

Verdin, Rachel; O'Reilly, Jacqueline

**Research Report**

## A gender agenda for the future of work in a digital age of pandemics: Jobs, skills and contracts

WSI Study, No. 24

**Provided in Cooperation with:**

The Institute of Economic and Social Research (WSI), Hans Böckler Foundation

*Suggested Citation:* Verdin, Rachel; O'Reilly, Jacqueline (2021) : A gender agenda for the future of work in a digital age of pandemics: Jobs, skills and contracts, WSI Study, No. 24, Hans-Böckler-Stiftung, Wirtschafts- und Sozialwissenschaftliches Institut (WSI), Düsseldorf

This Version is available at:

<https://hdl.handle.net/10419/232560>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# STUDY

---

No. 24 · January 2021 · Hans-Böckler-Stiftung

# A GENDER AGENDA FOR THE FUTURE OF WORK IN A DIGITAL AGE OF PANDEMICS

## Jobs, skills and contracts

Rachel Verdin, Jacqueline O'Reilly

---

## ABSTRACT

This article provides an exploration of the literature concerning the impacts of digitization and the fourth industrial revolution on the world of work, informed by the experiences of Covid-19 and focusing on the gendered implications. Key threats and opportunities are identified in projections for declining and emerging occupations, considering how women will fare in the workplaces of the future. These trends are discussed in terms of emerging skill gaps and women's positioning to exploit key areas of growth. Alternative forms of employment and atypical workers are creating regulatory gaps, challenging existing social protection systems, with the pandemic again demonstrating the need for interventions. The pandemic has highlighted the need for a specific gender agenda to ensure past progress is not eroded and the opportunities described are taken up.

## Contents

<b>Introduction</b>	<b>3</b>
<b>1 Sectoral variation and roles under threat</b>	<b>5</b>
1.1 Skills and sectors in decline	5
1.2 Skills and sectors anticipated to grow	6
1.3 Variable impacts across Europe for integrating women in the Information and Communications Technology (ICT) sector	8
<b>2 Skill shortages and new forms of employment</b>	<b>9</b>
2.1 Changing skill sets	9
2.2 Variability between and within countries	9
2.3 The cyclical nature of the barriers women face	10
2.4 Retraining for the future of work not just the pandemic	11
<b>3 The growth of precarious work and emerging regulatory gaps</b>	<b>12</b>
3.1 Divergent work formations	12
3.2 Regulatory and collective gaps	13
3.3 Emerging opportunities for reducing intersectional gender inequalities	14
<b>4 Discussion and conclusion</b>	<b>16</b>
<b>References</b>	<b>18</b>

## Introduction

The coronavirus pandemic has accelerated trends associated with the evolution of the Fourth Industrial Revolution (4IR) and deeply embedded patterns of intersectional and gender inequalities. Artificial Intelligence, machine learning and robotics are transforming the type, content and format of work at an exponential rate (Schwab, 2016; WEF 2018a; Neufeind, O'Reilly and Ranft, 2018). There have been variable projections of the impact on jobs and the value to be un-locked through successfully enabling such transformations. The World Economic Forum (WEF) estimate a global potential of \$100 trillion in value to society and industry through digitalization, whilst also recognizing that without intervention inequality is the greatest societal concern to accompany these benefits (WEF, 2018a; Schwab, 2016; WEF, 2020).

Existing trajectories of rising economic, gender and ethnic inequalities are being exacerbated by transformations in the world of work. The Covid pandemic has pulled back the veneer on these long-term trends making them even more apparent and poignant for those concerned with social cohesion. Consideration of how innovations impact on equality needs addressing, to ensure progress on multiple dimensions of gender equality is not eroded and opportunities and agendas for change are identified. This article sets out to do this by drawing particular attention to the gender agenda in the context of these fundamental shifts, which critics' note is at present largely missing from the more mainstream commentary (Howcroft and Rubery, 2018; Peetz and Murray, 2019).

The challenge for legislators and policymakers across Europe is varied, complex and extremely challenging. To understand what the impact of the digitalization of work will be for a diverse range of women in the new world of work the current literature presents three key themes:

- the creation and destruction of jobs as labor markets are re-structured;
- the skills and retraining needed to exploit new opportunities;
- and the implications of increasingly divergent working arrangements.

The risks and the opportunities in each area will be explored with a gendered focus.

Firstly, as new work is created and existing roles are changing, there is wide variation in projections for how this will alter the shape of the labor market (WEF, 2018c; WEF, 2016; Frey and Osborne, 2017; White et al., 2019; Brussevich et al., 2018; Arntz et al., 2016). The effects of automation are uneven across the skill distribution. This will be explored in terms of the job composition and sectoral variation of the roles under threat. The literature identifies the anticipated emergence of new and growing industries, through technology and resultant change. A gendered lens will be applied to these expanding

sectors. This will consider the projection of further polarization of the labor market as high skill / high pay and low skill / low pay jobs, are likely to grow (Caruso, 2018; Lawrence et al., 2017). In turn, the potential productivity improvements and growing flexibilities at work are explored in light of the benefits that they may afford to gendered inequalities. These themes and the gendered risks therein are considered in light of the developments and inequalities in working prompted by the Covid pandemic.

Secondly, the changed labour market may make some existing skills redundant and require new skill sets (Jandrić and Ranđelović, 2018). Outcomes here may magnify intersectional inequalities and threaten to enhance existing disadvantages (Howcroft and Rubery, 2018). The need for targeted policy interventions in the reskilling challenge has been writ large by Covid. Analysis of work flows shows there is little evidence of sectoral shift shaping job search behavior for the newly unemployed (Brewer et al., 2020). The need for retraining and on going learning to satisfy evolving labor markets prompts consideration of how well placed women are to meet the needs of growing industries. The growth of digital workplaces and new technologies may further disadvantage women in the digital workplaces of the future. The gender dimension of existing skill shortages in ICT and STEM subjects will be explored (Krieger-Boden and Sorgner, 2018). In addition, the factors impacting women's choices, such as the workplace culture and environment, will also be identified (Duke, 2019).

Finally, consideration will turn to the changing shape of jobs. New types of employment and categories of worker, that operate beyond existing legislative provisions, are highlighting both the threats and opportunities of alternative forms of working (Taylor, 2017; Mandl et al., 2015). An understanding of how precarious forms of employment precipitate risks to the effectiveness of employment rights and social protection systems, has been demonstrated by Covid. Applying a gendered lens to these risks demonstrates the inequalities inherent within them. In addition, the importance of unionization, collective bargaining and the readiness of unions to meet the challenge of the new world of work is also relevant (Simón, 2012; Blau and Kahn, 2003). The low value of precarious work is often accompanied by low expectations of employers and exploitation, again demonstrated by the pandemic and reiterating the importance of legislative and collective support (Conaghan, 2020).

While it is clearly difficult to imagine the workforce of the future, the pandemic has exposed and underlined the necessity of a gendered approach to core policy areas for change, those being, job creation, skills and contracts. Coupled with the UK's lack of exposure to regulatory developments, as a result of Brexit, divergence in legislative approaches across Europe may also emerge. This suggests that the UK may see further slippage in its pursuit of gender equality measures, and in so doing provide a useful comparator for the rest of the EU in the future. The article therefore concludes that an agenda for gender

needs to be a central focus for assessing projected transformations in the world of work in a digital age of pandemics.

## 1 Sectoral variation and roles under threat

### 1.1 Skills and sectors in decline

Organizations such as the WEF and McKinsey seek to understand how 4IR changes will impact according to industrial sector. It is clear the impact of technological change will not be skill neutral (Dachs, 2018; Bughin et al., 2018; WEF, 2018b). Projections anticipate declining employment in manufacturing and production, distribution, retail, and office and administration. For business and financial operations, sales and construction, there is a flat employment outlook. STEM jobs and non-routine manual work, currently outside of the scope of automation, are predicted to grow (WEF, 2016).

