



Wilfried
Martens Centre
for European Studies

The Future of Work:

Robots Cooking Free Lunches?

Žiga Turk





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Credits

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The Wilfried Martens Centre for European Studies is the political foundation and think tank of the European People's Party (EPP), dedicated to the promotion of Christian Democrat, conservative and like-minded political values.

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About the Martens Centre



The Wilfried Martens Centre for European Studies, established in 2007, is the political foundation and think tank of the European People's Party (EPP). The Martens Centre embodies a pan-European mindset, promoting Christian Democrat, conservative and like-minded political values. It serves as a framework for national political foundations linked to member parties of the EPP. It currently has 31 member foundations and two permanent guest foundations in 24 EU and non-EU countries. The Martens Centre takes part in the preparation of EPP programmes and policy documents. It organises seminars and training on EU policies and on the process of European integration.

The Martens Centre also contributes to formulating EU and national public policies. It produces research studies and books, electronic newsletters, policy briefs and the twice-yearly *European View* journal. Its research activities are divided into six clusters: party structures and EU institutions, economic and social policies, EU foreign policy, environment and energy, values and religion, and new societal challenges. Through its papers, conferences, authors' dinners and website, the Martens Centre offers a platform for discussion among experts, politicians, policymakers and the European public.

About the author



Dr Žiga Turk (1962) is a Professor of construction informatics at the University of Ljubljana, Slovenia. In 2007 and 2008 Dr Turk was Minister for Growth in the Government of Slovenia, national coordinator for the Lisbon Strategy and chief negotiator for Slovenia's accession to the OECD. From February 2012 to March 2013, he was Slovenia's Minister for Education, Science, Culture and Sports.

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His academic interests include information technology in architecture, engineering and construction; and future global developments. He studies the broader impact of information technology on society and democracy, and is active in the area of 'Internet science'. He is particularly interested in policy issues such as eDemocracy, eGovernance, net neutrality and fake news.

Early in his career Dr Turk was a founding editor of a personal computing magazine and took part in the growth of CNET.com. He was also the chairman of the supervisory board of Telekom Slovenia. He is an internationally recognised adviser, public speaker, columnist and lecturer on the topics of development, innovation, creativity, education, and science and technology policies.

Executive summary



The rapid technological progress in automation, robotisation and artificial intelligence is raising fears, but also hopes, that in the future the nature of work will change significantly. There will be changes in what we do, how we form workplace relations, how we find work and the role of work in a society. Some believe that these changes will be for the better: we will need to work less and thus will have more free time. Others think that the changes will be for the worse: there will be fewer ways to earn a living.

The central question of this paper is this: will adages such as ‘By the sweat of your brow you will eat your food’ and ‘No bees, no honey, no work, no money’ become obsolete? Will work disappear and with it the societal relations and inequalities that result from differing success in work? If this is going to happen, what policy options do we have to address the issue?

The nature of work will change because of the impact of globalisation and the exponential technological progress in computerisation, robotisation and artificial intelligence. It will not be the first time the nature of work has changed. Jobs have been eliminated on a massive scale in the past, and there are lessons to be drawn from those developments. What is happening now is only to some extent similar to the Luddite era of the nineteenth century or to the situations portrayed in the ‘technological unemployment’ narrative of the 1960s. In the near future some tasks will be replaced by automation. Many more will be augmented by machines so that work will be performed by man–machine teamwork. The automation of tasks does not necessarily entail the destruction of jobs. The digital revolution will change not only how work is performed but also how both employees and employers, and customers and providers find each other and maintain their relationships. These interactions are increasingly taking place on Internet platforms.

The future of work is ours to define in that we will have choices on two levels. The first concerns how we frame the problem politically; the second, how we address the problem technocratically with appropriate policies. A lot will depend on what we want work to be and how we understand the role it plays. Is work a curse that, thanks to technology, can be avoided; or is it a defining feature of a society? We have a choice between a society that ‘works to live’ and one that ‘lives to work’. This paper will argue that the latter, not the former, is what makes humanity great. It then illustrates various possibilities for the future by means of four scenarios.



