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Risks to job quality from digital technologies: Are industrial relations in Europe ready for the challenge?

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Janine Berg
International Labour Organization, Geneva, Switzerland

Francis Green
IOE, UCL's Faculty of Education and Society, UK

Laura Nurski
KU Leuven – CELM (Labour Market Monitoring Research Centre) and Bruegel,

David A Spencer
Leeds University Business School, Univerity of Leeds, UK

Abstract

We examine job quality effects of new digital technologies, using the European frame of seven job quality domains: Pay, Working Time Quality, Prospects, Skills and Discretion, Work Intensity, Social Environment, and Physical Environment. Theoretical effects are ambivalent across all domains. The analysis of these effects confirms that digital technologies can both improve and harm job quality depending on how they are used. In light of this analysis and to think through the challenge of regulating digital technologies, we review emerging regulations across several European countries. Drawing on the principles of human-centred design, we argue that worker participation is important for securing good job quality outcomes, at both the innovation and adoption stages. We also consider the application of data protection legislation to the regulation of job quality. Overall, the paper extends debate about the future of work beyond employment and pay, on to a consideration of job quality more broadly.

Keywords

Job quality, digital technology, regulation, participation, future of work, Europe

Corresponding author:
David A Spencer, University of Leeds, Leeds University Business School, Leeds LS2 9JT, UK.
Email: das@lubs.leeds.ac.uk

Introduction

Since before the first industrial revolution, social science has concerned itself with the relationship between new technologies and the transformation of work, with accompanying anxieties surrounding the volume and quality of work (Mokyr et al., 2015). In recent times, the rise of computerisation, ICT and the internet in the late 20th century has become the foundation in the 21st century for the 'Fourth Industrial Revolution'. Digital automation is the main driving force, using artificial intelligence (AI) and machine learning to enhance prediction, and capitalising on the collection of 'big data' and the exponential growth of computing power (Agrawal et al., 2019; Spencer and Slater, 2020). Accordingly, there has been substantive debate concerning the implications of the use of new digital technologies for labour demand and wages. The character of digital technologies – whether labour-saving or productivity-enhancing – is important in determining their employment effects (Acemoglu and Restrepo, 2019a, 2019b; Acemoglu, 2021). There are many and varied forecasts of how new technological change will affect employment growth, wages, occupation polarisation and inequality (e.g. Acemoglu and Restrepo, 2020; Aksoy et al., 2021; Antón et al., 2022; Arntz et al., 2016; Frey and Osborne, 2013; Graetz and Michaels, 2018). Yet for all scenarios, the response proposed in the dominant narrative – led by a broad range of consultants, think tanks, scholars and international organisations – is that digital automation is best managed by an upskilling of workers (Schlogi and Prainsack, 2021).

Studies of the effects of new technologies on non-wage aspects of job quality have been scarce, however (Antón et al., 2020; Min et al., 2021; Nurski, 2021; Smids et al., 2020; Spencer, 2018). Robots and AI might be expected to affect both extrinsic aspects of job quality that attach to the labour contract – such as working time and wages – and intrinsic domains associated with the work itself – such as worker autonomy. The aim of this paper is to investigate potential effects, both positive and negative, of new digital technologies in the current era for job quality in multiple domains and to review emerging regulatory responses in the European context.

Given that all domains of job quality – not just earnings – affect worker well-being and health (Eurofound, 2019), the shortage of debate surrounding digital automation and job quality is perhaps surprising. Moreover, the issue is emerging rapidly, with widespread evidence of recent expansion in the use of digital technologies. Robot use, for example, rose steadily from the mid-1990s onwards in the United States, Western Europe and China (Acemoglu and Restrepo, 2020; Cheng et al., 2019). The deployment of AI systems in the United States, already growing rapidly since at least 2010, accelerated from 2016 (Acemoglu et al., 2021). The focus in this paper is on Europe. According to the European Company Survey of 2019, 54% of establishments had purchased software that was specifically developed or customised to meet its needs in the 3 years preceding the survey, while 51% of establishments were using data analytics for process improvements, monitoring employees or both. The use, specifically, of robots was highest in industrial sectors – at 22% of establishments. The survey confirmed that, while digitalisation had proceeded at a varied rate across European countries, it was assuredly increasing at pace. Over half of establishments were increasing their deployment of data analytics.

