



Impact of digitalization and artificial intelligence as causes and enablers of organizational change

Implications for the International Civil Service

In view of global trends of increasing digitalization and the use of artificial intelligence (AI) in workplaces, more knowledge is required by staff representatives to support their members when these trends impact their organizations and trigger the implementation of drastic organizational changes. In addition, as of 2020, digitalization and AI have experienced an impetus caused by the COVID-19 pandemic and the need to adapt to ever new working environments and methods for many staff. Those include extensive teleworking and enhanced learning and use of online tools for communication. Due to the economic impact of the current health crisis, many of FICSA's member organizations are experiencing reorganizations, or are faced with plans of reorganization, with the aim of cost saving through downsizing and creating leaner structures, as well as putting in place ever faster ways of information generation and emissions. These new ways of working also bear challenges in relation to the introduction of more precarious working conditions. Clearly staff, as well as organizations will need to adapt, but not to the detriment of the health and safety of staff. This report has been commissioned by FICSA and its member organizations to review and analyze the literature and key policy developments on the impact of digitalization at work and discuss its implications for international civil servants. The review of the evidence will also be used to develop guidance for staff representatives to enable them to support their members within this context.



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1. Context

Technological advancement and the emergence of the internet are key drivers of organizational change and have led to many changes and innovations in work processes. For organizations to adjust to these technological advances, it is becoming ever more essential for their leaders to adjust their models and their culture to reap the benefits of these developments (Eurofound, 2018; Schwarzmüller et al., 2018). Digitalization emanates from information and communication technology (ICT) enabled technologies such as artificial intelligence (AI), advanced robotics, widespread connectivity, the internet of things (IoT) and big data, augmented and virtual reality, wearables, mobile devices and online-platforms that now provide essential services to all sectors of our economy and society, and moreover are likely to have major impacts on the nature and location of work over the next decades (EU-OSHA, 2018, 2019; OECD, 2019a). As highlighted by the Global Commission on the Future of Work, these new forces are transforming the world of work by changing who works and when, and how work is organized and managed (ILO, 2019a). Technological advancement, particularly since the early 2000s, has also brought about ‘the looming possibility of mass job displacement, untenable skills shortages and a competing claim to the unique nature of human intelligence now challenged by artificial intelligence’ (WEF, 2020a).

There is a general consensus in the literature that the digitalization of work increasingly impacts the quality of work and employment in organizations, across all sectors and in all regions of the world (Acemoglu & Restrepo, 2019; Autor, 2015; Buckley et al., 2020; Bughin et al., 2018; Degryse 2016; De Vries et al., 2020; Frey & Osborne, 2017; ILO, 2016a; Manyika et al., 2017; Schulte et al., 2020; Valenduc & Vendramin, 2017), and that the impact of the Covid-19 pandemic has only accelerated the pace of digitalization (OECD, 2020; WEF, 2020a). However, there is no clear approach to the direction that policy should be taking or the forms of regulation that should be pursued due to the complexity of these new processes and their interactions, contradictory stakeholder interests and the size and impact of developments (Meil & Kirov, 2017). At the same time, it is important to highlight that digitalization will not deterministically shape the future of work, as policy choices exist over what and how technology is implemented, which would then determine what digitalization effects (Warhurst & Hunt, 2019).

The evidence clearly suggests that digitalization can be both an opportunity and a threat. On the positive side, it is often linked to a growing autonomy for individual workers affecting working time as well as the place the work is done. On the other hand, advancements in technology also mean permanent access, control and possible blurring of work-life boundaries. New forms of work and employment have also intensified trends towards new kinds of dependency and precarious jobs as well as insecurity. Digitalization therefore opens the door to an increase in challenges relating to the health, safety, and well-being (HSW) of the workforce, that need to be better understood and managed. At same time, it also offers new opportunities to reduce some HSW risks or better manage them and maintaining a balance between the challenges and the opportunities presented by digitalization will depend on the proper application of the technology and on how it is managed (EU-OSHA, 2018). Responses to this digital transformation must evolve in an inclusive and human-centred way, emphasizing the importance of life-long learning and continued skills development (ILO, 2019b). Multilateral cooperation and coordinated approaches/action among stakeholders is needed to both capture the opportunities offered by the growth of digitalization as well as address the challenges it poses (WEF, 2020b), as is carrying out new research on the impact of skill gaps for vulnerable groups and mapping out policy responses for tackling skill shortages and unemployment (Cedefop, 2018).

The future of work and the workforce is a complex and multi-faceted issue that both international and national civil service leaders need to be proactive about. Developing a vision for the future workforce requires consistent steps forward over time and a balance of looking after people while looking to the future (KPMG,

2020). Digital transformations require changes, to both work processes and IT systems, that are often more challenging to implement in the public sector than in the private sector. The public sector must cope with additional management issues, including multiple agencies, a range of organizational mandates and constituencies, longer appropriation timelines, and the challenge of maintaining strategic continuity even as political administrations change (Daub et al., 2020; Dilmegani, Korkmaz, & Lundqvist, 2014; OECD, 2016). This report presents a review and analysis of the literature and key policy developments, discusses the impact of digitalization at work and its implications for the international civil service. The report begins by outlining some key terms and definitions and key trends relating to the adoption of digital technologies. It then discusses the opportunities and challenges posed by digitalization and examines some key considerations linked to change fostered by digitalization and AI. It concludes by examining avenues, including the important role of collective bargaining, for addressing challenges and maximizing opportunities, and discussing their implications for the international civil service.

1.1 What is digitalization?

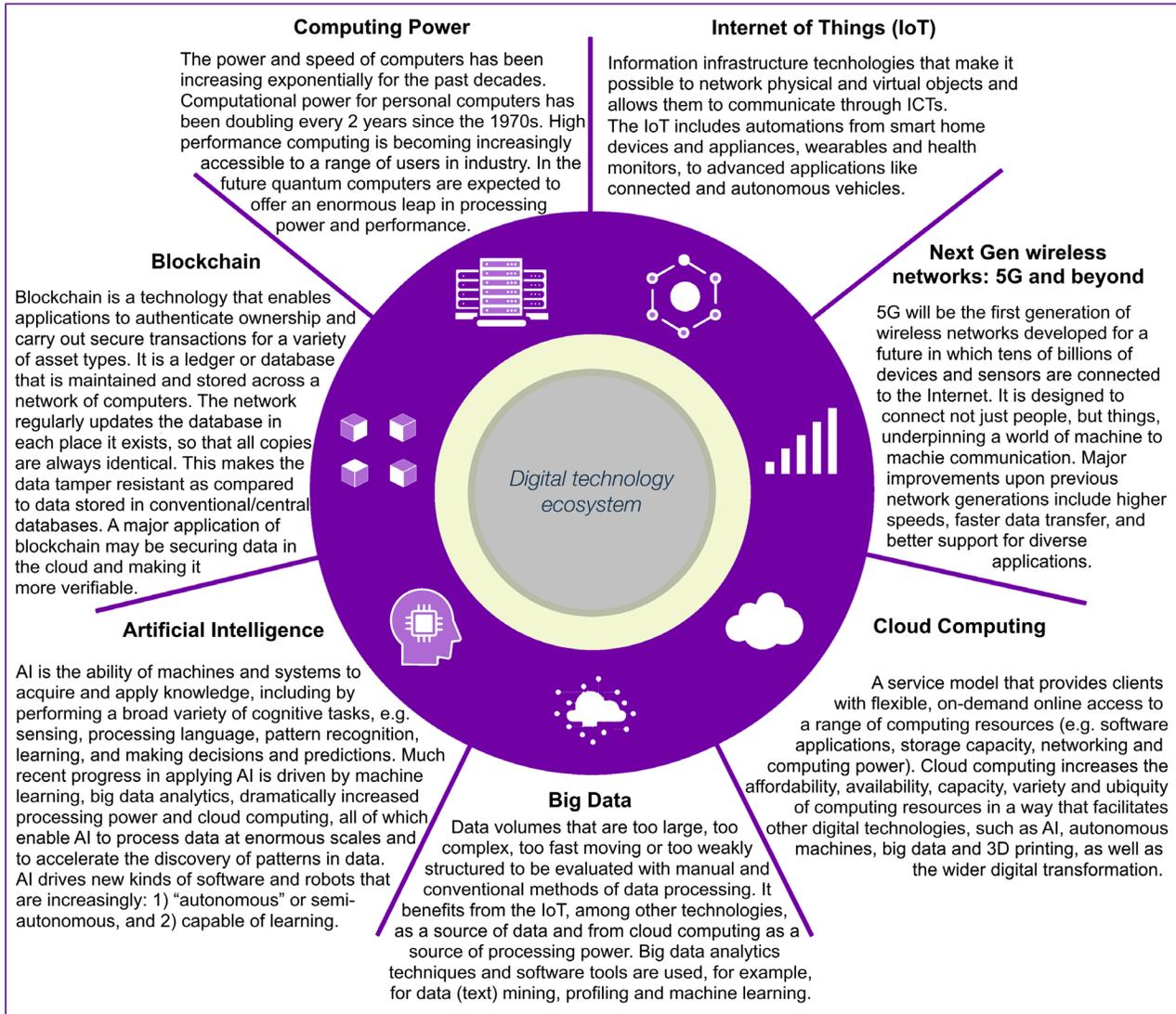
“Disruptive is a much-used buzzword in a lot of discourses and publications concerning the new digital technologies, the increasing digitalization of the economy and its estimated impacts on work and employment” (Valenduc & Vendramin, 2017:122). Disruption however is not new, and instead, is ubiquitous in the ever-changing world of work (Perez, 2015). After mechanization based on steam technology (first industrial revolution - Industry 1.0), mass production based on Taylorism (second industrial revolution - Industry 2.0), and automation based on electricity and analogue computing (third industrial revolution - Industry 3.0), the advent of digital technologies is leading to the fourth industrial revolution or Industry 4.0. (Voss, Maack, & Rego, 2019). The current wave of technological change characterised by breakthroughs in fields such as AI, robotics, the IoT, big data, quantum computing, 3-D printing, nanotechnology, biotechnology, materials science, autonomous vehicles, and energy storage is often referred to as the fourth industrial revolution, that is characterized by a fusion of technologies that are blurring the lines between the physical, digital, and biological spheres (Schwab, 2017).

While research on the social impact of ICT and the relationship between technology and employment has been conducted for over 40 years (Valenduc & Vendramin, 2017), it has been argued that the speed, scope, and systems impact of today’s transformations represent not merely a prolongation of the third industrial revolution but rather the arrival of a fourth and distinct one. The speed of current breakthroughs which are evolving at an exponential rather than a linear pace, has no historical precedent. Moreover, it is disrupting almost every industry in every country, and the breadth and depth of these changes herald the transformation of entire systems of production, management, and governance (Schwab, 2017). The onset of a fourth industrial revolution is also expected to cause significant social changes, and one such change will involve labour relationships and the individualization of the relationship between workers and machines, which will affect unions’ bargaining power and workers’ collective actions (Caruso, 2018).

Data increasingly underpins digital transformation and has become an important source of value and a critical resource for decision-making and production (OECD, 2019b). Although the role of digitized information as a strategic economic resource may seem to be a continuation of trends stretching back several decades, the most recent developments in massive data collection, storage, and processing, represent a quantitative and qualitative leap in this trend (Valenduc & Vendramin, 2016). This rapid advance of digital technologies has led to the development of an ecosystem of interdependent digital technologies, as depicted in Figure 1, that underpins the digital transformation that will drive future economic and societal changes. It important here to distinguish the terms digitization, digitalization, and digital transformation, which are often used interchangeably. While digitization is the conversion of analogue data and processes into a machine-

readable format, digitalization is the use of digital technologies and data as well as interconnection that results in new or changes to existing activities. Digital transformation, on the other hand, refers to the economic and societal effects of digitization and digitalization (OECD, 2019b).

Figure 1: An ecosystem of interdependent digital technologies



Source: Adapted from OCED (2019b), and Voss, Maack, & Rego (2019).

The focus of this report is to examine the impact of digitalization, and although the language used to describe this in practice varies (e.g. computerization, robotization, AI, advanced automation, Uberization, gig work), three 'vectors' of change have been suggested all of which rely on new digital technology and often overlap to create or enable specific work practices: a) digitally-enabled machines with AI; b) the digitalization of processes enabling enhanced possibilities of processing, storage and communication of information (enabling remote/virtual work); and c) the use of digital networks to coordinate economic transactions with algorithms through platforms (Warhurst & Hunt, 2019).

Over the past few years, the availability of big data, cloud computing and the associated computational and storage capacity and breakthroughs in an AI technology called 'machine learning', have dramatically

increased the power, availability, growth, and impact of AI (OECD, 2019c). This is expected to create opportunities but also new challenges, both in terms of quantity of jobs, but also job quality including aspects of health, safety, and well-being, as discussed in later sections of this report. Today, AI applications are already in everyday use, such as virtual assistants on our smartphones, interacting with chatbots¹, translating foreign languages online, or unknowingly being targeted by specific adverts and media content (Cedefop, 2019). AI is used in a range of applications and tools/machines for assisted work and data analytics, allowing the automation of increasingly complex tasks, as well as automated or semi-automated workplace decision-making and management. The applications of AI in working processes range from cobots², wearable technologies and assistive tablets on production assembly lines (supporting virtual/augmented/extended reality applications), chatbots in call centres, and smart personal protective equipment, to algorithmic processes in human resource applications such as people analytics (EU-OSHA, 2021).