The paper concludes with policy recommendations aimed at steering us away from the worst features of each of these scenarios. Given that work is not going to disappear, one recommendation is to preserve the social role of work. To date, technological progress has brought immense benefits to society. Throughout history work has become easier, but humanity has never been satisfied with what has been achieved and has kept working hard to improve its situation. It should do so in the future as well. We must reject suggestions that robots and artificial intelligence will be our slaves and that we will live idle lives, giving up all ambition to better our lives by working ourselves.

Another recommendation is for the EU and its member states to lead in innovations that will shape the future of work. This means leading in, first, relevant technological developments, and second, social policy innovations that will accommodate the disruptions caused by technology. As studies show, leaders will preserve employment and accelerate growth while the economies of laggards will suffer.



Introduction



The rate of technological change has never been as fast as it is today. Previous waves of innovation, such as the agricultural revolution (10,000 BC) and the industrial revolution (late eighteenth–early nineteenth century), provided humanity with, as the case may be, food, energy and industrial products. The current revolution in communication technology is supporting the innovation process itself. Never before have so many people had such easy access to so much knowledge, and never before has it been so easy to connect with other educated and empowered people.

However, there is a fear that the pace of innovation is killing jobs faster than new ones are being created. Nobel Prize winner Wassily Leontief stated as early as 1983 that ‘the role of humans as the most important factor of production is bound to diminish in the same way that the role of horses in agricultural production was first diminished and then eliminated by the introduction of tractors.’¹ There were 21 million horses in the US in 1900 and only 3 million in 1960. The number has climbed since, but not because horses are needed to do work. The complicated term for this phenomenon is ‘machine induced human redundancy’. The topic ‘the end of work’ has been getting a lot of public attention. This is because we are afraid that in the brave new world of robots and artificial intelligence (AI), humans will become redundant, just like horses became redundant with the invention of cars and trucks.²

Work defines our civilisation

More often than not, ‘the end of work’ is considered something to be feared.³ This is interesting because most of us look forward to weekends and holidays, and to going home from work. We look forward to having free time. The end of work should provide plenty of that. Moreover, fears about the end of work are being raised at the same time we are debating migration and ageing. Some say migration into Europe and the US is needed because, due to demographic trends, we will need more workers in the future. But if work is disappearing, our ageing, non-active populations do not pose a problem and migrants are not needed. Do we need more work or less? And why does the possible disappearance of work make us so uneasy?

¹ W. Leontief, ‘Technological Advance, Economic Growth, and the Distribution of Income’, *Population and Development Review*, 9/3 (1983), 403.

² E. Brynjolfsson and A. McAfee, ‘Will Humans Go the Way of Horses?’, *Foreign Affairs*, 5 September 2016.

³ A. Goldberg, ‘The Future of Work Is Here’, *Forbes*, October 2017.



These questions are the subject of so much debate because work has been a defining element of human civilisation. Work used to mean food, and food meant survival. As a species we are the offspring of those who worked the hardest and the most intelligently—and not of those who were happy with the living conditions in an ancient jungle or cave. When Adam and Eve were expelled from paradise, life became hard: ‘By the sweat of your brow you will eat your food’, says the book of Genesis.⁴ Old adages praise work and industriousness. Children used to be taught proverbs such as ‘No bees, no honey, no work, no money’ and ‘No pain, no gain’.

And not only did work provide for survival, but it also structured society and justified inequalities: ‘The hand of the diligent will rule, while the lazy will be put to forced labour.’⁵ In meritocratic societies those who worked the most and the most intelligently were rewarded and were expected to lead others. The role of work therefore goes beyond providing what is needed for survival.

The key question: why work?

The central question of this paper is this: Does work have inherent value? Is work valuable in itself and not only as something that provides for survival and comfort? Will work disappear and with it the societal relations related to work and the inequalities that result from differing success in work? If so, what is good and bad about this? If the main issue is whether work has inherent value, what policy options do we have that are consistent with universal values, and what proposals can we expect from others?

This paper will argue that work *is* valuable in itself. It will refer to several studies that try to predict what the job market will look like in the future and what skills will be needed. These studies suggest that the cloud of job destruction has a silver lining. Indeed, some jobs will change or disappear, but plenty of work will remain to be done. How we choose to react will be a matter of political debate. The central issue in this debate will therefore be, Do we want to preserve or destroy the social value of work? The paper will

⁴ Genesis 3:19. All biblical quotations are from the New International Version.