The European Working Conditions Survey (EWCS) separately confirmed that ICT had by 2015 established itself increasingly as part of everyday work life. Figure 1 (Appendix) shows the trends in ICT usage by workers in EU-12 countries between 1991 and 2015. It is clear from the Figure that the use of ICT devices by workers rose over this period. Figures 2 and 3 (Appendix) show the trend at country-level and again confirm the uniform rise in ICT usage by workers. EWCS data for 2021 are not included in the figures as there were methodological changes including changes in the options for response. Nonetheless for the EU-12, 52.5% reported 'always' using an ICT device at work, above the number reported in Figure 1 (Appendix).

The COVID-19 pandemic, in general, led to an acceleration in the deployment of digital technologies principally as a means to facilitate home and remote working. It also involved shifts towards Internet communication for monitoring workers: for example, employers started requiring employees to regularly disclose information on health status and deployed technologies such as GPS, radio-frequency identification, sensor and even facial recognition technologies (ILO, 2021; Ponce del Castillo, 2020). These technologies look set to continue (and grow) beyond the pandemic.

Absent interventions, Acemoglu (2021) has argued that this expansion of digital technologies risks becoming too much centred on automation and the displacement of labour rather than on raising productivity through balancing automation with human-friendly tasks. Where there are economies of scope, automation that removes tasks from humans reduces their productivity in complementary tasks and is linked to deskilling. And in the context of labour management, digital technologies risk being used excessively for enhancing monitoring of effort – the risk in this case is not just lower wages and higher economic inequality but also greater work intensity. We will suggest in this paper that whether the outcome of new digital technologies is beneficial or detrimental depends at least in part on factors influencing the balance of power in workplaces.

After delineating, in *Job Quality and Its Domains*, the seven domains that have emerged in the European discourse on job quality, we proceed, in *The Effects of Digital Technologies on Job Quality*, to consider the potential effects of new digital technologies in each domain. We show that digital technologies have the capacity to both improve and harm job quality depending on how they are used and deployed in workplaces. In *Worker Involvement and Regulation for a Human-Centred Approach*, we consider the challenge of regulation in defence of job quality. Reviewing developments across several European countries, and drawing on the principles of human-centred design, we advance the general hypothesis that worker participation is important in both innovation and adoption of digital technologies, while also considering the application of national and supra-national data protection legislation.

Job quality and its domains

The concept 'job quality' comprises those characteristics of a job[1] which normally contribute to allowing workers to fulfil their material, social and psychological needs from paid work. We begin by contextualising the concept, its domains and their measurement within the recent evolution of public and scholarly discourse. Job quality is an important

component of 'decent work' which has, since 1999, formed one of the core organising principles for the International Labour Organization's monitoring and policy frameworks (ILO, 1999). Decent work has been incorporated within the broader framework of the United Nation's Sustainable Development Goals.[2]

Job quality scholars mainly concur as to what characteristics of jobs should be considered components of job quality. For any domain (set of similar characteristics) to be included, there should be a good reason why it helps to meet the needs of workers; if not self-evident that reason should be supplied by robust empirical research. This condition is fulfilled by the classification proposed by the European Foundation for Living and Working Conditions (Eurofound), which includes three extrinsic domains (all aspects of the labour contract) and four domains intrinsic to the nature of the work (Eurofound, 2012). This typology has been endorsed by a European Parliament resolution in 2016 for the purposes of analysis and monitoring of socio-economic and policy developments (European Parliament, 2016):[3]

Extrinsic:

1. *Earnings.* Monthly earnings measure the extent to which jobs meet workers' material living needs.
2. *Working Time Quality.* The features of working time relevant to workers' needs include its overall duration, timing and flexibility. High-quality working time means avoidance of very long working hours, flexibility for workers to have some control over when to work and minimisation of working shifts such as night shifts that are known to be detrimental to health.
3. *Prospects.* Good prospects are found in jobs which offer high job security and the potential for future earnings growth.

