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AUTOMATION

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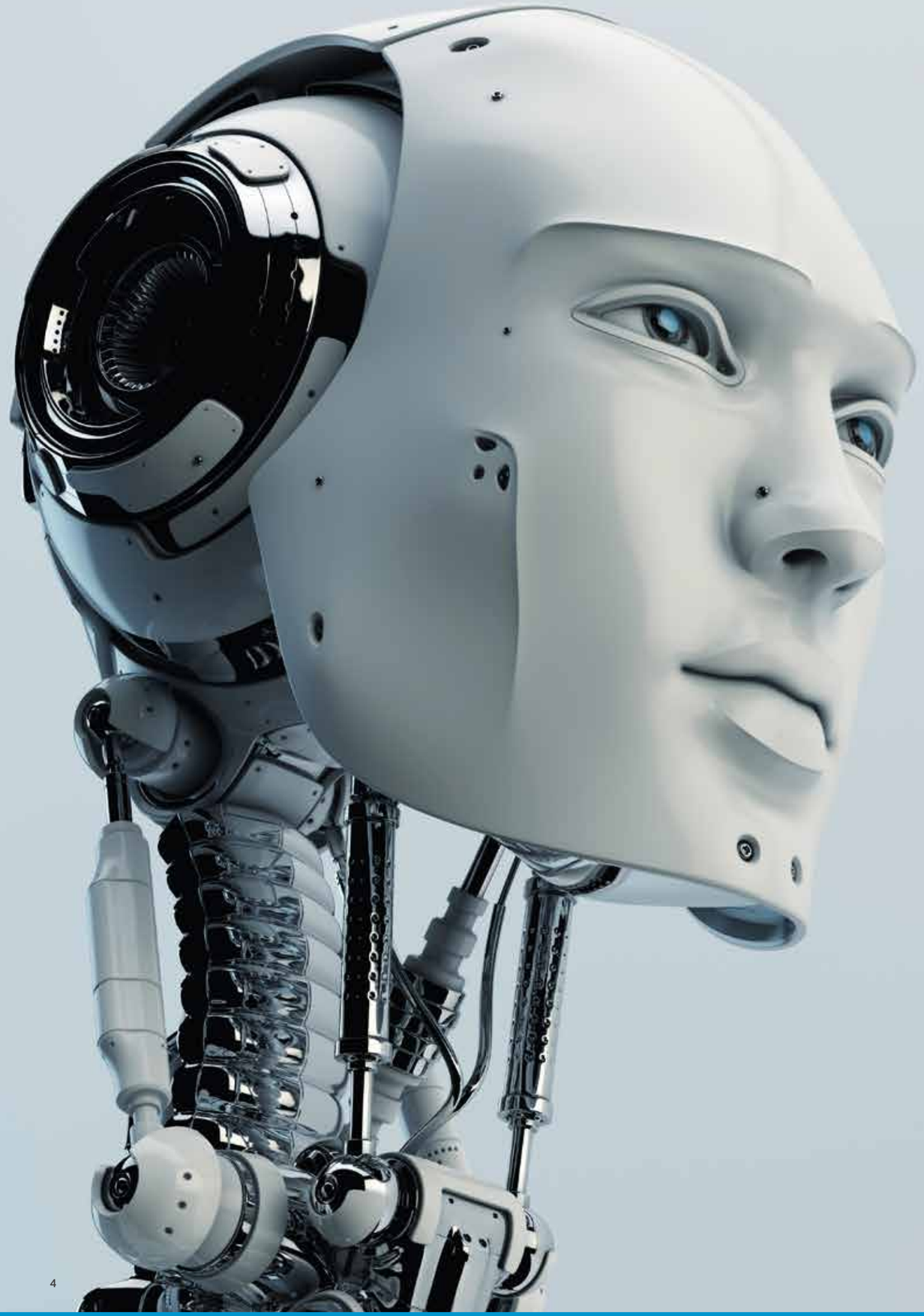

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ARE THE ROBOTS COMING TO TAKE AWAY ALL THE JOBS?

Popularised by Frey and Osborne's 2013 report *The Future of Employment: How susceptible are jobs to computerisation*, there is a belief amongst policymakers that the robots are coming to take our jobs. It the report, Frey and Osborne claimed that 47% of existing jobs will soon disappear. A raft of reports soon followed, often from consultancies such as McKinsey and Deloitte making similar claims but with different numbers (51% and 35% respectively) and also signalling the potential vulnerability of even highly skilled jobs. Whilst it is routine jobs that can easily be defined by a mathematical equation and are most at risk according to John Pugliano in his 2017 book *The Robots are Coming*, no occupation will be unaffected, according to Mark Muro and his colleagues in their 2019 report *Automation and Artificial Intelligence*. The result will be the substitution of human paid work by AI and advanced robotic automation, the outcome of which will be mass unemployment across the advanced economies.

Some countries, such as Germany, have actively embraced this development as part of Industry 4.0 or the next 4th industrial revolution. Centred on its manufacturing sector, Germany promotes a mixture of artificial intelligence (AI) and advanced robotic automation. With this new digital technology, clever robots undertake both manual and mental tasks, and with machine-to-machine communication linking production to customers and suppliers. Sensibly, Germany complements Industry 4.0 with Work 4.0 and policy intended to futureproof the employability of its workforce and avoid the social disruption that mass job losses would bring. What's interesting however is that even in Germany, the home of Industrie 4.0, only around 20 per cent of manufacturing companies have interconnected IT systems to control their production process. The question arises therefore about the accuracy of claims about technological mass unemployment through AI and advanced automation.

The starting point to any analysis has to be recognition that we have been here before. For example, in 1979, Clive Jenkins, the leader of the UK's Association of Scientific, Technical and Managerial Staffs, published *The Collapse of Work*. In it, he and his co-author Barrie Sherman argued that by the mid-1980s micro-chips would wipe out most jobs, leaving only software and technical workers to operate highlight automated companies. Academics in universities and polytechnics would be needed to train these workers and, for the enlightenment and entertainment of those without work, poets and clowns respectively would exist. However this collapse of work would be welcomed, they claimed, because most jobs were awful, just plain drudgery. 'It is an occasion for hope, not despair,' they said. The mass of the population, with their new non-working lives, would be supported by a welfare system paid for by the profits of the more efficient, more productive automated companies, they asserted.

Of course, it didn't happen. Instead of the collapse of work in the 1980s, by the 1990s a cult of work had gripped the UK according to Harriet Bradley and her colleagues in their 2001 book *Myths at Work*. This cult, it might also be said, was evident in the rest of the European Union and continues today in its efforts reduce unemployment and raise employment participation levels. The problem is that most claims about the impact of new technology – digital or otherwise – are based on forecasts based on economistic modelling or are simply predictions. Some, including that of Frey and Osborne also throw in some guesswork, even if it's sophisticated guesswork. Little empirical data exists.

To address this gap, with colleagues at my institute at the University of Warwick in the UK, I was commissioned to undertake a new survey of senior managers on behalf of the representative body for human resource professionals in the UK – the Chartered Institute for Personnel & Development (CIPD). The survey covered more than 750 UK organisations in the private, public and voluntary sectors that have invested in digital technology in the past five years. It explores who was involved in decisions about the introduction and implementation of the technology, the impact of the technology on the business of the organisation and its employees, and any further plans for investments in new technology in the next two years.

The findings focus on two types of AI and advanced automation: that for physical tasks and that for cognitive tasks. Those findings reveal a more mixed set of job outcomes in companies that have already invested in digital technology. While around two-fifths (40%) of the organisations introducing AI reported job losses, nearly half (48%) reported no job losses. In terms of job creation, just over two-fifths (43%) of organisations reported that jobs had been created. Of those organisations reporting job creation, two-fifths indicated that these jobs were mostly high-skilled and less than one in ten indicated that the jobs created were mostly low skilled. Of organisations reporting job elimination, more than two-fifths indicated that the jobs were mostly low skilled, see Table 1 below. On balance, it seems that AI may be more likely to eradicate lower-skill jobs and create higher-skilled jobs.

TABLE 1

Job loss and job creation in UK firms introducing AI and automation

	AI for physical and/or cognitive tasks
Has the introduction of the technology created any jobs in your organisation?	
Yes	43.0
No	44.1
Don't know	13.0
Base, N (unweighted)	226
What skill level were these new jobs created?	
Mostly high skilled	38.9
Mostly intermediate skilled	23.9
Mostly lower skilled	9.8
A range of skills levels	27.4
Don't know	0.0
Base, N (unweighted)	98
What skill level were these new jobs created?	
Yes	39.9
No	48.1
Don't know	12.0
Base, N (unweighted)	226
What skill level were the jobs eliminated/replaced?	
Mostly high skilled	29.0
Mostly intermediate skilled	17.3
Mostly lower skilled	44.2
A range of skills levels	9.5
Don't know	0.0
Total	100
Base, N (unweighted)	95

Note: In some cases organisations may have experienced both job creation and job destruction as a consequence of the introduction of AI.

There is, however, differing impact on cognitive and physical tasks. Bearing in mind that the same organisation can shed some jobs but create others, the findings reveal that the net effect on the number of jobs in the organisation depended on the type of AI introduced. Equipment using AI for physical tasks led to a net increase in jobs in 39% of organisations but a decrease in 21% of organisations; software using AI for cognitive tasks led to a net increase in 31% of organisations but a decrease in 28% of organisations. What is also important to note from the findings is that job security increased. Jobs became more secure in more than two-fifths (44%) of organisations but less secure in 18% of organisations introducing AI.

Beyond the sophisticated economistic modelling and bold predictions, it seems that outcomes in real organisations introducing clever robots are more mixed. There is both job loss and job creation, and some increased job security. The future therefore looks less bleak, particularly for high-skilled workers.

So why won't all the jobs be taken by the robots? The answer is complex with multi-level explanation. The first level is that of jobs. Some rule-based – that is, more routine – jobs are more vulnerable to technological substitution. Those jobs that are high-touch – meaning direct and non-routine engagement with people – or require complex reasoning are more secure, as Levy and Murnane noted back in their 2004 book *The New Division of Labour*, reflecting on the first wave of computerisation in the 1980s that Jenkins and Sherman thought would lead to the collapse of work. In addition, there are some jobs that the public or, more specifically, consumers would prefer not to be automated even though the technological capability to do so has long existed, aircraft pilots for example, as Arnold Reiner indicated in his 2016 article for *The Atlantic*. Few people, it seems, want to board a plane that takes off, flies and lands without human guidance.

The organisational level is also important. Managers in organisations weigh up the cost and benefits of introducing AI and automation against other options, for example, the relative cost of labour. Whilst is might be possible to substitute labour with technology, the cost of doing so can be prohibitive, in which case organisations are likely to stick with human not robot workers. For some organisations, such inertia might also reflect a lack of demand for change. In our survey for the CIPD, of those organisations that had not introduced AI and automation over the past five years, 33% said that there was simply no call for it from amongst their customers or clients. Another 20% said that they were just happy with the way things were at the organisation.

Finally the business environment can be an important factor. As consultancy firm McKinsey, for example, recognises, the state of the labour market can influence the adoption of AI and automation by organisations. In loose labour markets, with high unemployment, there tends to be plentiful and cheap workers. In this situation technological substitution is again less likely. In tight labour markets with full employment, few workers are available and the cost of labour tends to rise. If that cost exceeds that of the alternative – technology – then labour substitution is more likely. It is also the case that organisations ability to introduce new technology and use it in particular ways is likely to be mediated by the strength of labour markets institutions as Enrique Fernandez-Macias pointed out in his 2012 article for the *Socio-Economic Review*. Employment protection regulations that make it easy or difficult to hire and fire workers will influence employers' perceptions of the feasibility and desirability of substituting labour with technology, as will the relative strength of trade unions within organisations, across industries and nationally.

Such evidence does not mean that AI and advanced automation is having no impact and will have no impact of jobs. Clearly, as the CIPD survey highlights, change is happening within organisations. However that change is more incremental than radical and it is unlikely that mass unemployment will occur as the result of technology alone. AI and automation are just the latest phase in the long running and uneven transformation of jobs through technology. What the evidence does highlight however is that choices are available in both the introduction and implementation of AI and automation. Technology is never determinant and there is no pre-determined future of work. Rather there are a number of policy options available and it is organisations and governments, not algorithms, that will be making the choices.

The CIPD report, *People and machines: from hype to reality*, was published in April 2019 and can be downloaded at: https://www.cipd.co.uk/knowledge/work/technology/people-machines-report

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LABOUR MARKETS IN THE ERA OF DIGITALISATION

Public discussions on the future of labour in the era of digitalisation are dominated by notions of self-driving cars, factories without workers or fully automatic logistics. This creates fears of mass destruction of jobs and shrinking employment rates in the future. At the same time, it has led to intense debates on an unconditional basic income: While productivity would rise, a substantial drop in the number of jobs would question the income distribution mechanism our working societies are currently built on. This article argues that while replacement of existing jobs – or at least tasks – by technology will happen and has always happened, this is only one side of the coin. The future of labour markets will be more complex.

Employment: No decline, but stronger dynamics

A first assessment can be made by directly asking the firms on the consequences of digitalisation. Figure 1 shows results from a representative business survey in Germany. The respondents believe that digitalisation will increase labour productivity. This means that – all else equal – the same output can be produced with less employment of labour. Thus, the red bar might indeed reflect job substitution. However, companies also expect additional effects on new products, investments, further education, and data protection, among others. Obviously, all the blue items would come with additional tasks and jobs – the other side of the coin.

FIGURE 1

Corporate assessments of the effects of digitalisation

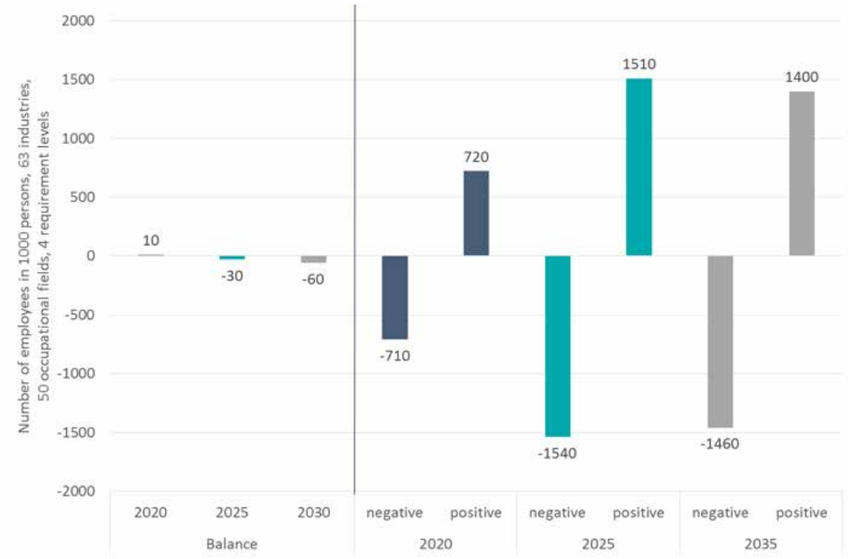
Source: Weber (2017) based on IAB/ZEW business survey "Working World 4.0"

It follows that a realistic assessment of the consequences of digitalisation on the labour market requires taking into account a variety of channels: Jobs disappear, new jobs are created, demands and activities change, production becomes more efficient, new products are created, income is generated and introduced into the economic cycle, labour supply and demand as well as wages and prices are adapted. A simulation study comprehensively analysing these effects of 4.0 digitalisation on the German economy can be found in Wolter et al. (2016).