The impact of automation on job roles and employment figures was considered in a seminal article by Frey and Osborne (2017), who suggested 47% of US jobs were susceptible. Application of their methodology to the UK scenario suggested a 35% risk of automation (White et al., 2019), while in the German context this rose to 51% of jobs (Naude and Nagler, 2017). Alternative research employing a different methodology has since suggested that, across OECD countries, the risk is far lower (14%), and with significant variation, ranging from 6% in Norway, to 33% in Slovakia (Nedelkoska and Quintini, 2018). The level of change anticipated in job roles encompasses huge variation, from 2 million to 2 billion by 2030 (WEF, 2018a: 26). While there is clearly debate on the estimation of numbers, just as in earlier industrial revolutions, labor deployment is being reshaped in new ways. The displacement of manual labor and routine tasks by mechanization in the 1980s and 1990s is now seeing new technology erode administration and communicative workplace functions (Autor and Dorn, 2013; Caruso, 2018: 387). Accompanying these potential job losses the WEF predicts “significant churn between job families and functions”(WEF, 2016: 13).

While some job roles have already undergone change, for instance in the UK’s retail market a 25% reduction of supermarket job roles (pre-Covid) occurred alongside record levels of overall employment (White et al., 2019; Lawrence et al., 2017; Bell and Gardiner, 2019). Projections are that change will be incremental (Howcroft and Rubery, 2018; Mönnig et al., 2019: 388). Indeed, some organizations have reduced their previous forecasts and recognize the tendency for a negative outlook, given the potential for technology is essentially unknown (White et al., 2019; Dachs, 2018). Coronavirus accelerated significant shifts in labor markets disproportionately impacting certain sectors (Brewer et al., 2020) and increasing the use of digital technologies. To illustrate, and continuing with the example of retail, a Covid induced increase has been noted in the German context, with particular

reference to e-grocery shopping. Pre-pandemic this remained niche, when compared to other retail (Dannenberg et al., 2020). It has since witnessed a dramatic escalation in use. The impact on women, given the gendered associations with delivery and transportation, may prove disruptive in the long term and reiterate the need for a gender agenda to understand how transformations will impact gender equality.<sup>1</sup>

Pre-Covid a widening of inequality had been acknowledged across Europe, and beyond (Lawrence et al., 2017; Dachs, 2018; Caruso, 2018; Goos and Manning, 2007; Weil, 2019; Bughin et al., 2018; Naude and Nagler, 2017). This was accompanied by an increasingly polarized labor market with concerns that impending change would further increase inequality. Technological innovation had begun displacing routine middle jobs, with a concurrent growth in low paying service occupations and professional and managerial jobs, and recognition of the socio-economic inequalities that these changes exacerbate (Brussevich et al., 2018). However, despite the proliferation of research in this area there is limited consideration of the gendered impact of these changes (Peetz and Murray, 2019). Those that do exist present varied conclusions. Some find the risk to women's employment is greater as a result of automation (Brussevich et al., 2018; White et al., 2019), others predict a similar risk of displacement for men and women (WEF, 2016; OECD, 2017; Lawrence et al., 2017), or alternatively research finds the greater risk is for men (Krieger-Boden and Sorgner, 2018; Sorgner et al., 2017). There does however seem to be greater agreement and consistency in the literature on the occupations likely to grow, and how well positioned women will be to take advantage of these growth areas.

## **1.2 Skills and sectors anticipated to grow**

A report by McKinsey Global Institute considers the changing skill requirements of the future workforce across five European countries and the US (Bughin et al., 2018). Alongside the decline of manual, routine and physical skills, they highlight the growing requirement for technological, social and emotional skills. They assess five different sectors of work and how they will be impacted. While the report does not make gendered assumptions, given the make-up of the sectors (finance, retail, manufacturing, mining and healthcare), this can be inferred.

Accordingly, the positioning of women in the labor market may mean that existing inequalities are likely to be enhanced, given the industries that are expected to grow. Some low pay occupations are at lower risk of automation, notably roles in the health and social services sector requiring social, emotional and manual dexterity skills, which are harder to automate. In addition, employment in this sector is likely to increase, given ageing populations across Europe (Naude and Nagler, 2017; WEF, 2016: 22). Historically these occupations are more likely

---

<sup>1</sup> This is highlighted in the UK context by the pending equal pay cases for retailers such as Asda, Tesco and Sainsburys, given the gendered dimensions of both shopfloor and warehousing and distribution roles (Croft, 2019).

to be occupied by women. Coronavirus has highlighted the prominence of women in frontline health and social care roles, alongside underlining the gendered division of unpaid labor within the home (Summers, 2020; Zoch et al., 2020; Brussevich et al., 2018). Women occupy two thirds of the paid health workforce worldwide, and across the OECD they represent 90% of long term care workers (Queisser et al., 2020).

The low value ascribed to care is apparent in the increasing shortage of workers in the sector, as low wages and poor opportunities for professional development, fail to encourage workers to these labor-intensive occupations (Hudson, 2017; Spasova et al., 2018). In addition, while gendered analyses of stress statistics is variable across the EU, according to countries that do measure it, the care sector represents one of the most stressful industries to work in (Buckley, 2019; Broughton, 2010). This too has become particularly apparent during the pandemic, with reports of high levels of employee burn out and stress in this sector (Kramer et al., 2020). In turn, if recruitment gaps are not met, the pressure on unpaid carers to fill the void will inevitably also have gendered implications (Craddock, 2017; Plomien, 2018). This has already been reported in the UK, resulting in the highest levels of women leaving paid employment as a result of unpaid caring responsibilities across Europe (DWP, 2019). The implications of Brexit for the UK further reiterate the need for policy intervention, given the skills shortage the sector was already facing pre-pandemic (Future, 2018). These trends have been exacerbated by the crisis, and yet the shortage of applicants for care roles, despite increasing levels of unemployment, underlines the urgent requirement for policy to address the problem (Brewer et al., 2020).

The consequences of the pandemic have polarized opportunities for those who are able to work from home and those who are not. Lower paid and lower skilled face to face jobs are vulnerable to increased economic uncertainty resulting from lockdowns and Covid restrictions. Conversely, there may too be an unintended consequence of the pandemic, given the widespread economic impact of lock-downs in sectors struggling as a result of the crisis. As organizations are compelled to reduce their operating costs, cuts to management roles and senior pay may inadvertently have a positive effect on gender pay inequity, partially offsetting these otherwise negative corollaries.

That said, areas of anticipated employment growth at the top of the pay spectrum are also predicted to increase existing inequalities and gender gaps (Mönnig et al., 2019; Quiros et al., 2018: 81). McKinsey points to the rising need for technological skills, suggesting there will be a 90% growth in the requirement for advanced technological skills between 2016-2030 (Bughin et al., 2018: 9). WEF note that in 2018 71% of tasks were completed by humans, they predict that by 2022 this will drop to 58%, as machines increasingly take on work tasks (WEF, 2018b). Given the occupational segregation already apparent in these sectors, men will be better placed to take advantage of the



growth that is expected in ICT and STEM roles, increasing gaps that are already apparent (Howcroft and Rubery, 2019; Duke, 2019).

### **1.3 Variable impacts across Europe for integrating women in the Information and Communications Technology (ICT) sector**

The challenges will vary according to the national context, as is clear from trends observable in the European Commission's Digital Economy and Society Index (DESI) (Neufeind et al. 2018). The DESI measures the performance of member states according to various dimensions: Connectivity; Human Capital - Digital Skills; use of Internet Services; Integration of Digital Technology; Digital Public Services; Research and Development, and ICT. Within these dimensions the level of ICT specialists is considered and currently provides 3.7% of total employment across Europe and growing. The UK and Germany have the largest number of ICT specialists at 1.6m in the labor force, followed by France with 1.1m ICT specialists (DESI, 2020). Alongside this aggregate benchmark of country performance, a more focused comparison to measure and target the participation of women in the ICT sector, with a view to improving their integration, was instigated by the European Commission's Women in Digital policy. Since December 2018, the Women in Digital Index (WiD) sits alongside the DESI with findings showing that more digitally advanced countries have a better integration of women across a range of simple measures.

Interrogation of the WiD index shows the highly gendered make-up of the ICT labor market. For instance, considering those frontrunners in employment, 17.6% of the UK's ICT specialists are women, whereas this falls to 16.6% in Germany, with the EU average at 17.2% (WiD, 2019b; WiD, 2019a).

