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The challenges and opportunities in the digitalisation of production

In recent years two types of digitalisation have sparked fears amongst policy-makers in the EU and beyond about the future of work. The first is what might be termed the *digitalisation of production* and epitomised by *Industrie 4.0*. The second involves the digitalisation of work, sometimes referred to as *gig work* based on *Uberisation*.

In different ways, both developments are important for both the volume and quality of jobs (Warhurst et al. 2019). However this chapter focuses on the first development – the digitalisation of production and its exemplar, *Industrie 4.0*. This singular focus is adopted because it is said to be at the forefront of a new 4th Industrial Revolution (WEF, 2017).

In the context of the 4th Industrial Revolution, the chapter first outlines what is meant by the digitalisation of production and *Industrie 4.0*. It then highlights some of the opportunities and challenges that they present. The following section then describes how EU policy is currently responding to these opportunities and challenges before making recommendations about how policy might be developed to ensure that the opportunities can be extended to all in the EU.

1 Digitalisation of production

Any technological revolution disrupts the economy and society but is capable of providing long-term development benefits (Perez, 2002). Strange to say that there is no consensus about which industrial Revolution is currently occurring. For some it is the 2nd, for others an extension of the 3rd and for yet others already the 5th or 6th. That it might be the 4th Industrial Revolution was popularised by Schwab (2016) via the World Economic Forum. The term is used as

shorthand to describe the new digital technology. This technology is general purpose and can transform all aspects of our lives: the way we buy, sell, network, communicate, participate, create, consume and, of course, the way we work (Meil and Kirov, 2017).

The term *Industrie 4.0* was first used in Germany in 2011 and was positioned as a strategy to modernise and make more competitive the country's manufacturing sector (EC, 2017). According to German Chancellor Angela Merkel, *Industrie 4.0* is “the comprehensive transformation of the whole sphere of industrial production through the merging of digital technology and the internet with conventional industry” (quoted in Davis, 2015: 2). It is also sometimes referred to simply as the “smart factory”. Significantly, it has not only become emblematic of the 4th Industrial Revolution (WEF, 2017) but also spread out of Germany to become global and beyond manufacturing to be applied to services.

As a form of the digitalisation of production, it involves a cyber-physical system of machines and humans, with Artificial Intelligence (AI) and advanced automation combined with big data, the internet of things and ever-increasing computer power. Although there are definitional problems and, as yet, there are few pure forms, even in Germany, *Industrie 4.0* has a number of agreed features:

- Application of information and communication technology (ICT) to digitise information and integrate systems across the whole production system within and outwith the host company
- Cyber-physical systems that use ICTs to monitor and control physical processes and systems such as embedded sensors and intelligent robots that can

configure themselves as product needs arise

- Use of network communications that link machines, products, systems and people both within the factory and out-with the factory amongst suppliers and distributors
- Simulation, modelling and virtualisation in the design of products and the establishing of manufacturing processes
- Collection, analysis and exploitation of vast quantities of data from within and outwith the factory
- ICT-based support for workers using augmented reality and intelligent tools (Davis, 2015)

This digitalised production system has become the inspiration and aspiration for both the EU and many of its Member States.

2 The opportunities and challenges

In assessing the impact these technologies have on organisation and employment, two main views dominate. On the one hand, the optimists see technology supporting new organisational forms with increased flexibility, reduced production time and enhanced productivity and growth. Organisations are transformed into smart producers of goods and services. With massively enhanced computer processing power, information and systems are integrated across the whole value chain including suppliers, distributors, contractors and customers. Customers can suggest bespoke products, which can be produced quickly (Davies, 2015). Processes are monitored and controlled and configured as product and production needs arise, with workers using augmented reality and intelligent tools. Furthermore, the vast quantities of data from these systems, activities and networks are collated and analysed for further commercial exploitation.

Moreover, combined with the emergence of big data, the internet of things and ever-increasing computer power, robotisation is *clever*. These robots do not just work continuously as they did in the past. Now, they are able to learn, machine from machine, and so adapt to be more efficient at these tasks. These technologies both enable production to become autonomous and offer opportunity to integrate the conception, production and consumption of goods and services. Digitalisation thus makes production of goods and services more efficient. Opportunities for more and better economic growth therefore beckon.