Figure 2 shows the labour market dynamics that result from a large-scale introduction of economy 4.0. Until the year 2025, one would see a loss of approx. 1.5 million jobs that were still there in the baseline scenario, but also a creation of 1.5 million additional jobs in other areas. Thus, despite higher dynamics, the employment level does not show any significant changes.

FIGURE 2

Digitalisation effect on jobs lost and gained compared to the baseline projection



Source: Wolter et al. (2016)

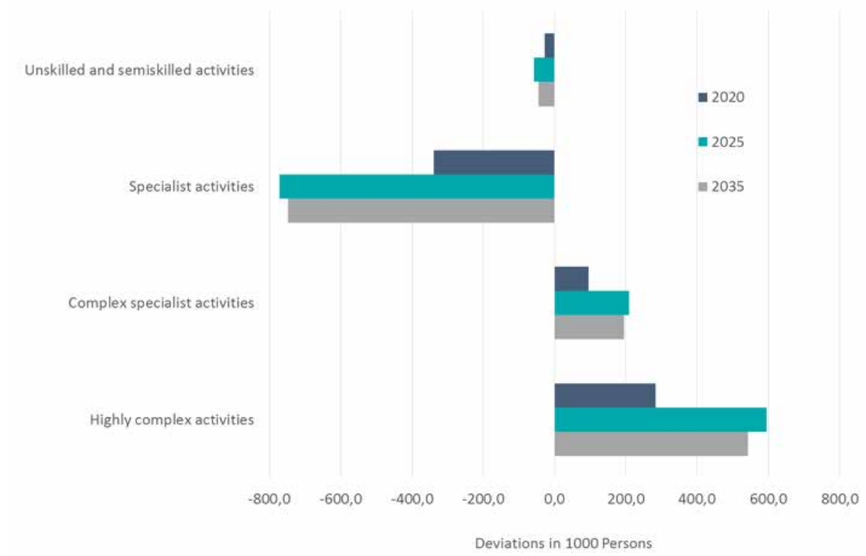
While these results are based on scenario simulations, they can be confirmed by analysing effects of digitalisation already realised in the firms. Warning/Weber (2018) make use of the German Job Vacancy Survey where they include questions on establishment-level digitalisation trends. Then, these trends can be connected to personnel policies. They find that firms with trends towards digitalisation have no higher dismissal rates, or, when they have, these are accompanied by similarly increased hiring rates. Therefore, no negative employment effects can be identified, but again, labour market dynamics become stronger. For firms digitalising their internal business processes, Warning/Weber (2018) even find substantially increased shares of abandoned search processes. Thus, there is even additional employment potential if these positions could be filled.

Requirements and conditions will change

Wolter at al. (2016) also look at the structure of the job gains and losses. Figure 3 shows that the demand for complex and highly complex activities is rising by approx. 800,000 while it declines for unskilled (-60,000) and particularly specialist activities (-770,000). Evidently, the development towards Economy 4.0 will also affect the medium-skill range of the labour market, while the usual automation since the 1960s primarily reduced the number of low-skill jobs. Particularly typical production jobs decline, such as processing material, operating machines or maintenance. But also office and commercial services professions such as finance or accounting are affected, connected to high shares of routine tasks that are comparatively easily programmable. By contrast, IT and scientific as well as teaching professions are on the rise, just as jobs in the social sector, which can be automated only to a limited extent but benefit from income and demand increases based on rising productivity.

FIGURE 3

Digitalisation effects on employees by requirement level compared to the baseline projection (in 1000)



Source: Wolter et al. (2016)

Warning/Weber (2018) further dig into which skills digitalising firms require when hiring new personnel as compared to non-digitalising firms. In general, this concerns competences acquired through courses that go beyond the initial education. Evidently, this sets further training at the centre of the stage. Particularly, social and communicative skills are in demand. The new opportunities of intelligent digitalisation will integrate various business processes and make different parts of enterprises grow together. Consequently, it becomes more important to look beyond the own job or field and to be able to communicate with other professions.

Concerning working conditions, the analysis of Weber/Warning (2018) shows that digitalising firms partly require higher time flexibility. This comprises tight schedules, overtime, and varying working hours. However, the strongest effects are found for varying work content. This implies that jobs in general become more diverse. Logically, they will be more demanding, but also more enriching – for those who can fulfil the demands.

Robots worldwide: emerging economies under pressure

Carbonero et al. (2018) investigated the impacts of the use of robots on worldwide employment using a novel instrumental variable approach. They find that this impact is small in developed countries, but substantially negative in emerging economies. The estimate implies that between 2005 and 2014 the latter have lost eleven percent of their employment due to domestic robotisation. Furthermore, the increasing use of robots in the industrialised countries has a negative effect on the offshoring of production. While this may be good news for these countries themselves, this channel stands for an additional loss of five percent of employment between 2005 and 2014 in the emerging economies.

Evidently, the low-pay routine jobs that were built up in emerging economies are highly vulnerable to automation. Furthermore, the robotisation in industrialised countries again facilitates competitive production also in high-wage regions of the world. In sum, robotisation more and more questions the conventional strategy of developing countries to grow by attracting low-pay manufacturing employment.

Digitalisation changes the way labour markets operate

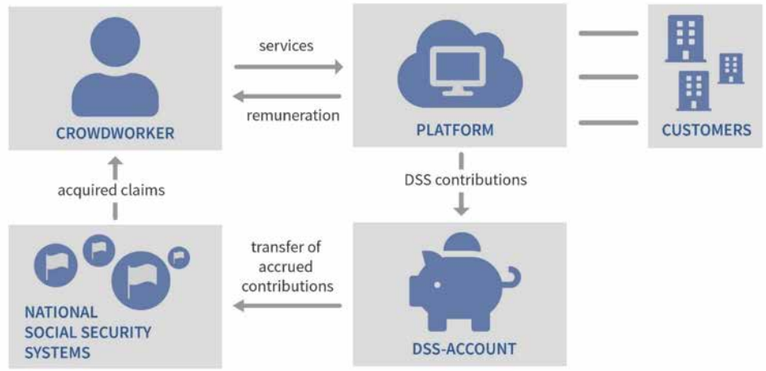
Digitalisation does not only affect jobs, but also the way labour markets operate. Especially the rise of platform work changes the rules. Platform work is still on rather low levels in most countries, but it follows a strong upward trend. Furthermore, various tasks are involved, which makes it an important phenomenon with political relevance.

While platform work bears potentials to increase market transparency, lower transaction costs or strengthen self-determined work, there are also risks involved. Above all, research results show a widespread lack of social protection. This is particularly critical since it may escalate poverty risks and hinder sustainable career development since any investments e.g. in human capital are thwarted for fear of calamities.

Due to the highly flexible, internationally integrated and short-term character of platform work, social protection is difficult to organise. In this respect, Weber (2018) proposed the concept of *Digital Social Security* (DSS). It would incorporate a digital mechanism directly into the platforms, which automatically pays a fixed percentage of the agreed salary into a personal DSS account of the worker when a job is finished (Figure 4). The accrued amounts would be transferred once a month from the DSS accounts to the relevant national social security systems, where all further steps (generating social security claims) could be handled within existing structures. This combines sustainable social protection with the flexible functioning of platform-based labour markets.

FIGURE 4

Digital Social Security (DSS)



Source: Weber (2018)

Conclusions

The advent of smart, interconnected digitalisation comes with great challenges. Notwithstanding, we will not have to adapt to an economy largely operating without jobs. Quite the contrary, the world is full of undone work. However, we will face the issue of economic adaptability to technological change. Thus, while we will not run out of jobs, structural unemployment may nonetheless build up if adjustment does not succeed.

The institutions and policies are faced with enormous challenges. It is necessary to take measures in economic, educational, and labour market policy, which are fit to support and advance a digital economic and labour market model. The further development of vocational training, the design of a policy of comprehensive further training, and the organisation of social security and corporate flexibility are the most deciding factors in this endeavour.

In many countries, during the structural change and departure from conventional factory work after the 1960s, the labour market failed to prevent the build-up and hysteresis of unemployment of low-skilled workers in particular. This teaches us that for the digital change to come, further training after initial training will be decisive. Educational policy is mainly concerned with initial training; labour market policy, with the unemployed. But the current technological change must be mastered by the currently employed. Therefore, a policy of further training on par with initial education is called for. This concerns both consulting in the fields of further and new qualification as well as support and funding for further training activities.

It stands to reason that digital content should be integrated more strongly into education and training. But it is at least as important to teach general competences such as conceptual and creative thinking as well as abstraction and communication skills. Above all, this concerns occupations with rather narrowly defined job profiles and high shares of routine tasks, which increase vulnerability to technological change.

Finally, working conditions and job quality are key. It will come as a challenge to reconcile rising flexibility needs both of employers and employees. Legal protection from overloading must remain in place, but great importance should also be placed on coordination processes both on the company level and among the social partners to make sure that the multitude of possible constellations can be sufficiently catered to. Flexibility and protection can be agreed under the principle that employees' concessions have to be balanced by the employer's side. Social protection is a further field of action, especially due to trends like the rise of platform work. Here, Weber (2018)'s proposal of *Digital Social Security* demonstrates how our institutions can adapt in order to take into account future digital developments.

In informal labour markets, particularly large in developing and emerging countries, one could take advantage of the new transparency of platforms in order to get through to these jobs e.g. by measures of social security and to organise more productive work environments. This could represent one way how innovative digitalisation concepts can create new inherently digital business models in developing and emerging countries. The more so as on the downside, robotisation more and more questions the conventional strategy of developing countries to grow by attracting low-pay manufacturing employment. The classical industrialisation process of following the same path as the developed economies in the past becomes less an option. Therefore, macroeconomic business models of emerging economies have to be rethought for the future.

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THE JOB TERMINATOR? AUTOMATION, ARTIFICIAL INTELLIGENCE AND THE FUTURE OF WORK

How the automation and artificial intelligence (AI) revolutions will affect the future of work is one of the key questions presently facing the global economy. Fears of job destruction are running rampant, with news organizations carrying stories with titles such as "The Robots are Coming" and "Will Your Job be Done by a Machine?"[1] Bestsellers like Martin Ford's *The Rise of the Robots* have warned about it. Even academics have provided some dismal forecasts. Carl Frey and Michael Osborne estimate in a 2013 paper that close to half of all US jobs are highly susceptible to computerization[2]. And a McKinsey Global Institute 2017 report concluded that by 2030, 400 million workers worldwide could potentially be displaced, with up to 30% of the global workforce automated.[3]

But cataclysmic fears of the replacement of humans by machines have often been exaggerated. From the automation of silk looms and windmills in the 18th century to the factories and assembly plants of the 20th century, the specter of machines taking over human employment have persisted. Kurt Vonnegut's 1952 novel, *Piano Player*, tells the story of a divided future society where mechanization has taken over human employment. In 1958, *The Nation* warned about "automation depression" caused by "worker-displacing innovations." More recently in 2011, Clayton Christensen, a professor at Harvard Business School, predicted that as many as half of American universities would close or go bankrupt within 10 to 15 years due to disruptions to be caused by online learning on higher education business models.[4] This has not happened yet.

Although the AI revolution will require significant adjustments in the world economy that cannot be ignored, warnings about the human workforce's demise are vastly exaggerated. First, many of the existing studies make forecasts that have huge standard errors. For instance, the study by Frey and Osborne noted earlier has been recently reanalyzed in a 2018 OECD Report using a more disaggregated and detailed analysis of how susceptible various occupational classifications are to automation.[5] The OECD study finds that about 14 percent of jobs, instead of 50 percent, are at risk of replacement by new technologies. Second, there is a large variety of possible effects arising from technological changes, some of which can destroy jobs but some that can also create them, and their relative weight is difficult to assess.

The main negative effect of greater automation and AI-induced technical change is the substitution of capital (machines, computers) for tasks previously performed by humans. This is already happening. Some of the tasks taken over by automation are routine tasks – tasks that follow a set of rules that can be codified mechanically or through software, and that machines or robots can perform faster and more efficiently than humans. These include manual tasks that involve repetitive or standardized production, like putting together auto parts in an assembly plant or vacuuming the floor. But recently, the AI revolution has allowed automation of activities that use significant deductive skills, such as bookkeeping, managing cash registers, automobile driving, and even cancer diagnosis.

On the other hand, there are a wide range of tasks that are much more difficult to automate. These are non-routine tasks that require abstract, problem-solving, and/or creative thinking skills. These activities are typical of professional, technical, and managerial occupations – including the software engineers who program robots – and are usually filled by highly educated workers. A second set of tasks that are non-routine and therefore difficult to computerize and automate are those that require human understanding, adaptability, judgement, and interpersonal interactions. These can include quite a variety of jobs in the service sector, including maintenance/janitorial jobs and food preparation. While many of these jobs tend to be manual, they do require a myriad of human understanding and nuances that present substantial challenges for automation. Although machine vision and translation, speech and facial recognition, and machine learning in general can over time chip away at some of these jobs, it is unlikely they will do so in the near future

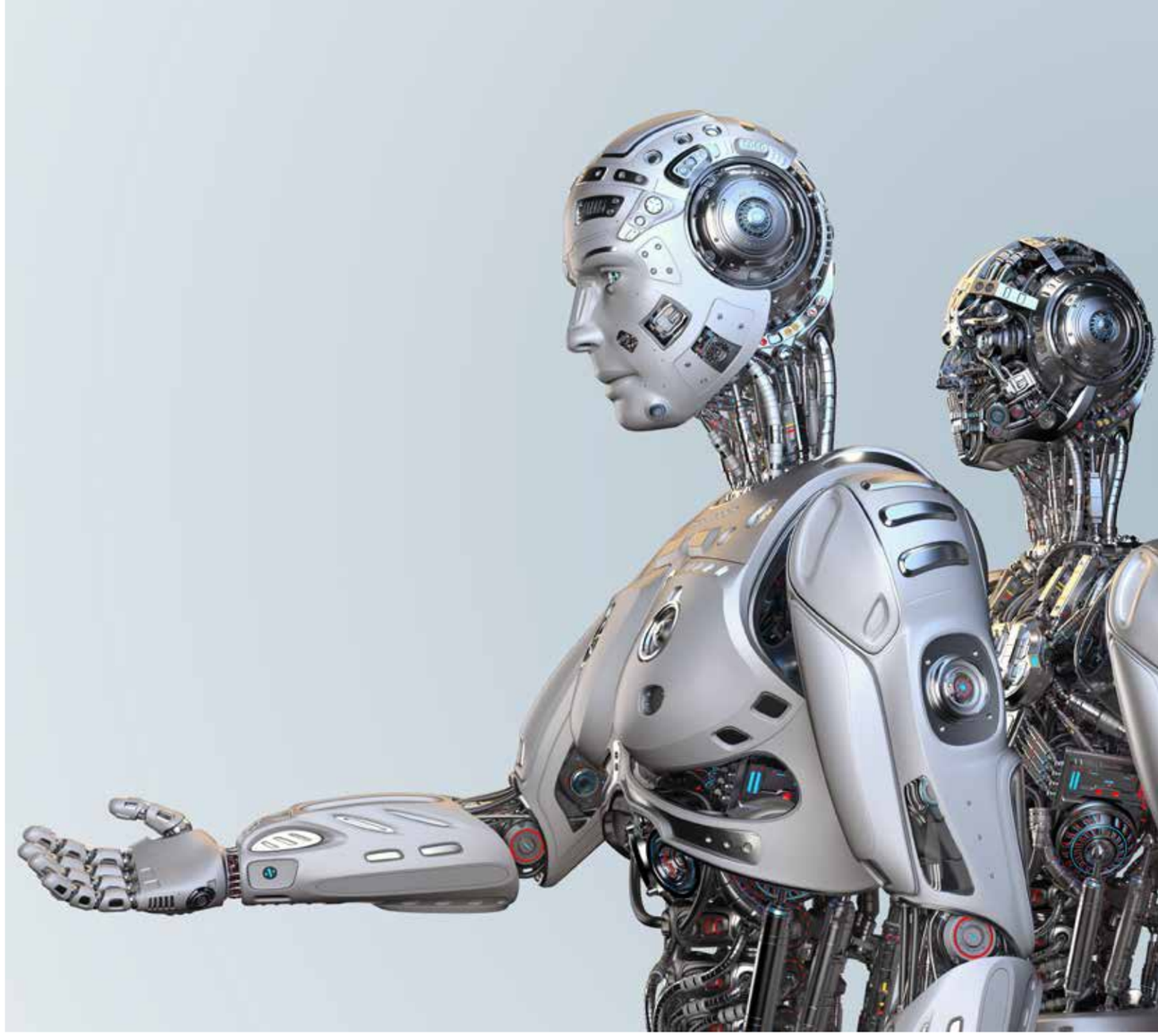
1 These are recent National Public Radio headlines in the US.

