm and related workers
Farm workers and gardeners	13
Forestry and fishery workers	8
Subsistence farm workers	18

Trades workers
Construction workers	16
Electroengineering workers	11
Handicraft and printing workers	18
Metal and machinery workers	15
Other manufacturing workers	18

Operators and assemblers
Assemblers	17
Drivers and vehicle operators	13
Machine and plant operators	17

Elementary workers
Agricultural labourers	12
Cleaners and helpers	13
Food preparation helpers	10
Other elementary workers	12
Street services workers	4
Technical labourers	13

Source: *Cedefop European Skills and Jobs Survey/Skills Panorama*

Automation, however, also gives rise to new business models such as systems integrator firms facilitating the deployment of robotics in established work environments, or companies specialising in analysing data generated through robots. This can result in employment growth. On the other hand, the quality of employment offered by these newly emerging job opportunities may not be high, as firms operating these new business models may not yet have secured sustainable business relationships and hence may engage in less stable employment relationships. More generally, the fragmentation of jobs into tasks, driven by automation, can result in a decrease in contractual stability and an increase in atypical employment.

Indirect job creation and enrichment opportunities are also expected. An example is the insurance industry, in which clerical staff will be required to familiarise themselves with automation technologies and related workflows, to be able to draft insurance policies adequately capturing inherent risks and liabilities.

Supply chain dynamics may change as a result of increased outsourcing of tasks (such as for ICT services) or decreased outsourcing of tasks (such as steps in automated production or service provision processes). If these tasks are not new, but their provision merely moves from in-house to external, the numerical employment impact should be neutral, but employment quality might be affected.

Replacing people with machines can be an attractive approach to tackling labour shortages. An example is shortages of professional (lorry) drivers in some Member States, such as Germany, which could be partly mitigated by means of autonomous vehicles.

Digitisation

Overall, indications of the potential employment impact of digitisation are very limited, probably because these technologies are not yet widely deployed (see Chapter 1).

Digitisation-based business models, notably those based on IoT, can draw on the data generated to improve business processes and management decision-making, with the aim of increasing competitiveness, sustainability and hence employment security.

Digitisation is expected to result in more outsourcing and networked cooperation relationships, leading to more specialisation within individual organisations and hence a likely impact on skills needs. More generally, higher skills demands are expected to result from digitisation owing to the need to handle and analyse the underlying and newly created data for effective deployment of these technologies.

This increased subcontracting and outsourcing may also trigger global competition for jobs. As a result, the contractual stability, income and working hours of workers might be negatively affected.

Platforms

Platform work offers workers easier access to work and income opportunities. Algorithmic matching has the advantage of removing bureaucracy from assigning work. Moreover, it is objective – at least in theory – which can benefit those labour market groups that might suffer from human selection bias in more traditional forms of work. This holds true in particular for those types of platforms that mediate low-skilled, small-scale tasks.

In addition, platforms that mediate moderately and highly skilled tasks and do not intervene in the management of tasks can contribute to stimulating self-employment and entrepreneurialism.

On the negative side, platform business models that are built around fulfilling small-scale, low-skilled tasks and that not only mediate between supply and demand but also strongly determine how the task is done are increasingly scrutinised for misclassification of workers' employment status as self-employed. Designating workers thus limits employment rights and entitlements, including social protection coverage. Furthermore, these business models also have the potential to contribute to labour market segmentation and deskilling of the workforce if such platform work becomes long-term employment and is not a stepping stone to a more traditional employment relationship should the worker wish it.

Table 1: Employment – Main opportunities and risks

Opportunities	Risks
Digitalisation	
• Increased competitiveness and sustainability of digitalised establishments • Employment opportunities and job security in digitalised establishments for high-skilled white-collar workers	• Job loss for workers in low-skilled, routine-heavy jobs • Skills shortages • Labour market polarisation • Increase in involuntary atypical employment
Automation	
• New employment opportunities due to new business models • Mitigation of labour shortages • Indirect job creation in other industries, such as insurance	• Decline in jobs with a high level of routine tasks • Decreasing employment quality
Digitisation	
• Use of data generated through IoT to improve management decisions and supply chains • Job creation for specialists and newly emerging occupational profiles	• Decreasing employment quality
Platforms	
• Access to the labour market and income, particularly for vulnerable groups • Fostering self-employment and entrepreneurialism	• Misclassification of workers' employment status • Contribution to labour market segmentation and deskilling

Source: *Author*

Work

While the potential impact of digitalisation on work is a broad subject, this flagship project focuses on three elements: work organisation, working time, and employee monitoring and surveillance. These aspects have been chosen because they are among the most commonly discussed topics in policy debate related to work in the digital age as of mid-2021.