Returning to the DESI, the index highlights growing recruitment difficulties within the sector between 2017-2018 (DESI, 2019a). Across the EU just under 60% of firms report finding vacancies hard to fill, but in places such as Romania, Czechia and Germany this rises to 70%+ (DESI, 2020). Intervention and a gender agenda is needed to both to meet demand and offset the increasing inequalities the sector is facing (Quiros et al., 2018).

## 2 Skill shortages and new forms of employment

### 2.1 Changing skill sets

Skills challenges are a significant part of these policy objectives to steer the evolution of emerging sectors and address issues of gender inequality. The WEF 2020 Global Gender Gap report shows that globally gender parity in education has nearly been reached (WEF, 2019). More women than men have achieved tertiary education in nearly all OECD and EU countries (OECD, 2019: 39, 50).

Given the exponentially growing need for ICT skills at work, consideration of how well placed the workforce will be to meet these increased needs, reveals the likely skills gaps of the future. WEF considers the qualification gap in information, communication and technology subjects, and among others note that the growth of ICT Roles is set to enhance a gendered skill gap (WEF, 2018c; OECD, 2019; DESI, 2019b). The European Commission's 'Women in the Digital Age' report suggests four times more men study Science, Technology, Engineering and Maths (STEM) subjects than women. Of all tertiary graduates in Europe, 21.2% are in STEM subjects, which when broken down by gender reveals 33.8% of male graduates, compared to 11.8% of women (Quiros et al., 2018). This divergence is even more marked in areas like engineering and physics.

### 2.2 Variability between and within countries

The DESI and WiD scoreboards enable evaluation of progress over time. Analysis shows that women's level of digital skill has increased, however men outpace this growth. Comparison of female STEM graduates between countries reflects the variability across Europe. In 2019 Slovenia (20.5%) and the UK (17.6%) had amongst the highest level of STEM graduates. The EU average is at 13.1%, with Germany at 11.4% (DESI, 2019a; DESI, 2019c; WiD, 2019b; WiD, 2019a).

The ability to track progress over time will be invaluable to measure how countries are progressing at different speeds and the impact of policy reforms to address these inequalities. The divergence between women and men within countries is also interesting. The relatively high level of female STEM graduates in Slovenia stands in stark contrast to the 45.3% of men that graduate in these areas, likewise in Germany 28.1% of men graduate in STEM subjects, marking the clear gendered skill gap. This highlights the need for change to ensure readiness for the future demands of work, so that it does not entail regression in terms of inequality.

Research has suggested that Northern and Western European labor markets have greater adaptability to meet this challenge than those in Southern and Eastern Europe (Jandrić and Ranđelović, 2018: 770). Alternative analysis from Naude and Nagler (2017) identifies specific

challenges some countries, like Germany, may face in their ability to meet new educational requirements. For example, in Germany the labor market is largely focused on specialized skills, that will in turn require a complete shift of the education system to refocus and meet emerging needs.

### **2.3 The cyclical nature of the barriers women face**

Qualifications aside, existing markers of occupational segregation present an additional challenge. In Europe women occupy 21% of the ICT workforce and 32% across the OECD (Davaki, 2018; Quiros et al., 2018; WEF, 2016). Women's presence in senior roles and STEM leadership positions is even lower (Adams and Kirchmaier, 2016). Women's underrepresentation in ICT has been attributed to unappealing workplace cultures, gendered environments and the long hours working culture. The sector also suffers from high levels of women leaving, the so-called 'leaky pipeline' (Quiros et al., 2018; Eden, 2017: 106). Women are not currently well placed to take advantage of a growing ICT sector given limitations to their educational orientation, dis-embedded workplace experiences and relative absence from relevant senior management positions (WEF, 2016).

The disruptive potential that these emerging inequalities may hold is two-fold. First, without addressing the inequities described, given the speed and scale of growth in the sector, the glacial progress towards pay equity looks set to stall or regress. Second, without diversity in the creation of new technologies, existing intersectional inequalities are likely to become further embedded. Recognition of these potential obstacles in the literature points to gender bias in the creation of computing and 'boys toys' as masculinized endeavors (Henn, 2014; Quiros et al., 2018; Hicks, 2018). The inevitable outcome of this process is visible in the inequality being reproduced by algorithms, data and machine learning. For example, the literature describes the digital platforms that preference men in their highly paid job adverts, the capacity of Artificial Intelligence (AI) to learn and magnify existing inequalities on social networking sites, and in fields as diverse as urban planning and medical research (Criado-Perez, 2019; Wellner and Rothman, 2019; Quiros et al., 2018; Howcroft and Rubery, 2019; O'Neill, 2016; Buolamwini and Gebu, 2018). This represents not merely the shifting of an existing goalpost in the drive for equality, but the emergence of a new one (Rubery and Grimshaw, 2015).

## 2.4 Retraining for the future of work not just the pandemic

The necessity for education systems to ensure that relevant provision is being delivered and is accessible, has been further underlined by the pandemic. The disruption to particular sectors, alongside the speed of change prompted in others, requires policy to support the resultant lifelong learning and retraining needs of the workforce. The pandemic is also perceived to have increased the demand for skilled workers, across the board (Lohr, 2020). To meet these needs, essential for future economic growth, provision should be made widely available to meet the anticipated supply / demand gap and in so doing offset rising levels of unemployment (DESI, 2019b; Brewer et al., 2020). Governments should also ensure that measures prompted by Covid are not merely focused on the short-term crisis but address the wider workplace changes and future of work. Evidence from the financial crisis and previous recessions shows that increased spending trends through periods of economic decline are typically withdrawn as economies recover (Chote et al., 2015: 25-26; Lohr, 2020). Investments for training need to maintain relevance beyond the current crisis. The prerequisite of a properly embedded gender mainstreaming approach to these policy programs is vital to address the barriers that women, and those with other intersectional inequalities may face, when pursuing STEM qualifications and occupations (Queisser et al., 2020). This reiterates the importance of a gender agenda.

In the UK context combined calls from both the business and the union community to use the downtime workers may have as a result of the pandemic to retrain, have, thus far, not been actioned.<sup>2</sup> There is mixed and uncertain messaging in the strategy proposed, as the promise of a 'Lifetime skills guarantee' has been somewhat undermined by the concurrent decision to remove the funding for Union learn (TUC, 2020; PM'sOffice, 2020). Thus far, the gender aware strategy that is required for a more equal future of work, is decidedly absent.

---

<sup>2</sup> <https://www.resolutionfoundation.org/events/jobs-jobs-jobs/>

## 3 The growth of precarious work and emerging regulatory gaps

### 3.1 Divergent work formations

Sectors are being transformed through the process of digital adoption, and more recently the consequences of the pandemic. Alongside the need to address the inequalities arising from the evolving patterns of skill requirements that this is prompting, regulation surrounding the employment contract itself also needs amending.

Research by Eurofound has categorized the emergence of nine new forms of employment across the EU, characterized by their unconventional work patterns, locations and hours (Mandl et al., 2015). They suggest that some forms are more commonly used in certain industries. For example, there are a disproportionate number of women undertaking casual work on zero-hour contracts in social care and increasing levels of precarious employment for women in growing sectors (Taylor, 2017: 93-4).

The rapid growth of platform work since the late 2000s similarly challenges the typical employment relationship, making protection systems concerning wages, holiday and sick pay hard to regulate (Jaehrling et al., 2016; Clarke and Cominetti, 2019: 7; Wood et al., 2020). Annual growth in global revenue from sourcing platforms has risen from 53% in 2010 to 74% in 2011 (Mandl et al., 2015: 112). Platform workers are more likely to come from households with dependent children, and use the work as a means to top up income from elsewhere (Pesole et al., 2018; Huws et al., 2017). Research is unclear as to the gender split of these workers across the EU, given sample limitations and heterogeneity of take up across member states (Pesole et al., 2018; Huws et al., 2017).<sup>3</sup> What is clear is that women are more prominent in certain lower skilled areas of the gig economy, for example ancillary and on-location work (ie. housekeeping, cleaning and beauty services).