2 Carl B. Frey and Michael A. Osborne, "The Future of Employment: How Susceptible are Jobs to Computerization?," mimeo. (Oxford: University of Oxford, September 17, 2013).

3 McKinsey Global Institute, *Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation* (San Francisco: McKinsey & Company, December 2017).

4 Clayton M. Christensen, *The Innovative University: Changing the DNA of Higher Education from the Inside Out* (San Francisco: Jossey-Bass, 2011).

5 Ljubica Nedelkoska and Glenda Quintini, Automation, Skills Use and Training, OECD Social, Employment and Migration Working Paper No. 202 (Paris: OECD Publishing, 2018).

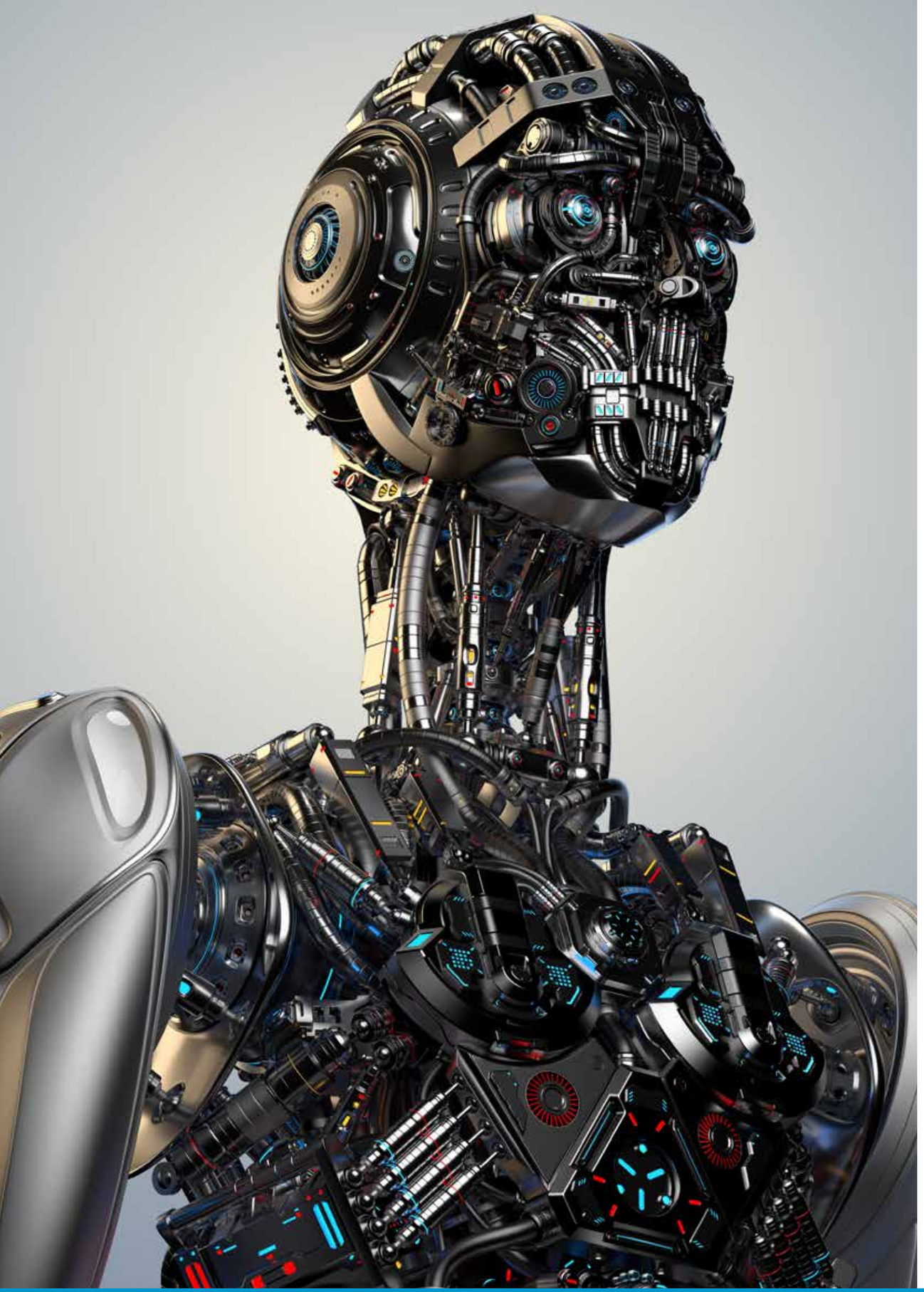


because they would have to be standardized to an extent that consumers would deem unacceptable. Since humans have a comparative advantage in fulfilling these tasks, it is unlikely that it would be relatively cost-effective to replace them.

Even when innovation substitutes some tasks that humans currently perform, it creates tasks that did not exist before and are complementary to the new technologies. Computers and the information technology revolution eliminated the need for secretarial typists, but generated increased demand for administrative assistants who utilize computers and the internet to manage the increasing variety of tasks that are now carried out by global firms.

Automation and AI also create jobs by making the economy more productive as well as making goods and services less costly. This generates a substantial rise of real income that spills over into increased demand for goods and services that spurs employment growth. Economists David Autor and Anna Salomons have examined the effects of automation using data for the last four decades and find that displaced jobs have been offset by job creation due to greater production in the automated industries, higher labor demand generated by income growth, and the induced demand for inputs and raw materials used by the automated industries.[6] Of course, the problem remains: as automated sectors of the economy shed workers while other sectors

6 David Autor and Anna Salomons, Is Automation Labor Share-Displacing? Productivity Growth, Employment and the Labor Share, *Brookings Papers on Economic Activity*, 2018, No. 1, pp. 1-87.



grow, what happens to the displaced employees? Policies that assist workers in the transition when jobs are lost due to automation, whether occupationally or geographically, are rarely implemented in any significant way. They may need to in the future.

In the past, major technological revolutions have been accompanied by booming economies. Economist Robert Gordon has examined the increases in productivity growth and real income that have been associated with innovation breakthroughs --including the electric lighting, home appliances, motor vehicles, air travel, and IT revolutions-- in his 2016 book *The Rise and Fall of American Growth*. Many expect the automation and AI breakthroughs to do the same. But Professor Gordon is skeptical about the past benefits continuing in the future.

Despite the likely long-run positive effects of the automation and AI revolution, there are significant short and medium-term challenges in the decades ahead. These challenges are magnified by recent trends that may derail the benefits of the innovation wave unless significant policy actions are implemented.

First of all, the countries that can innovate, produce, and export the new technologies first will have not only first mover advantages but also potential protections provided by patents and intellectual property. The programming, design, and production activities required to build a new generation of AI-connected products will provide a boom for economies that have a comparative advantage in them. That raises serious problems for countries that do not have the levels and quality of education or the expertise required to design or produce the new, highly-profitable goods and services associated with the automation revolution.[7] As has been the case in recent decades, global inequality is likely to continue rising, to greater extremes.

Secondly, the tasks that will be more difficult to substitute for automation and AI tend to be in occupations that require either greater cognitive skills, such as creative thinking skills, or otherwise significant non-cognitive skills, such as interpersonal and communication skills. Both skills are nurtured by schools and educational institutions. As labor economists have documented, the technological changes in the last 30 years have produced an increase in the demand for highly-skilled jobs, but have reduced demand for the less-skilled, particularly for those with middle-level skills (as noted before, some manual routine jobs are difficult to automate and, therefore, may not have been affected as much). But employers surveyed in high-income countries by Manpower Group and in developing countries by the World Bank report severe shortages in sectors requiring high-level cognitive and non-cognitive skills.[8]

These shortages are likely to grow over time. As a result, a skills mismatch that could severely limit the gains from the automation and AI revolution may emerge, as economists Daron Acemoglu and Pascual Restrepo have pointed out.[9]

For workers to remain competitive in the new labor market, the level and quality of schooling would need to rise in tandem with the new innovations. But rising inequalities in income and in education both within-countries and between-countries stand in the way of this happening unless major policy changes are implemented worldwide that insure the access of the poor and the working class to high-quality schooling.[10]

Ultimately, automation and AI can generate great improvements in the global standard of living. But for this to be realized, serious challenges --especially in the education area and in dealing with the rise of inequality-- need to be resolved in the short and medium-term. Without major policy actions now, potential benefits of the new technologies may be swamped by negative socioeconomic effects.

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7 Cristian Alonso, Andrew Berg, Siddarth Kothari, Chris Papageorgiou and Sidra Rehman, "Will the Robot Revolution Cause a Great Divergence?," mimeo. (Washington, D.C.: The International Monetary Fund, December 26, 2018).

8 See Manpower Group, *Global Employment Outlook Survey* (Milwaukee, Wisconsin: Manpower Group, 2019); OECD, *Getting Skills Right: Assessing and* Anticipating Changing Skill Needs (Paris: OECD Publishing, 2016); and World Bank, *Gaps and the Path to Successful Skills Development* (Washington D.C.: The World Bank, 2015).

9 Daron Acemoglu and Pascual Restrepo, "Artificial Intelligence, Automation and Work," MIT Department of Economics Working Paper No. 18-01 (Cambridge, Mass: MIT, January 2018).

10 World Bank, *Learning to Realize Education's Promise: World Development Report 2018* (Washington D.C.: The World Bank, 2018).

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AUTOMATION AS AN OPPORTUNITY, NOT THREAT

BRING ON THE ROBOTS

When it comes to automation, the predominant view currently is that it will lead to mass unemployment and hence it is perceived more as a threat than a gain which we must be wary about to avoid worst possible consequences. While automation is a disruptor, it is an opportunity that must be embraced not stopped in order for economies to grow and societies to develop, writes Roberts Zīle.

It appears that automation scare is lately everywhere. Nearly every week there is an alarming article in the press warning about robots that are coming to steal our jobs, often based on yet another report that coldly states a figure for the number of people that will be made technologically unemployed within a decade or two. Tech entrepreneurs are meanwhile calling for the introduction of support schemes modelled on universal basic income idea — unconditional monthly cash payments to every citizen — to compensate the masses of people who will be out of work soon.[11]

Yet concerns about technological progress and predictions about its role in displacing workers is nothing new. In fact, such worries date back to at least the Industrial Revolution when, fearing for their jobs, bands of English workers — Luddites — were destroying cotton and woollen mills in the early 19th Century.[12] Even those who now argue that "this time is different" as the forthcoming wave of automation will also affect the higher-skilled workforce are not novel in their thought. "In the past, new industries hired far more people than those they put out of business. But this is not true of many of today's new industries. .. Today's new industries have comparatively few jobs for the unskilled or semiskilled, just the class of workers whose jobs are being eliminated by automation," argued a journalist in TIME magazine back in 1961.[13]

Estimates about the number of jobs to be automated vary significantly. An oft-cited 2013 study by Frey and Osborne from Oxford University reason that 47 percent of total US employment is at risk of automation "relatively soon, perhaps over the next decade or two."[14] More recently, researchers from OECD assessed the potential of automation in 32 countries. They find that 14 percent of jobs have a probability of automation of over 70 percent. Another 32 percent of jobs have a risk of automation between 50 to 70 percent.[15] Although these estimates are lower than those of Frey and Osborne, they translate into 66 million jobs that could be lost.

While the above predictions on near future job losses could be true, it is important to understand that technological progress not only destroys, but also creates jobs. According to a 2014 poll by Pew Research Center, technology experts are almost equally split as to whether automation will destroy more jobs than it creates (48 percent) or add more jobs than it displaces (52 percent).[16] Historically it has been the latter.[17] Although focusing on the Unites States, Mishel and Bivens (2017) argue that automation has been taking place for many decades, yet the unemployment levels have not spiked.[18] Contrary to what Luddites expected, the number of weavers in the United States quadrupled between 1830 and 1900 as clothing became cheaper and demand for it increased.[19] In Europe more recently, the situation is no different. According to Eurostat, the employment rate in the European Union stood at 72.2 percent — "the highest rate ever recorded for the EU" and 5.4 percentage points higher compared to 2002.[20] Indeed, even Member States that were hit hard by the crisis such as Ireland are reaching full employment.[21]

11 See, for instance, Clifford, C. (2017) What billionaires and business titans say about cash handouts in 2017 (Hint: lots!) CNBC, December 28. Available at: https://www.cnbc.com/2017/12/27/what-billionaires-say-about-universal-basic-income-in-2017.html

12 See, for instance, Andrews, E. (2015) Who were the Luddites? History, August 7. Available at: https://www.history.com/news/who-were-the-luddites

13 TIME (1961) Business: The Automation Jobless. February 24. Available at: http://content.time.com/time/subscriber/article/0,33009,828815-1,00.html

14 Frey, C. B. and M. A. Osborne (2013) The Future of Employment: How Susceptible are Jobs to Computerisation? Oxford University, September 13. Available at: https://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf

15 Nedelkoska, L. and G. Quintini (2018) Automation, skills use and training. OECD, working paper No. 202. Available at: https://www.oecd-ilibrary.org/docserver/2e2f4eea-en.pdf?expires=1553795440&id=id&accname=guest&checksum=9464A736D8CCC9ADF813B09EC89F8CA9

16 Smith, A. and J. Anderson (2014) AI, Robotics, and the Future of Jobs. Pew Research Center, August 6. Available at: http://www.pewinternet.org/2014/08/06/future-of-jobs/

17 See, for instance, Stewart, I. et al (2015) Technology and people: The great job-creating machine. Deloitte. Available at: https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/finance/deloitte-uk-technology-and-people.pdf

18 Mishel, L. and J. Bivens (2017) The zombie robot argument lurches on. Economic Policy Institute, May 24. Available at: https://www.epi.org/files/pdf/126750.pdf

19 The Economist (2016) Automation and anxiety. June 25. Available at: https://www.economist.com/special-report/2016/06/25/automation-and-anxiety [Accessed 21 December 2018]

20 Eurostat (2018) Employment statistics. November 2018. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/Employment_statistics#Rise_of_temporary_and_part-time_work

21 Beesley, A. (2019) Skills shortage sends Irish employers on global hunt for staff. Financial Times, January 6. Available at: https://www.ft.com/content/ba62d352-fc67-11e8-ac00-57a2a826423e

Still, automation and the associated changes in job market is not a zero-sum game. We need robots that can replace us at doing mundane or dangerous tasks and we need algorithms where computing power can surpass that of our brains. Human replacement with machines has helped our economies to grow and our societies to progress. For the past centuries, living standards in the developed world have improved remarkably thanks to increased productivity. If a US worker in 2015 were wishing to have an income level of an average worker in 1915, he could achieve that by working only about 4 months a year.[22]

Thanks to technological progress, we can afford to work much less and have more means than the previous generations. According to Huberman and Minns (2007), working hours in New World — Europe and the U.S., Australia, and Canada — as well as Old World have decreased significantly for over a century. In 1870 a full time worker in New World worked 58.5 hours per week, but by 2000 — just 37.2.[23] Due to less time spent working, we can have longer holidays, have more time to spend with our families or to pursue our hobbies and are able to — relative to death — retire earlier.