Digitalisation

As digitalisation has the potential to affect business models and the task composition of jobs, it also influences how work is assigned, managed, coordinated and controlled within and across organisations. Digital technologies are reaching a high level of sophistication and affordability, and are therefore becoming more central to work management systems. Technologies taking on management functions can degrade the working environment. For instance, it can 'gamify' work by introducing elements of game-playing such as competition and point-scoring, creating additional pressure for workers, or result in 'platformisation' of work, and thus the objectification of employees.

One issue commonly discussed is the generation, ownership and use of data (including for monitoring and surveillance of employees and their performance). Digitalisation has the potential to raise employee monitoring to a new level by collecting more data more rapidly, and potentially capturing more personal data, including outside the employers' premises. Algorithmic task assignment and management is another issue that has generated attention. Technologies that enable 'people analytics' and 'profiling' (using algorithmic inferences drawn from personal data) are emerging, facilitating data-driven and intensive work management and human resources practices.

That said, data from the ECS 2019 show that only 5% of EU establishments with at least 10 employees used data analytics for employee monitoring before the COVID-19 crisis. Since then, however, and related to digitally enabled remote working (see the section 'Digitisation' below), the market for surveillance technologies has been expanding. Employee monitoring software companies reportedly increased their sales during the COVID-19 pandemic, and research has also found increased use of digital employee monitoring since the onset of the pandemic. It will be important to be attentive to such developments, because research highlights that intensive employee monitoring has negative implications for workers, as it inhibits creative and independent thinking, limits autonomy, induces stress and erodes trust in management. If well deployed, however, digitally supported monitoring can also act as an early warning tool to detect physical hazards, can optimise workflows and thus reduce work intensity and stress, and can identify and initiate skills development opportunities.

Digitalisation also affects elements of work organisation that are less directly digital, such as the place of work and working time. Some digital technologies enable people to work from any location and at any time, offering the potential for very high flexibility in work organisation, which can be beneficial for companies as well as workers. The recent large-scale social experiment of mass teleworking during the peak of the COVID-19 pandemic in 2020 showed that digitally enabled remote working can contribute to keeping businesses afloat and maintaining employment. Furthermore, previous research has highlighted that the flexibility inherent in some types of digital work organisation can improve workers' work–life balance. However, this research also shows the impact of company culture and management style: if not designed with workers' interests in mind, digitalisation can result in long and antisocial working hours; constant connectivity and the blurring of boundaries between private and working time; increased work intensity and stress; and hence physical and psychosocial risks.

Companies may adapt how work is coordinated if digitalisation gives rise to changes in the products and services offered, in the processes of production and service provision, or in the task composition of jobs. The ECS 2019, for example, finds that teamwork is much more prevalent in highly digitalised establishments (84%) than in those with limited digitalisation (55%). Furthermore, digitalisation can affect the nature of teamwork, by involving elements such as enhanced human–machine interaction or virtual cooperation through cloud solutions.
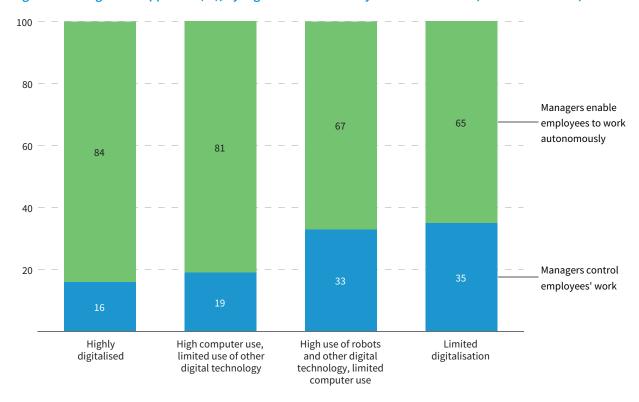
Figure 8: Management approach (%), by digitalisation intensity of establishments, EU27 and the UK, 2019

Source: *ECS 2019 management questionnaire*

Finally, digitalisation can affect management practices. Data from the ECS 2019 indicate that a corporate culture in which managers allow their staff to carry out their work autonomously is more common in highly digitalised establishments (present in 84%) than in those with limited digitalisation (65%) (Figure 8). While greater autonomy is generally assessed as beneficial for workers, digitally driven work arrangements can result in reduced job quality for those workers whose personal work organisation preferences do not fit well with this management style.