The rise of these forms of work are associated with lower job quality, risks of low pay, issues of timing, uncertain regularity, and insecurity in terms of employment protection. Social protection systems are outside the scope of atypical work and so policy is needed to protect from the “risk of substituting a traditional sweat shop for a digital one” (OECD, 2017). A gender agenda here would help flag the variant ways women use atypical work, the motivations for it and the consequences of it (Fredman, 2004). New legislative approaches are needed to offset emerging gaps in provision to ensure employment protection is still sufficient, with a specific understanding of the implications for women and families (Rubery, 2018; Howcroft and Rubery, 2018).

---

<sup>3</sup> Pesole et al., research (2018) is based on COLLEEM survey which covers 14 member states and finds that men occupy the majority of platform-based roles, while recognising disparity between nations. Huws et al., research (2017) covered 7 member states and found an overall even split, noting that in the UK and Italy women performed the majority, while in other countries, including Sweden and Germany, men were in the majority.

For instance, consideration of the impact that caring commitments have on women's ability to work, and how access to maternity provision may be affected by women's positioning within emerging forms of work. It is widely recognized that these evolving trends require a legislative response that will vary across the EU (Taylor, 2017; HM Government, 2018; Jaehrling et al., 2016; O'Reilly and Lewis, 2018). Gendered impacts may then be evidenced by inequalities such as increased child poverty levels, determined by the take up of atypical work and the varied social protection systems in operation (Papanastasiou et al., 2016: 78).

### **3.2 Regulatory and collective gaps**

The challenge of ensuring new jobs are good jobs also exists beyond the regulatory dimension, as there are other key actors within this framework (Goos and Manning, 2007). The importance of unionization and collective bargaining to promote equality and afford workers protection is clear (Blau and Kahn, 2003; Simón, 2012; Deakin et al., 2015; Jaehrling et al., 2016). The erosion of collective bargaining and declining union membership across the EU makes understanding and meeting the challenge of changing work relationships more important and yet more remote (Waddington, 2015).

The picture across the EU is diverse. After sharp falls in union density countries such as the UK and Germany are beginning to see union membership increase (Anders and Biebeler, 2015; Jaehrling et al., 2016; BEIS, 2018). New forms of unionism to represent platform workers have also started to emerge. Gender and ethnic representation within these organizations is variable. For example, Germany has a larger proportion of traditional union membership amongst men, while the UK has more female trade union members (BEIS, 2018; Anders and Biebeler, 2015). New forms of unions for gig workers, such as ride hailing and food delivery platforms, are also likely to have a higher proportion of younger and ethnically diverse members (Vandaele, 2019; Vandaele, 2018; Vandaele et al., 2019). Traditional unions are competing with new emerging unions responding to localized struggles of marginalized migrant and under-represented workers (Però, 2020; Perrett and Lucio, 2009; Connolly and Sellers, 2017; Alberti, 2016). Traditional unions are being challenged to respond and represent a diverse feminized labor force if they are to remain relevant in protecting them against the growing regulatory gap between different labor market segments (Zahn, 2019; Staton, 2020).

However, difficulties with organizing often remote workers means trade union presence is limited, resulting in the partial recourse to collective support and advice that workers experience. In addition, exploitation in precarious labor markets is rife (Jaehrling et al., 2016). This has been further exposed by the pandemic as the lack of basic protections, such as sick pay, has become all the more visible (Paul, 2020; Wong, 2020). Consequences, such as the inability to afford to self-isolate are apparent (Hendy QC, 2020). While these consequences

are clearly not restricted to women, the need for a gender agenda to address the specific impacts women face is vital.

### **3.3 Emerging opportunities for reducing intersectional gender inequalities**

The opportunities afforded by digital innovations and new forms of working may present potential benefits to address the limiting factors and barriers preventing women achieving economic independence (Rubery and Grimshaw, 2015; Krieger-Boden and Sorgner, 2018). The ability to balance work and family life and manage the “second shift” at home is a persistent barrier (Sayer, 2005; Hochschild, 2003; ONS, 2016; WEF, 2019). Policies to address this are recognized in the EU Employment policy on Work Family Reconciliation (Broughton, 2011; Quiros et al., 2018: 150).

The WEF claim the 4IR may provide opportunities to shift gendered roles, through developments such as improved workplace flexibilities and the increasing automation of household work (WEF, 2016). Evidence shows improved workplace flexibilities have a positive impact on gender pay gaps (GEO, 2018), and lead to higher rates of maternal employment (OECD, 2017: 271). Utilizing innovations and new flexibilities as a way to reimagine gendered identities may, in turn, enable changed approaches to care across the generations (Howcroft and Rubery, 2019).

However, caution is to be noted as greater flexibility may further institutionalize and embed women’s roles as carers (Grönlund and Magnusson, 2016). Flexibilities need to be available and utilized by both men and women in order to begin to reimagine approaches to care. The difficulty of this is apparent in the UK context, demonstrated by the low take up of Shared Parental Leave (BITC, 2018). Domestic arrangements and cultural constructs will inevitably impact as women’s workforce participation and divisions of labor within the home varies considerably across member states (WEF, 2019).

The improved productivity that the 4IR may create could be translated into shorter working weeks, which has a potential to disrupt existing gendered care patterns. Pre-Covid, organizations such as Microsoft Japan and Perpetual Guardian have reported how the implementation of a four-day working week translated into productivity gains. They also cited improved workplace stress levels and rates of absence amongst staff (Booth, 2019; Booth and Holmes, 2019; Stronge and Harper, 2019; Paul, 2019). Further research around the impact of increased productivity and reduced working hours may prove fruitful, given the ability for innovations to improve workplace efficiencies that have become so apparent during the pandemic with enforced home-working.

However, recent evidence has shown that those better able to work from home during the pandemic are more likely to be better-qualified and come from higher income households. This is in contrast to young adults, minority ethnic and immigrant communities, who were more likely to be concentrated in occupations that did not enable homeworking (Reuschke and Felstead, 2020; Felstead and Reuschke, 2020; Yasenov, 2020). In addition, there is evidence that male and female experiences of working from home varied significantly during the pandemic: while both men and women felt more negative about increased domestic work (Craig and Churchill, 2020), women often fared less well as a result (Conaghan, 2020; Wood, 2020; Queisser et al., 2020; Summers, 2020).

A gendered perspective on new forms of employment highlights how job markets can be opened up in new and inclusive ways to women, beyond the importance of flexibilities. Barriers that may have prevented women from accessing labor markets and limitations in accessing entrepreneurial funding, such as inherent bias and cultural stereotypes, can be offset (WEF, 2019: 11, 30). Platform work has the capacity to bypass national and cultural barriers. Equally, there is potential for greater financial and entrepreneurial inclusion as women are able to access financial services in new and different ways (Mariscal et al., 2019; Ruehl and Kynge, 2019). Understanding the myriad of ways that women may be limited from participating in the labor market, helps expose the opportunities that the 4IR may afford to re-navigate these trends.



## 4 Discussion and conclusion

Innovations are changing definitions of the ways we work and will work in the future at a rapid rate. The pandemic has escalated the speed of this change. While the full breadth of consequences arising from the 4IR may be unimaginable now, prompting a tendency for negative corollaries, there is a need to understand and address the outcomes we are facing. A central element within this context is inequality, which is predicted to rise.

This article has explored how changes to the world of work may impact men and women differently, given the varied roles and alternative forms of working they occupy. Within the literature key themes have been identified: jobs predicted to both decline and grow; the requirement for retraining to meet evolving needs, and the emerging regulatory and collective gaps that have accompanied the growth of precarious work. A gendered exploration has highlighted how gender inequality might well increase, demonstrating the need for policy intervention.

Firstly, patterns of declining and emerging employment may be inconclusive but highlight key areas of tension. The growth of low pay occupations in the field of health and social care, combined with ageing populations across Europe, is set to present an unmet labor demand and enhance existing inequalities. Given the redoubled pressures on the care sector, as a result of the pandemic, the requirement for policy here is clear. Corresponding growth in high skill fields such as STEM and ICT are again, without intervention, likely to magnify pay gaps, occupational segregation and see inequalities rise.