Intrinsic:

1. *Skills and Discretion.* High-quality jobs are ones which utilise workers' skills well, deploy higher level skills in complex jobs, provide training and allow significant autonomy including good opportunities for employees to organise their work and influence the tasks they are performing.
2. *Work Intensity.* Distinguished from working time, work intensity refers to 'the rate of physical and/or mental input to work tasks performed during the working day' (Green, 2001: p. 56). A high-quality job minimises the extent to which the work is highly pressured, with intensive tasks needing to be carried out at a high speed or to pressing deadlines with few pauses.
3. *Social Environment.* A positive social environment fosters support from co-workers and from line managers, and an absence of abusive experiences, such as verbal abuse, threats, humiliating behaviour, physical violence, bullying or sexual harassment.
4. *Physical Environment.* High-quality jobs are ones that avoid health risks, including many forms of environmental hazard and posture-related vulnerabilities.

Other scholars' domain lists (e.g. Horowitz, 2016) are, for the most part, similar. They either consist of subsets of the above, as mandated by the data they have available, or else involve intersections of domains; for a review of measures, see CIPD (2018). We opted for the Eurofound frame because its scope is practical, broad and unrestrictive. There are plausible mechanisms and evidence to link all these domains with well-being, while still allowing for interactions between them, or for multiple channels through which well-being is affected. However, some conceptualisations are broader in one respect, in that they include person-job fit (e.g. Leschke and Watt, 2008).

Indicators have been developed by Eurofound, and consistent data collection permits trends to be measured for some domains from 2000 onwards (and from earlier for a small range of countries) (Eurofound, 2012, 2017).[4] One common finding is the ubiquitous presence of a gender gap in *Earnings* with men earning more than women; while by contrast in almost all countries the *Physical Environment* indicator is higher for women than for men, reflecting lower exposure to physical hazards. For other domains, the gender gap varies among countries. Across Europe as a whole, job quality has trended modestly upwards in three domains – *Working Time Quality, Physical Environment* and *Skills and Discretion* – while others have shown remarkably little movement over time (Eurofound, 2017). Apart from *Earnings*, all other domains show little or no correlation with conventional measures of affluence, such as GDP per capita. Moreover, there are substantial differences and contrasting time trends in job quality between countries.

The effects of digital technologies on job quality

Using the above typology of job quality domains, and drawing on multi-disciplinary theories, this section considers whether the new technologies of the current era might have either a positive or a negative relationship with each domain. Indicative evidence from prior research is presented where available. Our analysis draws on but differs from that of Parker and Grote (2020) who organise a similar discussion and review of some intrinsic aspects of job quality through the prism of job design theory and its associated categories. Here, the analysis encompasses both extrinsic and intrinsic domains of job quality. Yet, a fundamental common point is the perspective that outcomes are not pre-determined but are instead dependent on choices made in the design and implementation of new technologies, as well as on the organisational context and regulatory conditions under which they are permitted to be deployed.

Earnings is the domain for which there is most evidence on links with new technologies. The use of digital technologies can help to create a higher demand for certain human skills such as those related to the development, maintenance and operation of the said technologies. Software designers, for example, may enjoy higher pay. In general, if digital technologies raise skill requirements in jobs, they create the possibility for higher wages (Acemoglu and Restrepo, 2019a, 2019b). An increase in real earnings may also arise from lower prices linked to the positive productivity effect of new technology. Germany is one example where firms' investment in new digital technologies between 2011 and 2016 is found to be related to higher pay (Genz et al., 2019). Where digital technologies displace workers from tasks that become automated, however, they lower

the demand for workers engaged in those tasks, pushing down wages. Also, by making some skills obsolete, digital technologies can erode the wages in these jobs: a classic case of deskilling and cheapening of labour. Increasing the reach of competition in the labour market, for example, via online digital platforms that allow employers to outsource tasks to workers located elsewhere, brings further downward pressures on wages (Bergvall-Kåreborn and Howcroft, 2014). Digital technologies also facilitate closer worker surveillance, thereby lowering the efficiency wages required to ensure effort compliance (Acemoglu, 2021). De Nardis and Parente (2022) list several studies with varied implications for wages, and their own evidence covering France, Germany, Italy and Spain suggests a negative association, as does the evidence on robotisation in the US (Acemoglu and Restrepo, 2020).