Automation

Advanced robotics is expected to affect workplace practices; it may, for example, increase remote working as machines can be operated from off-site locations. It may also change people management due to the complexities of human–machine interaction, which may increase the need for supervision of interactions with robots.

Data generated by the constant monitoring of the workplace and workers using automation technologies such as advanced robotics can improve understanding of workflows, processes and procedures. This information can be used to reorganise the workplace to achieve better productivity, workplace practices and working conditions. However, data collected through robots can also heighten workers' perception of being under constant surveillance, with negative impacts on the power dynamics in the workplace, workers'

autonomy and the overall worker–employer relationship (for example, trust).

Automation can also affect the time component of work organisation. As production hours are likely to increase, in extreme cases to 24/7, shift work or flexitime models will be required for those working with or supervising the technology. Both elements – the spatial and the time components of work organisation – are in turn likely to affect information, communication and coordination processes in organisations. Job quality may decrease because people perceive their work as less meaningful given the loss of a bigger picture in a fragmented automated workflow, or because of more limited autonomy as workers have to fit into a rigid workflow under the automated system.

After adoption, automation can be used strategically to improve work organisation and workflows by analysing the data generated through robots and other automation technology. It can reduce repetitive tasks (and hence job strain) and facilitate job enrichment.

Interaction with robots can, however, also increase accidents if workers, or their managers, are not adequately informed about potential hazards and trained in working with the technology. Psychosocial risks can emerge in the form of increased stress if work intensity or pace of work is determined by a machine, or if the data generated by the technology are used for employee monitoring and surveillance.

Digitisation

The work organisation of digitised workplaces is characterised by cooperation across organisational functions, across organisations and with customers. This can improve the job satisfaction of those workers who find networking and cooperation rewarding. As multidisciplinary cooperation in particular is likely to grow as a result of digitisation, job enrichment for some occupational profiles is expected.

Furthermore, digitisation has the potential to increase the incidence of remote working, as handling or working with digitised processes is less place-bound than more traditional processes. Often, working time flexibility results from remote working. This can be beneficial for work–life balance if workers have autonomy over their working time schedules. However, there is also a risk that workers are expected (or perceive they are expected) to be connected all the time and to work long hours. Moreover, in a digitised workplace, it tends to be more difficult to distinguish between working time and non-working time. Some authors have referred to this as 'increasing time permeability'.

Digitised work organisation is data-driven. The data underlying digitisation technologies and created by them can be used to optimise work organisation and workflows. At the same time, they can also be used for employee monitoring and control. Notably, IoT can create challenges for worker autonomy and privacy, because of potentially intrusive surveillance practices, with negative psychosocial effects for workers due to permanent monitoring (or the perception of it), resulting in stress, higher work intensity and longer working hours. The wealth of data collected through digitisation technologies, combined with data analytics technologies, can also contribute to a deepening of hierarchies and power asymmetries in employment relations. Furthermore, if the underlying mechanism of data collection and data use is not clear to employees, it is difficult for them to contest management decisions based on sensor-collected data.

Platforms

One key feature of work organisation in platform work is the algorithmic matching of supply of and demand for paid labour. Another is the prevalence of rating mechanisms, through which workers' performance is assessed – either manually by the client or algorithmically through the platform. In some types of platform work, platforms are also involved in managing the performance of the task by prescribing elements of work organisation, such as scheduling of tasks or workflows. As algorithms are at the core of business models in the platform economy, work organisation by platforms tends also to rely on algorithmic management. This can be a problem if algorithms are suboptimal and work to the disadvantage of workers or if they are not transparent to workers, with the result that workers are in a weak position to make their case if they feel unfairly treated in the context of task assignment or ratings.

Experts expect further growth in platform work, but they also anticipate that employers in the offline economy will increasingly use algorithmic task assignment and management for their internal staff (known as the platformisation of work). This risks disadvantaging workers, as described above, but also provides the opportunity for improved processes and workflows and for neutralising potential human bias in task assignment and performance assessment – if the algorithm is well designed.

The most commonly cited opportunity arising from platform work is its inherent flexibility. This makes it attractive for some types of workers who do not want to or cannot commit to more rigid work organisation. In theory, platform workers can choose when to be available for work, resulting in a high degree of working time flexibility. In practice, this depends on the type of platform and the activities it mediates. In some types, workers are requested to commit to certain working time slots and are then assigned specific tasks at short notice, including during antisocial hours, sometimes with sanctions if they don't take on the work. In other types, the worker has full discretion about when to use the platform, and about the working time schedule for assigned tasks. Another aspect to consider as regards working time and platforms is the accumulation of unpaid working time in some types of platform work, such as time spent searching and bidding for tasks in online platform work, waiting time in on-location platform work, or having to provide a deliverable without any guarantee of being paid for it in the case of contest-based work allocation.