Secondly, to meet the needs of the future workforce there is a gender dimension in the projected skill shortages. The current positioning of women further threatens to destabilize progress towards pay equity if it is not addressed. The importance of making this intervention now is underlined by the rapidly growing stream of literature exploring the embedded stereotypes and bias in data, artificial intelligence and new technologies. While technologies are tools created for change, a full appreciation of the change that is desired should inform that creation, or existing inequalities will again be reproduced.

Finally, invalidated regulatory approaches need to be updated to ensure that inaction surrounding new work formations does not further embed inequalities. This in turn may help enable opportunities that may arise through new forms of working and the productivity gains associated with them. Given the G20 commitment to reducing pay gaps and addressing inequality, the disruptions described could and should be utilized for the potential they hold.

Covid-19 has intensified the speed of change to the world of work. In so doing it has exposed the potential for inequality to deepen. The threats and opportunities discussed mark the need for readiness in the face of change to ensure that women can thrive in the workplaces of the future. Given the exponential speed of technological innovation, an

ability to be alert and respond to emerging issues is vital. As such, the requirement for a robust agenda that ensures gender equality tools are used, is paramount. Recognizing and understanding the projections described here through a gender lens will help to build collective understanding and consciousness of the varied inequalities that change will prompt.

This will be of particular relevance in the UK, as without exposure to key EU actors and the framework to benchmark against, the focus on gender equality may be deprioritized. The practicalities and costs of both Brexit and Covid have subsumed the UK government and workings of parliament, occupying national budgets and diverting attention from their Industrial Strategy (Partington and Inman, 2018; HM Government, 2017). The post 2007/8 financial crisis austerity measures, effectively deprioritized efforts directed at targeting inequalities, and this may be set to continue (Guerrina and Masselot, 2018; Macleavy, 2018; Rubery, 2015). It can be anticipated that the UK will fare less well in terms of gender impacts as a consequence of the 4IR and coronavirus. A continuation of EU / UK comparative analysis will provide a useful indication of the invaluable resource that peer review, soft law and hard law approaches provide, to those countries within the EU. The oversight that the EU affords through this period of change, through processes like the intergovernmental role of the Open Method of Communication, alongside gender mainstreaming, will be invaluable. The application of a gender agenda to address the jobs, skills and regulatory changes needed for the future of work, should ensure that these are not peripheral processes, but core elements accompanied by targeted efforts to shape an inclusive path to equality.

## References

**ADAMS, R. & KIRCHMAIER, T. 2016.** Women on Boards in Finance and STEM Industries. *The American Economic Review*, 106, 277-281.

**ALBERTI, G. 2016.** Mobilizing and Bargaining at the Edge of Informality: The “3 Cosas Campaign” by Outsourced Migrant Workers at the University of London: Mobilizing and Bargaining at the Edge of Informality. *Working USA*, 19, 81-103.

**ANDERS, C. & BIEBELER, H. 2015.** Membership Growth and Political Influence. *IW-Trends*, 1. Available at: Setting the record straight: How record employment has changed the UK. Resolution Foundation (accessed 14/12/20).

**ARNTZ, M., GREGORY, T. & ZIERAHN, U. 2016.** The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis. *OECD Social, Employment, and Migration Working Articles*, 50, 0\_1- 5,7-34.

**AUTOR, D. H. & DORN, D. 2013.** The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market. *American Economic Review*, 103, 1553-1597.

**BEIS 2018.** Trade Union Membership: Statistical Bulletin. London: BEIS. Available at: Trade union membership 2018: statistical bulletin (publishing.service.gov.uk) (accessed 14/12/20).

**BELL, T. & GARDINER, L. 2019.** Feel poor, work more: Explaining the UK's record employment. London: Resolution Foundation. Available at: Feel poor, work more. Resolution Foundation (accessed 14/12/20).

**BITC 2018.** Equal Lives: Parenthood and caring in the workplace. Equal Lives Research. London: Business in the Community. Available at: Equal Lives: Parenthood and Caring In The Workplace (bitc.org.uk) (accessed 14/12/20).

**BLAU, F. & KAHN, L. 2003.** Understanding International Differences in the Gender Pay Gap. *Journal of Labor Economics*, 21, 106-144.

**BOOTH, R. 2019.** Four-day week: trial finds lower stress and increased productivity. *The Guardian*, 19 February 2019. Available at: Four-day week: trial finds lower stress and increased productivity Work-life balance, *The Guardian* (accessed 14/12/20).

**BOOTH, R. & HOLMES, M. 2019.** String of British firms switch over to four-day working week. The Guardian, 12 March 2019. Available at: String of British firms switch over to four-day working week, World news, The Guardian (accessed 14/12/20).

**BREWER, M., COMINETTI, N., HENEHAN, K., MCCURDY, C., SEHMI, R. & SLAUGHTER, H. 2020.** Jobs, jobs, jobs: Evaluating the effects of the current economic crisis on the UK labour market. London: Resolution Foundation. Available at: Jobs, jobs, jobs, Resolution Foundation (accessed 14/12/20).

**BROUGHTON, A. 2010.** Work-related stress. In: IES (ed.) Health and well-being at work. Dublin: Eurofoundpean Foundation for the Improvement of Living and Working Conditions. Available at: Work-related stress (europa.eu) (accessed 14/12/20).

**BROUGHTON, A. 2011.** Reconciliation of work, private and family life in the European Union. Dublin: European Foundation for the Improvement of Living and Working Conditions. Available at: Microsoft Word - EU1101011D.docx (europa.eu) (accessed 14/12/20).

**BRUSSEVICH, M., DABLA-NORRIS, E., KAMUNGE, C., KARNANE, P., KHALID, S. & KOCHHAR, K. 2018.** Gender, Technology, and the Future of Work. IDEAS Working Article Series from RePEc. Available at: <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2018/10/09/Gender-Technology-and-the-Future-of-Work-46236> (accessed 14/12/20).

**BUCKLEY, S. 2019.** Work-related stress, anxiety or depression statistics in Great Britain, 2019. In: HSE (ed.). London: HSE Available at: Work-related stress, anxiety or depression statistics in Great Britain, 2019 (hse.gov.uk) (accessed 14/12/20).

**BUGHIN, J., HAZAN, E., LUND, S., DAHLSTROM, P., WEIESINGER, A. & SUBRAMANIAM, A. 2018.** Skill Shift: Automation and the Future of the Workforce. Brussels: Mckinsey Global Institute. Available at: <https://www.mckinsey.com/featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce#> (accessed 14/12/20).

**BUOLAMWINI, J. & GEBRU, T. 2018.** Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification. Proceedings of Machine Learning Research, 81, 15.

**CARUSO, L. 2018.** Digital innovation and the fourth industrial revolution: epochal social changes? AI & Soc, 33, 379-392.

**CHOTE, R., NICKELL, S. & PARKER, G. 2015.** Welfare trends report: June 2015. In: RESPONSIBILITY, O. F. B. (ed.). Office of Budget Responsibility. London: HMSO. Available at: <https://obr.uk/wtr/welfare-trends-report-june-2015/> (accessed 14/12/20).

**CLARKE, S. & COMINETTI, N. 2019.** Setting the record straight: How record employment has changed the UK. London: Resolution Foundation. Available at: Setting the record straight: How record employment has changed the UK • Resolution Foundation (accessed 14/12/20).

**CONAGHAN, J. 2020.** Covid-19 and Inequalities at Work: A Gender Lens. Futures of Work.

**CONNOLLY, H. & SELLERS, B. 2017.** Trade unions and migrant workers in the UK: Organising in a cold climate. In: MARINA, S., ROOSBLAD, J. & PENNINX, R. (eds.) Trade Unions and Migrant Workers: New Contexts and Challenges in Europe. Cheltenham: Edward Elgar.

**CRADDOCK, E. 2017.** Caring About and For the Cuts: a Case Study of the Gendered Dimension of Austerity and Anti-austerity Activism. *Gender, Work & Organization*, 24, 69-82.

**CRAIG, L. & CHURCHILL, B. 2020.** Dual-earner parent couples' work and care during COVID-19. *Gender, work, and organization*. Available at: <https://doi.org/10.1111/gwao.12497> (accessed 14/12/20).