People analytics (also called human analytics, talent analytics and human resource analytics) is an increasingly popular area of AI integration. It is defined broadly as the use of big data and digital tools to 'measure, report and understand employee performance, aspects of workforce planning, talent management and operational management' (Collins, Fineman & Tsuchida, 2017). This application of AI-enabled tools makes use of individualized data about people to help management and HR professionals make decisions about recruitment, i.e., who to hire, performance appraisals and promotion considerations, to identify when people are likely to leave their jobs and to select future leaders. People analytics are also used to look for patterns across workers' data, which can help to spot trends in attendance, staff morale and health issues at the organizational level (Moore, 2019).

AI-enhanced wearable self-tracking devices and assistive tablets are increasingly seen in workplaces, such as head-mounted displays with virtual reality (VR) functionality (e.g., HoloLens and Oculus), or computer tablets on stands used to carry out on-the-spot tasks in production lines, or to support training, collaboration and enhance user experience (Moore, 2019). AI enables creation of realistic VR computer-based applications with immersive, highly visual, 3D characteristics that allow participants to look about and navigate within a seemingly real or physical world (Lopreiato et al., 2016). Similar tools are also used to create augmented reality (AR), a type of virtual reality that overlays digital computer-generated information on objects or places in the real world for the purpose of enhancing the user experience (Milgram & Kishino, 1994), and extended reality (XR) which represents the spectrum between the part-digital world of augmented reality and the fully immersive experience of virtual reality. It is sometimes also referred to as spatial computing or immersive technology (PwC, 2019).

Developments in technology have allowed advanced communication processes such as livestreaming, video conferencing (Zoom, MS Teams etc.), enhanced document sharing and collaborative revision to facilitate the creation of virtual work environments. Instead of shared calendars and file servers, "groupware" collaboration offerings like Sharepoint, are now being replaced by on-demand sharing of software concepts, cloud compute/synchronization and machine learning, as further innovations in communication and collaboration technologies (Citi GPS, 2020). A virtual work environment or a virtual workplace can be conceived as a network of several workplaces technologically connected (via a private network or the Internet) without regard to geographic boundaries (Raghuram, Hill, Gibbs, & Maruping, 2019). Employees working in a virtual work environment are working remotely using a variety of technology-enabled tools to connect, collaborate and complete their tasks. 'New work', a term which amongst others refers to telework, i.e., working from home or a location other than the traditional office or 'virtual working', is now more widespread (Jimenez et al., 2017).

¹ AI-enhanced tool that can deal with a high percentage of basic customer service queries.

² A cobot (collaborative robot) is a robot that has been designed with the aim of having physical (and social) interaction with people in a shared work/living environment.

Individual virtual workplaces vary in how they apply existing technology to facilitate team cooperation and various definitions exist in the literature accordingly, which include (Leka, 2021):

- Telecommuting or Teleworking or Remote Work: The European Framework Agreement on Telework of 2002 defines telework as “a form of organizing and/or performing work, using information technology, in the context of an employment contract/ relationship, where work, which could also be performed at the employer’s premises, is carried out away from those premises on a regular basis. A teleworker is any person carrying out telework as defined here” (European social partners, 2002).
- Online jobs: jobs that are being done only online, virtually (online freelancing or mediated by a platform, e.g., Fiverr, Upwork etc.). In Europe, the term “e-worker (or e-nomad)” is generally used to refer to all work that is carried out virtually. This does not include other types of platform mediated work³ which are carried out offline (e.g., Uber, TaskRabbit etc.).
- Hot desking: employees do not have individual desks but are rather each day allocated to a desk where they can access technology services including the Internet, email, and computer network files.
- ‘At-home’ jobs: jobs done at home, also known as home-based jobs, are typically done 100 percent of the time from a home office without required trips to another workspace.
- Virtual team: employees collaborate by working closely together and in regular contact, although physically located in different parts of the world.
- Distributed team/Dispersed virtual team: groups of people who work (often from home) across geographic boundaries and time zones.

The important role of virtual telework in preserving jobs and production in the context of the Covid-19 crisis has been highlighted by the European Commission in its recent communication on the 2020 country-specific recommendations (European Commission, 2020). Once the pandemic ends, remote virtual work is likely to continue since teleworking can cut costs and improve business efficiency, which may catalyse wider adoption of teleworking practices also after the crisis. To maximise the gains for productivity and welfare inherent in the use of more widespread telework, governments should promote investments in the physical and managerial capacity of firms and workers to telework and address potential concerns for worker well-being and longer-term innovation related in particular to the excessive downscaling of workspaces (OECD, 2020).

1.2 Prevalence and trends

The impact of technological change on jobs has always been a focal issue (for a detailed overview see: Valenduc & Vendramin, 2017). However, much of the recent policy debate and work in this area centres on the predictions of Frey and Osborne (2013), which indicated that around half of all jobs, across 70 occupations, are susceptible to replacement by machines. Their predictions received wide coverage in the main-stream media and their methodology was replicated in other regions of the world. However, recent research has criticised their approach, and highlights that the forecasts by Frey and Osborne (2013) are likely to be overestimates (e.g., Arntz et al., 2016; Autor, 2015; Coelli & Borland, 2019). These and other dire predictions have been said to have created a degree of ‘technological alarmism’ within policy debate on jobs and automation (McGuinness et al., 2019), and much of the current debate has therefore been dominated by a perception that technology is deterministic. However, past debates about new technology show that its impact is shaped by the choices made by key actors both within and outside organizations (Warhurst & Hunt,

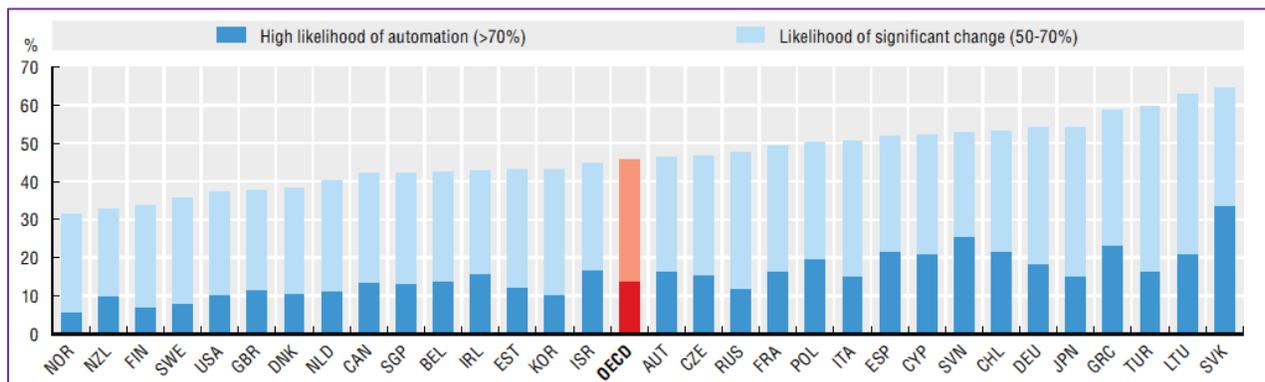
³ The “gig economy” (also called the “on-demand economy”) is a term that refers to work that is mediated through online web platforms. Forms of work in the gig economy are very heterogeneous, though the main ones are crowdwork and “work-on-demand via app” (ILO, 2016a). Work can either be carried out offline and locally (which include ride-hailing, delivery, and domestic services) or entirely online and hence globally (which included low-skilled ‘click work’ as well as high-skilled freelancing (OECD, 2018). *The impact of platform mediated work is not covered in this report, as it is not directly relevant to the international civil service.*

2019). Also, new evidence suggests lower estimates, which highlight that massive unemployment due to digitalization seems unlikely, however there will be significant changes to the nature of tasks and how work itself is undertaken (OECD, 2019a). It is expected that dynamically evolving technologies will render many workers' skills obsolete while placing a high premium on others, which further exacerbate the digital divide (Cedefop, 2017, 2018). Therefore, the expansion of mass reskilling and upskilling across industries, as well as new strategies for effective workforce transitions at scale is increasingly important (WEF, 2020a). The Covid-19 pandemic has radically changed the working arrangements for millions of workers, and it is important to consider the extent to which the pandemic could exacerbate existing labour market inequalities, and the extent to which these inequalities could further worsen amidst intensified technology adoption in the pandemic's aftermath (Espinoza & Reznikova, 2020).

1.2.1 Impact on work and employment

Technological unemployment is a recurring theme, but joblessness in the digital age will depend on human, not artificial, intelligence (Cedefop, 2017). The OECD based on an estimation of the tasks that could be automated over the next 10-20 years, predicts that, on average, 14% of jobs would be replaced by technology, while an estimated 32% of jobs are likely to face significant change in how they are carried out, due to automation of some tasks within these jobs (OECD, 2019a). Even though there are variations in the extent to which each country will be impacted, Figure 2 highlights that the impact is likely to be significant across the world, and this trend will only continue.

Figure 2: Likelihood of automation or significant change to jobs, as a percentage of all jobs, 2012 or 2015

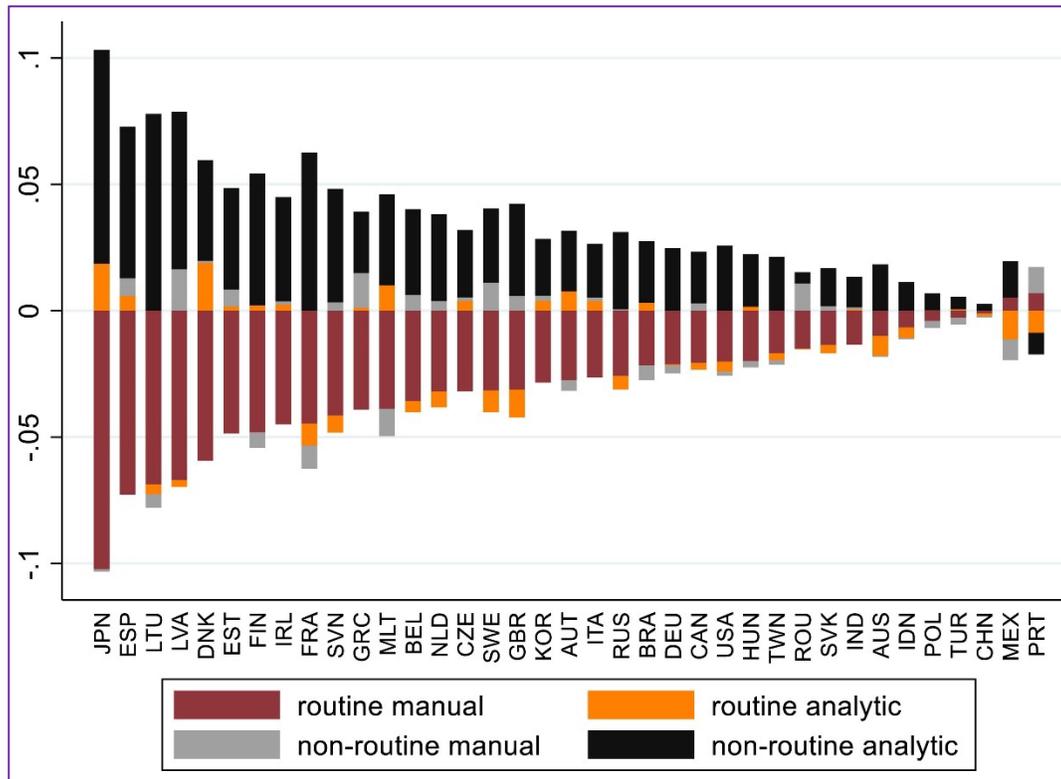


Source: Nedelkoska & Quintini (2018): Cited in OCED (2019a).

Orders of industrial robots have tripled over the last decade and are projected to increase rapidly (OECD, 2019a). De Vries and colleagues (2020) using a panel of 19 industries in 37 high-income and emerging economies from 2005-2015, found that increased use of robots is associated with positive changes in the employment share of non-routine analytic jobs and negative changes in the share of routine manual jobs, as depicted in Figure 3. They also reported that there was no significant relation between industrial robot adoption and aggregate employment growth, which indicates that industrial robots did not replace jobs, but they did impact task demand and thus had disruptive effects on employment. They highlighted that retraining and reskilling of workers is therefore crucial and that organizations should focus on educational goals, lifelong learning, and developing the right skills (Kim & Park, 2020). AI technologies are seeing rapid uptake in sectors such as transport, agriculture, finance, marketing and advertising, science, healthcare, criminal justice, security, the public sector, as well as in augmented and virtual reality applications. In these sectors, AI systems can detect patterns in enormous volumes of data and model complex, interdependent systems to generate outcomes that improve the efficiency of decision making, save costs and enable better resource

allocation (OECD, 2019c). About 40% of HR functions in international companies are now using AI applications and an increasing number of global businesses are beginning to see the value of AI in supporting workforce management (PwC, 2017). Recent IBM research indicates that two thirds of CEOs believe AI will drive value in HR, and in the world's 10 largest economies, even as many as 120 million workers may need to be retrained and reskilled to deal with AI and intelligent automation (IBM, 2018).