Working Time Quality could also be improved by digital technologies. Such technologies might be configured to reduce employers' needs for unsociable shifts (including night working), adding to working time quality. Platform working technologies may allow greater working time flexibility under workers' control (Chen et al., 2017), including the potential to concentrate working hours into 4 days. Stimulated by the pandemic, digital technologies have also enabled the reconfiguration of work locations and spaces (Felstead, 2022), curtailing commuting time. Yet this facility of new technologies to make working time and space more flexible can have negative effects. Digital technologies can create an 'always-on' culture by providing ready access to, and a near permanent connection with, work. Smartphones, for example, have become a way for workers to remain contactable by supervisors around the clock. At worst, work may come to colonise home-life and erode free time (Shevchuk et al., 2019; Wajcman and Rose, 2011). 'Digital scheduling' (forms of scheduling made possible by new digital technologies) can also be used by employers to extend hours of work (e.g. Moore and Hayes, 2018). 'Digital nudging' can encourage platform workers to continue working when it is time for rest (Scheiber, 2017). Europe-wide evidence suggests, too, a negative association between Working Time Quality and exposure to industrial robots (Berg et al., 2022).

Prospects may be improved by digital technologies where they generate jobs with rising skill requirements and a rising wage profile. Where firm-specific skill requirements are raised, workers working with robots could expect improved promotion prospects. Conversely, where digital technologies displace skilled production tasks, prospects would diminish. Prospects are also lowered by job insecurity, which could be worsened by new digital technologies. The most frequently cited example here is the rise of 'gig-work' (Berg et al., 2018; Cirillo et al., 2021). Applications developed by gig-economy platforms facilitate the immediate hiring of workers for one-off tasks, lessening the incentive for firms to hire workers on traditional employment contracts with associated labour protections. According to Hassel and Sieker (2022), platform companies stimulate the growth of independent contracting, with fewer protections.

Turning to the intrinsic domains of job quality, Skills and Discretion may be augmented by digital technologies, which can facilitate decentralised decision making. Where robots take on mundane tasks, workers could be afforded additional time for more skillful and autonomous work. Where digital technologies are used to augment humans' productivity rather than to automate, the resulting jobs may require

new skills (Daugherty and Wilson, 2018), and working with these technologies may help to make work more meaningful (Smids et al., 2020). Conversely, where digital technologies replace the more interesting and challenging aspects of work, skills and discretion will decline. Autonomy may also be impaired by over-controlling decision-making systems, or by forms of 'algorithmic management', where data are gathered that invade privacy and are used to monitor, assess and control workers' actions (Kellogg et al., 2020; Litwin et al., 2022). Whether the meaningfulness of work is raised or lowered by digital technologies ultimately depends on whether they are designed to replace or support skill levels and autonomy (Smids et al., 2020).

If digital technologies are designed to take on the most intensive aspects of work, this could leave workers with a more balanced pace of work. Yet previous studies have found that computer use at work has been effort-biased: both facilitating greater work intensity by enabling work to be delivered most efficiently to the worker, and enabling the close monitoring of effort by managers with associated penalties for working slowly (Green, 2006; Green et al., 2022). Digital technologies including robots and systems of algorithmic management offer possibilities for augmenting these same processes (Gilbert and Thomas, 2021). Digital scheduling, for example, intensifies the pace of work while working. Technology-enabled remote working potentially also raises work intensity (Felstead and Henseke, 2017). Indeed, there is some European-level evidence that industrial robots have a detrimental effect on work intensity (Antón et al., 2020; Berg et al., 2022).

The social environment of work could also be improved by digital technologies. Where they remove drudgery in jobs and create more scope for human interaction, they enhance the social environment. In contrast, if workers are required to work mostly with (and be controlled by) digital technologies, losing the opportunity for human interaction and social support, they may experience work as more alienating. For example, Knowledge Management Systems (KMSs), while providing back-up for absent workers and making jobs more accessible for untrained workers, reduce the need for knowledge-sharing between colleagues and thus also reduce social interaction. Especially for those working in online platforms, work may become a lonely endeavour (Parker and Grote, 2020). Digital technologies also increase the opportunity for online pressure or bullying. Uber drivers, for example, have faced trial by ratings, leading to instances of discrimination and account deactivation (Rosenblat and Stark, 2016; Rosenblat et al., 2017).

