Work in the Age of Intelligent Automation

Remarks on the Current Automation Debate

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1 Introduction

The relationship between the development of technology and the evolution of work is a matter that fascinates people's minds. Speculations on how different technologies will change work and employment have given rise to wild, both utopian and dystopian, predictions over the course of industrial history. The rapid progress of digital technology in the form of advances in artificial intelligence (AI), machine learning, robotics, cloud technology and the use of digital platforms in recent years has once again fuelled the debate on this subject also in economic and social sciences.

In this short critical overview, I try to put this debate into context by assessing the ongoing debate from two perspectives. The paper asks, first, whether we are heading towards a major transformation – or even disruption – in the world of work in the digital era, or whether changes that are taking place should rather be characterized as "business as usual". Second, the paper asks what kinds of effects could changes in work due to the advance of digital technology have on the quality of working life.

2 Three phases of automation debate

The concept of automation is quite new, even though the idea itself is old. The roots of modern automation debate date back to the late 1940s and the 1950s, when automation specifically referred to industrial automation that was at that time principally applied by technologically-advanced large enterprises in the automotive and continuous process industries. In most of the early automation debate, technological change was considered an inevitable feature of economic and social modernization and its impact on work and work organizations was largely seen as an inherent by-product of the nature of the technology itself (e.g. Blauner 1964; Bright 1958; Woodward 1965).

In the second phase of the automation debate that was fuelled by the development of a microprocessor in the early 1970s, understanding of the nature, dynamics and effects of automation and, in general, technological development, widened with the adoption of more advanced perspectives. If the first phase of the modern automation debate focused on the *rigid automation* applied in the industrial mass production and continuous process industries, the idea of *flexible automation* was the characteristic feature of the second phase of the automation debate in the late 1970s and 1980s. The development of the microprocessor enabled a rapid spread of microcomputers and, as a result, a more decentralized use of computers and an easier, more rapid and more flexible reprogramming of computerized machines and equipment. The discussion on flexible automation and its impact on work extended now to new types of industries and work

such as small-series and one-of-a-kind manufacturing and office and administrative work as well as work organizations of all sizes (e.g. Hirschhorn 1984; Kern & Schumann 1984; Piore & Sabel 1984).

The third phase of the automation debate, which has gained momentum in the 2010s, has largely focused on the potential of AI, machine learning, intelligent robotics and platform work. Its core theme is the idea of *intelligent automation*. Intelligent automation is considered to extend to all industries and all kinds of organizations and in a more pervasive way than during the two previous phases. The next chapter takes a closer look at this debate.

3 The third phase of the automation debate: intelligent automation

3.1 New features of automation

The advent of intelligent automation in the 2010s has given rise to an ever-growing number of books and other writings, focusing on the pervasive nature of new digital technology and its sweeping implications for work and employment. Views that follow this line of reasoning are generally built on one or more of the following three arguments.

First, machines have now new functional characteristics such as computer vision, speech recognition, natural language generation, enhanced predictive power, increased communicative ability and increased mobility. This means that machines such as smart robots can substitute for human input in an increasing number of jobs and tasks. In addition to that, the new functional characteristics of machines will, according to some authors, lead to profound and systemic changes in the nature of work by creating a new globally accessible information spaces in which work can be radically reorganized (Boes et al. 2017) or even something that can be compared to an industrial revolution (e.g. Brynjolfsson & McAfee 2014; Schwab 2016).

Second, machines have now increased ability to learn. The traditional models in the development of AI that were based on expert systems, ontologies and rule-based reasoning have in recent years given way to connectionist models based on neural networks, fuzzy systems and evolutionary computation. This, together with the increase in machine computing power, the explosion in the amount of digital data and the development of new machine learning algorithms, has led to an optimistic turn in the discussion on the future potential of AI. The significance of machine learning is well illustrated by the fact that almost 60% of companies' investment in AI in 2016 was specifically targeted at machine learning. The figure was twice as high as investments made in computer vision and far higher than those made in the ability of computers to master natural languages, autonomous vehicles, smart robots or virtual assistants (McKinsey Global Institute 2017). With the help of machine learning, and unlike traditional automation, intelligent automation does not wear out and lose its productivity potential in use, but is able to continuously develop and optimize its operations.