Figure 3: Changes in employment shares by country and task type between 2005-2015 due to robotization

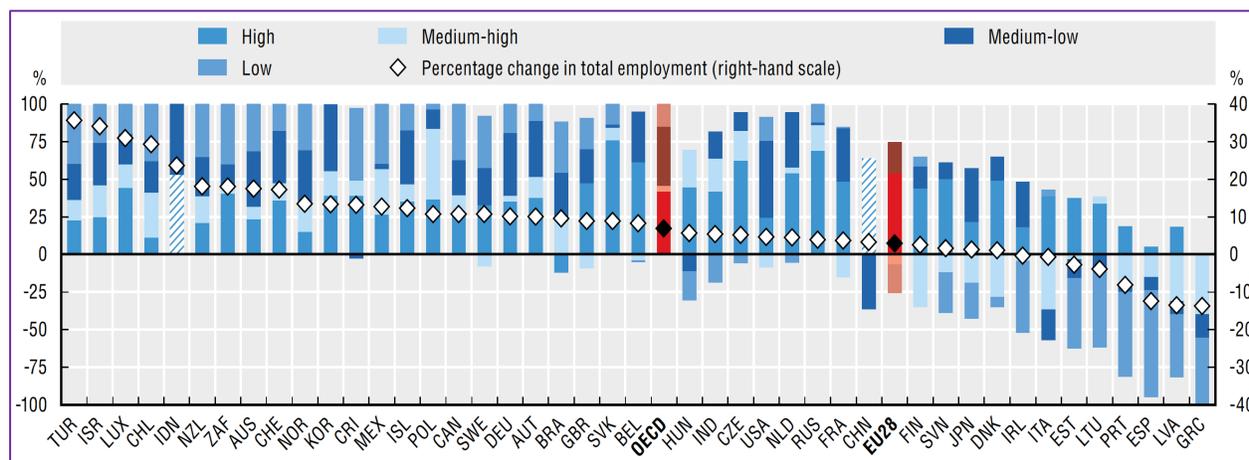


Source: De Vries et al. (2020)

Over ten years (2006-16), employment rates in most OECD countries had been on an upward trend, and grew by nearly 7% (OECD, 2019d) as digitalization created jobs at a faster rate than those that have been replaced, and greater opportunities are opening up to participate in the labour market for many people who were formerly excluded. Technological change and globalization contribute to this – by lowering the costs of production, boosting the quality of products, and opening up new markets – all of which lead to additional demand and boost productivity and, therefore, further job creation (OECD, 2019a). However, four out of the ten new jobs in the OECD were created in highly digital intensive sectors⁴ (OECD, 2019b), even though there are significant differences across countries around the world, as presented in Figure 4.

⁴ Examples of:

- High digital-intensity sectors include transport equipment, ICT services, finance and insurance, legal and accounting, advertising and marketing, professional, scientific and technical activities (R&D), administrative and support service.
- Medium-high digital-intensity sectors include ICT equipment and machinery, wholesale and retail, publishing, audio-visual and broadcasting.
- Medium-low digital-intensive sectors include textiles, chemicals, metal products, education, health and social work activities, public administration and defence, entertainment and recreation.
- Low digital-intensive sectors are agriculture, hunting, forestry and fishing, mining, utilities and supply, construction, transportation, accommodation, food service and real estate activities.

Figure 4: Likelihood of Contributions to changes in total employment, by digital intensity of sectors, 2006-16

Source: OECD (2019d) (based on STAN Database, National Accounts Statistics, national sources and Inter-Country Input-Output Database, December 2018).

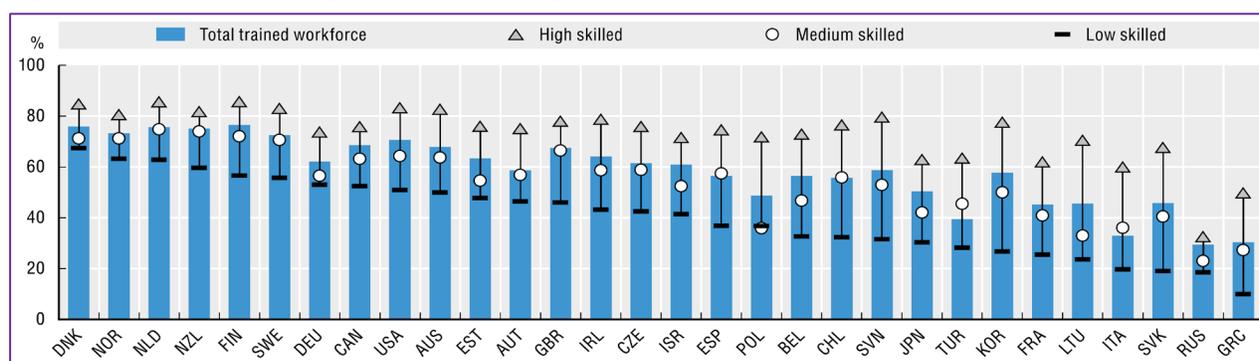
Labour markets in most OECD countries have been polarising with substantial growth in the share of high-skilled occupations and some growth in low-skilled jobs, but a fall in the share of middle-skilled ones. Employment in the manufacturing sector in particular has been on a long-term path of decline (shrinking by 20% over the period 1995-2015), while the share of jobs in the service sector has been steadily rising (growing by 27% over the same period), while in the emerging economies, there has been a substantial decline in the share of agricultural employment (OECD, 2019a). Similar estimations have been made by European agencies (EU-OSHA, Eurofound, Cedefop) which have projected that the sectors with the largest potential rates of job losses in the future due to digitalization are manufacturing, distributive trades, and administration and support services. The areas with the greatest potential for growth in jobs are professional, scientific and technical activities, information and communications, and repair of computers and household goods, with knowledge intensive and professional sectors expected to see most of their activity taking place virtually (Cedefop, 2019; EU-OSHA, 2018; Eurofound 2020).

1.2.2 Skills and the future of work

The extent to which technological progress translates into a jobless society will depend on the effectiveness with which education and training reforms, combined with smart innovation, product and labour market regulations, will empower rather than disable individual skills and incomes (Cedefop, 2018). Effective skills policies will be essential if individuals are to minimise the risks and maximise the benefits of changes in the labour market. In a context of changing skills needs, adult learning can help prevent skills depreciation and obsolescence, and facilitate transitions from declining jobs and sectors to expanding ones. However, many adults do not have the right skills for emerging jobs, and six out of ten adults lack basic ICT skills or have no computer experience (OECD, 2019a). Evidence shows that to keep up with digital developments, simply improving digital literacy is not enough (Cedefop, 2017). The importance of the type/level of training needed, might not be fully recognized by organizations or workers. Despite the high returns of training the low-skilled, organizations still provide more training to high-skilled workers (OECD, 2019b), while employee-level data from the European skills and jobs survey, indicated that only around 16% of EU workers experienced recent changes to the technology they used at work and simultaneously believed that some of their skills would become outdated in the future, and 5% of EU employees recently affected by technological change were afraid of losing their job (Cedefop, 2020).

Policies and training initiatives often fail to reach those adults who are more at risk from the changes that lie ahead (OECD, 2019a; WEF, 2020a). On average across OECD countries, participation in training by low-skilled adults – those who potentially need it the most as their jobs are at highest risk of being automated - is 40 percentage points below that of high-skilled adults. Similarly, workers whose jobs are at high risk of automation are 30 percentage points less likely to engage in adult learning than their peers in jobs with a lower risk. Even when the low-skilled and those in jobs at risk of automation participate in training, its low quality and limited relevance may be letting them down (OECD, 2019a). Training provided by employers helps to motivate and reward employees, as well as to align their competences to the needs of the organization. Training may also help to reduce income inequality and provide low-skilled workers with the skills needed to navigate the digital transformation. However, as shown in Figure 5, the evidence suggests that most training further upskills medium and high-skilled workers rather than lower skilled workers. In all countries on average, high-skilled workers have the highest incidence of training, almost 75% on average, compared to almost 55% of medium-skilled workers and 40% of low-skilled workers engaging in training (OECD, 2019d).

Figure 5: Workers receiving firm-based training, by skill level, 2012/2015



Source: OECD (2019d) (based on the Survey of Adult Skills (PIAAC) Database, October 2018).

According to the World Economic Forum, companies estimate that around 40% of workers will require reskilling of six months or less and 94% of business leaders report that they expect employees to pick up new skills on the job, a sharp uptake from 65% in 2018 (WEF, 2020a). Significant investments by organizations to train their workforce is therefore increasingly important, as are reform of vocational education and training systems that will play a key role in terms of enabling individuals to meet high or emerging skill needs in labour markets, spurred by digital technologies and artificial intelligence revolutions, and counteract skills obsolescence (Cedefop, 2018).

1.2.3 The digital divide

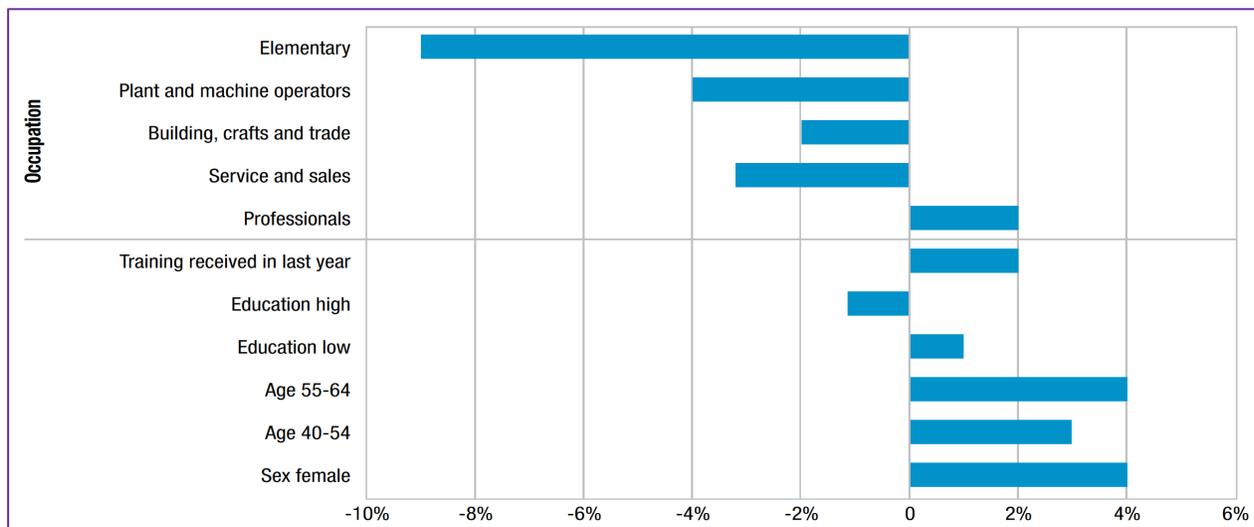
Digitalization is also closely interrelated with changes in demographics and globalization, which can affect the societal and organizational impact of digital transformation. This has led to the 'digital divide' which has been characterised as the exclusion of some population groups (women, older, lower-educated, unemployed or inactive, employed in low-skill jobs) from the advancements of the digital era (including access to ICT) (World Bank, 2016; Van Dijk, 2006). According to the ITU⁵, substantial digital divides persist between countries, with nearly 87% of people using the internet in developed countries in 2019, as compared to 47% in developing countries, and also evident within countries. Men, urban residents and young people are more

⁵ International Telecommunication Union (ITU) is the United Nations specialized agency for information and communication technologies.

likely to be online than women, rural dwellers and older people. The digital gender gap, when measured in terms of internet penetration, is relatively small in developed countries, more pronounced in developing countries and substantial in least developed countries. The divides often stem from insufficient or slow connectivity, the cost of connection and a lack of adequate digital skills. These barriers are therefore often related to age, gender, disability, socioeconomic status and geography (ITU, 2019).

The European skills and jobs survey (ESJS) presents some of the best available evidence which illustrates the digital skills divide, which prevails in Europe despite the extensive diffusion of technology across all walks of life. The data shows that a high share of the European workforce is excluded from the digital economy with 56% of workers in elementary occupations (labourer in mining, construction, manufacturing), 33% in agriculture, and 25% in service and market sales reporting that they do not need ICT skills in their jobs. While many are seeing change at work (46% of the adult workforce), they report that they have not seen, nor expect to see the skills they use in their jobs change significantly. These findings highlight that those in jobs that do not require digital technologies may be less inclined to use them outside work, and this may underlie the high proportion of the EU population with low digital skills and who do not use the internet, and particularly impeding some groups of workers in their ability to keep up with the digital technologies. Women, older-aged and lower-educated workers, as well as professionals in high-skill intensive jobs and who need to update their skills continuously, have a higher likelihood of digital skill gaps, as depicted in Figure 6 (Cedefop, 2018).