In respect of the physical environment of work – the final domain of job quality – a well-designed robot work system can help to reduce health risks by taking on dangerous, dirty and health-limiting work, such as transporting linen and waste around hospitals (Lloyd and Payne, 2021). Many 'Operator 4.0' technologies are designed with the goal of enhancing physical well-being and safety. Examples include exoskeletons, AR/VR applications and (biometric) wearables (Romero et al., 2016). Gihleb et al. (2020) find evidence of lower physical injury when workers work with industrial robots in the United States, even if the robots also undermine job security. But there are risks, if the design of AI work systems fails to embed health and safety principles. Parker and Grote (2020) provide examples of unintended consequences from sub-optimal, 'techno-centric' work design that fails to incorporate the perspective of technology users. Automated Amazon

warehouses have also been criticised for their harsh and health-limiting physical environments (Sainato, 2020).

In sum, this review shows that digital technologies have the potential for improvement of job quality in many dimensions but also for making it worse. Our analysis points, therefore, to an uncertain future for job quality, with associated promise and risk for health and well-being, as deployment of these technologies accelerates. What, then, are the policy and regulatory implications of these risks to job quality?

Worker involvement and regulation for a human-centred approach

The near-exclusive focus on skills upgrading, as the labour market policy response to new digital technology's effects on employment, has been criticised as de-emphasising redistributive policies, and as displaying an unwarranted deterministic acceptance of new technology together with an unjustified faith in supply-side skills policies (Schlogi and Prainsack, 2021). To these points, we add that, in respect of technology's job quality effects, a reliance on policies to address worker reskilling would be wholly inadequate because the external effects and market imperfections that stem from the uncertain effects of digitalisation are pervasive and are not confined to the skilled labour market.

In this section, we consider the role of participation for mitigating job quality risks and review recent developments in Europe. It can be suggested that, in determining job quality outcomes, what may be important is the form taken by the technology – in particular, whether it has been designed to be human-centred (Parker and Grote, 2020).[5] Such an outcome would be unlikely in an unregulated market. Power resources theory suggests that a key factor in determining the forms of innovation and adoption of new technologies is the opportunity for participation in the process, which is closely related to the balance of power between labour and capital. Participation can entail bargaining over multi-dimensional working conditions, but it also affords a channel for two-way communication over job quality and productivity concerns. A body of evidence is emerging around the beneficial effects for job quality beyond wages of forms of institutional participation, including in the context of innovation (e.g. Doellgast, 2010; Esser and Olsen, 2012; Grande et al., 2020; Hoque et al., 2017; Kornelakis et al., 2022; Wagner and Refslund, 2016). Where labour is empowered, whether through unions or works councils at firm level or through industry-level regulation in which the participation of social partners is embedded, it can positively affect both the form of the innovation and the design of jobs.

We consider two avenues for potential reform. First, worker participation in either the design or the application of technologies (or both), tipping the balance of power some way back towards those who will work alongside the technologies, is the key to ensuring positive outcomes with respect to job quality. Such participation is most likely to occur where workplace consultation is already part of the industrial relations system, most notably in the Nordic countries and Germany. Yet participation is also possible in the absence of inclusive industrial relations systems: organisational structures that support teamwork, problem-solving and decentralised decision making also empower workers, including in the process of technology adoption. Second, supplementing multi-level

participation, statutory regulations also have a role to play in shaping job quality vis-à-vis technology, especially if such regulations ensure workers' data privacy, give workers access to their data, and put limits on monitoring, surveillance and algorithmic management (Hendrickx, 2019).

Engaging workers in the design of technological systems – prior to their implementation – can not only mitigate negative effects but also potentially improve outcomes for both job quality and productivity. The concept of 'human-centred technology' was developed in the 1970s and 1980s as an antidote to 'technology-centred systems' which, since the days of Taylor, have been guided by the conviction that technology is superior to humans. In human-centred technology (Hancke et al., 1990), the user is acknowledged as a source of tacit knowledge and creativity that should be harnessed. However, the degree of involvement of the user in human-centred technological design and innovation varies (Asaro, 2000). At its most inclusive, it relies on participatory design methods, whereby stakeholders are involved in design to ensure that plans, implementation processes and results meet their needs (Simonsen and Robertson, 2013). Involving workers increases the likelihood of their accepting and productively using the new technology after implementation (Felstead et al., 2020; Vereycken et al., 2021). A case study in a German steel plant, for example, has shown that participatory design can have significant positive effects on technology acceptance and innovation outcomes (Kohlgruber et al., 2019).