Table 2: Quality of work and working conditions – Main opportunities and risks

Opportunities	Risks
Digitalisation	
• Flexible and remote working • Improved work–life balance • Enhanced teamwork and improved cooperation within and across organisations • Management culture characterised by workers' autonomy • Digitally enabled monitoring potentially beneficial for workers' health and safety, and skills development	• Long and antisocial working hours, 24/7 availability • Physical and psychosocial risks • Unfavourable remotely dispersed workflows and coordination challenges • Decreasing job satisfaction due to management and workplace practices that do not fit with workers' preferences • Violation of workers' privacy and data protection rights • Intensification of power asymmetries within organisations
Automation	
• Modernisation of work organisation and workflows • Reduction in repetitive tasks and physical strain • Job enrichment • Greater autonomy as regards time and place of work • Digitally enabled monitoring potentially beneficial for workers' health and safety	• Fragmentation of jobs into tasks, which challenges workflows, coordination and communication • Limited autonomy regarding task organisation and working time schedule • Potential on-call working time in some jobs with expectation of constant availability • Violation of workers' privacy and data protection rights • Less perceived meaningfulness of work • Physical and psychosocial risks
Digitisation	
• More effective and efficient workflows and greater possibilities for anticipating and adjusting workloads • Job enrichment • Remote working with greater flexibility and autonomy • Improved work–life balance • Skills development in the workplace	• Blurring of boundaries between working and private time • Constant and intrusive employee monitoring and surveillance, resulting in negative psychosocial effects • Limitations of employee performance-monitoring systems exclusively based on sensor-collected data • Difficulties for workers in contesting decisions based on sensor-collected data
Platforms	
• Flexibility • Improved work–life balance • Automated or algorithmic monitoring to improve efficiency in business processes and work organisation • Automated or algorithmic performance monitoring contributing to overcoming human bias in performance appraisal	• Deficiencies in algorithmic task assignment and rating mechanisms • Lack of transparency of algorithms • Work demanded at short notice, algorithmically driven work schedules, antisocial hours and unpaid working time • Spillover of algorithmic management into traditional employment relationships

Source: *Author*

Social dialogue and collective bargaining

Digitalisation

Building upon their more general role in anticipating and managing structural change, the social partners at EU and national levels (together with governments) have engaged with the digital transition through policies, strategies, social dialogue and collective bargaining. Discussions cover a wide range of issues, such as industrial policies, employment and labour market impact and reforms, effects on working conditions and job quality, skills needs and skills development measures, social protection, and taxation. As regards specific topics, the priorities seem to be skills and training, working time, and data protection and employee surveillance.

That said, digitalisation is not yet fully integrated into collective bargaining, although prominent examples can be found in the financial sector and in large companies.

Digitalisation is seen as an opportunity to review and modernise existing policy approaches and to revitalise social dialogue. Policy actors are aware that there may be a need to deviate from traditional approaches and to come up with new responses to tackle emerging issues;

however, quite naturally, this is challenging and may be affected by some structural risks, such as:

- a focus on wage setting and working time in negotiations between employer and employee representatives without sufficient consideration of the wider effects of implementing digitalisation

- the tradition of considering that changes in production or service provision are at the discretion of the employer, and not subject to negotiation unless there are substantial implications for workers

- incremental rather than disruptive introduction of digitalisation, resulting in limited opportunities to anticipate the medium- and long-term implications in the workplace, or for the sectoral, regional or national labour market

- the increasingly challenging task of representing and mobilising workers owing to decreasing unionisation and the fragmentation of work related to some technologies

Automation

Automation in the workplace changes work organisation, which should be addressed in the context of workers' information and consultation rights and should thus be a subject of social dialogue. This is crucial for determining how robots are to be integrated with work systems, existing hierarchies and management practices. It also helps to ensure that adequate information is provided on the potential dangers related to working with automation technologies such as robots or self-driving vehicles, as well as on data collection and data use.

A challenge for social dialogue is that shifts in employment resulting from automation could compromise the minimum threshold for consultation rights and thus the ability of employee representatives to engage in negotiations. This could diminish opportunities for workers to organise into trade unions and, consequently, reduce collective bargaining rights and workers' participation in the decision-making processes that affect working conditions.