Figure 6: Probability of digital skill gap, adult employees, 2014, EU-28



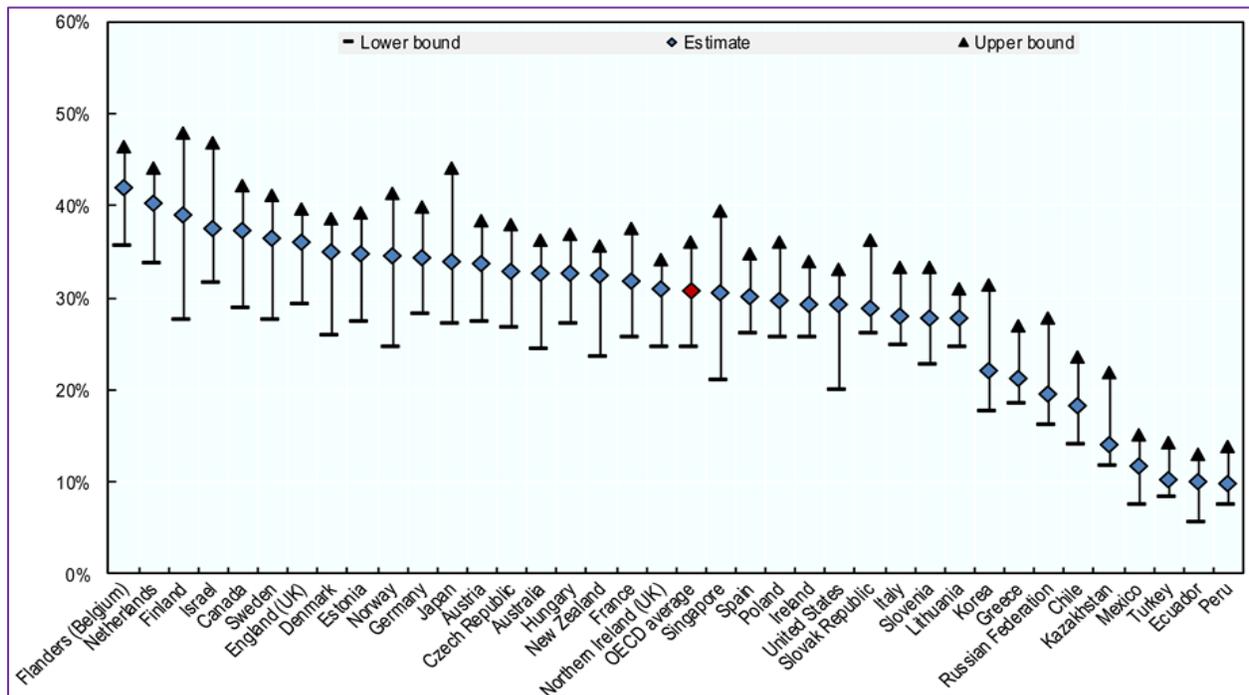
Source: Cedefop (2018) (based on data from the 1st European skills and jobs survey).

Age plays a key role in the context of continuous skill development, particularly when it overlaps with low skills, jobs at high risk of automation or in sectors undergoing structural change (Martin, 2018). In countries with rapidly ageing populations, shortages of qualified labour may arise as the number of older workers retiring rises relative to the number of young people entering the labour market. These shortages may in turn lead to faster automation or stronger pressures to attract immigrant workers. Ageing will also have a direct impact on skills demands and the types of jobs available as consumption patterns shift and economics become more service oriented (OECD, 2019a). Older adults are likely to experience significant skills obsolescence, particularly in the context of technological change, unless further training is available to upgrade what they learnt in initial education. At the same time, incentives for adults to train and for employers to provide training opportunities tend to decline with age as there is less time to recoup the investment made before retirement (OECD, 2017).

While in some emerging economies, the challenge is to integrate large numbers of young people with varying levels of education into the workforce. The labour market experiences of many young people, and in particular those with less than tertiary education, have already worsened in several respects. The risk of non-employment and underemployment has increased over the past decade more for men than for women in most countries but still remains much higher for women. Women are also still more likely than men to be working in low-paid jobs and less likely to be working in high paid ones. Failing to address these disparities is likely to result in a future of work with deeper social divisions, which could have negative ramifications for productivity, growth, well-being and social cohesion (OECD, 2019a). It is anticipated that competition for high-skill workers will increase, while displacement will mainly affect low-skill workers, continuing a trend that has exacerbated income inequality and reduced middle-wage jobs (Bughin et al., 2018).

The evidence of the digital divide can also be seen in newer forms of work made possible by increasing use of technology-enabled tools resulting in teleworkable jobs, as discussed previously. Drawing on data from the OECD Survey of Adult Skills (PIAAC), Espinoza and Reznikova (2020) estimated that while 30% of workers could telework across the OECD, the likelihood decreases for workers without tertiary education and with lower levels of numeracy and literacy skills, see Figure 7. A similar divide is also seen in Europe when looking at the differentiation by education, gender, ethnicity, educational qualification, and residence (Milasi, et al., 2020a, 2020b). Around 66% of tertiary education graduates work in teleworkable occupations, against a much smaller share of those with lower qualification levels (Milasi, et al., 2020b). Gender differences also emerge, with a much higher share of women than men (45% compared to 30%) in teleworkable occupations, reflecting patterns of sectoral segregation, as women are under-represented in sectors with limited teleworkability and more likely to be in office-based jobs which are more amenable to teleworking. Teleworkable employment is also more common among native-born workers than foreign-born, and among those living in urban areas than those in rural areas, as cities have a larger fraction of employment in ICT-intensive occupations as well as better connectivity and access to ICT (Milasi, et al., 2020a).

Figure 7: Feasibility of teleworking, by country



Source: OECD (2017), OECD Skills Surveys: Survey of Adult Skills (PIAAC): Cited in Espinoza & Reznikova (2020)

Therefore, although the fraction of potential teleworkable employment in Europe is between 35% and 41% (Eurofound 2020), this estimation likely provides an 'upper bound' on the percentage of jobs that can currently be done remotely, to a large extent due to the current digital divide. More virtual teleworking is prevalent among highly skilled workers, where the highest rates were found among ICT professionals, managers and teachers (Milasi, 2020a). Furthermore, the socioeconomic profile of workers in teleworkable occupations in shows stark differences, with three-quarters (74%) of those in jobs in the highest paying wage quintile who can telework, compared to only 3% of those in the lowest quintile, while teleworkable employment also tends to be more common those in larger establishments than smaller establishments (Milasi, 2020b), and the focus remains on highly skilled, while collar workers, and not on the one-third of the EU labour force that has very limited digital skills or none at all (Sostero et al., 2020).

In order to avoid a divide between countries, highly educated workers in higher wage, white-colour jobs and lower educated, blue colour workers in lower wage jobs, access to remote virtual working arrangements should be provided also among younger and lower-qualified employees together with extensive training opportunities (Milasi, et al., 2020), as discussed in the previous section. This context, however, also raises important questions with respect to the extent to which the Covid-19 pandemic could intensify existing challenges relating to the impact of digitalization on work and employment, on skills and the future of work, and the widening digital divide (Espinoza & Reznikova, 2020).

1.2.4 The Covid-19 pandemic

In the absence of proactive efforts, inequality is likely to be exacerbated by the dual impact of technology and the pandemic recession. Jobs held by lower wage workers, women and younger workers were more deeply impacted in the first phase of the economic contraction. Comparing the impact of the Global Financial Crisis of 2008 on individuals with lower education levels to the impact of the COVID-19 crisis, the impact today is far more significant and more likely to deepen existing inequalities (WEF, 2020a). The Covid-19 pandemic drastically changed working practices since response measures accelerated the transition to virtual telework, with the proportion of Europeans working remotely virtually shooting up from 5% to 40% (Eurofound, 2020).

For the first time in the age of technology, ad hoc face-to-face meetings are no longer an option for many organizations because of the COVID-19 pandemic. The global work-from-home movement intended to contain the spread of COVID-19 crisis allows us to reflect on how to succeed in virtual environments. In comparison to previous research, several key factors that make virtual teams effective have changed because of the current crisis. These factors are physical space, privacy, personal choice, and increased uncertainty (Kramer & Kramer, 2020). Many people are now working in their homes with noise from their family or housemates. Furthermore, the element of personal choice to work remotely is taken away from the employees (Bloom, 2020) and previous studies suggest the element of personal choice is an important factor contributing to the success of remote working and employees' well-being (Horwitz et al., 2006).

As the weeks stretch into months and the post-pandemic new reality of work unfolds, governments and organizations need to plan the shape of their future workforces. Temporary fixes have served their purpose but, without a clear vision, policy and decision makers risk things falling back to how they were before. Covid-19 has lifted much of the inertia around challenging what, how, when and where people work, and evolving to the new reality could accelerate workforces of the future (KPMG, 2020). Many have previously considered technology-mediated work to be less productive than face-to-face interaction (Ferrazzi, 2014), this is often due to increased misunderstandings and poorer knowledge sharing (Dhawan & Charmorro-Premuzi, 2018).

Although these new practices can result in positive outcomes, research has also identified several potential negative outcomes. The impact of the pandemic has further highlighted the importance of managing the psychosocial work environment (ILO, 2020a), as psychosocial factors⁶ moderate the relationship between telework and productivity and well-being (Kran & Block, 2020).

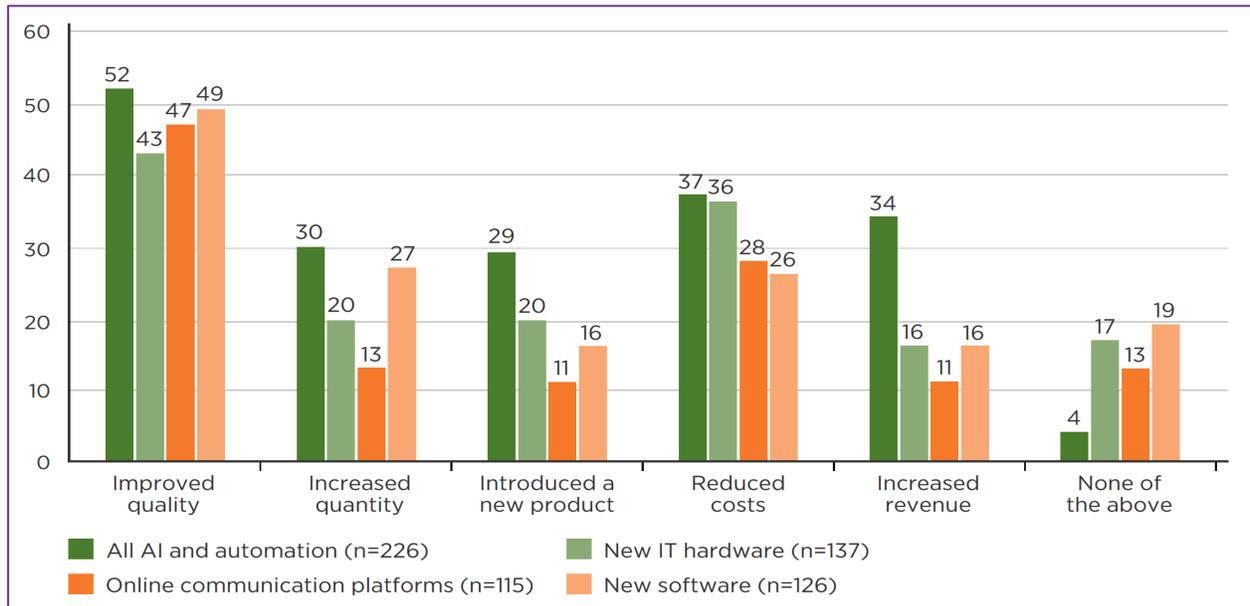
According to more recent Eurofound (2020) projections post-pandemic, nearly all financial-services employment is potentially virtually teleworkable (93%) as well as 79% in information/communication, and around two-thirds in real estate, professional, scientific, and technical activities, education and public administration. Although there have been earlier projections of an increase in virtual work, the Covid-19 pandemic has accelerated this development with a large part of the working population working remotely and virtually from home most or all of the time. It is projected that this new reality will continue post-pandemic, bringing with it new opportunities and challenges (Smit et al., 2020).

2. Opportunities

New technologies and a more integrated, globalized world offer many opportunities for creating new jobs, improving the quality of existing jobs, and bringing previously underrepresented groups into the labour market. Both technological change and globalization create jobs by lowering the price of goods and services, increasing their quality and, hence, boosting consumer demand. They also create entirely new jobs, like big data managers, robot engineers, social media managers and drone operators - all occupations that did not exist a generation ago. The quality of jobs can be improved: dangerous or boring tasks can be automated; people can choose where and when to work more freely, resulting in a better work-life balance; work environments can be made safer and healthier; and informality could be reduced. By breaking down traditional barriers to labour market participation, previously underrepresented groups can increasingly participate in the labour market, resulting in greater inclusiveness. In a world of rapid population ageing and longer lives, better working conditions will in turn contribute to more opportunities to continue working at an older age (OECD, 2019a). Similar opportunities have also been reported for organizations in the public sector and those delivering public services (OECD, 2016; Voss, Maack, & Rego, 2019).

A recent CIPD study, highlighted that the most commonly cited reasons by senior managers for introducing AI and automation, was to improve the quality of goods and services, to deliver goods or services more cheaply or reduce overall costs, and to keep up with competitors or the wider industry. Overcoming skill shortages, to make the workplace more pleasant, and to improve the safety or working conditions were also cited as reasons but by less than 20% of the respondents (see Figure 8) (CIPD, 2019). The next sections take a more detailed look at the opportunities, in relation to work and employment and skill development, presented by AI and automation and virtual work, particularly telework/remote work and the increasing trend of using VR/AR.

⁶ *Psychosocial factors* refer to aspects of work organization, design and management that include, among others, work demands, the availability of organizational support, rewards, and interpersonal relationships in the workplace. These factors do not immediately carry a negative or positive connotation. However, when reference is made to *psychosocial hazards* then it is implied that these aspects of work organization, design and management have the potential to cause harm to individual health and safety as well as other adverse organizational outcomes such as sickness absence, reduced productivity or human error. *Psychosocial risk* has been defined as the potential of psychosocial hazards to cause harm. Whether an organization will have a positive or negative psychosocial work environment will depend on how effectively it manages risk associated with its various dimensions (Leka, Jain & Lerouge, 2017).