**CRIADO-PEREZ, C. 2019.** Invisible women: data bias in a world designed for men, New York, Harry N. Abrams.

**CROFT, J. 2019.** Women fight for equal pay at supermarkets. *Financial Times*, 16 June 2019. Available at: <https://www.ft.com/content/73dd0976-83d4-11e9-b592-5fe435b57a3b> (accessed 14/12/20).

**DACHS, B. 2018.** The impact of new technologies on the labour market and the social economy. European Parliamentary Research Service. Document PE 604.539. Brussels: Publications Office of the European Union. Available at: [https://www.europarl.europa.eu/RegData/etudes/STUD/2018/614539/EPRS\\_STU\(2018\)614539\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2018/614539/EPRS_STU(2018)614539_EN.pdf) (accessed 14/12/20).

**DANNENBERG, P., FUCHS, M., RIEDLER, T. & WIEDEMANN, C. 2020.** Digital Transition by COVID-19 Pandemic? The German Food Online Retail. *Tijdschrift voor economische en sociale geografie*, 111, 543-560.

**DAVAKI, D. K. 2018.** The underlying causes of the digital gender gap and possible solutions for enhanced digital inclusion of women and girls. Policy Department for Citizens Rights and Constitutional Affairs. Document PE 604.940. Brussels: Publications Office of the European Union. Available at: [https://www.europarl.europa.eu/Reg-Data/etudes/STUD/2018/604940/IPOL\\_STU\(2018\)604940\\_EN.pdf](https://www.europarl.europa.eu/Reg-Data/etudes/STUD/2018/604940/IPOL_STU(2018)604940_EN.pdf) (accessed 14/12/20).

**DEAKIN, S., FRASER BUTLIN, S., MCLAUGHLIN, C. & POLANSKA, A. 2015.** Are litigation and collective bargaining complements or substitutes for achieving gender equality? A study of the British Equal Pay Act. *Cambridge Journal of Economics*, 39, 381-403.

**DESI 2019a.** Digital Economy and Society Index. 2019 ed. Brussels: Publications Office of the European Union.

**DESI 2019b.** Human Capital: Digital Inclusion and Skills. 2019 ed. Brussels: Publications Office of the European Union.

**DESI 2020.** Digital Economy and Society Index 2020: Human capital. Brussels: Publications Office of the European Union. Available at: <https://ec.europa.eu/digital-single-market/en/digital-economy-and-society-index-desi> (accessed 14/12/20).

**DUKE, S. 2019.** Women lag behind men in the race for tomorrow's jobs. But one skill could close the gender gap. Geneva: World Economic Forum. Available at: [Women lag behind men in the race for tomorrow's jobs. But one skill could close the gender gap, World Economic Forum \(weforum.org\)](https://www.weforum.org/articles/2019/02/20/women-lag-behind-men-in-the-race-for-tomorrows-jobs-but-one-skill-could-close-the-gender-gap/) (accessed 14/12/20).

**DWP 2019.** Informal carers and employment: summary report of a systematic review. London: HMSO. Available at: [Informal carers and employment: summary report of a systematic review - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/421112/informal-carers-and-employment-summary-report-of-a-systematic-review.pdf) (accessed 14/12/20).

**EDEN, C. 2017.** Gender, Education and Work: Inequalities and Intersectionality. London: Taylor & Francis Ltd.

**FELSTEAD, A. & REUSCHKE, D. 2020.** Homeworking in the UK: Before and During the 2020 Lockdown. Cardiff: Wales Institute of Social and Economic Research, Data and Methods. Available at: [Homeworking in the UK: Before and During the 2020 Lockdown | WISERD](https://www.wiserd.ac.uk/wp-content/uploads/2020/07/Homeworking-in-the-UK-Before-and-During-the-2020-Lockdown.pdf) (accessed 14/12/20).

**FREDMAN, S. 2004.** Women at Work: The Broken Promise of Flexicurity. *Industrial Law Journal*, 33, 299-319.

**FREY, C. & OSBORNE, M. 2017.** The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, 114, 254-269, 278-280.

**FUTURE, G. 2018.** 100,000 carers missing: How ending free movement could spell disaster for elderly and disabled people. A Global Future Report August 2018. London: Global Future. Available at: [GF-Social-care-report.pdf](#) ([ourglobalfuture.com](#)) (accessed 14/12/20).

**GEO 2018.** Reducing the gender pay gap and improving gender equality in organisations: Evidence-based actions for employers. London: HMSO Available at: [Actions to close the gender pay gap - Gender pay gap service](#) ([gender-pay-gap.service.gov.uk](#)) (accessed 14/12/20).

**GOOS, M. & MANNING, A. 2007.** Lousy and Lovely Jobs: The Rising Polarization of Work in Britain. *The Review of Economics and Statistics*, 89, 118-133.

**GRÖNLUND, A. & MAGNUSSON, C. 2016.** Family-friendly policies and women's wages - is there a trade-off? Skill investments, occupational segregation and the gender pay gap in Germany, Sweden and the UK. *European Societies*, 18, 91-113.

**GUERRINA, R. & MASSELOT, A. 2018.** Walking into the Footprint of EU Law: Unpacking the Gendered Consequences of Brexit. 17, 319-330.

**HENDY QC, L. J. 2020.** The gaps in the government's coronavirus income protection plans. Liverpool: IER. Available at: [The gaps in the government's Coronavirus income protection plans - IER](#) (accessed 14/12/20).

**HENN, S. 2014.** What Happened to Women in Computer Science. *PlanetMoney* [Online]. Available at: [When Women Stopped Coding : Planet Money : NPR](#) (accessed 14/12/20).

**HICKS, M. 2018.** Programmed inequality: how Britain discarded women technologists and lost its edge in computing. Cambridge, London: MIT Press.

**HMGOVERNMENT 2017.** Industrial Strategy: building a Britain fit for the future. Industrial Strategy White Article. London: HMSO. Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf) (accessed 14/12/20).

**HMGOVERNMENT 2018.** Good Work: A response to the Taylor Review of Modern Working Practices. Industrial Strategy. London: HMSO. Available at: [Good Work](#) ([publishing.service.gov.uk](#)) (accessed 14/12/20).

**HOCHSCHILD, A. R. 2003.** The second shift, New York: Penguin Books.

**HOWCROFT, D. & RUBERY, J. 2018.** Gender equality prospects and the fourth industrial revolution. In: Neufeind, M., O'Reilly, J. & Ranft, F. (eds.) *Work in the Digital Age: Challenges of the fourth industrial revolution*. London: Rowman & Littlefield.

**HOWCROFT, D. & RUBERY, J. 2019.** 'Bias in, Bias out': gender equality and the future of work debate. *Labour & Industry: a journal of the social and economic relations of work*, 29, 213-227.

**HUDSON, B. 2017.** Will 2018 be the year the adult social care market in England collapses? *Research, Policy and Planning*, 33, 27-34.

**HUWS, U., SPENCER, N. H., SYRDAL, D. S. & HOLTS, K. 2017.** *Work in the European Gig Economy: Research results from the UK, Sweden, Germany, Austria, the Netherlands, Switzerland and Italy*. Hertfordshire: FEPS, UNI Europa & University of Hertfordshire. Available at: [Huws\\_U.\\_Spencer\\_N.H.\\_Syrdal\\_D.S.\\_Holt\\_K.\\_2017\\_.pdf](#) (herts.ac.uk) (accessed 14/12/20).

**JAEHRLING, K., WAGNER, I. & WEINKOPF, C. 2016.** *Reducing precarious work in Europe through social dialogue: The case of Germany*. Duisburg-Essen: European Commission.

**JANDRIĆ, M. & RANĐELOVIĆ, S. 2018.** Adaptability of the workforce in Europe – changing skills in the digital era. *Zbornik Radova Ekonomski Fakultet u Rijeka*, 36, 757-776.

**KRAMER, V., PAPAZOVA, I., THOMA, A., KUNZ, M., FALKAI, P., SCHNEIDER-AXMANN, T., HIERUNDAR, A., WAGNER, E. & HASSAN, A. 2020.** Subjective burden and perspectives of German healthcare workers during the COVID-19 pandemic. *European archives of psychiatry and clinical neuroscience*. Available at: <https://pubmed.ncbi.nlm.nih.gov/32815019/> (accessed 14/12/20).