The third argument is not based on the nature of digital technology as such, but its combined effects with the globalization and deregulation of the economy. Companies have now greater leeway to locate their production and organize their work processes

by making use of the possibilities for offshoring or acquiring work via digital platforms compared with earlier phases of automation. Thanks to improved availability of digital information and ease of communication, companies do not have to insource as many operations and grow in size (and increase their bureaucracy) as before, because decisions over the location of different stages of their value chains can be increasingly made even on the level of individual tasks and operations. As Baldwin (2016) notes, this is making changes in working life more sudden, more individual, more unpredictable and more uncontrollable.

3.2 The transformation of work thesis and its critique

According to the much-referred calculations by Frey and Osborne (2013), as much as 47% of jobs in the United States would be threatened by technological development over the next 10 to 20 years. The authors separated 702 different occupations based on the US professional classification. In the light of the expected development of technology, they assessed the extent to which different occupations included work tasks that could be automated. As high-risk occupations, they considered those of which at least 70% was prone to computerization in the next few years.

A qualitatively new feature in technological development is, according to Frey and Osborne, that the replacement of human work with technology is increasingly extended to cognitive non-routine tasks as well. Big data, increased computing power of machines and the development of machine learning make it possible to automate the kind of cognitive non-routine work that is predictable by outcome or way of implementation and that has previously been protected by the large amount of tacit knowledge it usually contains. Frey and Osborne also argue that the increasing possibility for automation will accelerate the simplification of jobs, because job simplification will further lower the threshold to automate individual work tasks. The main bottleneck for automation will in the longer term be the amount of creative and/or social intelligence required in the job.

Another influential analysis that largely shares the pessimistic overtone about the extent of job losses due to automation is the work of Ford (2015) on the rise of the robots. Ford's basic argument is that developed industrialized countries have moved to an era in which productivity growth has been increasingly separated from the growth of employment and average wages. Ford shares the views of Frey and Osborne (2013) and Brynjolfsson and McAfee (2014) according to which the new stage of technological development is leading to an ever-increasing substitution of machines for mental (both routine and non-routine) work as well.

However, Ford is more pessimistic than Brynjolfsson and McAfee in their view on how the "second machine age" will influence jobs. Brynjolfsson and McAfee believe that new "best practices" in the "second machine age" can well be found in solutions in which the strengths of the machine, such as tirelessness, repetition and computing power, and human strengths, such as creative and social intelligence in their various forms, complement each other in an optimal way. Ford suspects that this may only concern certain core groups of highly skilled workers in certain specific businesses and occupations. In many cases, a more likely solution is to outsource remaining work activities. Another reason why Ford is suspicious towards Brynjolfsson's and McAfee's

view is related to machine learning and increasing machine intelligence. The optimal relationship between man and machine, from a business point of view, is a dynamic process. The area in which man has an advantage over machine is constantly narrowing with technological progress, which is why the relationship is under continuous renegotiation. As a result, Ford believes that full automation will continue to involve more and more tasks.

Ford is not alone with his views. Susskind and Susskind (2015) argue in their work on the future of professions that technological development also profoundly changes the content of many highly-qualified specialist professions, breaking their exclusive right to exert expert knowledge and their monopolistic power that derives from this privilege. They distinguish six new models that utilize digital technology to produce expert knowledge. In the future, expert knowledge will be produced more and more often, besides trained individual experts, among others, by networked experts, voluntary communities of practical experience, semi-professional utilizing AI-based solutions and highly autonomous technological systems. However, unlike the Susskinds, Ford sees the development in a much more pessimistic light and doubts whether the massive substitution of machines for labour can any longer be compensated by sufficient job creation.

Views predicting a major transformation of work and loss of employment have faced critique on many grounds. The calculations of Frey and Osborne, for example, have been heavily criticized for methodological flaws and the narrowness of their approach (Arntz et al. 2016; Atkinson & Wu 2017). An empirical basis for claims on a sudden and qualitative break in work and employment is not particularly strong, at least so far. The claims are mainly based on individual examples, largely theoretical considerations or other kinds of rather speculative assumptions concerning future developments of digital technology and the speed of diffusion of its future applications and the way it is in practice utilized at work.