Figure 8: Outcomes of new digital technologies (%)

Source: CIPD (2019) (Base: UK employers introducing a new technology, n=644).

2.1 AI and Automation

AI offers the potential for innovative and exciting developments in the workplace through the increasing availability of data and big data and the capacity to process data through algorithms, leading to widespread and profound changes in how work is done (EU-OSHA, 2021). Research on 12 developed economies estimated that AI could increase labour productivity by up to 40% by 2035 compared to expected baseline levels, through intelligent automation, complementing and enhance the skills and ability of existing workforces and driving innovations. Human-AI teams help mitigate error and could expand opportunities for human workers. Human-AI teams have been found to be more productive than either AI or workers alone (Prudy & Daugherty, 2017). Consultancies' and thinktanks' forecasts run alongside a series of governmental, regional and international organizations' high-level reports on the significant impact of AI on economies and societies, including the United States, United Kingdom, ILO, and the European Union, which in most cases predict that AI will improve productivity (Moore, 2019).

AI is expected to improve productivity in two ways. First, some activities previously carried out by people will be automated. Second, through machine autonomy, systems will operate and adapt to circumstances with reduced or no human control. AI is expected to change, and accelerate, the profile of tasks that can be automated – through intelligent automation. New AI-powered applications can increasingly perform relatively complex tasks that involve making predictions, such as transcription, translation, driving vehicles, diagnosing illness and answering customer inquiries (chatbots) (OECD, 2019c). Robots embedding AI are becoming mobile, smart and collaborative. Their use removes workers from hazardous situations and the quality of work is improved by handing repetitive tasks to fast, accurate and tireless machines. Cobots can also facilitate access to work for many people (ageing workers or with disabilities) and collaborate with human workers in a shared workspace (EU-OSHA, 2021).

AI technologies leveraging big data can also help inform governments, employers and workers about local labour market conditions, which can help identify and forecast skills demands, direct training resources and

connect individuals with jobs. The organizational level AI-enhanced HR practices have already begun to make job matching and training more efficient. It can help better connect job seekers, including displaced workers, with the workforce development programmes they need to qualify for emerging and expanding occupations. AI may help make work more interesting by automating routine tasks, allowing more flexible work and possibly a better work-life balance (OECD, 2019c). Digitalized management methods/People analytics tools can aid employers to measure, report and understand employee performance, aspects of workforce planning, talent management, distribution of work, and operational management (Collins, Fineman & Tsuchida, 2017; PwC, 2019). Indeed, algorithmic decision making in people analytics could be used to support workforces by aligning employee performance feedback and performance pay - and workforce costs - with business strategy and support for specific workers (Moore, 2019). This also has the potential of facilitating less hierarchical and more participative management practices (Smit et al., 2020).

New forms of AI-based monitoring of workers may also provide management access to data about workers, to allow them tailoring worker protection and enable them to prevent risks to health, safety and well-being at the individual level by reducing exposure to various risk factors, including harassment and violence, and providing early warnings of stress, health problems and fatigue (van den Broek, 2017). Real-time advice tailored to the individual can influence workers' behaviour and improve safety and health. AI-based monitoring could support evidence-based prevention, advanced workplace risk assessment and more efficient, risk-based, targeted health and safety inspections. Information could be used by organizations to identify HSW issues, including psychosocial risks, and where HSW interventions are required at organizational level (EU-OSHA, 2021).

While AI requires large datasets to be productive, there are some potential risks when these data represent individual workers, especially if the AI systems that analyse the data are opaque (OECD, 2019c). It is important to highlight here that to benefit from these opportunities, ethical decisions and effective strategies and systems are needed for handling the large quantity of sensitive personal data that can be generated. Adequate legal provisions giving national labour inspectorates access to anonymised data could, provide an opportunity for evidence-based prevention and policy making. The need to collect data about workers should be balanced against the rights of workers to privacy and their health, safety and well-being. It is important to ensure transparency in collecting and using such data, and workers and their representatives should be empowered through the same access to information (EU-OSHA, 2021). Workers should be personally empowered by having access to new forms of data that help them to identify areas for improvement, that stimulate personal development and that achieve higher engagement (Moore, 2019).

2.2 Virtual/Remote work

Virtual work, and particularly telework or remote working confers a diverse range of benefits and has been reported to reduce operating costs (Hertel et al. 2005; Bloom et al., 2015), improve the ability to attract and retain employees (Johns & Gratton, 2013), and enhance flexibility and work-life balance for employees (Gajendran & Harrison, 2007). Remote working is seen as a way for organizations to increase job motivation, effectiveness and offer flexibility for their employees (Lewis & Cooper, 2005). Some studies suggest that using computer-mediated communication benefits team effectiveness. One of these studies found that perceived social loafing decreases (i.e. team satisfaction and cohesiveness increases) with the use of richer technology media in a virtual team environment (Bryant et al., 2009). Moreover, Anderson et al. (2007) revealed virtual teams reduce status differences between team members which encourage increased communication level, and research suggests that individuals working from home express a higher level of positive emotions (Anderson & Ostrom, 2015). Studies also suggest that organizational support around remote e-working increases job satisfaction and reduces psychological strain (Bentley et al., 2016), and

positive links between remote e-working and employee well-being could be because of improvement in communication technologies which allows employees to be more connected to their workplace (Charalampous et al., 2019). According to the ILO, telework can offer workers the flexibility to do their work at the times that are most convenient for them, while remaining contactable during the normal business hours of the organization. This flexibility is essential for making telework effective because it allows teleworkers to schedule their paid work around their personal responsibilities, such as caring for children, elderly parents, and sick family members (ILO, 2020b).

VR and AR development has the potential to transform virtual work in the future by dramatically changing and facilitating it. It can unify geographically diverse workplaces beyond current widely used technologies by making it easier for employees to connect with one another digitally. A 2019 PwC report predicted that nearly 23.5 million jobs worldwide will use AR and VR by 2030 for training, work meetings or to provide better customer service, and the use of VR and AR has the potential to add 1.6 trillion to the global economy by 2030. In terms of opportunities, use of VR can have many advantages, as it can make work faster, more efficient and more cost-effective. It can even facilitate work from anywhere and connect individual workplaces, which can reduce commuting and cut carbon emissions contributing to more leisure time and a greener environment. VR and AR can also be used to organize documents and other resources in our peripheral vision for easy reference or retrieval and display real-time changes to critical data as we work on our projects (EU-OSHA, 2018). They enable telepresence and high-tech conference technologies that will allow workers to have a superior experience in virtual meetings, due to advanced sensory stimulation, which can improve communication and collaboration processes, foster multidisciplinary work and strengthen teamwork (PwC, 2019).

As summarized in a recent discussion paper by EU-OSHA (Leka, 2021), virtual work can make jobs more flexible and more accessible to a larger and more diverse pool of people, including older workers. It can remove humans from hazardous environments, reducing for example physical risks, ergonomic risks, biological risks and exposure to dangerous substances. It can create safe, controlled and well-equipped testing and training environments. It can also support the development of healthy workplaces as VR/AR in particular can help with worker relaxation through immersing them into a relaxing VR environment (Citi GPS, 2020). Virtual prototyping will safely test (and develop faster) new products, methods and knowledge. There are also opportunities in rethinking risk assessment and management processes, using Big Data, smart devices, etc. and encouraging more active participation of workers in these processes (EU-OSHA, 2018). AR can incorporate instructions, which could reduce human error, as workers would not need to refer to separate guidance while their hands are needed for maintenance activity. AR can also improve situational awareness by providing supplementary contextual information, for example on the presence of hidden hazards such as asbestos, electricity cables and gas pipelines (EU-OSHA, 2018). Talent acquisition is another emerging application for VR in the workplace since it can allow prospective employees inhabit the workplaces/environments their new job requires so that they can experience them in a deeply immersive way in order to make a fully informed decision about pursuing that particular position or field of work (PwC, 2019).

3. Challenges

The previously discussed changes in the world of work and trends have often resulted in work intensification in organizations and regions around the world (Warhurst & Hunt, 2019). In terms of employment, the result is income and job insecurity for workers and, with pressures to turn around profits in a short timescale, the squeezing of costs through redundancies and outsourcing (Cushen & Thompson, 2016). There is clear evidence which indicates that digitalization, if not implemented in an inclusive and human-centred way (ILO, 2019b), can pose individuals, organizations and society a number of challenges. Digitalization leading to new

forms of work and employment has intensified trends towards new kinds of dependency and precarious jobs as well as insecurity, and further amplified challenges relating to the health, safety, and well-being of the workforce. Advancements in technology have also led to a negative impact on working conditions, blurring of work-life boundaries, increased work monitoring and surveillance, and to an exacerbation of existing and creation of new inequalities in the labour market and workforce (EU-OSHA, 2018; Voss, Maack, & Rego, 2019). The next sections examine the challenges presented by AI and automation and virtual work in relation to work, employment and skill development.

3.1 AI and Automation

With the increasing use of AI, automated systems are now able to carry out not only physical tasks but also a variety of cognitive tasks, such as driving autonomously or assisting with, for example, legal casework or medical diagnoses. The use of AI-based systems is, therefore, anticipated in many different sectors and settings, from manufacturing and agriculture to the care sector, hospitality, and transport and services, including customer-facing jobs. As the content of these jobs and the tasks to be performed will change, new challenges for HSW may arise. For example, automation of tasks can be associated with more sedentary work and with less variation of tasks, with workers being left with repetitive work. Automation of tasks can result in cognitive underload and boredom, in performance pressure and intensification of work and certain risk factors, such as isolation and lack of interaction with peers, and can have a negative impact on teamwork, all of which are known psychosocial risks (EU-OSHA, 2021).

Although there are significant possibilities for workplace progress and growth in productivity, there are important health, safety and well-being related questions arising as AI is integrated into workplaces (Moore, 2018). The increased mobility and decision-making autonomy of AI enhanced machines such as cobots, based on self-learning algorithms, could make their actions less predictable for the workers collaborating with them. This may result in an increased risk of accidents through collision or arising from the equipment used by cobots. Over-reliance on technology could also lead to deskilling and safety risks. As cobots are connected to the internet of things, there are cybersecurity issues and associated risks of functional safety. Workers having to keep up with a cobot's pace and level of work may be put under pressure to achieve the same level of productivity. Increased working with robots may also significantly reduce contact with human peers and social support, which may have negative impacts on workers' safety and health, particularly their mental health (EU-OSHA, 2018; Moore, 2019).

Digital, AI-based technologies allow for new, widespread, continuous and lower cost forms of worker monitoring and management based on the collection of large amounts of real-time data on workers, both during and outside working hours and in a variety of workplaces as well as outside the workplace, and sometimes beyond what is strictly necessary or legal. The data collected may allow employers to increase control over their workers and the workplace, incorporate rating systems or other metrics into performance evaluation, improve workers' performance and productivity, rationalize the organization of work and production, reduce the cost of monitoring and surveillance, profile workers, influence their behaviours, discipline them or improve HR management (EU-OSHA, 2021). However, if processes of algorithmic decision-making in people analytics do not involve human intervention and ethical consideration, this human resource tool could expose workers to heightened structural, physical and psychosocial risks and negatively impact workers' mental health and well-being (Moore, 2019; van den Broek, 2017).

Psychosocial risks, work-related stress, violence, harassment, and bullying are widely recognised major challenges to occupational health, safety and well-being. A poor psychosocial work environment can result in absenteeism, reduced productivity, safety, job dissatisfaction, intention to quit, and negatively impact

worker health. Psychosocial risks at work have been found to be associated with heart disease, poor mental health, burnout, musculoskeletal disorders and behavioural health (e.g., ILO, 2016b; Leka & Jain, 2010; Siegrist, Rosskam & Leka, 2015). These risks could be exacerbated when AI augments already existing technological tools or are newly introduced for workplace management and design (Moore, 2018) resulting in workers being exposed to a large number of psychosocial hazards such as losing control over their jobs, increased micromanagement, performance pressure, competitiveness, individualization and social isolation. Workers may feel that their privacy is being invaded, also a source of anxiety and stress. They may be unable to take breaks when they need to, which may cause accidents and health issues such as musculoskeletal disorders and cardiovascular diseases. Unstable work schedules, such as the short-term schedules established automatically by algorithms, have a variety of negative impacts on workers, including increased work–family conflict and work stress. The use of workers' data to reward or penalize them could lead to job insecurity and stress. As the key operational components of AI-based forms of managing workers often comprise a 'black box', workers and their representatives may lack information on and power over strategies adopted and decisions made (EU-OSHA, 2021). At the organizational level there is, therefore, a clear need for systematic and effective policies to prevent and control the various psychosocial risks at work, clearly linked to companies' management practices which take into consideration the impact of digitalization on work, employment and skill development.

3.2 Virtual/Remote work

Working in a virtual environment is a complex area that involves various aspects (e.g. virtual telework, working virtually from home, working in a VR/AR environment) and there are unique managerial, technical and social challenges of virtual work and remote working (Powell et al., 2004). For instance, dispersed teams may have a negative impact on employee emotions (Johnson et al., 2009), increase workplace conflict (Crisp & Jarvenpaa, 2013), negatively impact team effectiveness (Johnson et al., 2009) and negatively impact on team members' work motivation (Kirkman et al., 2004). This is due to the difficulty in implementing common goals and trust, increased social loafing, and reduced feedback (e.g., Hertel et al., 2005). Research also demonstrates how remote work can lead to employees experiencing more emotional exhaustion and feelings of social isolation (Montreuil & Lippel, 2003; Sullivan, 2012), which can be detrimental to their health and well-being. Furthermore, people suffering from emotional exhaustion experience higher levels of work-life conflict (Hilbrecht et al., 2008) and usage of communication technology can affect work-life balance by causing burnout as people end up working longer hours (Derks & Bakker, 2014). Telework can result in blurring the borders between working and private life. Work can take place outside the traditional working hours as well as at home or when travelling. Hence, it may impinge on the need for rest and recuperation or interfere with personal commitments (ILO, 2016a).