On the other hand, the technology pessimists worry that there will be massive job losses with increased social exclusion, and reduced job quality for remaining workers. The clever robots can undertake both physical (manual) tasks and, increasingly, cognitive (mental) tasks. In doing so, they can substitute human labour. The outcome is the end of (paid) work and mass redundancies. Triggered by the influential report by Carl Frey and Michael Osborne (2013) which claimed that up to 47% of jobs in the US were at risk of eradication, a raft of publications quickly followed. Although citing different numbers, all contained the same message: significant job losses will occur – what has been called “robo-geddon” in a 2019 review from the Welsh Government. If economic growth occurs, it could be without employment. Existing concerns that the distribution of value generated by firms is draining away from workers and being consolidated in the hands of management and shareholders are compounded by this fear of technology-driven mass unemployment. If wages are a key distributor of wealth from production, with fewer people in work,

even if more wealth is created from the new technologies, less of it will be spread around, creating exclusion, poverty and even political unrest.

Even if paid work remains, there are other challenges. The new production system could lead to polarised workplaces with a small number of high-skilled workers designing, introducing and maintaining the digital technologies, and low-skilled other workers either being left with only monotonous tasks for which technological substitution would be too expensive or sidelined into machine-minding, simply overseeing machines that do the work. The digital illiteracy that exists amongst some types of workers and regions within the EU (EC, 2015) could become entrenched. There are also concerns that the new technologies will create new psychological strains as humans are subordinated to intense machine surveillance that intrusively monitors workers' behaviour and impersonally measures and evaluates their performance, sometimes in discriminatory ways (e.g. Eurofound, 2016).

To try to get the balance right between the opportunities and challenges, the German Federal Ministry of Labour and Social Affairs (2017) argues that policy has to avert a techno-centric future in which machines make the decisions without human consideration. Instead, the Ministry argues, the future has to be human-centric in which people make decisions for people.

3 How is the EU responding?

Despite this call for a human-centric approach to the 4th Industrial Revolution, much current policy thinking is based on the new technology determining the future, assuming that the predictions will simply translate into socio-economic reality. Policy is then shaped to

that assumed reality. In this respect, two main policy positions can be identified, one a feature of mainstream politics, the other of more radical politics (Warhurst and Hunt, 2019).

The first policy position, evident in mainstream politics, recognises and worries about mass unemployment. It offers two approaches to policy: one more conservative, the other more ground-breaking.

The more conservative response rests on workers needing help to adjust to the new circumstances. The solution offered is to develop policies that, firstly, will ensure the employability of workers in what will become a highly competitive labour market and, secondly, help regions adjust by creating jobs that are less at risk of technological substitution. A number of policy prescriptions follow from the OECD, ILO and European Commission that, in effect, seek to shape welfare broadly defined around the anticipated mass unemployment (e.g. OECD, 2017; ILO, 2017; EPSC, 2016). Active labour market policies are needed to support workers displaced by digital technology to find new jobs. Social protection needs to include income support and re-employment assistance. Enhanced skill policies need to focus on both digital literacy and soft skills such as problem-solving. Schools and university curricula need to focus more on STEM subjects, human interaction and employability. Lifelong learning opportunities need to update workers' skills over their working lives. Big Data could be used to monitor skills demands and changing occupational compositions to enable better career advice and guidance. To aid regional development, entrepreneurship skills are needed to help create new jobs in sunrise industries. The call for Industrie 4.0 itself typically suggests a vertical policy for

support of traditional manufacturing industries to enable digital changeover.

The more ground-breaking response argues that if growing poverty and social inequalities are to be avoided, welfare will need to be more drastically redesigned. It will mean entitlement aligning within individual needs rather than jobs or unemployment. Residual work could be distributed across the workforce, with workers again supported by digital, soft skills and other types of training. For periods between work, welfare support will again be needed as a safety net. However this welfare would be based on explicit redistribution policies, delivering a guaranteed minimum income level financed through robot (including algorithm) taxes. In addition, a minimum level of employment protection would be introduced for all workers (e.g. Berg et al., 2018; OECD, 2017; Ojanpera et al., 2018). Going further, some argue that Industrie 4.0 requires a new social contract with improved worker consultation and participation (e.g. Davies, 2015). Such arguments resonate with calls for new minimum standards of job quality and which might even extend along global value chains. New cooperative ownership models or sustainable ownership models might also be encouraged to give workers a voice in business development, a fairer share of the gains and provide location-specific benefits.

To varying extents, what is being suggested in this first position are versions of flexicurity for the digital age. Safety nets for workers between jobs are to be created and transitions for workers to new jobs are to be enabled. These jobs should be good jobs. The underlying principle is that workers, welfare and regions need to accept and adjust to the changes that are coming.

The hope is that fear of digitalisation would be eradicated and public support for the impending changes secured.