Having an official structure for employee representation, either a works council or trade union delegation, can be a useful way for employers to engage with workers in a human-centred technological design and application process. However, such a structure is only present in 29% of EU27 establishments, and not all company-level employee representation is involved in technological design and application (Eurofound and Cedefop, 2020). Representation of platform workers remains in its infancy, limiting the scope for mutual gains (Borghi et al., 2022). Some of the best practices come from the Nordic countries, which have a long tradition of participatory design (referred to as 'cooperative design') where it has been used by trade unions since the 1960s to develop strategies for workers to influence computer applications (Asaro, 2000). In the mid-2010s, three German trade unions launched Arbeit 2020, a project aimed at preparing works councils to participate in shaping technological change associated with Industry 4.0.[6] The project trained work councilors on the potential impact of digitalisation through an analysis of change processes induced by digitisation in an entire plant. The training sought to strengthen co-determination by improving the ability of work councilors to respond and negotiate workplace agreements on this issue. As a result of the project, numerous agreements (called 'Agreements for the Future') were signed that included provisions for skills development, working time flexibility, data protection, performance monitoring, project management, corporate governance, health and safety and workload reductions, as well as the early involvement of works councils and employees in managing change (Bosch and Schmitz-Kießler, 2020; Haipeter, 2020). These provisions were designed to ensure that the outcomes for job quality are more favourable for workers.

In exceptional cases, some enterprises without official employee representation may involve their workforce in managing technological adoption out of recognition of the

benefits for productivity as well as job quality (Kelly and Moen (2020). In most instances, however, workers' feedback is not solicited before the technology is put to use. Depending on the technology, there may still be scope for adjustment at this late stage. Unsolicited feedback from staff is more likely to occur in high-engagement workplaces – that is, those that regularly facilitate the direct participation of employees in organisational decision making. Yet, according to the 2019 European Companies Survey, fewer than one-third (31%) of companies in the EU27 meet this criterion (Eurofound and Cedefop, 2020). The possibilities for employee feedback are less likely if workers are on temporary contracts, as job insecurity can keep workers from voicing opinions or concerns (Sluiter et al., 2020). In low-engagement workplaces, technological change is more likely to be viewed by workers as a hostile and threatening force.

A focus for potential future engagement and negotiation, not yet widely embraced by unions, surrounds the use of monitoring and surveillance through data analytics software and, relatedly, the growth in algorithmic management. Where consequences are foreseen and engagement takes place, technological systems can be designed to abide by laws or collective bargaining agreements. For example, scheduling software can incorporate regulation on advance notice in its design, or monitoring systems can be rendered transparent so that workers are aware of their monitoring, have access to the data and have avenues for redress in cases of dispute.

The growing digitalisation of workplaces has prompted trade unions to increasingly consider monitoring and surveillance as well as workers' data privacy in collective agreements and other negotiations (Akhtar and Moore, 2016). Nevertheless, the use of collective agreements to address such issues differs greatly across EU countries. In Italy, the ADAPT dataset revealed that just 4–8% of Italian company-level collective agreements between 2014 and 2018 included clauses regulating employee data processing. By contrast, data from the Hans Boeckler Foundation showed a different situation in Germany, with over 63% of works agreements including clauses on employee data protection in 2015, increasing to almost 70% in 2017 (Dagnino and Armaroli, 2019). The Italian and German workplace-level agreements also differ in character, in that the Italian agreements focus on the use and processing of data collected by new technologies and the reasons behind their introduction, whereas in Germany the management of data tends to represent just one issue in a broader regulation related to the installation of a new device. The greater and more encompassing collective negotiation in Germany stems from the German Works Constitution Act (1972, last amended in 2001), which provides works councilors with the right to co-determination in matters related to the introduction and use of technical devices to monitor employees' behaviour and performance. Unlike the Italian case, in Germany, if no agreement between workers and the employer is reached, a conciliatory procedure is activated that takes the place of the agreement between the employer and the works council. These procedural requirements are stricter than in Italy where, in the case of the failure to conclude an agreement, the employer can act unilaterally.

In other European countries, such as Belgium and Spain, workers' representatives and trade unions have fewer information and consultation rights. In Belgium, there are collective labour agreements ('CAOs') on data from cameras and electronic

communication in the workplace.[7] In Spain, a new data protection regulation — updated in accordance with the Regulation (EU) 2016/679 — was adopted in 2018, including specific provisions on data protection in employment contexts. However, it did not include binding procedural measures to enable its systematic implementation. As a result, collective agreements in Spain tend to set out provisions in law with respect to data privacy or the right to disconnect but rarely include text on worker consultation.