**KRIEGER-BODEN, C. & SORGNER, A. 2018.** Labor market opportunities for women in the digital age. *Economics*, 12, 1-8A.

**LAWRENCE, M., ROBERTS, C. & KING, L. 2017.** *Managing Automation: Employment, inequality and ethics in the digital age*. London: Institute of Public Policy Research. Available at: [Managing automation CEJ \(ippr.org\)](#) (accessed 14/12/20).

**LOHR, S. 2020.** The Pandemic Has Accelerated Demands for a More Skilled Work Force. *The New York Times*, 13 July 2020. Available at: [The Pandemic Has Accelerated Demands for a More Skilled Work Force - The New York Times \(nytimes.com\)](#) (accessed 14/12/20).

**MACLEAVY, J. 2018.** Women, equality and the UK's EU referendum: locating the gender politics of Brexit in relation to the neoliberalising state. *Space and Polity*, 1-19.



**MANDL, I., CURTARELLI, M., RISO, S., VARGAS LLAVE, O. & GEROGIANNIS, E. 2015.** New forms of employment. Research Report. Luxembourg: Eurofound.

**MARISCAL, J., MAYNE, G., ANEJA, U. & SORGNER, A. 2019.** Bridging the Gender Digital Gap. Economics, 13, 1-12.

**MÖNNIG, A., MAIER, T. & ZIKA, G. 2019.** Economy 4.0 – Digitalisation and Its Effect on Wage Inequality. Journal of Economics and Statistics, 239, 363-398.

**NAUDE, W. & NAGLER, P. 2017.** Technological Innovation and Inclusive Growth in Germany. Discussion Article Series. Bonn: IZA Institute of Labour Economics. Available at: Technological Innovation and Inclusive Growth in Germany (iza.org) (accessed 14/12/20).

**NEDELKOSKA, L. & QUINTINI, G. 2018.** Automation, skills use and training. OECD Social, Employment and Migration Working Articles. Paris: OECD. Available at: OECD iLibrary | Automation, skills use and training (oecd-ilibrary.org) (accessed 14/12/20).

**O'NEILL, C. 2016.** Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy, New York, Crown.

**O'REILLY, J. & LEWIS, C. 2018.** Social protection of mainstream and marginal employment in the UK. In: SCHULZE BUSCOFF, K. (ed.). Dusseldorf: WSI Institute of Economic and Social Research. Available at: [https://www.wsi.de/de/faust-detail.htm?sync\\_id=8210](https://www.wsi.de/de/faust-detail.htm?sync_id=8210) (accessed 14/12/20).

**OECD 2017.** Going Digital: The future of work for women. The pursuit gender equality: an uphill battle. Paris: OECD Publishing. Available at: OECD iLibrary | Going digital: The future of work for women (oecd-ilibrary.org) (accessed 14/12/20).

**OECD 2019.** Education at a Glance. OECD Indicators. Paris: OECD. Available at: OECD iLibrary | Education at a Glance 2019: OECD Indicators (oecd-ilibrary.org) (accessed 14/12/20).

**ONS 2016.** Women shoulder the responsibility of 'unpaid work'. London: ONS. Available at: Women shoulder the responsibility of 'unpaid work' - Office for National Statistics (accessed 14/12/20).

**PAPANASTASIOU, S., PAPTAEODOROU, C. & PETMESIDOU, M. 2016.** Child Poverty and intergenerational poverty transmission in the EU: What is the impact of social protection policies and institutions? In: Petmesidou, M., Delamonica, E., Papatheodorou, C. & Henry-Lee, A. (eds.) Child Poverty, Youth (Un)Employment, and Social Inclusion. Stuttgart: Columbia University Press.

**PARTINGTON, R. & INMAN, P. 2018.** Businesses warn that Brexit is delaying industrial strategy. The Guardian, 10 June 2018. Available at: Businesses warn that Brexit is delaying industrial strategy, Business, The Guardian (accessed 14/12/20).

**PAUL, K. 2019.** Microsoft Japan tested a four-day week and productivity jumped by 40%. The Guardian, 4 November 2019. Available at: Microsoft Japan tested a four-day work week and productivity jumped by 40%, Microsoft, The Guardian (accessed 14/12/20).

**PAUL, K. 2020.** Hundreds of Amazon warehouse workers to call in sick in coronavirus protest. The Guardian, 21 April 2020. Available at: Hundreds of Amazon warehouse workers to call in sick in coronavirus protest, Amazon, The Guardian (accessed 14/12/20).

**PEETZ, D. & MURRAY, G. 2019.** Women's employment, segregation and skills in the future of work. Labour & Industry: a journal of the social and economic relations of work, 29, 132-148.

**PERÒ, D. 2020.** Indie Unions, Organizing and Labour Renewal: Learning from Precarious Migrant Workers. Work, employment and society, 34, 900-918.

**PERRETT, R. & LUCIO, M. M. 2009.** Trade Unions and Relations with Black and Minority-Ethnic Community Groups in the United Kingdom: The Development of New Alliances? Journal of ethnic and migration studies, 35, 1295-1314.

**PESOLE, A., URZI BRANCATI, C., FERNANDEZ-MACIES, E., BIAGI, F. & GONZALEX VAZQUEZ, I. 2018.** Platform Workers in Europe. Evidence from the COLLEEM Survey. Luxembourg: Joint Research Centre. Available at: Platform workers in Europe - Publications Office of the EU (europa.eu) (accessed 14/12/20).

**PLOMIEN, A. 2018.** EU Social and Gender Policy beyond Brexit: Towards the European Pillar of Social Rights. Social Policy & Society, 17, 281-296.

**PRIME MINISTERS OFFICE 2020.** Major expansion of post-18 education and training to level up and prepare workers for post-COVID economy. London: HMSO. Available at: Major expansion of post-18 education and training to level up and prepare workers for post-COVID economy - GOV.UK (www.gov.uk) (accessed 14/12/20).

**QUEISSER, M., ADEMA, W. & CLARKE, C. 2020.** COVID-19, employment and women in OECD countries. London: VoxEU. Available at: COVID-19, employment and women in OECD countries | VOX, CEPR Policy Portal (voxeu.org) (accessed 14/12/20).

**QUIROS, C. T., MORALES, E. G., PASTOR, R. R., CARMONA, A.F., IBANEZ, M. S. & HERRERA, U. M. 2018.** Women in the Digital Age. Luxembourg: Publications Office of the European Union. Available at: Increase in gender gap in the digital sector - Study on Women in the Digital Age | Shaping Europe's digital future (europa.eu) (accessed 14/12/20).

**REUSCHKE, D. & FELSTEAD, A. 2020.** Changing workplace geographies in the COVID-19 crisis. *Dialogues in human geography*, 10, 208-212.

**RUBERY, J. 2015.** Austerity and the Future for Gender Equality in Europe. *ILR Review*, 68, 715-741.

**RUBERY, J. 2018.** A Gender Lens on the Future of Work. *Journal of International Affairs*, 72, 91.

**RUBERY, J. & GRIMSHAW, D. 2015.** The 40-year pursuit of equal pay: a case of constantly moving goalposts. *Cambridge Journal of Economics*, 39, 319-343.

**RUEHL, M. & KYNGE, J. 2019.** Fintech: the rise of the Asian 'super app'. *Financial Times*, 12 December 2019. Available at: Fintech: the rise of the Asian 'super app' | *Financial Times* (accessed 14/12/20).

**SAYER, L. C. 2005.** Gender, Time and Inequality: Trends in Women's and Men's Paid Work, Unpaid Work and Free Time. *Social Forces*, 84, 285-303.

**SCHWAB, K. 2016.** The Fourth Industrial Revolution: what it means, how to respond. Geneva: WEF. Available at: The Fourth Industrial Revolution: what it means and how to respond | World Economic Forum (weforum.org) (accessed 14/12/20).

**SIMÓN, H. 2012.** The gender gap in earnings: an international comparison with European matched employer-employee data. *Applied Economics*, 44, 1985-1999.

**SORGNER, A., BODE, E. & KRIEGER-BODEN, C. 2017.** The effects of digitalization on gender equality in the G20 economies. *Women 20 Dialogue*. Kiel: Kiel Institute for the World Economy. Available at: [http://www.w20-germany.org/fileadmin/user\\_upload/documents/20170714-w20-studie-web.pdf](http://www.w20-germany.org/fileadmin/user_upload/documents/20170714-w20-studie-web.pdf) (accessed 14/12/20).