⁵ Proverbs 12:24.



argue for preserving it. Technological progress should not and will not be stopped. But there are different options for how to incorporate those developments into the fabric of our societies.

Report structure

This report first examines the ‘Drivers of change’ that are affecting jobs and work: globalisation, information and communication technology, and the interplay between them. It looks in detail at the digital revolution and agrees with those who claim that we are still in the early stages of this transformation. The second section reviews studies that attempt to predict the ‘Future of work’: what the future holds for the job market, skill needs and employment relations.

The key choice concerns the role we are willing to give to work. The third section, ‘Why work?’ elaborates on two conflicting views, which can be summarised as ‘work to live’ versus ‘live to work’. It warns about the dangerous agenda that the end-of-work community may have: to push their dystopian ideas.

To illustrate the possible futures, four scenarios will be presented in the fourth section. These scenarios can help us evaluate policy proposals: do they lead to the outcomes we want or to those we hope to avoid?

The main takeaways and policy proposals are listed in the concluding section. We will see that while uncertainties exist, the future is ours to choose. We need to choose not only measures and policies, but views and perspectives as well. The key choice is between seeing the world as a place of abundance or seeing it as a place of scarcity, between seeing the glass as half empty or as half full.

If we choose to see the future world as a place of abundance, then the problem becomes one of distribution. If we are not happy with what we have and what we have achieved, if we believe things could be even better, we can choose to see the world as a world of scarcity. In this case the key issue is what to do, how to work, to reduce this scarcity. From the perspective of the present, the past certainly looks like a world of scarcity. Because our parents and grandparents worked, we are better off than they were. We should keep making the world better for our children.

Drivers of change



Several innovation trends are affecting the work landscape:

1. economic, political and informational globalisation;
2. the digitalisation of communication, information processing and production;
3. the development of machine intelligence.

Each of these trends will be discussed briefly in the subsections that follow. It is important to note, however, that each is not independent of the others; rather, they are all mutually reinforcing. Digitalisation is speeding up globalisation by shrinking distances and making processes and transactions run more smoothly.⁶ Machine intelligence, enabled by cognitive technologies such as AI, is an example of innovation accelerating innovation. Change is accelerating and is global: every innovation reaches all parts of the world almost concurrently. However, as this paper will argue later, these technological changes do not significantly alter human nature. Moreover, these are not the only trends shaping the future. Demographics and ageing are also affecting the future of work. However, they will not be given separate treatment but will be dealt with within the discussions of other trends.

Globalisation amplifies success

The world has always been interconnected, but the speed of connection was orders of magnitude slower than it is today. The flow of commerce between Asia and Europe, for example, was limited to precious metals, silk and spices. Only after the end of the Middle Ages did the navies of European powers start to make the world increasingly interconnected. The barriers to the free exchange of scientific ideas, technologies and goods that persisted into the twentieth century were political in nature. China started to open up in 1972, and the Berlin Wall fell in 1989. Today comparable political barriers do not exist. Free trade and cross-border investments are increasingly bringing about the industrialisation of Asia and

⁶ B. Gates et al., *The Road Ahead* (New York: Viking, 1995).



Latin America. The first wave of losses of manufacturing jobs was due to Europeans' and Americans' inability to compete with the less expensive workforce in the Second and Third Worlds.

But the economies of the West have survived because their workforces moved into the service sector and enjoyed a high standard of living made possible by imports of inexpensive clothing, electronics, cars and other products. The jobs that have been lost are gone for good.⁷ They are being displaced by robots in countries such as Japan and, increasingly, China.

The bottom line is that the world is so interconnected, the transportation of goods so cheap and the flow of capital so unrestricted that it is no longer possible to hope that one part of the world can keep jobs at the expense of another. We might try to comfort ourselves by saying that, because we have a more educated workforce, we will work smarter and thus be better paid—but such a strategy would be short-lived. Studies by the Programme for International Student Assessment (PISA) reveal that good educational policies are no longer the domain of the West.⁸ Some of the best school systems are now in Asia. Competition is and will remain global. And the same holds for the rewards.