An ILO database on collective agreements (ILO IRCBA) covering 2020–2021 and containing 222 collective agreements from Europe, of which 19 are from Spain, finds that only in one of the Spanish collective agreements is there any reference to worker consultation on decisions concerning the adoption of new technologies.[8] While this sample of collective agreements cannot be assumed to be representative, in fewer than 10 cases (which were limited to Denmark, Finland, Germany and Italy) is there explicit mention of worker involvement in the evaluation of technological adoption through joint employee-management committees. In Italy, a sectoral agreement in a manufacturing sector sets out that the parties have agreed 'to jointly monitor both the regulatory and administrative development of [agile work] and its concrete application in companies in the sector. This monitoring will be studied by a special joint working group, the results of which will be submitted to the Parties within the term of this Agreement'.[9] In Sweden, a sectoral agreement states that it is the decision of the parties that provisions on 'electronic control and surveillance systems' will not be part of the collective agreement but rather be the subject of local codetermination negotiations.[10] As such, the agreement reflects the prevailing practice in Swedish industrial relations of local co-determination (Levinson, 2000). In contrast, in the UK, an enterprise-level collective agreement for a parcel-delivery company sets out the parameters of the technology used to schedule deliveries, granting workers the ability to schedule the delivery within a 2-hour window and a margin of 5% on the delivery times once they are accepted. The agreement provides no mention of evaluation of the system. In general, the scope of these collective agreements reflects the institutional framework – both the structure of the industrial relations in the country as well as prevailing laws.

While workplace consultation and negotiation are best suited for addressing issues of technological adoption and use, broad regulation such as the EU's General Data Protection Regulation (GDPR) is nonetheless useful in establishing safeguards not just within collective bargaining agreements but also in non-unionised firms (Johnston and Silberman, 2020). In particular, the GDPR constrains fully automated decision making by allowing the affected party to object to how their data are used, to be informed about the use of their data and to demand a human interface. Though its application to the employment context is not straightforward (Aliosi and De Stefano, 2021), some workers are asserting their data rights as a result of the GDPR, with Uber drivers in London, for example, suing to get access to their data (Lomas, 2020).

Three supra-national developments could extend such protections across the European Union. Firstly, the EU's draft proposal on the regulation of AI aims to protect workers by classifying workplace applications of AI as 'high-risk' for the health, safety and fundamental rights of workers.[11] The 'high-risk' status means that workplace AI systems would be subject to strict obligations such as risk assessments and transparency measures.

However, as the proposed regulation only requires *self-assessment* by the provider of the system and the mentioned risks do not explicitly cover job quality beyond the health and safety of the worker, the extent to which this regulation provides sufficient protection is debatable.[12]

Secondly, the European Commission has drafted a directive aimed at improving working conditions in platform work.[13] While its main aim is to ensure that people working through digital labour platforms are granted the correct legal employment status, it also aims to provide additional protection regarding the use of algorithmic management. The directive requires platforms to be transparent about the use of algorithms, ensures human monitoring of working conditions and gives workers the right to contest automated decisions. This will be supported through the right to information and consultation: the directive requires platforms to inform and consult workers' representatives when introducing and modifying automated monitoring or decision-making systems. As algorithmic management in various forms is already pervasive outside of platform work as well, this regulation could serve as a precedent, leading to its further application to the wider economy.

Thirdly, the European social partners signed a landmark framework agreement on digitalisation in June 2020.[14] The agreement acknowledged the significant contribution of digital technologies to security, health and safety and efficiency, but it stressed the risk of deterioration of working conditions and well-being of workers of excessive data collection and monitoring. The draft calls for regulation to minimise the amount of data that employers collect about their workers and for clear rules on the processing of personal data to limit intrusive monitoring and data misuse. It also calls for worker representatives' involvement to address issues related to consent, privacy protection and surveillance.

The future projection for these and other supra-national protections through the 2020s is hard to call. Yet, it seems that the long-standing contentious issues of employee voice and workplace governance are likely to matter more than ever, and in new ways, as the Fourth Industrial Revolution unfolds.