Collective bargaining can play a role in redistributing efficiency gains (for example, through wages, employee financial participation or benefits) in certain sectors where automation enables new functions or drastically changes processes. However, fully or partially individualised wage setting and supplementary remuneration tend to undermine collective bargaining.

Furthermore, skills development and training programmes for reskilling and upskilling are already a significant aspect of automation discussions and arrangements in collective bargaining alongside wages, since changing skills needs arise from reorganisation and from changes in job content through automation.

In addition, across Europe there are examples of collective bargaining dealing with flexible working arrangements (affecting working time and remote working) enabled by automation.

Digitisation

Digitisation tends to result in more complex, and externally networked, organisational forms of production and service provision. It challenges worker representation by blurring company boundaries and creating online rather than physical workplaces. This disrupts solidarity and collective representation.

Once digitisation technologies reach a critical mass in operational deployment, they have the potential to incentivise businesses to redefine their production and distribution processes and to streamline their organisational structures, with significant effects on working conditions. Accordingly, worker representatives should be consulted on their introduction and implementation. In this context, the most important aspects to consider are likely to be temporal and spatial work arrangements (including the right to disconnect), data generation and use (including for employee monitoring and surveillance), and the potential growing polarisation and wage inequality between high-skilled and low-skilled workers.

Social dialogue in the workplace can also be an enabling framework for skills development and health and safety standards related to digitisation. Digitisation technologies provide opportunities in both areas, and social dialogue could contribute to realising them for the benefit of both employers and employees.

Platforms

The specific characteristics of platform work – including the fragmentation of work into individual tasks, the diversity of platform business models and of workers' motivations to engage in platform work, and the geographical dispersion of workers – pose challenges to workers' representation and ability to make their collective voice heard. The unclear employment status of workers exacerbates the issue. As platform workers are widely considered self-employed, at least in some Member States, traditional trade unions do not have a mandate to represent them, and competition regulation may not permit them to organise.

Nevertheless, some early examples of platform economy actors engaging in forms of social dialogue and collective bargaining can be found, driven by trade unions or grassroots organisations. As of mid-2021, such initiatives tended to focus on small-scale, low-skilled, on-location platform work in which platforms have a determining influence on work organisation (for example, taxi-like services or food delivery). In most cases, they are at too early a stage for their effectiveness to be assessed.

Table 3: Social dialogue and collective bargaining – Main opportunities and risks

Opportunities	Risks
Digitalisation	
○ Potential to trigger constructive and cooperative social dialogue ○ Development of new approaches to worker representation and social dialogue at workplace level	○ Social dialogue and collective bargaining lagging behind digitalisation ○ Decreasing level of unionisation
Automation	
○ Social dialogue potentially shaping the impact of automation on workers ○ In agreement with worker representation, constant data management could improve working conditions and health and safety in the workplace	○ Job loss could challenge minimum thresholds required for representation ○ Fully or partially individualised wage setting and supplementary remuneration undermining collective bargaining
Digitisation	
○ Social dialogue potentially shaping the way in which digitised workplaces are organised ○ Opportunities to design and support skills development and health and safety measures	○ Increasing difficulties in representing and organising geographically dispersed workers ○ Unionisation challenged by outsourcing and subcontracting
Platforms	
○ Emergence of new forms of worker representation	○ Individualisation and fragmentation of labour relations ○ Disruption of union solidarity ○ Low levels of collective labour rights and worker representation

Source: *Author*

3 | Conclusions and policy messages

Below is a summary of the conclusions and policy messages derived from Eurofound's research on the implications of digitalisation for work and employment. More detailed information and additional policy messages can be found in Eurofound's online resource The digital age: Automation, digitisation and platforms.

Further support for digitalisation in the EU

- To ensure that Europe remains at the forefront of technological developments and reaps the benefits of digitalisation, policymakers should explore ways to further support the digitalisation of European businesses. Existing support instruments in the field of innovation and technologies could be reviewed as regards their effectiveness and, if necessary, adapted. This includes the state support linked to the European Commission's Recovery and Resilience Facility, as a minimum of 20% of the expenditure under national recovery and resilience plans must be devoted to fostering digital transition.

- Governments and the social partners (in line with the EU social partners' 2020 framework agreement on digitalisation) should make advice and consultancy on the design and implementation of digital solutions available to businesses. They should endeavour to raise awareness among businesses of the potential benefits of digitalisation by demonstrating how technologies can be applied in practice to improve and modernise products and services and their delivery.