It is true, however, that in short term, not everyone may benefit from the foreseen wave of automation. As in the past, there will certainly be professions and jobs that will be affected more profoundly. Just as milkmen were displaced by invention of a fridge, analogue graphic designers by computers and most of film developers by introduction of a digital camera, continuous technological progress will make a number of still existing jobs obsolete in future. Store cashiers and ticket offices are already being replaced by self checkouts and automated machines. The continuous development of various driving assistants, aided by improving algorithms, are bringing us closer to self-driving cars. In Swiss town of Neuhausen Rheinfall a self-driving bus is already integrated in the public transport system.[24] Meanwhile in the medical field, among other developments, an artificial intelligence powered device that can diagnose complex eye diseases in real time is being readied for commercialisation.

Doctors are unlikely to be replaced by robots anytime soon, but car and bus drivers are. So are, according to most predictions, telemarketers, data entry clerks and to some extent even lawyers and accountants.[25]

22 Autor, D. H. (2015) Why Are There Still So Many Jobs? The History and Future of Workplace Automation. Journal of Economic Perspectives, Vol. 29 Nr. 3, pp. 3-30. Available at: https://economics.mit.edu/files/11563 [Accessed 8 December 2018]

23 Huberman, M. and C. Minns (2007) The times they are not changin': Days and hours of work in Old and New Worlds, 1870–2000. Explorations in Economic History, 44 (2007) 538–567. Available at: https://personal.lse.ac.uk/minns/Huberman_Minns_EEH_2007.pdf

24 CNN (2018) Self-driving electric bus propels Swiss town into the future. June 27. Available at: https://edition.cnn.com/2018/06/27/sport/trapeze-self-driving-autonomous-electric-bus-switzerland-spt-intl/index.html

25 See, for instance, WEF (2018) The Future of Jobs Report 2018. Available at: http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf

Indeed, it is more helpful to look at the professions and tasks that are unlikely to be automated even in distant future, if ever. Creative people like painters, musicians and poets are believed to be safe. For the rest, adequate preparing for future changes is key.

Governments can play an important role. First, financial support for lifelong learning should be stepped up and workers in professions at high risk of automation need to be upskilled before it's too late. Similarly, welfare programmes and social assistance schemes must be reformed in order to better address increasing number of workers with flexible hours as well as those in-between jobs. The much discussed universal basic income scheme is unlikely to be a solution as providing a meaningful monthly payment for every citizen would prove too costly for most economies. Nonetheless, making unemployment benefits unconditional so that a person can for instance start a new job or a business whilst still receiving them as opposed to sitting idle for fear of losing the benefits could be one very helpful initiative that would not even cost extra.

However, today's and tomorrow's workers are equally responsible for their future employment. Given the changes ahead, many will be unable to have the same career for the rest of their lives. Becoming a painter or a musician is also not an option for everyone as there is a finite number of creative people a society needs. The best option is to start preparing for the future now by investing in one's skills and education.

Unfortunately most of today's workers are largely oblivious. According to one recent study, 75 percent of the workers surveyed believe that many of the jobs currently performed by humans will be done by robots over the next 10 years. Yet, just 7 percent are worried that *their* jobs will be automated.[26]

In the short term at least, the above-surveyed workers could actually be right. The current worry of the developed world and especially Europe should be that there is too *little*, not too much automation. Labour productivity growth, a good measure of the pace of automation, remains at dismal levels in the EU, averaging just 1.2 percent in 2018. Nonetheless, such average masks the great divergences between the "new" and "old" EU countries. Whereas in the former group productivity growth largely ranges between 1 and 3 percent, in "old" Europe, with the exception of Ireland and Austria, no country has even reached a 1 percent productivity growth in the relevant year. In industrial powerhouses France and Germany labour productivity growth was just 0.5 and 0.1 percent respectively, while in Luxembourg, Denmark and Finland it was negative.[27] It is almost as if humans are stealing jobs from the robots, not vice versa.

With drastic ageing of societies and decrease of workforce in Europe, high productivity growth is a vital necessity, not an option. Unfortunately politicians in "old" European countries are unwilling to carry out the much needed reforms, preferring short term gains at the expense of the long term ones. Such approach is undermining the spirit of the single market where intra-EU competition should be stimulated, not stifled. Instead we have highly unionised and protected workers in a number of Western European countries who are thus undermining not only growth of their own countries, but that of the EU as a whole.

Europe is starting to lose its competitiveness to other industrialised regions of the world. The overly protected worker in Germany or France may save his job from another human or a robot in Europe, but could still lose it to one in another advanced economy elsewhere. The highly sheltered workers of certain "old" EU countries enjoy their protection to the detriment to their own as well as to their grandchildren's future.

With uncompetitive economies, the loss for the European Union will not only be economic, but also geopolitical. Waning influence in the global arena would further undermine future economic prospects of the bloc.

It does not have to be that way. High productivity growth is achievable with automation being the main driver. As opposed to dismissing or even limiting it, we should embrace automation as we need more, not less of it. With such a move the EU will secure its future in the world and remain relevant for all its members. The more and the faster the robots come, the better.

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26 in Warhurst, C. (2019) The coming of the robots: shifting from predictions to evidence of their impact on jobs. January 24, [presentation].

27 Eurostat (2019) Real labour productivity per person employed - annual data. Available at: https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tipsna70&plugin=1

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FUTURE OF WORK, FUTURE OF SOCIAL SECURITY

NON-STANDARD EMPLOYMENT AND SOCIAL SECURITY

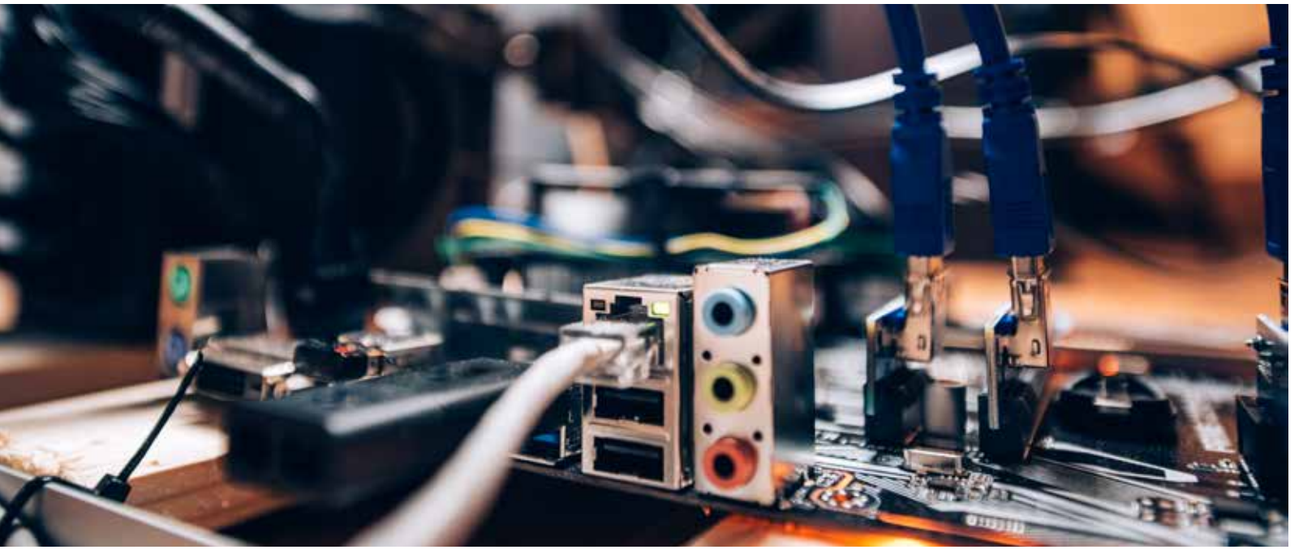
New forces are transforming the world of work – technological development, climate change, demographic shifts, globalization. These transitions will have both disruptive and transformative effects on our economies and on future of work. The recently published report of the Global Commission on the Future of Work (2019) outlines the steps needed to achieve a future of work that provides decent and sustainable work opportunities for all. In particular, the Global Commission calls on countries to "strengthen social protection systems to guarantee universal coverage of social protection from birth to old age to workers in all forms of work, including self-employment, based on sustainable financing and the principles of solidarity and risk-sharing".

Europe has been experiencing a growing diversification in working arrangements, as exemplified through the decline of "standard employment" (namely, work that is full time, indefinite, as well as part of a subordinate relationship between an employee and an employer), and the significant growth of "non-standard forms of employment," such as temporary arrangements (fixed-term contracts and casual work), part-time and on-call work, temporary agency work or other multiparty employment arrangements, as well as disguised employment relationships and dependent self-employment. The rise of the "platform economy" (also called the gig or on-demand economy) which describes work that is mediated through online web platforms, is an important recent development.

The emergence of non-standard forms of employment has created serious challenges for decent work, in particular when employment in non-standard arrangements is not voluntary (in 2014, 62 percent of European workers replied that they were in non-standard employment because they could not find a permanent job (ILO 2016)). An important concern is its implications on workers' representation and other fundamental rights at work. Workers in non-standard employment may lack access to freedom of association and collective bargaining rights, either for legal reasons or because of their more tenuous attachment to the workplace.

Moreover, non-standard forms of employment can have a variety of effects on all aspects of working conditions, including employment security, wages, working time, occupational safety and health conditions, work organisation, work-life balance, opportunities for training, as well as social security coverage. In particular, they have raised questions about how social security systems, including social insurance and tax-financed social benefits, can adapt to these changes.

In most social security systems, coverage rates of workers in non-standard arrangements are lower than those of workers in standard employment due to statutory provisions that impose thresholds on minimum tenure, earnings or hours, or simply exclude some workers outright (such as casual work). Even if workers are eligible, their benefit levels can be insufficient because of lower wages and shorter contribution period due to their intermittent attachment to the labour market.



The ILO Social Protection Floors Recommendation No. 202 adopted in 2012 calls for ILO member States and social partners to establish as quickly as possible and maintain their social protection floors comprising basic social security guarantees, as part of comprehensive social security systems. The guarantees should ensure at a minimum that, over the life cycle, all in need have access to essential health care and to basic income security, which together secure effective access to goods and services defined as necessary at the national level.

Five main policies have been identified which aim to extend the social security coverage to workers in non-standard forms of employment (ILO 2016).

Firstly, social insurance coverage for temporary, part-time and other workers can be improved by lowering the thresholds set out in the legislation regarding the minimum duration of employment, minimum hours worked and by ensuring equal coverage across different forms of employment. Furthermore, access to benefits can be improved by allowing greater flexibility with regard to interrupted contribution periods, for instance, by extending the period in which contributions to social insurance are considered.

Secondly, social insurance coverage should also be extended to the categories of workers who are previously outside the scope of compulsory coverage. While in European countries, the existing social insurance schemes cover a large majority of employees, coverage gaps continue to exist in many countries, e.g. casual workers and self-employed workers. Social insurance schemes should be made more inclusive by specifically addressing these gaps and ensuring coverage for workers in all forms of employment, as agreed in the European Pillar of Social Rights in 2017. Some countries have developed mechanisms to cover certain categories of workers adapted to their specific characteristics and needs.

Thirdly, access to social security systems should be enhanced to facilitate the social security coverage at all stages of one's life cycle. Such measures include simplifying administrative procedures for registration and contribution payments, enhancing access to information about individual entitlements, and enacting measures to facilitate the portability of entitlements between different social security schemes and employment statuses.

Fourthly, compliance and collection of social security contributions should be improved. Responding to a tendency to misclassify workers as self-employed to avoid social insurance contributions, some countries have taken measures to extend the compulsory coverage to the workers in dependent self-employment.

Fifthly, both contributory and non-contributory systems should be used to achieve a comprehensive social security system. In Europe, the existing contributory social security schemes will continue to play the core role in social protection and adapt to non-standard forms of employment. Tax-financed benefits also play an important role in filling the gaps and ensuring at least a basic level of coverage especially for those who are not covered or not sufficiently covered by contributory mechanisms. While there has been a discussion on the possibility of introducing an unconditional universal basic income, there are still many open questions regarding its feasibility. In the area of health protection, tax-financing is essential for national health services and for subsidizing health insurance contributions for low-income workers.

Countries should further strengthen their social security systems to cover workers in all types of employment in line with the policies set out above. In the face of future of work challenges, forging a new path requires committed action on the part of all key stakeholders.

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ETHICS AND ARTIFICIAL INTELLIGENCE

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Introduction

Machine learning and artificial intelligence (AI) systems are rapidly being adopted across the economy and society. These AI algorithms, many of which process fast-growing datasets, are increasingly used to deliver personalised, interactive, 'smart' goods and services that affect everything from how banks provide advice to how chairs and buildings are designed.

There is no doubt that AI has a huge potential to facilitate and enhance a large number of human activities and that it will provide new and exciting insights into human behaviour and cognition. The further development of AI will boost the rise of new and innovative enterprises, will result in promising new services and products in – for instance – transportation, health care, education and the home environment. They may transform, and even disrupt, the way public and private organisations currently work and the way our everyday social interactions take place.

Early excitement about the benefits of these systems has begun to be tempered by concerns about the risks that they introduce. Concerns that have been raised include possible lack of algorithmic fairness (leading to discriminatory decisions), potential manipulation of users, the creation of "filter bubbles", potential lack of inclusiveness, infringement of consumer privacy, and related safety and cybersecurity risks. There are also concerns over possible abuse of dominant market position,[28] for instance if big data assets and high-performing algorithms are used to raise barriers to entry in digital markets.

It has been shown that the public – in the widest sense, thus including producers and consumers, politicians, and professionals of various stripes – do not understand how these algorithms work. For example, it has been shown that Facebook users have quite misleading ideas about how algorithms shape their newsfeeds (Eslami et al.).[29] At the same time, the public is broadly aware that algorithms shape how messages are tailored to and targeted at them – for example, in the case of news or political information, and of online shopping. Algorithms also shape the logistics of vehicles, trades in financial markets, and assessments of insurance risks.