Conclusion

Our analysis suggests that it is important to move debate about the effects of digital technologies on from its preoccupation with employment and pay to a consideration of job quality more broadly. Until quite recently, the study of technology's effects on employment has been virtually coterminous with the discourse on the future of work. The onset of the COVID-19 pandemic altered that through its enforced change of working patterns with significant implications for working time quality, work intensification and the social environment of work (ILO, 2021). Digital communication technologies were of course indispensable for these changes, many of which – such as hybrid working – appear set to endure following the collective learning that has taken place. Even apart from these shocks, however, the implications of new technologies for job quality merit closer attention.

The analysis has shown that technology's effects are ambivalent: for each of the seven domains of job quality reviewed, there are situations in which digital technologies may

enhance working life, and others where job quality is at risk. What matters is how these technologies are used and deployed and whether workers have the power to shape their use in ways that meet their needs.

Given the effects of job quality on worker well-being and public health, our analysis confirms the need for policies to secure good regulation of job quality in the context of new digital technologies. Unfortunately, despite persistent rhetoric proclaiming the need for 'more and better jobs', job quality has yet to become a prominent target for policy makers within European employment ministries, or even to figure in a practical and non-rhetorical manner in the Employment Guidelines or the Joint Employment Reports issued from the EU. Piasna et al. (2019) attribute this failure to the fact that job quality policies lie in contested political terrain, with 'flexicurity' policies continuing to dominate the employment discourse and European policy-formation. Our overview of some regulatory developments across Europe – those aimed at limiting the techno-centric orientation of digital innovations and embedding the principles of human-centred design – suggests that regulatory developments are promising but are lagging behind the spread of AI systems. Forms of worker participation, whether in design, innovation or application, are needed, perhaps more than ever, to ensure that digital technologies deliver net benefits for workers and society more generally. Workers are more likely to share in the gains if they have some say over how technology is used and deployed at work. The downside risks to job quality, in all its domains, could be reduced by adopting a human-centred approach. Ultimately, a future of high-quality jobs will depend on strengthening the voice and bargaining power of workers who will use the technology.

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ORCID iD

David A Spencer https://orcid.org/0000-0002-7803-6105

Supplemental material

Supplemental material for this article is available online.

Notes

1. While outside the scope of this paper, we note that the quality of unpaid domestic labour is also likely to be affected by new digital technologies.
2. www.un.org/sustainabledevelopment/wp-content/uploads/2016/08/8_Why-It-Matters-2020.pdf.
3. One potential further domain remains contentious: namely, the extent to which a job permits participation in organisational decision making (Green, 2021).
4. Most research at the macro level now agrees that job quality should be measured using only objective indicators (even if sometimes reported by individuals) rather than including subjective evaluations such as job satisfaction, but for a contrasting perspective for qualitative research see Findlay et al. (2013).
5. Human-centred design is also important for workers to 'accept' the technology and actually use it.
6. Work 2020 (arbeit2020.de).
7. See CAO 68 and CAO 81 and law (cameralaw); see also: https://blog.associatie.kuleuven.be/paradigms/data-op-de-werkvloer-en-de-rol-van-sociale-dialoog-een-kleine-stand-van-zaken/
8. Spain, CBA no. 429, ILO IRCBA database.
9. Italy, collective agreement no. 147.
10. Sweden, Collective Agreement #295, ILO IRCBA database.
11. European Commission, COM/2021/206 final, 'Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL LAYING DOWN HARMONISED RULES ON ARTIFICIAL INTELLIGENCE (ARTIFICIAL INTELLIGENCE ACT) AND AMENDING CERTAIN UNION LEGISLATIVE ACTS »'.
12. http://global-workplace-law-and-policy.kluwerlawonline.com/2021/04/16/the-eu-proposed-regulation-on-ai-a-threat-to-labour-protection/.
13. European Commission, COM/2021/762 final 'Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on improving working conditions in platform work'.
14. The full agreement is available at Social dialogue texts database - Employment, Social Affairs & Inclusion - European Commission (europa.eu).

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Author biographies

Janine Berg is a Senior Economist at the ILO.

David Spencer is Professor of Economics and Political Economy at Leeds University Business School, University of Leeds, UK.

Laura Nurski is a Research Expert at the Centre of Expertise for Labour Market Monitoring at the Faculty of Business and Economics of KU Leuven, Belgium, and a non-resident fellow at Bruegel.

Francis Green is Professor of Work and Education Economics, IOE, UCL's Faculty of Education and Society, UK.