Lack of social interaction and support might emerge as challenges despite technological advancements supporting better communication. More diverse workforce participation might make communication more challenging while cyberbullying may increase in virtual work. Furthermore, as seen during the pandemic, remote working from home has often resulted in more pressure on female workers due to juggling additional care responsibilities. All these issues might lead to more work-related stress (Leka, 2021). Working from home also has implications in terms of suitability of work stations, equipment and connectivity and could pose ergonomic risks, leading to musculoskeletal disorders. Sedentary work is associated with virtual work and can lead to obesity, heart disease, and diabetes. Increased virtual work and use of 5G technology will also mean more exposure to electromagnetic fields (EU-OSHA, 2018). The use of new smart equipment and devices, especially in the case of VR, can present challenges in terms of eye strain, repetitive strain injury, increased cognitive load and decreased situational awareness. As a result, there can be issues such as loss of awareness of users' actual surroundings during and even for some time after their use, physical

disorientation and motion sickness that can result in accidents (Leka, 2021). Cybersickness, which refers to a constellation of unpleasant physiological symptoms, such as nausea and dizziness, experienced as result of exposure to a virtual environment is expected to become more prevalent with the increased use of VR headsets, such as Oculus Rift and HTC Vive (Yildirim, 2020). Cybersickness has been found to be associated with 'presence', the observer's sense of psychologically leaving their real location and feeling as if transported to a virtual environment (Weech, Kenny & Barnett-Cowan, 2019). AR devices overlay reality with computer-generated information which could make it less easy to see critical situational information because of distraction, disorientation or information overload. In the case of interacting with robots through VR interfaces and avatars, more cognitive load and technostress are possible, especially if the robot controls the pace of work and outpaces the worker (Leka, 2021).

4. Key considerations linked to change fostered by digitalization & AI

Reaping the opportunities and addressing the challenges of the digital age requires narrowing the gap between technological developments, and both public and organizational policies. Many policies are the legacy of the pre-digital era, and difficulties in understanding the changes underway and their implications may delay the review and adaptation of these policies. Such an understanding is imperative as digital transformation affects organizations, the entire economy and society (OECD, 2019b). It is important to reiterate again that it is not technology in isolation that creates benefits or risks, it is instead the implementation of technologies that creates negative or positive conditions (EU-OSHA, 2019). Therefore, we do need to prepare for deep structural changes that appear inevitable. Managing transitions well and avoiding growing disparities can be achieved if effective and adequately resourced policies are put in place. The future of work will largely depend on the policy decisions countries and organizations make (OECD, 2019a).

Even though the ongoing technological change is rapid, and more research is needed to fully appreciate its impact, the evidence presented in this report allows the identification of some key considerations linked to change fostered by digitalization and AI which are presented in Table 1. It is important that appropriate action is taken at policy and practice levels to address these challenges in a proactive manner, based on continuous assessment of new and emerging risks. Social protection and inspection of working conditions are of paramount importance and these need to be grounded in an appropriate and comprehensive policy framework. While regulation needs to be updated to address the changing nature of work and emerging risks linked to digitalization and AI, other forms of policy (such as guidelines, sectoral agreements and standards) can also help employers clarify and implement good practices (Leka, 2021).

Digitalization also presents opportunities to rethink risk assessment and management processes which should aim at continual improvement. New and emerging risks, e.g. risks associated with VR/AR as well as psychosocial risks in virtual work and a strong focus on well-being and adopting and supporting a lifelong perspective to working lives should be prioritized. Furthermore, a strong 'prevention through design' approach should be taken. Lack of knowledge and skills represents one of the key challenges that need to be addressed, especially if the accelerated move towards more virtual work is considered in light of Covid-19. Therefore, appropriate training should be developed and provided that is frequently updated to address technological developments and associated challenges. While providing such training, accessibility issues should also be considered across countries as well as depending on workforce characteristics. Finally, issues in relation to privacy, security and ethics should be carefully considered in the development and implementation of these strategies.

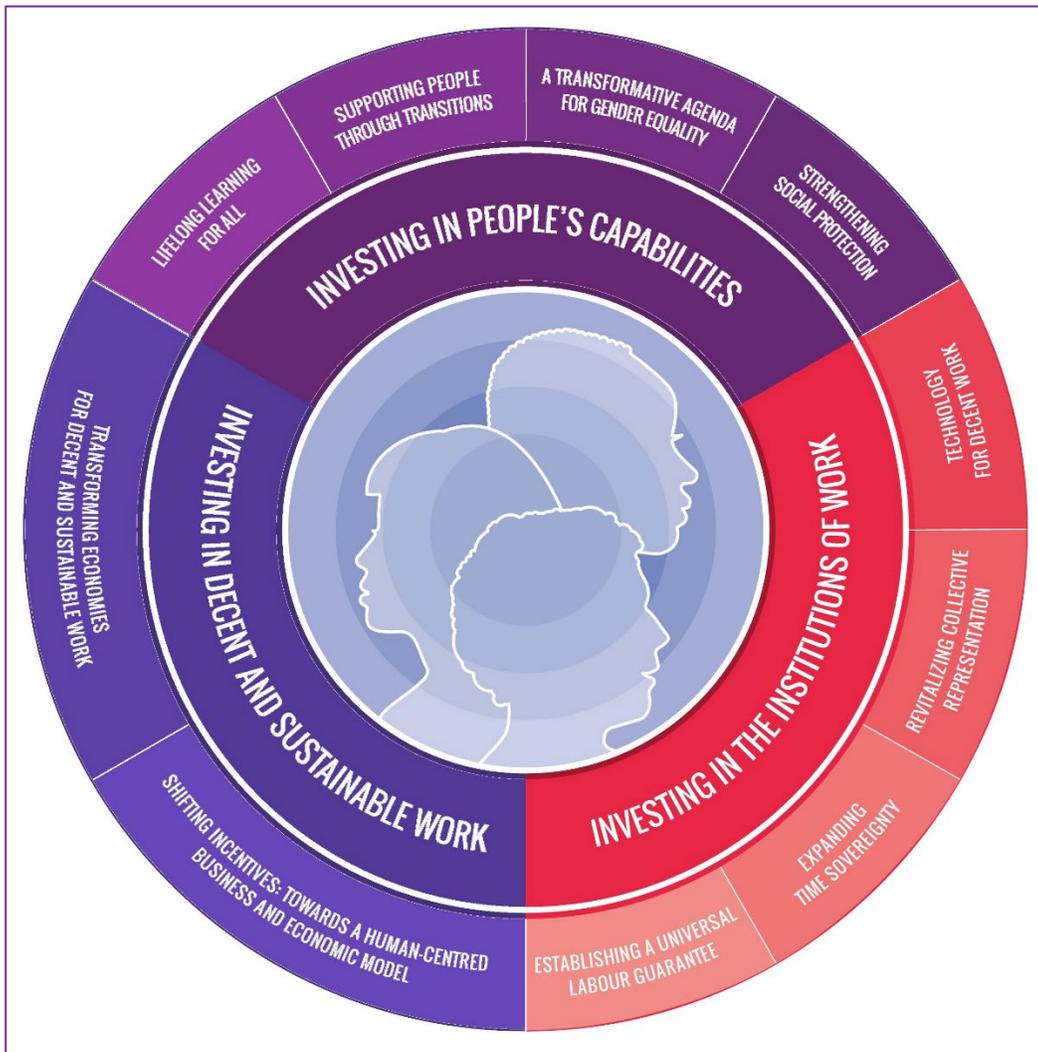
Table 1: Considerations linked to change fostered by digitalization and AI

Policy	How to achieve a good balance between regulation and other types of policy in order to address new and emerging risks in new forms of work while not hindering rapid progress, both within the organization and beyond.
Responsibility	How to define employer and worker responsibility in relation to risk management while working in new digitalized work contexts and conditions (e.g. remote virtual work; virtual work from home; working in a VR environment; working with AI-enabled machines). How can social protection, and employee welfare be ensured even for independent workers?
Autonomy and control	How to balance flexibility through with worker autonomy and control over their work. How can worker participation and collective bargaining be supported?
Privacy	How to protect worker privacy in a digital work environment while using algorithmic monitoring and surveillance. How can ethical hiring, appraisal and evaluation processes be developed maintaining human dignity?
Technology interface	How to incorporate new technological interfaces (e.g., enhanced sensory stimulation, AI and robotics) in virtual work processes while ensuring human sensitive and human-in-control design?
Productivity	How to balance organizational economic performance against social performance. How can health, safety and well-being be addressed in a preventative way in the context of digitalization?
Workforce diversity	How to support more participation of diverse groups (e.g. female, older, younger, migrant, low educated workers, other marginalized groups) in virtual work while developing their skills and providing appropriate support. How can a lifelong perspective to the development of the workforce be promoted?

Source: Adapted from Leka (2021).

The 'human-centred agenda' for the future of work proposed by the Global Commission on the Future of Work provides the guiding principles on the basis on which stakeholders, both internal and external, can start a dialogue on these key considerations, examining interconnections between them and create a context within which actions to address the challenges and maximise the opportunities can be discussed. The 'human-centred agenda' for the future of work seeks to strengthen the social contract by placing people, and the work they do, at the centre of economic and social policy and business practice to drive growth, equity and sustainability for present and future generations. As presented in Figure 9, this agenda consists of three pillars of action, a) increasing investment in people's capabilities, enabling them to acquire skills, reskill and upskill and supporting them through the various transitions they will face over their life course; b) increasing investment in the institutions of work to ensure a future of work with freedom, dignity, economic security and equality, which involves strengthening social dialogue, giving everybody a voice in shaping the changes under way and the quality of their working lives; c) increasing investment in decent and sustainable work and shaping rules and incentives so as to align economic and social policy and business practice with this agenda, which requires guaranteeing fundamental rights at work, ensuring that all workers are afforded adequate labour protection, and actively managing technology to ensure decent work (ILO, 2019a).

Figure 9: Delivering the social contract: A human-centred agenda



Source: *Global Commission on the Future of Work*, ILO (2019a).

5. Addressing the challenges and maximising the opportunities: Implications for the International Civil Service

As labour markets transform, it is imperative to promote successful and fair transitions from declining to expanding jobs, e.g., by striking a balance between flexibility and mobility, on the one hand, and job stability on the other, including through social dialogue (OECD, 2019b). Organizational strategies and the balance of power within and outside the workplace can be central drivers of change and happen in the context of labour market and welfare institutions, and public policy (Warhurst & Hunt, 2019). The role of the Human Resources (HR)/Personnel departments, and equally that of trade unions/staff associations in the context of digitalization is particularly important if the human-centred agenda is to be implemented. It is crucial that HR and trade unions/staff associations are involved in decisions that affect roles and therefore should play an instrumental role in decision-making on applications of AI and automation and the wider impact of digitalization on work and employment.

Collective bargaining and social dialogue at the organizational, sectoral and national levels can complement government efforts to make labour markets more adaptable and secure. In some OECD countries, social partners play a significant role in providing active support to workers who have lost their jobs and in anticipating skills needs. Collective bargaining and social dialogue can be useful tools in helping organizations respond to demographic and technological changes by allowing them to adjust wages, working time, work organization as well as tasks to new needs in a more flexible and pragmatic manner than through labour regulation (while remaining fair) (OECD, 2019a). In all world regions, trade unions have been actively involved in debates and the development of public policies regarding digital transformation processes and their impact on employment and work. They were often the first organizations to highlight not only positive aspects but also the critical impacts digitalization had on working conditions. Although their level of influence differs, trade unions have been successful in shaping public policies and legal reforms in certain countries, notably as regards the “right to disconnect” or workers’ data protection (Voss, Maack, & Rego, 2019).

HR and unions are key stakeholders in enabling organizations develop the skills and abilities and advise on where AI or automation could provide skills augmentation. Their role should ensure that the implementation of digital technologies enables the design of new organizational structures and work processes that deliver a more satisfying employee experience (CIPD, 2019). Evidence also indicates that those organizations that provide employees with information on plans to introduce new technology and consult workers and worker representatives about decisions on working practices and new technologies, see more growth and are more sustainable, as opposed to organizations without such a consultative culture (CIPD, 2019; Cedefop, 2020).

Yet collective bargaining has been on a declining trend for decades and, in the context of a rapidly evolving world of work, this poses serious challenges for workers’ rights, benefits and protections and may sometimes leave employers and employer organizations without a clear counterpart (OECD, 2019a). A study of over 600 senior managers in the UK highlighted that of all the departments within their organizations, the HR department was least likely to be involved in investment decisions on AI and automation (being involved in 55% of cases). The prevailing view amongst senior managers was that neither HR nor trade union involvement are related to how successful employers view their input on matters relating to AI and automation, and this possibly reflects a lack of confidence within these groups to inform AI and automation agendas. Alternatively, it may reflect how little expertise or impact either HR or trade unions are currently able to have when AI and automation implementation is under way (CIPD, 2019).