To date, however, by far the most common and dominant implementation of algorithms has been in messages that target people directly. Thus, to build awareness among a broad public, the topic of platforms that affect everyone cannot be avoided. The two domains, shopping and news (or political information: whether some non-news dissemination can be counted as 'news' is precisely at issue in algorithmically disseminated 'fake news') are also relatively long-established.

But it is not only the public that does not understand how algorithms work. Many AI experts themselves are painfully aware of the fact that they cannot explain the way algorithms make decisions based on deep learning and neural networks. Hence there is also considerable concern among AI experts about the unknown implications of these technologies. They call for opening up this blackbox: from this perspective explainability of algorithms is one of the key priorities in this field.[30]

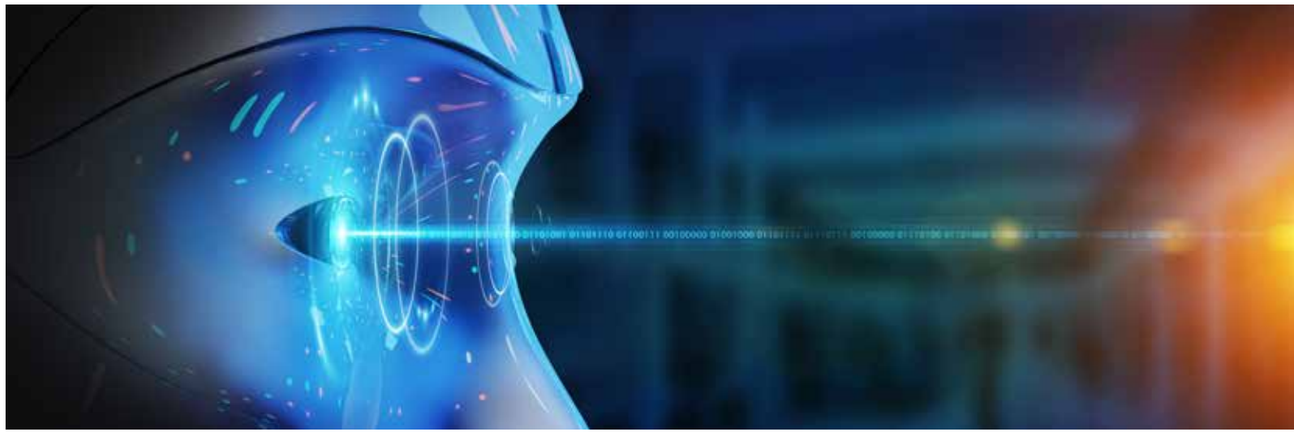
Furthermore, the application of AI in robotics has created numerous new opportunities but also challenges. Already the extensive use of industrial robots in production has raised productivity for decades. The introduction of smart robots will only increase this trend and transform employment conditions in an unpredictable way.

The introduction of autonomous vehicles certainly has the promise of leading to smart and efficient (urban) transportation systems. However, autonomous vehicles also raise ethical issues related to the decision-making processes that are built into their hardware and software. A widely used example is the case of an unavoidable accident where the autonomous car is called to choose at an instant of

28 See Ariel Ezrachi and Maurice E. Stucke (2016), Virtual Competition: The Promise and Perils of the Algorithm-Driven Economy, Harvard University Press.

29 Eslami, M., Karahalios, K., Sandvig, C., Vaccaro, K., Rickman, A., Hamilton, K. & Kirlik. A. 2016. First I "like" it, then I hide it: Folk Theories of Social Feeds . Human Factors in Computing Systems Conference (CHI). See also Eslami, M., Rickman, A., Vaccaro, K., Aleyasen, A., Vuong, A., Karahalios, K., Hamilton, K., and Sandvig, C. 2015. "I always assumed that I wasn't really that close to [her]:" Reasoning about invisible algorithms in the news feed. Proceedings of the 33rd Annual SIGCHI Conference on Human Factors in Computing Systems, Association for Computing Machinery (ACM): 153-162.

30 See for instance: https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/



time whether it will sacrifice its occupants to protect pedestrians or not.

An area of immediate concern is the possible use of AI technology to develop lethal autonomous weapons. As illustrated very graphically by the video "Slaughterbots" (see autonomousweapons.org) it is conceivable today that drones equipped with AI software for navigation and face recognition can be turned into cheap lethal weapons capable of acting completely autonomously. Allowing such weapons to become reality will likely have catastrophic consequences at a global scale.

In terms of ethical challenges AI and robotics raise questions that are unprecedented. Given the increasing autonomy and intelligence of these systems we are not just talking about societal implications that merely ask for new ethical and legal frameworks. As the boundaries between human subjects and technological objects are virtually disappearing in AI, these technologies affect our fundamental understanding of human agency and moral responsibility. Who bears responsibility for AI-behaviour is a complex ethical issues. What is needed is a shared or distributed responsibility between developers, engineers, industry, policymakers and users. And last but not least we will also need to take into account the moral responsibility of the technology itself, as it develops towards increasingly autonomous behaviour and decision-making.

Policy response

The breakneck pace of development and diffusion in AI technologies urgently requires the development of suitable policies and regulatory infrastructures to monitor and address associated risks, including the concern that vast swaths of the economy and society might end up locked-in to sub-optimal digital infrastructures, standards and business models. Addressing these challenges requires access to better data and evidence on the range of potential impacts, sound assessment as to how serious these problems might be, and innovative thinking about the most suitable policy interventions to address them, including through anticipatory and algorithmic regulation strategies that turn big data and algorithms into tools for regulation. We need to adopt a more balanced approach that also considers 'the human factor' and the proper place of AI in our democratic society. And for this we need a trans-disciplinary research agenda that enables the building of knowledge on which responsible approach towards AI can flourish.

However, the research community concerned with algorithms is diffuse. Different academic disciplines are studying these issues from a variety of perspectives: technical, social, ethical, legal, economic, and philosophical. This work is incredibly important, but the lack of a shared language and common methods makes discourse, synthesis, and coordination difficult. As such, it has become near-impossible for policymakers to process and understand this avalanche of research and thinking, to determine which algorithmic risks are already being tackled through technical measures or better business

practices, and what algorithmic risks are relatively underserved.

'Formal' policy interventions and regulatory frameworks are unlikely to be enough to steer an increasingly algorithmic society in desirable directions. It is likely that corresponding changes are also called for in the behaviours of day-to-day users of algorithmic services and platforms whose choices eventually determine the success or failure of online platforms, products and services. A better understanding of the risks and hidden costs of AI decision-making could inform their choices. This could lead in turn to the development of social norms upholding regulation and making it more effective. Europe should take the lead in developing the codes of conduct and the regulatory and ethical frameworks that guide the AI community in developing 'responsible AI'.[31]

Recommendations

Adopt transparency by design principles over how the input data in AI algorithms is collected and is being used. Many times algorithmic bias is inherited by the fact that input data does not well represent the sample and introduces bias towards specific categories of people. Transparency over how data is collected in decision-making algorithmic systems is necessary to ensure fairness.

Invest in research on explainable AI. In this way we can increase the transparency of algorithmic systems. AI systems are based in deep-learning techniques in which many times the intermediate layers between the input data and the algorithmic output are considered a "black-box". Explainable AI can substantially contribute to understanding how these automated systems work.

Integrate technology assessment (TA) in AI research. In order to create awareness of the potential societal and ethical impacts of AI not after the fact but in an early stage of development, prospective policy research such as TA helps to create both awareness of unintended consequences of AI within the AI community and agility among policymakers.

Increase public awareness. As AI algorithms penetrate more and more our life we should be well informed about their usefulness and potential risks. Educational and training programmes can be designed for this purpose. In this way, individuals will not only be aware of dangers but they will also maximise the value from using such systems. In addition, public discussions at a local level on the implications of AI systems should be organis

Develop regulatory and ethical frameworks for distributed responsibility. These frameworks should include clear standards and recommendations over the imposed liability rules which facilitate the protection of both users and manufacturers through efficient and fair risk-sharing mechanisms.

Develop a consistent code of ethics in the EU and at the international level, based on shared European values that can guide AI developers, companies, public authorities, NGOs and users. Authorities, big professional organisations (e.g. the partnership on AI) and NGOs should work together closely and systematically to develop a harmonised code of ethical rules that will be, by design, satisfied by AI systems.

Experimentation. As with clinical trials of new medicines of pharmaceutical companies, AI systems should be repeatedly tested and evaluated in well-monitored settings before their introduction in the market. In such experiments, it should be clearly illustrated that the interaction between individuals and AI systems (e.g. robots) satisfies the standards of safety and privacy of human beings. They should also provide a clear message on how the design of AI systems should be modified in order to satisfy these principles.

Ban lethal autonomous weapons. Europe should be at the forefront of banning the development of lethal autonomous weapons, which includes the support of the respective initiatives by the United Nations.

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31 See for instance V. Dignum (2017), Responsible Artificial Intelligence: Designing AI for Human Values. In: ITU Journal: ICT Discoveries, Special Issue, No 1. Sept 2017.

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SKILLS AND JOBS IN DIGITAL AGE

The impact of digitalisation and automation on jobs is one of the most widely discussed topics of skills and labour market analysis nowadays. The work of Cedefop – European Centre for Development of Vocational Training – approaches the topic from different angles. Its core is skills-based approach to measurement of automation risks, supported by literature review and quantitative forecasting of future employment.

Future jobs

Cedefop Skills Forecast looks at the future employment trends by sector and occupation in the period 2016-2030. The forecast predicts there will be 6% more jobs in 2030 – almost 14 million more than in 2016 - over this period, but with significant differences across occupations.

FIGURE 1

Cedefop's forecasts of employment growth (2016-2030, in %)

Source: Cedefop Skills Forecasts, own calculations

IT, science & engineering professionals, which Cedefop also refers to as "high-tech occupations", are expected to grow the fastest and their growth can be linked to growing innovation expenditures and further adoption of automation and digitalisation technologies. Other high-skilled occupations, like medical doctors, teachers or business and administration professionals benefit from the technological progress too – it makes their tasks easier and more effective. In a way, automation and digitalisation is one of the enablers of their future employment growth.

Sales and service workers are expected to experience growth too. Their outlook with regard to technology adoption is, however, mixed: occupations like cashiers and clerks are more prone to automation than, for example, care workers or hairdressers.

Some jobs will be lost for skilled manual workers. This is where most of automation actually takes place as these jobs entail a lot of routine technical tasks which are carried out in a rather controlled environment (like a factory production line), where robots do not have to cope with much unpredictability. Cedefop predicts only 3% jobs decline though. Isn't this too modest?

High-tech occupations

Cedefop uses ISCO-08 classification in its Skills Forecast. High-tech occupations cover the following ISCO categories:

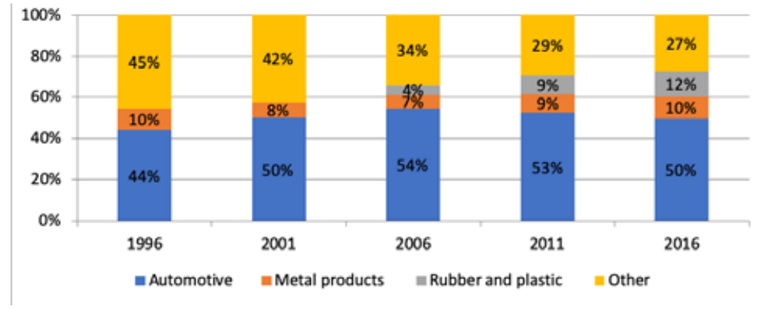
- ISCO 21: Science & engineering professionals
- ISCO 25: ICT professionals
- ISCO 31: Science & engineering associate professionals
- ISCO 35: ICT technicians

Looking at the deployment of robots across the EU economy, 85% of them are indeed used in manufacturing[32]. But within the manufacturing sector, half of the robots are deployed in only one industry – automotive – and penetration into other sectors is still quite limited.

32 European Commission (2018): Less labour, more capital? Existing evidence. In: Employment and Social Developments in Europe. Annual Review 2018. Accessed from: http://pmb.cereq.fr/doc_num.php?explnum_id=4530

FIGURE 2

Deployment of robots in manufacturing (1996-2016, in %)



Source: DG JRC calculations based on data from International Federation of Robotics

Strong wave of automation in the automotive has already taken place and with slowing demand across Europe, there may be fewer incentives for companies to automate their production lines further.

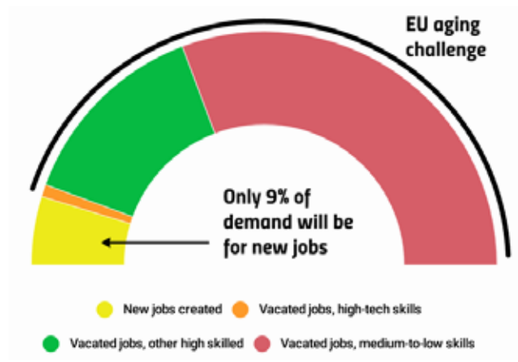
Interestingly enough, the employment growth of low skilled workers is predicted to be rather strong. Cedefop research suggests few factors that may play an important role: one is that automation of these jobs is rather difficult as tasks are often carried out in uncontrolled and unpredictable environment (e.g. street cleaners) and because of low wages, automation may also be less profitable than in case of better paid occupations. In addition, immigration to Europe provides strong supply of workers that are often employed in low skilled jobs[33] – another reason why motivation of employers to automate may be lower.

The ageing challenge

The key factor behind future job openings is not the employment growth, though – it is the ageing of the European workforce. Retirements will represent major reason why employers will be searching for people; out of more than 150 million work opportunities between years 2016-2030, less than 1 of 10 will be created because of a new job opening. Thus despite all the automation and high skilled jobs growth, most of the future job demand will still require up to medium level skills.

FIGURE 3

Openings for new and vacant jobs in Europe (2016-2030)



Source: Cedefop Skills Forecast, own calculations

33 Cedefop (2011): Labour-market polarisation and elementary occupations in Europe. Accessed from: http://www.cedefop.europa.eu/files/5509_en.pdf

Future skills and automation risk

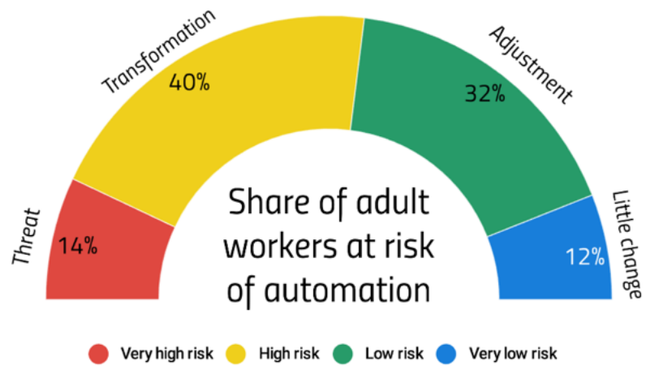
Today's state-of-the-art research on automation and digitalisation risks focuses not on direct jobs destruction, but rather on identification of skills and tasks that are most prone to automation. The findings acknowledge that while some jobs may be automated either fully or to a significant degree, this may represent both risk, but also an opportunity to the workers exposed.

The exposure to automation and digitalisation change is higher for jobs that predominantly require technical and numerical skills and which tasks can be mostly described as routine. Based on share of these tasks and skills in jobs of European labour market, we may estimate what will be the levels of impact of automation and digitisation across European workforce.