- In the provision and exchange of use cases on digitalisation, specific care should be taken to emphasise the need for human-centric approaches, to ensure that standards previously established at workplace level do not deteriorate as a result of the deployment of digital technologies. Businesses should be made aware of the human and ethical implications of digitalisation and the potential unintended side-effects that could negatively affect their staff.

- Based on existing initiatives, policy could also further facilitate cooperation between technology developers and companies. This could be done through 'matchmaking facilities' and also through active support for the induction phase of collaboration, to ensure that expectations, understanding, processes and so on are aligned across the different types of organisations.

- Special attention should be paid to supporting small and medium-sized enterprises (in line with the vision for Europe's Digital Decade) and specific sectors and countries that need to increase the pace of digitalisation.

- Governments and the social partners should monitor developments in national and global digitally enabled supply chains, to ensure a level playing field for actors in the digital economy. Particular attention should be devoted to large market players that might dominate the market and supply chains, potentially exploiting their business partners (including self-employed individuals). Enterprises could also benefit from support in identifying suitable business partners and in negotiating the terms and conditions of cooperation. This might be most useful for smaller enterprises lacking specific organisational roles and expertise in this area, and for cross-national, cross-disciplinary cooperation, where different cultures, languages, practices and understanding can make the establishment and implementation of cooperation challenging. Initiatives could be carried out, for example, in the framework of the Digital Services Act and the Digital Markets Act.

Skills in the digital world of work

- At European level, Cedefop provides various tools to anticipate future skills needs and trends in the labour market, accessible through its Skills Panorama. Similarly, across the Member States, several observatories, surveys and administrative data repositories have been established to map supply and demand in the labour market, including in relation to anticipating future skills needs. Such efforts should be maintained and, if necessary, further developed to focus on skills needs in the digital age. One potential means of doing so is greater involvement of the social partners (as already implemented in some existing measures).

- The new and changed skills of the digital environment might require adaptations to education systems. The current systems for both initial and continuing education could be reviewed to ensure that they are fit for purpose and, if necessary, modified. This could be done in the framework of the European Commission's Recovery and Resilience Facility; its priorities include reskilling and upskilling, the adaption of education systems to support digital skills, and education and vocational training for all.

- Pathways to equip not only the 'elite' in the labour market with digital skills but also more vulnerable groups (such as older workers or those with low formal educational attainment) should be explored, in line with the European Pillar of Social Rights Action Plan and the European Skills Agenda. Curricula should not focus only on specialised occupational skills but follow a more multidisciplinary approach that fosters the development and improvement of transversal skills.

- Management education and training curricula should be reviewed and adapted to the particularities of workplace practices in digital workplaces. Managers need to be made aware of the need for modified or new ways of working. Examples relate to managing remote or multidisciplinary teams and teams composed of people and machines. Furthermore, new management approaches may be needed to organise task assignment, working time or employee monitoring and performance appraisal in a human-centric way in a work environment in which technology can be used for many human resources applications – not always to the benefit of the worker. The social partners should be involved in the operational design and implementation of such management approaches, for example when introducing a right to disconnect or algorithmic task assignment and monitoring instruments. Accordingly, skills development and capacity building may be required to support both managers and worker representatives in conducting such discussions and negotiations.

- Some technologies, notably those related to digitisation, create a substantial amount of data that can be used to improve business performance. Managers should be trained in how best to exploit such data for the benefit of the company, while at the same time fully respecting the interests of the data owners (workers, clients and so on). Such training should have several components, such as data analytics (including competence to assess the quality of the data and the underlying digital tool, including AI), business strategy and data protection. This could be addressed by combining elements of the EU's Digital Education Action Plan and the *White paper on artificial intelligence*.

- If a tendency towards digitally driven deskilling in certain occupational profiles becomes apparent (for example, due to fragmentation and routinisation of tasks), pathways for fostering workplace practices such as job rotation or job enrichment could be explored, to provide workers with a more diverse portfolio of tasks. This could reduce deskilling risk and increase job satisfaction. Social dialogue and collective agreements could have a decisive role in planning and implementing such approaches.

- Policy interventions to reduce or even avoid the risk of deskilling posed by platform work will be more difficult to develop, as the fragmentation of work into small and often low-skilled tasks is in many cases a key characteristic of this form of employment and business model. This has the potential to contribute to labour market segmentation if workers conducting such tasks over a long period of time have limited opportunities to transition to more stable jobs in the traditional economy should they wish to do so. Policy could tackle this risk by exploring which of the wide variety of potential instruments to address labour market segmentation could be applied to platform work. Overcoming labour market segmentation would, in turn, reduce the risk of deskilling on the labour market.