The review of the evidence in this report, clearly highlights the crucial importance of involving HR and trade unions in considering the implications of digitalization for workers, as worker consultation, participation, and social dialogue and collective bargaining at organizational, sectoral, national, and international levels can not only address the challenges of work transformation due to digitalization, but also promote productive and decent virtual work. HR policies can be designed to enhance employee engagement and improve company performance, but on their own cannot prevent negative effects on working conditions associated with virtual work. HRM actions, need to be supported and supplemented by participatory mechanisms through trade unions/staff associations and collective bargaining to offer better working conditions under a more transparent regulatory framework. This would allow the establishment of a framework for ongoing negotiations to keep regulations up to date with new challenges (Sanz de Miguel, 2020).

The next sections first discuss the importance of collective bargaining in the context of digitalization, and then propose the adoption of the European social partners autonomous framework agreement on digitalization (European social partners, 2020) for the international civil service. This agreement provides a practical framework which proposes a number of actions that can support the development of a human-oriented approach, as recommended by the Global Commission on the Future of Work, to the integration of digital technology in the world of work, to support/assist workers and enhance productivity.

5.1 Collective Bargaining and social dialogue

Digitalization has put many issues related to working time, back on the agenda of workers' participation, namely the impact of automatization and rationalization gains on working time (reduction), conditions of working time, regulation of ICT-related work at home or outside normal working time, availability, monitoring and documentation of working time, maximum hours, remuneration, as well as several aspects related to the increasingly blurred boundaries between working and private life (Voss & Riede, 2018). Virtual work and new technology present opportunities both for worker collective representation and bargaining, and for inspection. Trade unions/staff associations should develop appropriate policies to support workers and actively consider new forms and approaches to collective bargaining, using Big Data and smart devices. For example, digital technologies can facilitate the development of new, more direct collective bargaining structures. Trade unions/staff associations could redesign ethical codes of practice for their members in line with new considerations. The provision of appropriate occupational health services to virtual workers would also need to be considered through the use of new technology (Leka, 2021).

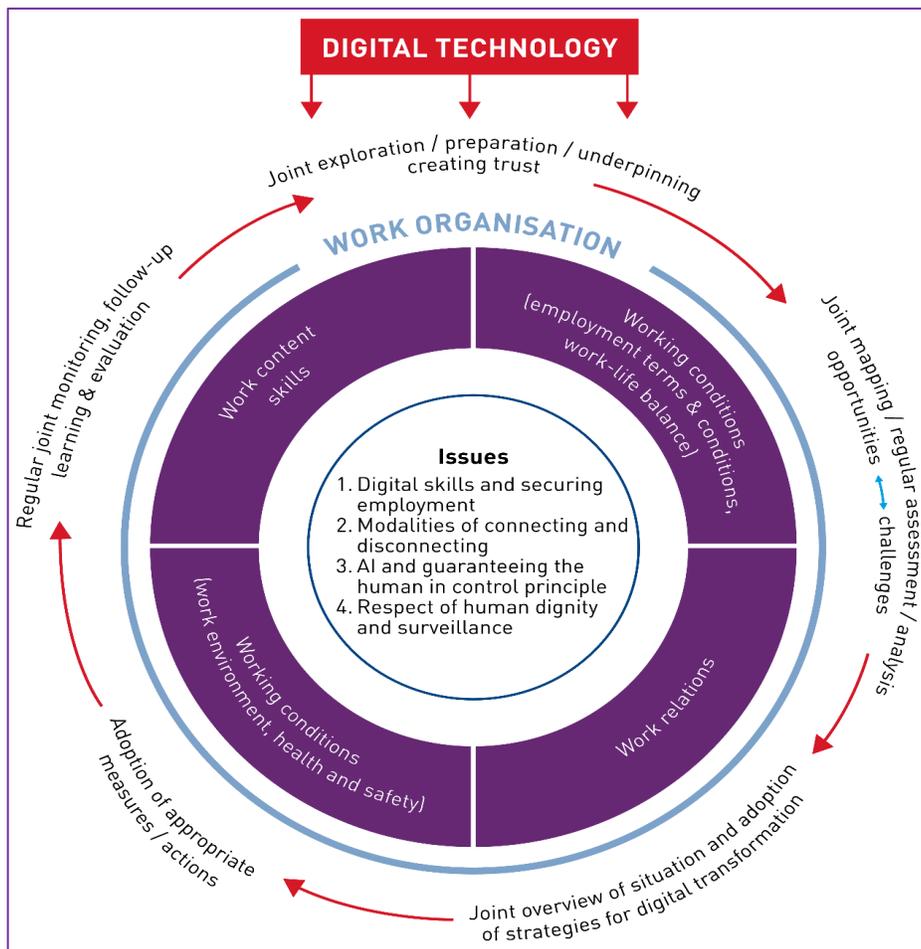
Collective bargaining and workers' voice can help addressing the challenges posed by a changing world of work. As demographic and technological changes unfold, collective bargaining can allow organizations to adjust wages, working time, work organization and tasks to new needs in a flexible and pragmatic manner. It can help with shaping new rights, adapting existing ones, regulating the use of new technologies, providing active support to workers transitioning to new jobs and anticipating skills needs (OECD, 2019e). Informing workers and their representatives in a timely manner is a crucial condition for the proper anticipation of digital change and its impact on employment and work. Trade unions/staff associations consider the introduction of new technologies - automation technologies in particular - to be significant restructuring events that should be addressed by information and consultation procedures and ensure collective negotiations and worker participation as early as possible to avoid negative impacts (Voss, Maack, & Rego, 2019). The primary way for trade unions/staff associations to get the best out of digitalization and protect their members is negotiating collective agreements that can help regulate many of the issues arising from digital change, whether these impact on pay, working time, work-life balance or aspects linked to health, safety and well-being such as psychosocial risks (Voss, Maack, & Rego, 2019). The European social partners autonomous framework agreement on digitalization is a primary example of such a collective agreement.

5.2 Adopting the Social Partner Framework Agreement on Digitalization

The governance of digitalization, whether at the national or organizational level, covers not only the introduction of digital technologies, but also allocation of tasks, use of new skills and arrangements to realize efficiency savings. Policy makers focus on the strategic responses to the direct issues relating to digital transformation – strategic direction and priorities, involvement across levels of an organization, collaboration and partnerships, priorities and funding – and also the ethical dilemmas discussed in this report. Decision makers, at different stages of the design, funding, development, testing, implementation and review stages of digitalization projects need to be: clear about the project approach, including project governance, having a clear long-term vision, the right team, appropriate mechanisms for project testing and bringing together a strong business case; involve the right groups of people from the outset – users (staff directly impacted), staff representatives, IT professionals and management; maintain strong communication practices, through communication networks specific to the project and sharing information through general networks to support wider collaboration; and review and evaluation stages, articulated from the outset for identifying relevant evidence to support the project, through solid documentation and a clear evaluation framework and practices (OECD, 2016).

The European social partners⁷ autonomous framework agreement on digitalization (European social partners, 2020), Figure 10, provides an ideal framework for the governance of digitalization in the international civil service, which can then be further adapted by constituent organizations in accordance with their needs. The agreement signed in June 2020, supports the successful integration of digital technologies at the workplace, investment in digital skills, skills updating and the continuous employability of the workforce. The agreement enables employers and unions to introduce digital transformation strategies in partnership in a human oriented approach at national, sectoral, company and workplace levels, including on the modalities of connecting and disconnecting and respect of working time rules and appropriate measures to ensure compliance.

Figure 10: Digitalization partnership process for addressing challenges and maximising opportunities



Source: European social partners (2020).

⁷ The European social partners are the EU-level employer organizations and trade unions that are engaged in European social dialogue. The main cross-industry organizations representing the social partners at EU level are the European Trade Union Confederation (ETUC), the Confederation of European Business (BusinessEurope), the Association of Crafts and SMEs in Europe (SMEunited, formerly UEAPME) and the European Centre of Employers and Enterprises providing Public Services and Services of General Interest (CEEP). Framework agreements are the result of the European social dialogue autonomous process. Two different procedures exist for their implementation:

- the European social partners ask the European Council to adopt a decision, following which the agreement becomes EU law.
- or when the European social partners conclude autonomous agreements, they themselves take responsibility for implementing measures at national, sectoral and organizational level, as now in the case of the autonomous framework agreement on digitalization.

This action-oriented agreement aims to raise awareness and improve understanding of managers, staff and their representatives of the opportunities and challenges in the world of work resulting from the digital transformation and encourage a partnership approach between them while enabling them to identify concrete approaches, actions and measures, they can take, according to their specific needs and circumstances, to address issues across four key areas:

- a) digital skills and securing employment,
- b) modalities of connecting and disconnecting,
- c) AI and guaranteeing the human in control principle, and
- d) respect of human dignity and surveillance.

Table 2: Key topic areas to be considered during the digitalization partnership process

Work Organization	Work organization ⁸ is the distribution and coordination of work tasks and authority in an organization and the ways in which these are then coordinated to achieve the final product or service. It provides the structure of who is doing what, be it in teams or not, and who is responsible for what.
Work Content and Skills	Work content is about looking into the impact of digital technology/tools on the content of the job and the skills needed to perform the work and to (digitally) interact with others (co-workers, management, clients, intermediaries). It takes into account aspects such as autonomy, coherence, variation, workload, information, clarity of the role.
Employment and Working Conditions	Working conditions refers to the working environment (e.g. health, safety, wellbeing, physical and mental demands, climate, comfort, sanitary provisions, work equipment) and aspects of a workers' terms and conditions of employment. The latter covers matters such as: working time (schemes), rest periods, work location(s), work-life balance, leave systems, training and learning opportunities, evaluation mechanisms.
Work relations	The work relations or interpersonal relations have an impact on the performance and the well-being of staff. These encompass the social interaction between staff members themselves and between staff and the organization (formal and informal relations with the direct supervisor, HR and management). Relations with clients and other third parties are also part of this. It is important to take into account the quality of the relations (collaboration, integration, contact moments and possibilities, communication, work atmosphere), the management style, the occurrence of violence or harassment, conflict management, support procedures and mechanisms.

Source: Adapted from *European social partners (2020)*.

It recognizes that digital technologies have an impact on several, often interrelated, topics such as (Table 2) work content and skills, working conditions (work environment, health and safety), employment/working conditions (employment terms and conditions, work-life balance), work relations, work organization, and therefore promotes a broad multidisciplinary approach, to enable managers, staff and their representatives to devise measures and actions aimed at reaping these opportunities and dealing with the challenges, whilst taking into account existing initiatives, practices and collective agreements that may already be in place. It is applicable to all staff and employers in the public and private sectors and in all economic activities and is relevant to the organization and activities of the international civil service. The next sections discuss the different stages in the process, and the measures that should be taken in each of the four key areas.

⁸ As discussed previously, work organization is part of the psychosocial work environment. Psychosocial factors refer to aspects of work organization, design and management that include, among others, work demands, the availability of organizational support, rewards, and interpersonal relationships in the workplace.

5.2.1 Stages in the process

The process of implementing the agreement on digitalization is based on the well-recognized and widely used organizational process of continual improvement⁹, which ensures that a digitalization programme would meet the needs of all concerned, align with existing/ongoing processes and activities with the organization and is sustainable over time. Several risk management systems/processes in place in UN agencies and developed by organizations in the UN system such as the 'WHO Healthy Workplace Model' (WHO, 2010), the 'ILO Guidelines on Occupational Safety and Health Management Systems' (ILO, 2001) and ToRs of the implementation board of the UN System mental health and well-being strategy 'A healthy workforce for a better world' (UN, 2018a), are based on the same process. Therefore, the adoption of the framework agreement on digitalization potentially offers several synergies with exiting systems already in use, thereby avoiding the need to introduce entirely new systems and processes.

The framework agreement on digitalization outlines the following five stages or steps:

1. The first stage, '**joint exploration/preparation/underpinning**,' is about exploring, raising awareness and creating the right support base and climate of trust to be able to openly discuss the opportunities and challenges/risks of digitalization, their impact at the workplace and about the possible actions and solutions.
2. The second stage, '**joint mapping/regular assessment/analysis**,' is a mapping exercise looking into the topic areas in terms of benefits and opportunities (how successful integration of digital technology can benefit the staff and the organization) and in terms of challenges/risks. Possible measures and actions are also identified at this stage.
3. The third stage, '**joint overview of situation and adoption of strategies for digital transformation**,' is about having a basic understanding of the opportunities and challenges/risks, the different elements and their interrelationships, as well as agreeing on digital strategies setting goals for the enterprise going forward.
4. The fourth stage, '**adoption of appropriate measures/actions**,' is based on the joint overview of the situation. It includes prioritization of actions, piloting, clarifying roles/responsibility and securing resources and any support needed.
5. The fifth stage, '**regular joint monitoring / follow-up, learning, evaluation**,' come full circle to a joint assessment of the effectiveness of the actions and discussion on whether further analysis, awareness-raising, underpinning or actions are necessary.

The process, carried out with the active engagement of staff representatives, can be tailored to the needs of any organization, and the agreement recognizes that a wide range of digital tools, training-arrangements and joint procedures may have already been introduced by organizations. Its adoption would therefore be cognizant of the complexity of the UN system of agencies, recognition of agency autonomy and a desire to proactively implement what is 'right' for their agency. Consequently, when implementing the agreement, any existing tools and procedures should be taken into account in the joint mapping/regular assessment/analysis and where there are concerns about the impacts on employment and working conditions, and health, safety and well-being needing urgent attention, action should be taken. It is in the interest of managers and staff to adapt work organization, where needed, to the ongoing transformation of work deriving from the use of digital work devices. This adaptation should occur in a way that respects the interests of staff and managers' prerogatives in terms of work organization at the enterprise level (European social partners, 2020).