Neither have recent developments in digital technology been (yet) able to bring about a positive turn for productivity growth in the biggest industrialized countries. On the contrary, productivity growth has rather continued to slow down in many of these countries in the 2010s, and it seems that the process from new technological inventions to widely-diffused commercial innovations that will benefit a large proportion of businesses has become increasingly sluggish and complicated (e.g. Andrews et al. 2016; Baily & Montalbano 2016; Erixon & Weigel 2016). The process of creative destruction with its major implications for work and employment has not become more prominent in recent years.

It is interesting that people's own perceptions of the future substitutability of their current jobs with robots are much less gloomy than those seen by Frey and Osborne or Ford. In the 2014 Eurobarometer survey, the probability that robots could do one's own job "completely" was believed only by 4% of the employed citizens of the EU-28 aged 15 or older. If those who believed that robots would be able to do one's own job "mostly" or "partially" are also included, the figure rises to 36% (European Commission 2015). In the Eurobarometer survey conducted in 2017, the figures were only slightly higher: 5% believed in complete substitutability and, in addition to this, 39% that replacement would be "mostly" or "partially" possible (European Commission 2017).

The difference between citizens' self-assessments and expert evaluations is obvious. It can be explained by different perceptions of the possibilities to automate work and different time spans used in assessments. On the one hand, citizens may not be as well informed as experts about the latest developments in robotics and AI, and the practical applications and experiments based on them. On the other hand, especially those experts who resort to the use of macro-level data alone may not be sufficiently aware of all the tacit knowledge that may be contained in many such work tasks and activities that seem easy to automate from the outside. The third phase of the automation debate has also been characterized by vagueness in the time spans where technology is believed to displace work. This is the case with many expert evaluations as well as the Eurobarometer surveys, in which the time span is not defined in any way.

One way to bring the automation debate to a more realistic level is to start from the fact that only in a relatively few cases the job can be automated entirely at the level of current technology development. It is more common that automation only applies to certain individual work tasks included in the jobs. Experts of the McKinsey consulting company have estimated with the help of US data that it is possible to automate 45% of the work tasks currently being done by humans in the country (Chui et al. 2015). If machines were able to understand the spoken language like the average person, the share would increase to 58%. However, according to the same estimate, only less than 5% of current jobs in the United States could be totally automated with existing technology.

Starting from this observation, the key issue concerning how digital technology will change work is not the number of jobs disappearing, but how to reorganize, if not rethink, the human-machine relationship in the changing technological landscape. Technological development opens new opportunities for both job upgradation, in the form of more versatile and skills-enhancing work contents, and job degradation, in the form of increasingly standardized and fragmented work contents. The choice between these two alternatives is not basically constrained by the technology in question, but it is, for the most part, socially shaped, if not determined. From a constructive perspective, the main question that rises is how companies can make full use of this leeway so that advanced digital technology would also fully support people's potential to utilize and develop their skills and competences at work (e.g. Agrawal et al. 2018; Daugherty & Wilson 2018; Jesuthasan & Boudreau 2018). From a critical sociological perspective, the main question is how companies, in practice, act in these situations and what kinds of assumptions and managerial logics affect their decision making.

3.3 Intelligent automation and the role of filters

A characteristic feature of all three phases of the automation debate has been a worry about the future of employment and the content of jobs. So far, the worst worries, let alone dystopian nightmares, have not materialized. The history shows that the relationship between technological development and the evolution of work and employment is nothing but straightforward. The effects of technology on work and employment are filtered through a variety of factors.

In the sociology of work, there is a long tradition of studies in which differences between countries in the quality of working life (QWL), or some other aspects of work and employment, have been explained by differences in the country's institutional settings. According to the so-called institutional theories, institutional frameworks mediate the global pressures for change, and they act to maintain or even widen national differences in QWL. The *production regime theory* argues that employment dynamics are influenced by means by which different countries coordinate economic activity, while the *employment regime theory* emphasizes the significance of the extent of involvement of organized labour in decision-making over employment policy and employment regulation. For example, the Nordic countries are regarded as examples of "coordinated market economies" (production regime theory) or "inclusive employment regimes" (employment regime theory), both creating favourable conditions for a high QWL (Gallie 2007). The high QWL in the Nordic countries compared with other countries in Europe is demonstrated in many empirical studies (Mustosmäki 2017).