What types of jobs entail lowest share of automatable tasks? The hardest to automate seem to be jobs of care workers; legal & social professionals; CEOs and senior officials; health professionals and teaching professionals. In the forthcoming years, new technologies should little impact the way these jobs are carried out.

FIGURE 4

Share of adult workers at risk of automation



Source: Pouliakas, K. (2018). "The risk of automation in EU labour markets: a skills-requirements approach"

The best possibilities for automation are provided in tasks carried out by assemblers; plant & machine operators; electro-engineering workers; metal and machinery workers and technical labourers. In the figure above, the category of most exposed jobs is called "threat". Their share – 14% - seems to be low, but it still represents over 30 million of jobs in the European Union.

As discussed above, Cedefop looks at jobs with high probability of automation both as a risk and an opportunity. As examples of various technologies that changed the workplaces in the past clearly show, the dividing line is whether the exposed workers are given an opportunity to cope with the change. When provided with adequate learning, workers in high threat of automation or digitalisation can adapt; and some may even reach higher-level and better paid jobs. This is the risk and the opportunity at the same time. That is why Cedefop also looks at training accessibility in jobs susceptible to automation[34]. Unfortunately, around 18 million people in workplaces across Europe face the automation challenge with little or no support. To help them to cope with the change should be one of the highest employment policy priorities in Europe.

34 Pouliakas, K. (2018). "The risk of automation in EU labour markets: a skills-requirements approach"

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A TRANSITION AGENDA FOR A FUTURE THAT WORKS FOR ALL

Many new technologies are being developed with the aim of replacing human labour. Sometimes this is simply to cut costs for businesses. Sometimes it is to free workers from tedious, dangerous or unpleasant tasks. Whatever the ultimate objective, robots and algorithms are being developed at a dizzyingly fast pace, and tasks that used to be carried out by humans are increasingly being automated.

Analysts are divided about the potential impact of automation on the workforce. Some believe that up to 50% of jobs might be taken over by robots over the next couple of decades. Estimates by the OECD are more conservative and place this figure at 14%, on average, across the OECD. However, on top of this, another 32% of jobs are likely to undergo significant change: these are jobs where a large share of tasks are likely to be automated and which will, therefore, imply significant on-the-job adjustments for workers.

Of course, automation is not a new phenomenon. As far back as in the 11th century, engines powered by water were used to drain water out of shafts and tunnels in underground mining. In the 18th century, cotton spinning became mechanished and machines were used in paper production as well. In the early 20th century, a wave of automation swept across the automative industry.

None of these earlier waves of automation have resulted in massive technological unemployment. This is because technology creates, as well as destroys, jobs. It creates jobs directly by giving rise to entirely new occupations. Think, for example, about app developers, social media managers, AI engineers, cloud architects: these are all jobs that did not exist ten years ago. But technology also creates jobs indirectly. It raises productivity and wages and, therefore, demand. It also raises the quality and lowers the cost of producing goods and services which, in turn, raises consumption and, therefore, the demand for workers.

Certainly, when we look at employment rates, these have tended to rise, and not fall, in the majority of OECD countries. In many countries, employment rates now stand at record highs, despite the current wave of automation. Moreover, many of the jobs that are being created are better than the ones that are disappearing. Over the past two decades, the share of high-skilled jobs in OECD countries has risen by around 25%.

While these global figures indicate that we may not need to worry about a jobless future just yet, they do not mean that we can sit back and relax. In fact, technological change does bring a number of important challenges which, if they are not managed effectively, are likely to result in increased disparities in the labour market.

To begin with, the risk of automation is not the same for everyone. Some vulnerable workers, like the low-skilled and youth, are at a higher risk of automation than others. These are also the groups that will struggle most to gain access to the new job opportunities that are arising, or even to adapt to new skills needs on the job. And, yet, these are the individuals who are less likely to participate in training which would prepare them for the new world of work. Data from the OECD show that just over 60% of high-skilled workers take part in training, compared to only about 20% of low-skilled workers.

There is also an important geographical dimension to all this. While massive technological unemployment may not seem like an immediate risk at a global level, it may well become a reality in certain regions. The risk of job loss due to automation varies a lot among regions and local communities. The difference in the share of occupations at high risk of automation varies over nine-fold across regions in the 21 OECD countries for which data is available. For instance, the regional share of such jobs reaches almost 40% in West Slovakia, but is as low as 4% in Oslo and Akershus region, Norway.

At the same time, job creation is also highly concentrated. Over the period 2006-16, in 15 out of 27 OECD countries, more than 30% of net employment was generated in the capital region. In Japan, Finland, Denmark and Ireland, more than 80% of job creation occurred in the capital region.

These challenges point to the importance of managing transitions and targeting efforts on the most vulnerable groups in society. There is a clear need to invest in skills and boosting the participation in training of the low-skilled in particular. But skills policies on their own are unlikely to be sufficient.

Countries also need to put in place adequate social protection systems coupled with effective activation strategies which balance, on the one hand, protection against income losses and, on the other hand,

incentives to work throughout the unemployment spell. Here, OECD countries already face important challenges: in a majority of countries, fewer than one third of jobseekers receive unemployment benefits. In some countries, the rise in non-standard work (e.g. temporary, on-call or own-account) work is exacerbating these existing challenges.

At a local level, skills, social protection and activation policies will need tbe complemented by regional development policies which promote entrepreneurship, increase the value-added content of existing firms, and aim to boost the demand for less risky occupations.

Finally, it is important to maintain a healthy dialogue on the kind of future we want, involving all stakeholders from employers and workers, through to policy makers, civil society and experts. The future of work is not written in stone. As a society, we need to make important decisions about what tasks and jobs we think should be automated, and what tasks we want to keep for humans. We also need to discuss how losers are compensated, and how potential productivity gains are shared fairly.

Managing transitions effectively will be costly and, while it may be possible to free some resources by reviewing priorities and increasing the effectiveness of existing public spending, there will also be a need to broaden the tax base and strengthen tax systems against abuse. Additional revenues raised from these initiatives would increase the capacity of governments to support a Transition Agenda for a Future that Works for All, and help reconnect the many who feel left behind by the digital transformation.

DIGITALISATION OF WORK AND ITS IMPACT ON SOCIAL SECURITYY

PLATFORM WORK AS AN EMERGING ATYPICAL WORK FORM

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Atypical work is (once again) in the ascendant partly as a result of the flexibilisation of the labour market.[35] Self-employment and part-time work are on the up. 'Newer' forms of atypical work are also visible in the ever-growing sharing economy, such as platform work (portfolio work, crowd work), unpaid work forms (sharing activities, internship work) or activities that do not follow a fixed pattern of work, but that do, nonetheless, create regular income (owner-manager activities that yield capital).

In this article we seek to answer several questions from the perspective of social security law. Is there such a thing as a standard employment relationship? And if so how does it work? What does it mean for social protection in terms of content? Work-related social security schemes are designed based on the typical 'default' situation of the employee.[36] However, when the work is organised in a non-typical form, legal problems arise in the application of social security law. As a result, in many countries self-employed workers are not eligible for unemployment benefit. It appears that European systems are finding it increasingly difficult to bring the new forms of work within the scope of social security law. We examine the issue from a transnational, comparative legal perspective.

As a basis for this contribution we use the comparative research on atypical work in social security that is currently running at the University of Tilburg.[37] The working definition of atypical work that we use in the research is presented here (in synthesis) in the first section. Then (§2) we discuss some challenges for our social systems. In the next section (§3) we present some findings with regard to the legal impact that atypical employment relationships have on social security systems in Europe. Finally, in the conclusion we combine our initial findings.

Definition of standard or typical work

In order to better understand the problems associated with atypical work, we must first of all define the concept of 'standard' or 'typical' work. The 'standard' social security law for work-related schemes has been developed with this in mind. The 'typical' worker was the model for this. If we can clearly define the elements in respect of which the atypical employment relationship deviates from the 'standard', then we can take these into account when deciding on the content of social security law. This was one of the conclusions of a comparative study of social security for self-employed workers in the European Union conducted at KU Leuven.[38] It suggested that in order to be able to apply social security in an adequate manner to the group of self-employed workers, attention should first be paid to the specificity of the group with regard to their work organisation. In what respects does the employment relationship differ from that of standard workers? Only then can social security be satisfactorily adjusted to this specificity. We started from the assumption that work-related social security is neutral with regard to its basic principles (the neutrality of the working status), but that these principles need an adapted application for specific forms of employment (work status-specific application). Applied in this context, this means that social security for atypical workers aspires to similar protection objectives as those on which the social protection of employees is based, but that in practice when applied to the various atypical groups it can have its own specific application.

In order to be able to define the atypical form of work, we first need to know who the typical employee is and what is so typical about the employment relationship between the employee and the employer.

35 See §2 for some figures.

36 For an (historical) overview of this see: K. VLEMINCKX and J. BERGHMAN, 'Labour Market Deregulation, Non-Standard Employment and the Reform of Social Security', in Secretaría de Estado de Seguridad Social (ed.), Social Security and the New Work Patterns: Atypical Insurance Careers, Madrid, Ministerio de Trabajo y Asuntos Sociales, 2003, pp. 31–44.

37 Project 'Grenzen aan atypische arbeid: flexwerk en zelfstandige arbeid getoetst aan Europese beginselen van het socialezekerheidsrecht', runs until 29 February 2020, financed by Instituut Gak. The following countries are included in the comparison: France, Spain, the United Kingdom, Germany and the Netherlands. The initial findings are published in A. BARRIO en P. SCHOUKENS, "The changing concept of work: when does typical work become atypical?", 2017, 34p. and in A. BARRIO, S. MONTEBOVI and P. SCHOUKENS, "The EU social pillar: an answer to the challenge of the social protection of platform workers?", *European Journal of Social Security,* 2018, Vol 20, Issue 3, 219-241.

38 See PhD P. SCHOUKENS, *De sociale zekerheid van de zelfstandige en het Europese Gemeenschapsrecht: de impact van het vrij verkeer van zelfstandigen*, Leuven, Acco, 2000, 615p.

Further to an extensive study of the literature[39] we used the definitions applied in *Eurostat*[40] and at the *International Labour Organization*[41]as a basis. The 'standard' refers here both to the regulatory model[42] that forms the basis for the regulation of social law and to the labour market model that is regarded as 'standard' in all existing employment relationships. Employment relationships that differ from this, are regarded as 'atypical'.

From this point of view perhaps Walton[43] provides the most complete description of the typical standard employment relationship. This can be defined as the "*stable, open-ended and direct arrangement between a dependent, full-time employee and their unitary employer.*" The definition not only contains the traditional elements of the employment relationship (the personal subordination, the bilateral nature of the relationship, the wage as a source of income, the economic dependency, the reciprocity of the commitments and the place where work is carried out; together the first characteristic), but also implies qualitatively the job security (2nd characteristic) and income security (3rd characteristic) that are the objective of the permanent employment relationship. Below is a brief explanation of the three characteristics:

THE ELEMENTS OF THE STANDARD EMPLOYMENT RELATIONSHIP (1ST CHARACTERISTIC)

Personal subordination

The first, and perhaps most important, element is the personal subordination of the employee to the employer. Legally, subordination is traditionally interpreted as the control and supervisionthat the employer has over the employee.[44] As the work became more intellectual in nature (for example with highly educated employees), the nature of the instructions and control also changes. For example, the functional coordination of the work and the degree of integration of the work gradually dominates in the labour organisation of the employer. Control over the duration, the formal organisation and the scope of the work prevail over the substantive control by the employer.[45]

Bilateral employment relationship

The unequal bargaining position that lies at the (normative) basis of labour law aimed at protecting employees. According to *Freedland* and *Controuris*, this is intrinsically linked to the bilateral contractual nature of the standard employment relationship whereby one of the parties, the employee, is in an economically weaker position and therefore needs more protection.[46]

Reciprocity of the commitments

The contractual relationship between employee and employer in turn leads to a reciprocal relationship. Employers pay wages in exchange for the work delivered by employees and are therefore obliged to provide (sufficient) work so that employees can obtain sufficient income security and can further develop their skills (to strengthen their position in the labour market and to earn more). On the employee's side this implies being available to perform the work on offer.

Salary (remuneration)

An essential component in the (regulation of the) employment relationship is the salary that is paid

39 See A. BARRIO en P. SCHOUKENS, "The changing concept of work: when does typical work become atypical", *l.c.*

40 Alzo wat bedoeld met 'Alzo'? in de *European Union Labour Force Survey – Annual Results.*

41 International Labour Organization (2006), *Recommendation 198: Employment Relationship Recommendation* in 95th Session International Labour Conference, Genève (ILO).

42 In contrast to the deregulating model that is now gradually being used as a standard, for instance, flexicurity. See S. DEAKIN, *Addressing labour market segmentation: the role of labour law*, Genève, International Labour Office, 2013, p.4.

43 M.J. WALTON, "The shifting nature of work and its implications", *Industrial Law Journal*, 2016, 45/2, pp. 111-121 with reference to K.V.W. STONE and H. Arthurs, 'The Transformation of Employment Regimes: A Worldwide Challenge', in Stone, K.V.W. and Arthurs, H. (eds.), *Rethinking Workplace Regulation: Beyond the Standard Contract of Employment*, New York, Russell Sage Foundation, 2013, pp. 1–20; M. FREEDLAND 'Burying Caesar: What Was the Standard Employment Contract?' in Stone, K.V.W. and Arthurs, H. W. (eds.), *Rethinking workplace regulation: Beyond the standard contract of employment*, New York, Russell Sage Foundation, 2013, p. 82.

44 B. VENEZIANI, "The employment relationship", in HEPPLE, B en VENEZIANI, B. (eds.), *The transformation of labour law in Europe: A comparative study of 15 countries 1945-2004*, London, Hart Publishing, 2009, 109.

45 Eurofound, *Time Constraints and Autonomy at Work in the European Union*, Luxembourg, Publications Office of the European Union, 1998. Applied to the increasing autonomy of translators see J. FRASER and M. GOLD, '"Portfolio workers": Autonomy and Control amongst Freelance Translators', *Work, Employment and Society*, 15/4, 2001, pp. 676–697.

46 M. FREEDLAND and M. CONTOURIS, *The Legal Construction of Personal Work Relations*, Oxford, Oxford University Press, 2011, p. 370.

to the employee in exchange for the work done. In view of the intended (income) security, the salary is extensively protected.[47] After all, it must enable employees to generate an income that leads to sufficient social security for them and their family. And that income offers companies (employers) and the economy in a broader sense, consumption assurance. So there is a reciprocal interest in income.

Economic subordination

Salary dependency leads to the economic subordination of employees towards their employer. The employment relationship is the most important, sometimes even the only source of income for employees. This means they are not in a position to sufficiently spread the economic risks of earning income.[48]

At the employer's workplace

Finally work is generally done at the employer's workplace. This is an element that follows from a traditional *Fordism*,[49] but that became relatively less important in light of the increasing possibilities to spread the work geographically in the space.[50]Some argue that the workplace is not an essential part of the traditional standard employment relationship (see below).

WORK STABILITY (2ND CHARACTERISTIC)

The traditional employment relationship leads to work and income security (the social function of the employment relationship). Work stability covers two elements. The employment relationship is *permanent*. It can only be terminated under certain conditions or for certain reasons such as incompetence, bad behaviour or economic reasons. This long-term solidarity between employees and employers can manifest further into permanent training facilities that might create an increasing autonomy on the part of employees within the company.[51] Mutual trust and loyalty in this sense therefore become important elements in the employment relationship between both parties. In addition, work stability refers to the *full-time* nature of work that translates into a working week established in advance (standardised working hours).