- For those workers affected by redundancies, the European Globalisation Adjustment Fund for Displaced Workers (EGF) can play a role in supporting reskilling and upskilling. The EGF is a long-standing instrument aimed at helping workers who lose their jobs as a result of restructuring to find new employment. For 2021–2027, the EGF has a budget of €210 million, which can be used to fund 60–85% of the costs of projects targeting redundant workers. As experience shows that avoiding stints in unemployment, or making them as short as possible, smooths transitions in the labour market, pathways for providing workers with access to training before they actually become unemployed could in particular be further fostered.

Ensuring employment protection in the digital age

- Governments and the social partners should monitor the development of forms of employment driven by various technologies in different sectors and countries. Early warning tools should be used to warn of tendencies towards decreasing employment quality and to explore their causes and the impacts on businesses and workers, as a basis for informed policymaking.

- Further emphasis should be placed on counteracting misclassification of employment status, including bogus self-employment, resulting from forms of employment and business models emerging as a result of digitalisation. Clarification of the legal framework and support for workers in bringing cases to court could be approaches for governments and the social partners to take in this context.

For those who (temporarily) lose employment owing to digitalisation, safety nets need to be in place to ensure that they are not left behind. This will entail a review of and, if necessary, adaptations to social protection and welfare systems, for example as regards their coverage of certain types of workers (such as those in non-standard employment relationships, which are expected to become more common as a result of increased use of some types of technology) and their financial sustainability. The Council of the European Union recommendation on access to social protection could be an important instrument in this context.

Maintaining and improving working conditions

Policy needs to ensure that digital technologies are deployed in the workplace in a human-centric way. The opportunities inherent in digitalisation to improve working conditions should be exploited, while risks need to be anticipated and avoided or mitigated. To achieve that, further information on the use of different technologies in the economy and the impact that deploying them has on working conditions is needed, and should be disseminated to policymakers, employers and workers.

The opportunities for working time flexibility and improved work–life balance related to digitisation and platform work could be used strategically to support the labour market integration of specific groups, such as those with care responsibilities or health issues. At the same time, the danger of working hours that are too short, too long, unpredictable or antisocial and requirements for constant availability should be addressed. Some of the existing working time regulations, at both EU and Member State levels, were established a long time ago and might not take full account of the particularities of working time in the digital age. A critical review and, if needed, modernisation of such regulations could be beneficial for the labour market, particularly if it results in more clarity about what constitutes working time. At the same time, the implementation of the Directive on Transparent and Predictable Working Conditions should be closely monitored, and lessons learned exchanged across Member States.

As of mid-2021, some countries had established regulations on remote working and the right to disconnect, while others were discussing and considering such regulations. At EU level, information on the different approaches could be collected and disseminated, to foster exchange among Member States. At national level, systems to monitor the implementation and effectiveness of such regulations should be established and the results used to adapt the systems as necessary.

Digital technologies, notably those involving digitisation, create a large amount of data on workers that can be used, including in combination with AI and algorithms, for various labour-related purposes, such as recruitment, task assignment, management of workflows, performance appraisal, and monitoring and surveillance. However, not all that is technically possible is ethically acceptable. Policy needs to ensure transparency about what data are generated for what purposes and whether they are used in a human and ethical way. There is a need to build upon the GDPR, the EU legal framework on AI and relevant national legislation, and to modernise national regulatory frameworks with a view to addressing the challenges posed by digitally enabled work organisation. Objective redress bodies that workers can approach if they feel that their data have been misused or that algorithm-based systems have been designed to their disadvantage need to be established and sufficiently resourced (both in terms of financial resources and skills to make sound assessments). All these aspects should apply not only to employees but also to self-employed workers (for example, those involved in digitised supply chains or networks or engaged in platform work).

Owing to the pervasiveness of IoT technologies, policymakers might consider building on Article 35 of the GDPR to develop a European data protection impact assessment framework for IoT. Privacy-invasive devices such as those equipped with IoT sensors should be designed with privacy and data protection principles in mind and their use governed by stringent adherence to privacy law.

Algorithmic matching of the supply of and demand for paid labour, as in platform work, provides opportunities for effective and efficient task assignment. However, policymakers could engage in ensuring greater transparency of algorithms and in reducing dependency on algorithms when they are not fully developed. Safety nets should be established in relation to algorithmic management, including in the context of traditional employment relationships.