In a similar vein, Boxall and Winterton (2018) explain the distinctiveness of the Nordic countries shown in comparative studies of QWL by referring to the special nature of the Fordist compromise in those countries. According to a standard view of the Fordist compromise, labour unions trade a high degree of management control over work organization for greater levels of pay and security. Such a compromise leads to Taylorist jobs that do not leave much room for discretion and autonomy at work for most employees. However, in the Nordic countries, characterized since WWII by powerful unions and a relatively high level of trust between organized labour and employers, a different kind of compromise took shape. In the Nordic version of the Fordist compromise, labour unions traded their demands for higher levels of discretion and autonomy at work for a high degree of task and working time flexibility required by employers, leading to "saturated jobs", i.e. jobs in which high autonomy is combined with high work intensity.

It has often been argued that the globalization of the economy and the increasing connectedness enabled by developed information and communication technologies will make national, or any other geographical, borders even more insignificant from the perspective of businesses. However, one can with good reason assume that even in the age of intelligent automation the role of the filters that mediate the relationship between technological development and work and employment will not lose their meaning. This assumption is based in particular on the following two aspects:

First, the globalization of the economy – in the form of the New Globalization, as Baldwin (2016) calls it – has not led to the emergence of genuinely supranational labour markets even within the EU. Furthermore, analyses based on the Eurofound's European Working Conditions Survey suggest that, in recent years, differences between European countries in the ways work is organized have anything but levelled out. The overall decline of Taylorized jobs in countries like Finland and Denmark in recent years is contrasted with a steady increase of such jobs in countries like Germany, Hungary and Italy (Makó et al. 2018). The "country effect" found in many studies cannot be explained exhaustively by country-wise differences in industrial or occupational structures.

Second, in addition to national-level social and institutional filters, there are other kinds of filters whose significance as mediating factors between the potentials of new digital

technology and work may increase in the future. Advances in AI have raised new kinds of ethical issues in public discussion. The new ethical issues concern, above all, the transparency, traceability and accountability of algorithm-based decision making and the fair distribution of its benefits in society. It seems that perceptions of how to respond to these demands vary greatly from country to country, leading to different guiding frameworks and practical applications (Cath et al. 2018). Besides ethical considerations, also the role of national-level regulatory filters may be emphasized. An illustrating example of this are autonomous vehicles. The future use of autonomous vehicles in road traffic, for example, will not be depend so much on the development of technological applications and standards as such than national-level regulations concerning vital issues such as traffic security, data protection, data security, accountability issues and the use and management of the data that are generated.

4 Summary and conclusions

This brief review discussed the current automation debate from two perspectives. The paper asked, first, whether the world of work is heading towards a major transformation due to the rapid progress of digital technology. Despite certain qualitatively new features of intelligent automation, the paper took a rather cautious position towards claims on a sudden and qualitative break in work and employment, referring to certain conceptual and empirical weaknesses of these claims. The new phase of the automation debate has been rather vague – with certain exceptions such as the PwC's (2018) analysis in which the development of advanced digital technology and its impact on work is analysed as three successive waves – concerning the time spans of the effects of digital technology. Empirical studies which would allow us to make reliable statistical generalizations on the future developments of work and employment are still thin on the ground.

The paper also asked what kinds of effects could changes in work due to the advance of digital technology have on the quality of working life. As it seems that the "effects" of intelligent automation on work and employment will percolate through different kinds of filters, this question is difficult – and maybe even impossible – to answer. One implication from the filter-based sociological approach adopted in this paper is that the question that was posed in the beginning may be misleading. Instead of asking "how will intelligent automation change work and the quality of working life?", a more relevant question would be "what factors determine whether work will be upgraded or degraded and what kind of social innovations are needed in the future for supporting the chances of upgrading?".

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