INCOME SECURITY (3RD CHARACTERISTIC)

In turn work stability creates the intended income security for employees. Income security relates to earning a salary that is sufficient to provide for livelihood security, but also to the expectation of sufficient social protection when there is a risk of loss of income due to unemployment or incapacity for work (role of social security as income replacement). Income security allows people to consume and plan in the long(er) term, making long-term investments once again possible.[52] The government also assumes (macro) income security since it guarantees stable income through taxation. It enabled Europe to develop the welfare state after World War Two.[53]

Atypical forms of work

Generally speaking, atypical work involves the disappearance of one or more of these typical characteristics, such as economic subordination, at the employer's workplace or work or income security. We refer to these as the external challenges. Nevertheless, it may happen that all the characteristics are present, but that the characteristics themselves are subject to developments; these are the internal challenges. Below we first discuss the internal changes followed by a discussion of the external changes.

47 R. KNEGT, 'The Employment Contract as an Exclusionary Device', in KNEGT, R. (ed.) *The Employment Contract as an Exclusionary Device: An Analysis on the Basis of 25 Years of Developments in the Netherlands*, Antwerp, Intersentia, 2008, p. 3

48 G. DAVIDOV, 'Freelancers: An Intermediate Group in Labour Law?', in FUDGE, J., Mc CRYSTAL, S. and SANKARAN, K. (eds.), *Challenging the Legal Boundaries of Work Regulation*, London: Hart Publishing, 2012, pp. 171-185.

49 Reflecting the work organization introduced by Ford and referring to stable employment based upon an open ended, full time and direct arrangement with a unitary employer leading to the necessary job-security allowing in its turn to the necessary amount of consumerism and economic activities affording the (further) development of our welfare states.

50 J.E. VLEMINCKX and J. ROJOT 'The Fissured Workplace in France', *Comparative Labor Law & Policy Journal*, 2015, 37/1, p. 165.

51 N. ZEKIC, 'Job Security or Employment Security: What's in a Name?', *European Labour Law Journal*, 2016, 7/4, p. 568.

52 G. BOSCH, 'Towards a New Standard Employment Relationship in Western Europe', British Journal of Industrial Relations, 2004, 42/4, p. 619-620.

53 H. GOTTFRIED, 'Insecure Employment: Diversity and Change', in WILKINSON, A., WOOD, G. and DEEG, R. (eds.), *The Oxford Handbook of Employment Relations: Comparative Employment Systems*, Oxford, Oxford University Press, 2014, pp. 541–570.

Internal developments

The traditional characteristics of the standard employment relationship can themselves be subject to evolution. The employment relationship retains its traditional characteristics, but the content-specific interpretation of the element evolves. For example, work is no longer necessarily done at the employer's workplace, but it can be spread out geographically or done at the employee's home (home work or more recently teleworking). The working conditions that relate to the workplace will necessarily have to be adapted to this situation (consider, for example, the establishment of working hours, rest times, but also the suspension of the employment contract in the event of a technical defect at the workplace).

Similarly, the interpretation of the element *legal (personal) subordination* has also evolved. For example, the service economy is increasingly characterised by more complex forms of work that require a high level of education on the part of employees. The employer depends on the intellectual autonomy of the employee. Consequently, the assessment of legal subordination will focus more on the functional context within which the employee is active (and the possible freedom that the employee has: working hours, use of equipment, use of rooms made available by the employer, etc.). The characteristics of standard work therefore also come under pressure from 'from within' and must, where necessary, be given a *new interpretation*, adapted to social and/or technological evolutions.

External developments

More important for this contribution is the evolution in which the traditional elements of the standard employment relationship come under external pressure. Atypical work can also be regarded as an external development of typical work caused by the absence of one or more characteristics.

Atypical work is not a recent phenomenon. In a certain sense it is of all times and it is precisely in the standard employment relationship that it finds its rationale. After all, as soon as work is done in which one or more elements typical of the standard relationship are absent, we are dealing with atypical work.

Originally, these atypical forms developed around the absence of a legal subordination (independent work) and/or because of the absence of a stable employment relationship (fixed-term work) or income security (part-time work). It is also these atypical forms of work that are still the most prevalent in Europe. For example, roughly speaking, 60% of the working population in the European Union is still employed on the basis of a permanent contract[54] *and employment in the form of temporary and/or part-time work is 'limited' to 14% and 19% respectively of the workforce (combined or not), while self-employed work still only occupies a modest share of 4.5%. However behind these figures there are some interesting trends to be observed. For example, these three main forms of atypical work account for one third of all employment relationships in the OECD countries and account for half of the net employment growth since the 1990s.*[55] *In Italy, France and Germany the percentage of professional activity in the age group between 15 and 24 years on the basis of a standard employment relationship has dropped by 30 to 40 percent in the period 1985-2015.*[56] *In the Netherlands, half of the workforce is employed in some form of part-time employment.*[57] *These figures indicate that atypical forms of employment are (again) in the ascendant. But perhaps more important than the bare figures is the increasing variety under which atypical work manifests itself.*

New forms of atypical work come to the fore, *deviating* from the other elements of standard work, including for example (the lack of) salary, reciprocity or economic subordination. For example, non-paid forms of work such as internships, apprenticeships or doctoral fellowships are increasingly being used, whereby the doctoral student is qualified as a student for the application of employment and social security law. Also in the ascendant are employment forms in which the employee is increasingly paid on the basis of the return of the operating capital and less in proportion (or 'reciprocity') to the work done.[58] Similarly, the remuneration by companies of 'popular' participants in social networking sites is increasing; people with many followers or friends are regarded by companies as (potential) trend-setters and paid in proportion to success - and not to the work done.

Furthermore, it is striking that new forms of work increasingly contain more different atypical work elements at the same time. Atypical work has generally developed into a combination of temporary, part-time and self-employed work, possibly even further supplemented by other atypical elements, including for example the lack of reciprocity, bilateral legal relationship or economic subordination. *Crowd-work* is a good illustration of this.

Crowd-work is when a client offers work on an on-line platform, which is done by an individual. The work can be performed off-line (Uber, Deliveroo, TaskRabbit, etc.) or (immediately) on-line (Amazon Mechnic Task). Depending on the platform, there are different levels of control carried out on the established legal relationship and/or the delivered result. For example, the high level of control and pricing exercised by Uber is increasingly becoming an element that is taken into account in the case law to nevertheless qualify the 'atypical' employment relationship as paid employment.[59]

54 Eurostat (2015c), European Union Labour Force Survey - Annual Results 2014, retrieved August 2016, http://ec.europa.eu/eurostat/statisticsexplained/index.php/Labour_market_and_Labour_force_survey_(LFS)_statistics

55 OESO, *In It Together: Why Less Inequality Benefits All,* Paris, OECD Publishing, 2015, pp. 137—139.

56 K.V.W. STONE, 'The Decline in the Standard Employment Contract : A Review of the Evidence', in STONE, K.V.W. and ARTHURS, H. (eds.), Rethinking Workplace Regulation: Beyond the Standard Contract of Employment, New York, Russell Sage Foundation, 2013 p. 374.

57 Eurostat, Part-time Employment as Percentage of the Total Employment, by Sex and Age, retrieved August 2016, http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_eppga&lang=en

58 In 2013, the Employee Shareholder Status was introduced in the UK, where the employee opts for a share in working capital in exchange for a loss of employment protection against dismissal and severance pay. Likewise, the large numbers of self-employed workers in Belgium that are organised in company form and that pay themselves an income that is fixed at a fixed rate independently of the work done.

59 In this sense, for example Federal District Court San Francisco 11 March 2015 and London Central Employment Tribunal *Aslam and Farrar v Uber*, 28 October 2016.

Consequences for social security

What exactly are the elements that deviate from the standard employment relationship which should be taken into account when drawing up the (work-related) social security schemes? The typical employment relationship of the 'full-time employee' is the basis for this standard.[60] A unique, specific solution must be found in the social security system for forms of work that deviate from the standard employment relationship. For example, earlier research has shown that unemployment insurance can be organised for the group of self-employed workers[61]. The uniqueness of the group will, however, need to form the basis from which the fundamental principles of social security can be translated correctly: the fact is that unemployment insurance for self-employed workers will be different because there is no subordinate relationship with the employer. The conditions for the granting of a benefit will first and foremost have to relate to the discontinuation of the self-employment and not to dismissal.

Thus, for atypical forms of work, it will be appropriate to examine where the specificity (deviation from the standard) lies and how this uniqueness can be translated into an adapted application of social security protection. Due to the increase in atypical forms of work and the simultaneous application of several atypical work characteristics in each of these types, more and more challenges arise. Given the limited structure of this contribution we cannot here examine each atypical group individually. Without being exhaustive, we list a number of atypical elements that require a *review of social security*, at least if we want to keep the atypical workforce in the system.

Many atypical work forms do not (any longer) entail (full time) work activities that are performed in exchange for wages (reciprocal commitments). The relationship between work activity and income is called into question (see above examples of the employee shareholder, the non-work-related activities on social networking sites that generate income, etc.). It will become increasingly difficult to determine when the 'activity' can be considered as a *work activity* to be taken into account for the application of work-related social security schemes. Conditions that are determined in terms of the number of hours worked or other work volumes in social security law (access conditions, contribution provisions in respect of which the amount is related to the number of hours worked) are harder to apply to atypical forms of work. It can be expected that as work becomes more flexible, the income factor will play a greater role in determining the (scope of) social security rights and obligations and that this will be at the expense of the *work (volume)* element.

What is more, many atypical forms of work appear to be based on work that is not paid or is paid only marginally (reduction of the income security and salary elements). It becomes more difficult to determine whether the activity performed has the underlying objective of generating income (livelihood security), or focuses rather on a different (non-mercantile) *objective*, such as learning more during an internship. To what extent can these forms of work (still) be included in work-related social security? What *minimum thresholds* will we apply for taking work into account for accruing entitlements to social security?[62] How far can we go in financially supporting this type of (non-economic) activities (role subsidies, in-work benefits)? Thresholds are exclusive and therefore less desirable as work flexibility increases. It might be necessary to switch to more transparency, with every euro earned from an activity creating entitlement to social security. There is also the observation that the Nordic two-pillar system has fewer problems protecting atypical forms of work (in particular non-economic activities) due to the general protective function of the first universal pillar. Yet, here attention should be given to the financing side, as atypical work forms such as platform work may for the moment not be well enough incited to pay in proper taxes/contributions

60 K. VLEMINCKX and J. BERGHMAN, 'Labour Market Deregulation, Non-Standard Employment and the Reform of Social Security', *o.c.*, 2003, pp. 31–44.

61 P. SCHOUKENS, *De sociale zekerheid van de zelfstandige en het Europese Gemeenschapsrecht*, 2000, 615p.

62 An initial comparative study shows us that Member States deal very differently with the definition of 'marginal' work and that the minimum thresholds for accessing social security schemes in Europe vary widely.

for social security purposes. arrangements meet the first protection needs of the growing group of atypical workers.

Atypical forms of employment deviate more from the bilateral relationship with one employer. For example, multiple clients can be considered to be the *employer* (see platform work, temporary work, etc.). In traditional social security, the employer still has an important (administrative) position, for example with regard to collecting the contributions or with regard to the final conditions for the granting of benefits during illness and unemployment. Who will take on this role or duty with regard to the non-traditional work forms? The client, the customer, the platform at the centre of the sharing economy, the state? When there are multiple clients (see crowd work) the question arises as to how this client responsibility can be spread. Alternative forms will have to be thought up to accommodate the *declining role* of the employer. With regard to this, inspiration can be drawn from the solutions implemented in numerous systems for agency workers in Europe.

Atypical forms of work are at risk of presenting an increasing *qualification problem* (absence of traditional legal subordination). In a derived form, this qualification conflict threatens to culminate in a growing number of sham employees who can be deployed more for the client more ‘cheaply’ (because less protected). To prevent this, efforts must be made to guarantee full social protection for all forms of work, taking into account the uniqueness of the form of work in each of the work groups. For this purpose, a link can be sought with the aforementioned distinction between work status neutrality and specificity as refined and applied for self-employed workers.

Conclusion

The increase in the group of atypical workers means that their social security protection needs reviewing. How far should we go in approaching social security for self-employed workers, flex workers, crowd workers and all new employment relationships differently? This will depend on the number of elements in respect of which the atypical employment relationship differs from the established standard: the full-time employee with a permanent employment contract. But first it must be clear, from the perspective of social security, what the universal core elements of the employment relationship are (§1) and what internal and external deviations from this exist (§2). Once this has been done atypical elements can be examined with regard their discordant relationship with current social security law (§3). And then, if necessary, they can be tailored within national social security law.

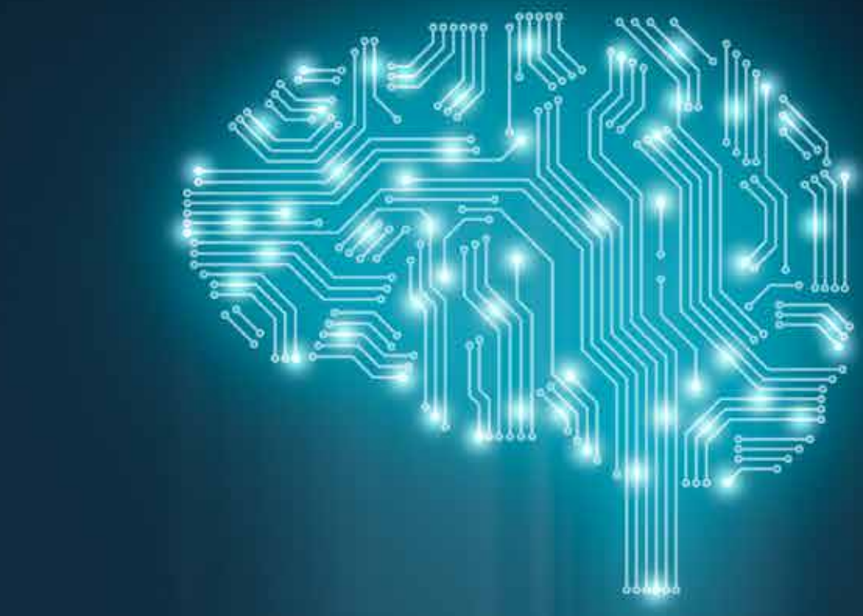
What we have in mind is a social security system that is sufficiently flexible in its implementation to give the different groups of workers an equal place and at the same time maintain a financially sustainable social security system providing sufficient social security protection for typical and atypical workers. In essence, this constitutes the theory of work status specificity: the underlying objective of social security is in principle neutral with regard to the various forms of work, but when implementing these objectives they should be adapted to the specificity of activities that the different types of work entail.

However, the platform economy, and the digitalisation of work in general, show us that our social security is facing an additional challenge. While for many years working 9 to 5 was the standard earning model in our welfare state, today there are a variety of different ways to generate income. Each individual (whether or not in a family context) will continue to feel the need to generate income to build their life and to improve their standard of living or to find meaning in work. If social security wants to safeguard its role with regard to income protection, it will have to accommodate this evolution of possibly multiple forms of income acquisition in existing or new protection systems. In doing so, a balance must be found between general protection (for all workers) and adapted protection (taking into account differences in the underlying earning models of families and individuals).