- Another area that deserves policy attention is the health and safety of workers. In the field of automation, for example, policymakers could increase their efforts to inform employers about how robots and other technologies can best be used to reduce physically demanding and hazardous tasks for workers and could help them to adopt such solutions through financial support and advice and consultancy. At the same time, both employers and workers should be informed about the physical risks in environments where humans work with or next to advanced automation technologies. The proposed regulation of the European Parliament and of the Council on machinery products could address harmful incidents arising from the use of AI-empowered machinery, since it proposes that AI software ensuring the safety of machinery is to be independently vetted.

- In relation to digitisation and platform work, psychosocial issues may become an increasingly important topic, for example in relation to algorithmic management and control, which can cause stress and alienation. Existing health and safety regulations should be reviewed for their coverage of psychosocial harm, and monitoring bodies (such as labour inspectorates) could be encouraged to pay additional attention to psychosocial risks and impacts.

Opportunities and challenges for the social partners

- Workers and their representatives should be involved in decisions about the introduction of technology into the workplace, as well as in its design and in the monitoring of its implementation. Information on the characteristics and mechanisms of digital solutions, as well as the purposes for which they are to be deployed, needs to be transparently shared with workers. The European social partners' framework agreement on digitalisation has set such discussions in motion at national and local levels. Measures and actions to be negotiated by the social partners at national, regional or company level may bring forward solutions that highlight the positive use of digital technologies in ways that respect human dignity and employees' fundamental rights.

- Further capacity building among the social partners may be needed to ensure that the required quantitative and qualitative resources are available to the parties involved. Policy could support this financially (for example, through training and skills development support for the social partners) or through the facilitation of exchange and mutual learning (for example, organising cross-company, cross-regional, cross-sectoral or cross-national workshops focusing on the particularities of social dialogue and collective bargaining in the digital age).

- Social dialogue and collective bargaining at national, sectoral and workplace levels should pay increasing attention to elements of employment and working conditions in the digital age that may challenge traditional standards. Examples are the type of employment contract (non-standard); working time (for example, long or short hours, on-call duties, expected availability and the right to disconnect, unsocial working time schedules and lack of work–life balance); data generation, ownership and use; algorithmic task assignment, management and surveillance; and training and skills development. Across Europe, some such approaches managing these issues through social dialogue are already being implemented. They could be analysed as regards their specific characteristics and effectiveness, and the lessons learned could then be disseminated among the social partners.

- Worker representatives could be supported to identify and test approaches to organising and representing fragmented and remote workforces, including those split across borders. As it is expected, following the COVID-19 pandemic and the related surge in telework, that in the years to come remote and hybrid workplaces will become more common, it is important to explore options, opportunities and challenges related to providing a collective voice to workers in such workplaces.

- Cooperation between traditional and newly emerging actors active in the field of organising and representing workers could be supported by policy, to capitalise on the complementary advantages of the different types of actors (for example, expertise in collective bargaining versus easier access to workers). This could be done through awareness-raising among both types of actors about the potential benefits of cooperation and through organising or supporting networking and 'matchmaking' events.

Bibliography

This report summarises a variety of articles published in Eurofound's online resource on digitalisation as of December 2021. The individual articles, in turn, draw on a variety of publications, from both Eurofound and other institutions and authors. The full list of references used can be found in the individual articles. Here, Eurofound's key publications with relevance to digitalisation are listed for further information.

Online resources

Eurofound's Digitalisation online resource:
http://eurofound.link/digitalresource

Eurofound's Platform economy repository:
http://eurofound.link/platformeconomy

Eurofound topic 'Digitalisation':
https://www.eurofound.europa.eu/topic/digitalisation

Publications

All Eurofound publications are available at
www.eurofound.europa.eu

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Technological change is accelerating as the capacity of electronic devices to digitally store, process and communicate information expands. Digitalisation is transforming the EU economy and labour markets: nearly one-third of EU workplaces are categorised as highly digitalised. What are the implications of the digital revolution for employment and work? And how might it affect social dialogue?

Eurofound has produced a body of work to explore these questions. The work is structured around three vectors of change in digitalisation – automation, digitisation and platforms – that are affecting employment and working conditions and social dialogue. The main results of this research have been compiled in the online resource The digital age: Automation, digitisation and platforms. This report draws from that resource to provide a digest of the findings and policy pointers.

The European Foundation for the Improvement of Living and Working Conditions (Eurofound) is a tripartite European Union Agency established in 1975. Its role is to provide knowledge in the area of social, employment and work-related policies according to Regulation (EU) 2019/127.