The second, more radical position rests on a post-work scenario, and tends to be argued outwith mainstream policy circles. Proponents of this position do not see the point of safety nets and transitions. They do not seek to adjust work and tinker with welfare but instead want to realise the full potential of the new digital technology to eradicate not redistribute work. They advocate the end of all paid work and see a new welfare society replacing capitalist society. Claiming that paid work is exploitative and dehumanising, they call for full unemployment to be adopted as policy. Humans would be liberated as a consequence. The robots would create value still; indeed they are needed to maximize the productive capacity of digital technology. The wealth created would then be redistributed to all through a *universal basic income (UBI)*. This UBI would go beyond the provision of minimum needs intended to sustain workers between jobs and support them into new jobs. Instead, it would provide for all life's needs. In doing so, it would provide social stability and support outside the wage system and also end the inequalities that are structural features of capitalism. Freed from paid work, humans could then relearn how to be human (e.g. Dunlop, 2016).

The crux of this second position is that work in the future should be done by the clever robots. Policy should focus less on delivering decent jobs but instead on providing decent lives underpinned by a revolution in welfare provision. Whilst unashamedly utopian, this policy position highlights the ultimate possibilities of digitalised production and infuses more radical politics.

4 Ensuring opportunities extend to all in the EU

The two policy positions outlined above emerge from what might be called the first wave of thinking about the digitalisation of production. A new wave of policy thinking is beginning to emerge that is more cautious. It appreciates that, as with all technological change, there is likely to be job creation and job change as well as job loss. However it still needs an evidence base that identifies not just the challenges and opportunities but also the available options for policymakers.

This need for new policy thinking comes at a time when the EU is already concerned about a rise in non-standard work, job polarisation, labour market flexibility and now the likely recession caused by the Coronavirus. The European Commission has introduced the European Pillar of Social Rights to address some of these concerns (EC, 2018). These rights cover equal opportunities and access to the labour market; fair working conditions; and social protection and inclusion. To support these rights, the Commission also wants upward convergence towards better living and working conditions in the EU (Eurofound, 2018).

Thus, in the context of an emerging digital transformation of work and welfare, there is already a clear political desire to develop an inclusive European future that provides decent work and decent lives for all. The key issue is how to deliver that future in ways that maximize the opportunities and mitigate the risks with the digitalisation of production.

To ensure that opportunities of the digitalisation of production extend to all in the EU, policymakers need to recognise that technology is not deterministic. Instead, choices exist in how digital technology is used by firms.

Moreover a role exists for government and other social partners in shaping these choices across sectors, regions and countries. It is exercising these choices that will make the future human-centric, as the German Federal Ministry of Labour and Social Affairs (2017) desires.

The focus of debate also needs to be extended. Current mainstream policy thinking about the digitalisation of production focuses on job losses, the solution to which is supply-side interventions in the labour market, most obviously skill acquisition through education and training. However, it is just as likely that new jobs will be created and residual jobs reconfigured. As part of their deliberations, policymakers therefore also need to focus on the issue of job quality as much as job quantity.

In this respect, whilst the challenges for workers arising from Industrie 4.0 are currently clear, what opportunities exist is less clear. How increased efficiency and productivity for firms translates into mutual gains for workers needs to be made evident. What the benefits are for workers and how they are to be realised requires understanding of the business models of companies and how value is created, captured and then used and distributed (Findlay et al., 2017).

One way to think about these benefits and how they might be accrued for the benefit of all is for government to proactively steer innovation and investment towards particular objectives or missions, for example to enhance the wellbeing of EU citizens (Jacobs and Mazzucato, 2016). Firms digitalising their production could then be encouraged to compete for government funding based on how they help deliver this mission. In doing so, government can have a role in *market shaping* rather than just deal with *market failures*, providing

safety nets to deal with rising inequality. This government role will also be crucial in delivering post-coronavirus economic recovery. At the same time, there is a role for the social partners in negotiating and delivering this mission and within which trade unions and other worker representative organisations can protect and promote the interests of employees and workers – vulnerable or otherwise. As the OECD and ILO (2018) notes, strong labour relations are important in helping to reduce inequality and meet the challenges of the future of work.

Finally, government needs to re-think the design of welfare in the digital

age so that it can shape not just respond to work. Longstanding policy thinking is premised on moulding welfare to work, funded through tax receipts drawn from standard employment relationships, maximising employment participation and business models in which revenues and revenues streams are transparent. The digitalisation of production is a challenge to the standard employment relationship. Governments need to rebalance labour markets and, with it, the welfare of citizens if the debate about the digitalisation of production is to turn from fear to favour.

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