**SPASOVA, S., BAETEN, R., COSTER, S., GHAILANI, D., PENACASAS, R. & VANHERCKE, B. 2018.** Challenges in long-term care in Europe: A study of national policies. European Social Policy Network (ESPN). Brussels: Publications Office of the European Union. Available at: <https://ec.europa.eu/social/main.jsp?langId=en&catId=89&newsId=9185> (accessed 14/12/20).

**STATON, B. 2020.** The upstart unions taking on the gig economy and outsourcing. Financial Times, 19 January 2020. Available at: The upstart unions taking on the gig economy and outsourcing | Financial Times (ft.com) (accessed 14/12/20).

**STRONGE, W. & HARPER, A. 2019.** The Shorter Working Week: A Radical And Pragmatic Proposal. Cranbourne: Autonomy. Available at: Shorter-working-week-docV6.pdf (autonomy.work) (accessed 14/12/20).

**SUMMERS, H. 2020.** UK society regressing back to 1950s for many women, warn experts. The Guardian, 18 June 2020. Available at: UK society regressing back to 1950s for many women, warn experts, Inequality, The Guardian (accessed 14/12/20).

**TAYLOR, M. 2017.** Good Work: The Taylor Review of Modern Working Practices. London: HMSO. Available at: Good work: the Taylor review of modern working practices (publishing.service.gov.uk) (accessed 14/12/20).

**TUC 2020.** Don't let the government cut union learning. London: TUC. Available at: Don't let the government cut union learning, TUC (accessed 14/12/20).

**VANDAELE, K. 2018.** Will trade unions survive in the platform economy? Emerging patterns of platform workers' collective voice and representation in Europe. ETUI Research Article - Working Article 2018.05. Brussels: ETUI. Available at: Will trade unions survive in the platform economy? Emerging patterns of platform workers' collective voice and representation in Europe, etui (accessed 14/12/20).

**VANDAELE, K. 2019.** How can trade unions in Europe connect with young workers? In: O'Reilly, J., Leschke, J., Ortlieb, R., Seeleib-Kaiser, M. & Villa, P. (eds.) Youth Labor in Transition: inequalities, mobility, and policies in Europe. New York: Oxford University Press. 660-688.

**VANDAELE, K., PIASNA, A. & DRAHOKOUPIL, J. 2019.** 'Algorithm breakers' are not a different 'species': attitudes towards trade unions of Deliveroo riders in Belgium. Working Article 2019.06. Brussels: ETUI. Available at: 'Algorithm breakers' are not a different 'species': attitudes towards trade unions of Deliveroo riders in Belgium, etui (accessed 14/12/20).

**WADDINGTON, J. 2015.** Trade union membership retention in Europe: The challenge of difficult times. *European Journal of Industrial Relations*, 21, 205-221.

**WEF 2016.** The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. *Global Challenges Insight Report*. Geneva: World Economic Forum. Available at: [WEF\\_Future\\_of\\_Jobs.pdf](#) (weforum.org) (accessed 14/12/20).

**WEF 2018a.** Digital Transformation Initiative. Geneva: World Economic Forum. Available at: [reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/dti-executive-summary-20180510.pdf](#) (accessed 14/12/20).

**WEF 2018b.** The Future of Jobs Report. *Insight Report*. Geneva: World Economic Forum. Available at: [WEF\\_Future\\_of\\_Jobs\\_2018.pdf](#) (weforum.org) (accessed 14/12/20).

**WEF 2018c.** The Global Gender Gap Report. *Insight Report*. 13th ed. Geneva: World Economic Forum. Available at: <https://www.weforum.org/reports/the-global-gender-gap-report-2018> (accessed 14/12/20).

**WEF 2019.** Global Gender Gap Report 2020. *Insight Report*. Geneva: World Economic Forum. Available at: [http://www3.weforum.org/docs/WEF\\_GGGR\\_2020.pdf](http://www3.weforum.org/docs/WEF_GGGR_2020.pdf) (accessed 14/12/20).

**WEF 2020.** Global Risks Report 2020. 15th edition. Geneva: World Economic Forum. Available at: [www3.weforum.org/docs/WEF\\_Global\\_Risk\\_Report\\_2020.pdf](http://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf) (accessed 14/12/20).

**WEIL, D. 2019.** Understanding the Present and Future of Work in the Fissured Workplace Context. *The Russell Sage Foundation Journal of the Social Sciences*, 5, 147-165.

**WELLNER, G. & ROTHMAN, T. 2019.** Feminist AI: Can We Expect Our AI Systems to Become Feminist? *Philosophy & Technology*, 1-15.

**WHITE, S., LACEY, A. & ARDANAZ-BADIA, A. 2019.** The probability of automation in England: 2011 and 2017. *People in work*. London: ONS. Available at: [The probability of automation in England - Office for National Statistics \(ons.gov.uk\)](#) (accessed 14/12/20)

**WID 2019a.** Women in Digital Scoreboard 2019: Germany. Luxembourg: Publications Office of the European Union. Available at: <https://ec.europa.eu/digital-single-market/en/scoreboard/germany> (accessed 14/12/20).

**WID 2019b.** Women in Digital Scoreboard 2019: United Kingdom. Luxembourg: Publications Office of the European Union. Available at: <https://ec.europa.eu/digital-single-market/en/scoreboard/united-kingdom> (accessed 14/12/20).

**WONG, J. C. 2020.** Coronavirus divides tech workers into the 'worthy' and 'unworthy' sick. The Guardian, 12 March 2020. Available at: [Coronavirus divides tech workers into the 'worthy' and 'unworthy' sick, Coronavirus, The Guardian](#) (accessed 14/12/20).

**WOOD, A. J., GRAHAM, M. & ANWAR, M. A. 2020.** Minimum wages for online labor platforms? Regulating the global gig economy. In: LARSSON, A. & TEIGLAND, R. (eds.) The digital transformation of labor : automation, the gig economy and welfare. London: Routledge.

**WOOD, J. 2020.** COVID-19 has worsened gender inequality. These charts show what we can do about it. Geneva: World Economic Forum. Available at: [How has COVID-19 affected gender inequality? | World Economic Forum \(weforum.org\)](#) (accessed 14/12/20).

**YASENOV, V. I. 2020.** Who Can Work from Home? Discussion Article Series. Bonn: IZA Institute of Labor Economics. Available at: <https://ssrn.com/abstract=3590895> (accessed 14/12/20).

**ZAHN, R. 2019.** Trade unions, the gig economy and the feminisation of work. In: Blackham, A., Kullmann, M. & Zbyszweska, A. (eds.) Theorising Labour Law in the Changing World: Towards Inclusive Labour Law. West Sussex: Hart Publishing.

**ZOCH, G., BACHMANN, A.-C. & VICARI, B. 2020.** Care-arrangements and parental well-being during the Covid-19 pandemic in Germany. LIFBI Working Articles. Bamberg: Leibniz Institute for Educational Trajectories. Available at: <https://doi.org/10.5157/LifBi:WP91:2.0> (Accessed 14/12/20).

#### Imprint

Publisher: Hans-Böckler-Stiftung  
Georg-Glock-Str. 18, 40474 Düsseldorf, Germany  
WSI Study is an online publication series available at: <https://www.wsi.de/de/15341.htm>

Authors:  
Rachel Verdin  
ESRC Digital Futures at Work Research Centre,  
University of Sussex Business School  
[r.f.m.lyons@sussex.ac.uk](mailto:r.f.m.lyons@sussex.ac.uk)

Jacqueline O'Reilly  
ESRC Digital Futures at Work Research Centre,  
University of Sussex Business School  
[j.o.-reilly@sussex.ac.uk](mailto:j.o.-reilly@sussex.ac.uk)

The views expressed in this paper do not necessarily reflect those of the WSI or the Hans-Böckler-Foundation.

All rights reserved. Reproduction for educational and non-commercial purposes is permitted provided that the source is acknowledged.

Study (Internet) ISSN 2367-0827