⁹ The concept of continual improvement was first popularized in the 1950s by social scientists such as Edward Deming, who developed the Plan, Do, Check, Act (PCDA) model. This, in turn, was inspired by the scientific method of "hypothesize, experiment, evaluate." (WHO, 2010). PDCA can be briefly described as: Plan: establish the objectives and processes necessary to deliver results in accordance with the organization's policies; Do: implement the processes; Check: monitor and measure processes against the established policies, objectives, legal and other requirements, and report the results; Act: take actions to continually improve performance.

5.2.2 Digital skills and securing employment

Sections 1.2.2 and 1.2.3 discussed the importance of providing the current and future workforce, and organizations with appropriate skills by focusing on continuous/life-long learning (upskilling and reskilling) and bridging the digital divide to reap the opportunities and deal with the challenges of the digital transformation in the world of work. Social partners at the organizational level (management and staff representatives) have a shared interest in facilitating access to quality and effective training and skills development while respecting the diversity and flexibility of training systems to create a learning-oriented culture within the organization. For management, this entails the organizations' commitment to use digital technology positively, seeking to improve innovation and productivity, for the long-term health of the organization, for better working conditions, and for the employment security of the workforce. For staff and their representatives, it entails staff commitment to support the growth and success of the organization and to recognize the potential role of digitalization to improve quality and efficiency.

A shared analysis and joint commitment to action should be supported by organizational social dialogue structures, comprising management and staff representatives, to assess and identify training needs linked to digitalization for the organization and its workforce. These can be hard skills and soft skills, set out in an agreed skills training approach. Organizational social partners should consider measures at the appropriate levels to ensure that the impact on employment is well anticipated and managed in digital transformation strategies ensuring that both the organization and staff benefit from the introduction of digital technology, e.g., considering impact on working conditions, innovation, productivity and share of productivity gains, sustainability, and employability. It is critical that digital technology is introduced in timely consultation with staff, and their representatives, so that trust in the process can be built. The framework agreement suggests the following measures should be considered (European social partners, 2020):

- Access to and arrangements of training, in line with diverse employment relations and training practices within member organizations, and taking into account the diversity of the workforce, such as in the forms of training funds, learning accounts, competence and career development plans etc.
- A focus on quality and effective training: This means to provide access to relevant training responding to the identified training needs of managers and staff. A key aspect of this in the context of the digital transformation is to train all affected staff, not just a select few, to help them make the best possible use of the digital technologies that are introduced.
- Where the organization requests staff to participate in a job-related training that is directly linked to the digital transformation of the enterprise, the training is paid by the organization and takes place at an agreed time by both the manager and the staff member, and where possible during work hours.
- Training arrangements that provide skills by retraining and upskilling, which could support mobility between and within roles/ organizations, so that staff can transfer to new jobs or adapt to redesigned jobs within the organization.
- The redesign of work organization to take account of changed tasks, roles or competencies, and where possible, the redesign of jobs to allow staff to remain within the organization in a new role if some of their tasks or their job is impacted due to digitalization.
- An equal opportunities policy to ensure that digital technology results in benefit for all staff, which proactively seeks to address the digital divide that may exist within the organization.

5.2.3 Modalities of connecting and disconnecting

As discussed in sections 2.2 and 3.2, the presence and/or introduction of digital devices/tools in workplaces can provide many new opportunities and possibilities to organize work in a flexible way to the benefit of managers and staff. At the same time, this may create risks and challenges around the delineation of work

and of personal time both during and beyond working time. It is the employer's duty to ensure the health, safety and well-being of staff in every aspect related to the work. According to the WHO, a healthy job is likely to be one where the pressures on employees are appropriate in relation to their abilities and resources, to the amount of control they have over their work, and to the support they receive from people who matter to them (WHO, 2010), and creating a healthy work environment (both physical and virtual) becomes increasingly important in the context of digitalization and in the post Covid-19 pandemic world of work (as discussed in section 1.2.4)

It is in the interest of managers and staff to adapt work organization, where needed, to the ongoing transformation of work deriving from the use of digital work devices, thereby creating a positive psychosocial work environment. Achieving clarity on the legitimate expectations that can be placed on staff when using such devices can be supported by collective bargaining at the appropriate levels in member organizations. To avoid possible negative effects on the health, safety well-being of staff and on the functioning of the organization, the focus should be on prevention. This refers to a culture where managers and staff actively participate in securing a safe and healthy working environment through a system of defined rights, responsibilities, and duties, and where the principle of prevention is accorded the highest priority (European social partners, 2020). While effective prevention requires the implementation of multiple strategies for all United Nations staff that address the constellation of risk and protective factors associated with poor mental health and well-being as highlighted in the United Nations system mental health and well-being strategy (UN, 2018b). The framework agreement suggests the following measures should be considered during social dialogue (European social partners, 2020):

- Being clear about the policies and/or the agreed rules on the use of digital tools for private purposes during working time.
- Providing guidance and information for managers and staff on how to respect working time rules and teleworking and mobile work rules including on how to use digital tools, e.g., emails, including the risks of being overly connected particularly for health, safety and well-being.
- Respect of working time rules and teleworking and mobile work rules.
- Commitment from management to create a culture that avoids out of hours contact.
- Psychosocial risk management - work organization and workload, including the number of staff, are key aspects which need to be identified and evaluated jointly between managers and staff and/or their representatives.
- Appropriate measures to ensure compliance.
- Alert and support procedures in a no-blame culture to find solutions and to guard against detriment for staff for not being contactable.
- Prevention of isolation at work.

A number of these measures have also been proposed by the ILO to reduce the negative impact of the Covid-19 pandemic and to protect the mental health and well-being of staff working remotely/teleworking. Every effort should be made to help teleworkers stay connected with supervisors, colleagues, and the organization as a whole to deal with the risk of social isolation that is associated with full-time teleworking. It is still essential to allow staff to create their own personal strategies for effective management of the boundary between paid work and personal life. This should include a dedicated workspace free from disruptions, and the ability to disconnect from work at specified times reserved for rest and personal life. Ensuring management commitment and support (from top management to frontline supervisors) is crucial to ensure that such measures are implemented and applied in dealing with the challenges arising due to the pandemic (ILO, 2020b).

5.2.4 Artificial intelligence and guaranteeing the human in control principle

AI will have a significant impact on the working world of tomorrow and present a number of opportunities (section 2.1) and challenges (section 3.1). Whereas AI systems and solutions have the valuable potential to increase the productivity of the enterprise and the well-being of the workforce and a better allocation of tasks between humans, between different parts of the enterprise, and between machines and humans, it is also important to make sure that AI systems and solutions do not jeopardise but augment human involvement and capacities at work. The potential tensions between respect for human autonomy, prevention of harm, fairness and explicability of decision making should be acknowledged and addressed. The Social Partners' Autonomous Agreement, therefore, emphasizes the importance of the 'human in control principle', control of humans over machines and artificial intelligence should be guaranteed in the workplace and should underpin the use of robotics and artificial intelligence applications whilst respecting and complying with safety and security controls (European social partners, 2020).

It is important to ensure that deployment of AI is fair, transparent, safe, and secure, and complies with all applicable laws and regulations as well as fundamental rights and non-discrimination rules. It should follow agreed ethical standards¹⁰, ensuring adherence to fundamental human rights, equality, and other ethical principles and, it should be robust and sustainable, both from a technical and social perspective since, even with good intentions, AI systems can cause unintentional harm. The framework agreement suggests the following measures should be considered (European social partners, 2020):

- Deployment of AI systems:
 - should follow the human in control principle.
 - should be safe, i.e., it should prevent harm. A risk assessment, including opportunities to improve safety and prevent harm such as for human physical integrity, psychological safety, confirmation bias or cognitive fatigue should be undertaken.
 - should follow the principles of fairness, i.e., ensuring that staff and groups are free from unfair bias and discrimination.
 - needs to be transparent and explicable with effective oversight, with checks in place to prevent erroneous AI output.
- In situations where AI systems are used in human-resource procedures, such as recruitment, evaluation, promotion and dismissal, performance analysis, transparency needs to be safeguarded through the provision of information. In addition, an affected staff member can make a request for human intervention and/or contest the decision along with testing of the AI outcomes.
- AI systems should be designed and operated to comply with existing law, including the data protection regulations, guarantee privacy and dignity of staff.

5.2.5 Respect of human dignity and surveillance

Digital technology and AI surveillance systems, along with data processing, offer the possibility of securing the working environment and ensuring healthy and safe working conditions and improving enterprise efficiency (as discussed in sections 2 and 3). However, at the same time, they raise the risk of compromising the dignity of the human being, particularly in cases of personal monitoring. This could lead to deterioration of working conditions and well-being of workers. Data minimization and transparency along with clear rules on the processing of personal data limits the risk of intrusive monitoring and misuse of personal data (European social partners, 2020). Additionally, since the monitoring of work effort in virtual teleworking

¹⁰ Key ethical requirements for achieving trustworthy AI • human agency and oversight • robustness and safety • privacy and data governance • transparency • diversity, nondiscrimination and fairness • societal and environmental well-being • accountability (European Parliament, 2019).

requires a higher level of trust, its expansion would require a shift in cultural and organizational norms that will be more difficult to achieve in organizations with more traditional work arrangements. There is also the danger that organizations respond to this challenge by using intrusive digital tools for remote monitoring work effort, which will have implications in terms of job quality, privacy, and autonomy (Milasi et al., 2020). Overall, these considerations mean that future projections in terms of working in a virtual environment are challenging, and the framework agreement suggests the following measures should be taken to mitigate potential negative impacts (European social partners, 2020):

- Enabling staff representatives to address issues related to data, consent, privacy protection and surveillance.
- Always linking the collection of data to a concrete and transparent purpose. Data should not be collected or stored simply because it is possible or for an eventual future undefined purpose.
- Providing staff representatives with facilities and (digital) tools/equipment to fulfil their duties in a digital era.

6. Conclusion

The impact of technology on work and workers is multifaceted and complex. Technology is not homogenous and at least should be thought of in terms of enabling and replacement technologies, and the impact of technology on work and workers also should be considered as a process that occurs over time (Schulte & Howard, 2019), and decisions must increasingly be made under uncertainty about future digital and other developments (OECD, 2019a) while taking forward the 'human-centred agenda' for the future of work. With advancements in digital technology, work will become faster and more efficient. Virtual prototyping will accelerate knowledge and product production, while training will be revolutionized, and become faster and more efficient. Workplaces will become more connected, and work practices more flexible, which might bring about an increase in working hours, and introduction of monitoring systems to track virtual work and productivity. However, the boundary between work and private life will become more blurred leading to an increased risk of longer working hours, cognitive strain, fatigue, and emotional exhaustion, especially where there is lack of experience of virtual work and lack of support (Leka, 2021).

Working in a virtual environment will continue to accelerate following the Covid-19 pandemic. However, the pace of progress will vary across organizations and will depend on actions taken. It is likely that there will be an overall decrease of physical workplaces with more virtual remote work and hot desking. With advancements in new technology and VR/AR, work will become faster and more efficient however, psychosocial risks and work-related stress will increase since the pace of work will be faster and employees might have less control over their work, especially if this is machine dictated through algorithmic management. This may also lead to a loss of workers' control over their data while cybersecurity risk will be higher. Changes in technology will bring about frequent changes in work processes, job insecurity will increase and there will be more frequent job changes and organizational change. With many people working remotely and from home, social isolation will increase, and social support will be hindered despite new advances through VR. Interpersonal issues and cyberbullying might also increase, especially since more workers will work in virtual teams, often having little opportunity to get to know their fellow workers who might be living in other countries or might be hired only to complete that particular task/project. These issues will result in a rise in mental ill health problems such as anxiety and depression (EU-OSHA, 2018, Leka, 2021; Moore, 2019).

It is therefore important that the future of work and the workforce must be seen against the backdrop of technological change and working life, not just at the level of a single job or task. Digitalization will continue to impact all work and nonwork periods over the working life. Hence, health, safety and well-being and other

public policies should address not only hazards in a single job but also hazards along the whole working-life continuum. This means addressing the precarious nature of work, as well as focusing on the lack of appropriate skills of present and future workers (Schulte & Howard, 2019). This requires significant efforts to upskill and reskill the workforce, while decreasing the divide between organizations, and workers in terms of job level, content, education and pay (Cedefop, 2018). Organizations need to develop ethical frameworks for digitalization, codes of conduct and proper governance, which are aligned with holistic health, safety and well-being policies (e.g., WHO, 2010).

This report underscores the necessity of working with a wide range of stakeholders and co-ordinating across disciplinary and policy silos, and levels/functions, within and outside organizations, to steer policies towards an inclusive and sustainable digital future. Multiple interlinked topics play a role in the context of digitalization and should not be dealt with in isolation. A broad multidisciplinary approach is therefore necessary, and holistic policy models should be developed adopting a lifelong perspective to working life with a strong well-being focus. A key to a successful strategy or policy is the engagement of stakeholders from the early stages of strategy and policy development to its implementation and evaluation. Involvement of staff and their representatives in the design and implementation of any digitalization strategy is crucial, and staff associations must play a key role in enabling the 'human-centred agenda' for the future of work, by designing a digitalization strategy and related policies that are inclusive and useful for all.

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