The economy 4.0 is therefore an invitation to review social security, to go back to the essence while at the same time thinking out-of-the-box. Not responding to the challenges fundamentally is not a policy option, at least not if you want to preserve the foundations of the social security system.

Max Rangley
Founder of ReboundTAG and manager of the Cobden Centre

CAN WE ROADMAP ARTIFICIAL INTELLIGENCE FOR ECONOMIC POLICY-MAKERS?



There is certainly a lot of talk at the moment about the economics of artificial intelligence. How will labour markets develop over the next generation? Will people be able to adapt quickly enough? What will the appropriate policies be for reacting to these forces? If we look at the most successful economies of the last generation more broadly, we see a variety of different economic models which stand out. The most prosperous countries include Norway, Switzerland and Singapore, all of which have very different political systems and attitudes towards economic development. When it comes to artificial intelligence we shall see similar trends—different cultures will approach it in different ways, and over time we shall see which adaptive responses work best within different contexts.

Given this flexibility, one of the most important aspects of the economics of AI will not be a list of specific policies per se, but rather looking at how artificial intelligence can be roadmapped for economic policy-makers. Are there ways that we can predict how AI will evolve? The speed with which self-driving cars arrived on the scene surprised many people, yet there were AI engineers such as Ray Kurzweil predicting with quite good accuracy that self-driving cars would become feasible in this decade. Kurzweil, who is now head of engineering at Google, wrote a series of books—the first in 1990—making predictions of how AI would develop; he predicted that in 1998 a computer would beat the world chess champion (he was correct to within a few months accuracy) by looking at how fast computer chips were evolving and extrapolating from the amount of computation that would be needed. Given this, it is worth looking at some of the most successful methodologies used for roadmapping artificial intelligence to see what the economics community can learn from them.

DARPA's 3 Waves of AI

John Launchbury, who was head of the Information Innovation Office (I2O) at the Defence Advanced Research Projects Agency, which is responsible for developing emerging technology projects for the US military, has lectured about the 3 waves of AI.

The initial wave, which we saw over the last few decades, was based on handcrafted AI. For instance, the types of computer programs which could do your tax returns or manage flight departures at an airport would fall into this category; they are programmed by people, and therefore do not learn or evolve, yet they are capable of complex procedures, often at a higher level of competence than humans.

The second wave is machine learning, which is the phase we are in right now. Machine learning allows computers to learn statistically from data, whether this be a self-driving car learning to drive, a chatbot learning to converse with people, or a game-playing AI learning to play Go or Chess better than the best human players just by playing itself over and over again.

The third wave is contextual adaptation, which allows AI to build underlying explanatory models of the world. The word "understand" can be a charged term in the philosophy of AI—to read more just google "Chinese Room Experiment" and you can learn about the controversies—yet this wave of AI comes closer to actual "understanding" than the previous two waves. This would mean that for AI to learn a new topic or skill, it would not need to be given thousands of examples as with current machine learning techniques, but rather could use an abstract model of the world to "reason" about how best to proceed.

The first wave caused disruption to routine-based jobs, for instance involving data processing. The second wave has the potential to bring more profound changes as learning enables machines to outperform their masters in subtle and unpredictable ways—a machine learning project recently learned how to predict the outcome of Supreme Court cases with more accuracy than the best legal experts. The third wave is the most likely to cause widespread disruption as it involves the kind of contextual thinking used for, for instance, thinking through scientific theories—this third stage is some way off, but will be by far the most disruptive.

Exponential Increases in Computation

In 1965, Gordon Moore, the founder of Intel and Fairchild Semiconductor, wrote a paper describing how the number of components on an integrated circuit was doubling every two years and would continue to do so for the foreseeable future; this became known as Moore's Law. Intel executive David House would then add to this by outlining how actual computer power doubles roughly every eighteen months due to both the density of circuitry but also the speed with which each transistor was operating. Moore's Law has been used for the last few decades in the computer industry to predict the amount of computation that will be available in future time periods.

The human brain is largely designed to make linear calculations; it evolved in an environment thousands of years ago where there were few visible exponential trends. It is therefore not intuitive what a continued doubling of computer power means for the economy. If you incrementally add a unit 30 times, starting from 1, you get to 30. If you start from 1 and double 30 times, you get to a billion. This is how we have had such incredible development of computer technology, a modern smartphone has millions of times more processing power than all of the computers combined which were used to put a man on the moon in 1969.

Moore's Law has recently been slowing for central processing units, but different chip designs are used for modern machine learning and are, if anything, developing faster than Moore's Law trends would predict. These chips, which are similar to graphics processing units, also tie in with the second wave of AI talked about by John Launchbury at DARPA, allowing far more complex forms of machine learning to take place, hence the sudden burst of progress in self-driving cars and facial recognition capabilities.

Economic History Analogies

The Stanford AI engineer Andrew Ng compared the economic impact of AI to the impact of electricity a century ago. Economic historians often use the term "general purpose technology" to describe technologies that affect many sectors of the economy. Electricity was different from, for instance, the invention of antibiotics, as it directly fed into almost all sectors of the economy, including of course pharmaceutical companies. AI has the potential to be as pervasive as electricity. Ubiquitous intelligence will become possible as devices all around us will be able to connect to pools of computation.

Robert Solow won the Nobel Prize in economics for his work studying the nature of economic growth; he came to the conclusion that 87.5% of long term economic growth comes from technology. He coined the term "productivity paradox", whereby as he put it "You can see the computer age everywhere but in the productivity statistics", yet the same could be said of electricity a century earlier. Much of the development within AI will be more subtle than the headline-grabbing developments such as self-driving cars. This becomes even more so as research and development becomes automated as we move into the third wave of AI.

What can we learn from these concepts?

By using Moore's Law, many in the computer industry have been able to make accurate predictions about how AI will develop. Ray Kurzweil has become famous for his predictions by extrapolating from exponential increases in computation. But the roadmap for AI is more complex than this; John Launchbury, in producing roadmaps of AI for the US military, showed how we should think not just of "artificial intelligence" or "automation" as a monolithic concept, but rather should think of AI having at least 3 waves associated with it, each bringing new opportunities and challenges. By looking at economic history, we can see that there are certainly analogous periods of technological development, but we should always be aware that AI challenges humans in our comparative advantage as a species— our smartness—and is therefore also different from electricity or the internal combustion engine.

Max Rangeley recently moderated the Future of Artificial Intelligence roundtable discussions in the European Parliament and has given seminars on the economics of artificial intelligence at AAAI and at the IMF. Max is the founder of ReboundTAG and is the manager of The Cobden Centre, he also sits on the Executive Board of the Initiative for Free Trade and the Advisory Board of the Ludwig von Mises Institute.

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AUTOMATION MAY LEAD TO JOB LOSSES BUT IT WILL ULTIMATELY BENEFIT CONSUMERS AND THAT IS WHAT MATTERS

That the welfare state is unsustainable is becoming ever more evident. In Prussia in 1889, Chancellor Bismarck granted workers for the first time a pension at 70, when they would pass away at 45 on average. Not very generous. When everyone lives a lot longer, the funding needs to come from somewhere.

In recent decades, the situation has become a lot worse. In Belgium, one of the world's oldest welfare states, people used to work until age 64, on average, in 1975. Then, the average life expectancy was around 72. Today, Belgians start enjoying state-provided pensions or similar arrangements already before they are even 60, on average, due to a whole range of measures providing pensions or de facto pensions to people that lost their job at a later age. The average life expectancy has however climbed to around 80, making it a challenge for the Treasury to afford this.

Increasing taxes has helped to finance this and when people are overtaxed there is always good old money printing to keep the scheme going for a bit longer. At a certain point, however, the private sector is no longer able- never mind willing - to bear the cost of an ageing population expecting a state pension or cheap health care provision.

At worst, this all ends with governments not only debasing savings but also defaulting on its debt, thereby damaging the reputation of any government succeeding it, hurting the country's credit rating and thereby making debt more expensive.

For all this doom and gloom, even in case of badly mismanaged welfare states, one should look at the whole picture. At the end of the 1980s, when many Western welfare states were struggling with their ever increasing debt burdens, worsened by increased interest rates, we could witness the fall of the Iron curtain. This geopolitical event led to a great opening of global trade, resulting in economic growth that compensated for the existing damage. Dire predictions of all kinds have therefore not materialized. The lesson is that even if dysfunctional government policies cause a lot of damage, it is always possible that this will be compensated by geopolitical events enabling more trade or technological progress creating more wealth.

That technological progress will bring great economic benefits is not universally accepted. One particular concern in this regard is that automation would hit exactly those people that are already heavily burdened by strained welfare states, as automation would lead to mass job losses. One 2015 report, from ING Bank, claims that in Germany, two thirds of the current jobs are going to disappear, so that 18 million out of the 30.9 million workers in the country would be made redundant by improved technology.

To be fair, the authors concede that automation will also create new jobs, as humans will need to maintain and manage the machines. Up to 800 million global workers will lose their jobs by 2030 and be replaced by robotic automation, McKinsey Global Institute has estimated, urging for people to be retrained.

Yet another study, published in 2018 by the World Economic Forum (WEF), however claims that robots 'could create double the jobs they destroy', as 133 million jobs would emerge globally, by the middle of the next decade, versus only 75 million jobs that would be destroyed. The findings stem from a survey of company executives representing 15 million workers in 20 different countries.

Who's right and are company executives even able to predict all of this in the first place?

Between World War II and today, a period of strong technical progress, which made a lot of manual workforce redundant, the U.S. labor force participation rate first increased for fifty years, in order to then decrease during the last 20 years. This proves that technological progress alone is not sufficient to determine whether the number of jobs will increase or decrease.

What's certain is that the question whether technology and automation will increase jobs or destroy them attracts doom prophets of all stripes.

Mady Delvaux, a Socialist Member of European Parliament from Luxembourg, who was involved in looking at possible regulation in this area, has stated: "My main concern is that humans are not dominated by robots, but robots serve humans." Her institution, the European Parliament, has gone as far as to pass a resolution envisioning a special legal status of "electronic persons" for the most sophisticated autonomous robots, something which was slammed in an open letter drafted by more than 150 experts, who stated that this idea was based on a perception of

robots "distorted by science fiction and a few recent sensational press announcements".

Another rather hostile policy response to automation is the idea of a so-called "robot tax". Not only French socialists have supported the idea. In South Korea, it has even been implemented, as tax deduction benefits which companies received for productivity boosting infrastructure investment were axed. In the U.S., it is also something self-proclaimed democratic socialist Alexandria Ocasio-Cortez and tech billionaire Bill Gates agree upon. Gates thinks that the receipts could be used to pay to retrain workers that have lost their jobs.

Of course it's not a bad idea to retrain people if necessary, but fundamentally, many do not look at the whole picture here. When automation is implemented, customers ultimately benefit from this, either in terms of receiving a better service or enjoying cheaper prices for products. So even if people may lose their jobs as a result of automation, consumers are also able to save more money. Any robot tax will ultimately need to be paid by these consumers, so as a result they wouldn't be able to save more.

The more savings there are, the more resources there will be available for investment into new companies and the more consumers will be able to buy new products. In other words: market mechanisms already provide a way to cushion the blow for those losing their jobs as a result of automation. Higher savings will result in more investment, so new companies where emerge where these people will be able to work for. We don't have to look very far to think of new services that didn't even exist a short while ago and are now household names: Uber, Airbnb, Twitter, Spotify. Even if most of these are American firms and even if it is a problem that not enough new companies are started in Europe, Europeans do keep more money in their pockets as a result of these innovations.

The great French 19th century economist, Frederic Bastiat, has always stressed to not only look at "What Is Seen" but also to "What Is Not Seen". When looking at automation, many only see the jobs that are lost. They don't see consumers being able to save more money, so they can buy services that otherwise would have been unaffordable luxuries, or their extra savings can be invested in companies that otherwise wouldn't be able to raise enough cash to survive. When in doubt, on any economic topic, one must ask the question whether the consumer benefits, because everyone is a consumer. In case of automation and technology, it's obvious that this is a good thing for consumers. So on the whole, economically, it therefore is also a good thing and may compensate for the challenges of unsustainable welfare states.

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Former Member of European Parliament

ARTIFICIAL INTELLIGENCE IS AN OPPORTUNITY FOR THE WEST, BUT A HUGE PROBLEM FOR THE DEVELOPING WORLD

The general assumption is that the widespread adoption of Artificial Intelligence will lead to significant job losses. These losses will not be confined to low income unskilled jobs, but will increasingly also extend to traditional middle class and white collar jobs which will start to undermine the social fabric of societies in the West.

This view has been reinforced by a number of publications. Martin Ford devotes most of his book "The Rise of the Robots" to this premise.[63] A University of Oxford study estimated that 42% of total employment in the United States was at risk of disappearing over the next two decades.[64] The McKinsey Global Institute predicted that as will cause between 40 and 160 women worldwide to have to change occupations by 2030.[65] Oxford Economics estimated that 20 million manufacturing jobs will be lost by 2030. [66]

Yet, as has been the case in every previous economic revolution, history suggests that over time jobs and industries that are lost will be replaced by many more better and higher paying jobs. There are not and have never been a fixed number of jobs in the economy.

Although AI seems different, it is no different to any other technological advancement in the past. Each new technology replaced the need for humans to do the work, increasing productivity, lowering the cost of doing business and freeing up workers to do more productive and better paying jobs. This revolution will do the same over time.

However, the potential scope of AI as a job destroyer in the short term does mean that there will be an impact on society while we transition from the modern economy to a future AI driven one. This is where the great challenges will be for all societies, but the West is far better placed to benefit from it than the developing world.

Many of the jobs that have migrated from the West to the developing world in the past 20 years are those which will be destroyed by the first wave of automation. That automation will drive the production, but not the jobs back to the West. The major markets are in the West, the infrastructure is there and the educated workforces are there. The production will return and the economic benefit and jobs will filter through the supply chain and ancillary services close to those production centres. Manufacturing is also only a small part of most Western economies, in the UK for instance it accounts for only around 10% of the economic output.

The major threat of Automation and AI is not therefore job losses in the West, but in the developing world and the potential instability that could bring. China is aware of this and has become the world's leading investor in AI research to try to mitigate the potential risks. However despite this investment, its data scientists are still less experienced, China produces far fewer patent applications than the US and has fewer workers in AI positions than Europe or the US.[67]

China is still in a better position than other developing countries such as Vietnam, Bangladesh, Indonesia or those in Sub Saharan Africa. They face a future where a large and cheap workforce is no longer enough to encourage manufacturing production to set up there rather than in the West. With growing populations, educational systems and infrastructure not sufficiently developed to take advantage of the new opportunities that AI will bring, they appear vulnerable to being left behind by the AI revolution.

The instability this could cause will be a major issue that the West will need to address in the coming decades. For the world outlook to be stable, there needs to be economic opportunities for the young in their home countries, especially as those countries have rapidly growing working age populations. If those opportunities are not there, it will feed instability and conflict in those countries and will force many to seek opportunities abroad.

The real job challenge of AI is not in the West, it is in the developing world, for that is where the storm will blow the hardest. The West will need to be prepared for this, economic growth in the West is not enough, it needs to ensure that the developing world can also reap the benefits of AI and automation.

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