Everything is digitised

Progress in many fields of science, technology and business is connected to the exponential progress in digital technology. In 1965 Gordon Moore, the founder of a small semiconductor company now known as Intel, predicted that the number of transistors that could be integrated on one circuit would double every 24 months.⁹ Fifty years later Moore's law is still valid. The number of transistors that can fit on one integrated circuit is directly related to computing speed, data transfer rates and storage capacity. As users of consumer electronics know, our devices are getting faster, displays and cameras come with more megapixels and gigabytes, and content can be downloaded ever more quickly. The specifications

⁷ H. Zhang, 'U.S. Manufacturing Jobs Are Not Coming Back', *Kennedy School Review*, 27 February 2017.

⁸ L. Zhang, G. Khan, and A. Tahirsylaj. 'Student Performance, School Differentiation, and World Cultures: Evidence from PISA 2009', *International Journal of Educational Development* 42 (2015), 43–53.

⁹ Intel, 'Moore's Law and Intel Innovation' (4 October 2017).



of new devices are double those of the devices we bought a few years ago.

The computers that helped put a man on the moon were about as powerful as the first home computers in the early 1980s, for example, the Apple II or the Sinclair Spectrum. They were several thousand times less powerful than the first iPhones.¹⁰ But it is not only sheer computing power that has been improving. Programmers have been developing new algorithms and methods that make more efficient use of the computer power available. This too has improved the accuracy of engineering analyses, weather forecasts and financial simulations.

Computing is getting smarter

AI has been a particularly disruptive development. Here machines exhibit the characteristics of which human beings are the proudest: our intelligence and rationality. In 1996 the IBM supercomputer Deep Blue beat a human player in chess, a game that for centuries has been reserved for the smartest and brightest. In 2017 the Google neural network machine Alpha Go beat the world champion in go, a game in which the number of moves that can be made is orders of magnitude greater than the number of moves possible in chess, and which is therefore much more demanding from a computational perspective.

Some have argued that it is easy for computers to succeed in chess or go—or tic-tac-toe, for that matter—because all these games are played within a finite synthetic world. ‘What good is a brilliant chess move if instead one should evacuate the house because it is on fire’, quipped one of the pioneers of AI.¹¹ But computers are catching up with general and common-sense knowledge too. In 2011 a computer won the popular television quiz show Jeopardy, which tests contestants’ general and trivia knowledge.

In 2014 a computer passed the Turing test. This test was devised by Alan Turing, one of the pioneers of computer science. He claimed that it would be a good sign of a computer’s intelligence if a human be-

¹⁰ C. Saran, ‘Apollo 11: The Computers that Put Man on the Moon’, *Computerweekly.com* (July 2009).

¹¹ T. Winograd and F. Flores, *Understanding Computers and Cognition: A New Foundation for Design* (New Jersey: Ablex, 1986).



ing was unable to determine whether he or she was talking to a real person or a machine.¹² In such a test a human chats—by typing and reading—with two interlocutors in remote locations. He or she should be able to determine which of the two is human and which is not. A computer passed this test in 2014. And now, just a few years later, we can sit in our own living rooms chatting with assistants such as Google Home or Amazon Alexa—which might be able to pass the Turing test in a couple of years.

While the achievements described above were accomplished by computers, the knowledge required was to a large extent spoon-fed to them by humans. For example, the chess computers were fed the results of thousands of human games. The human logic for the value of the pieces and the relative importance of the different squares on the board were programmed into the logic of chess software. A major breakthrough was achieved in December 2017 when Google’s Alpha Zero computer was just told the basic rules of chess—such as how pieces are allowed move—and was then allowed to learn to play the game entirely by itself. It turned out that after 4 hours of self-play, it had reached the grand-master level, and after 24 hours it had learned enough to become the most powerful computer playing chess. No human knowledge about chess was needed for the machine to learn how to play better than any human or any computer taught by humans.

Human intelligence has competition

The Alpha Zero’s capacity for self-learning may make it possible for Polanyi’s paradox to gain a technological dimension. According to this paradox, ‘we can know more than we can tell, i.e. many of the tasks we perform rely on tacit, intuitive knowledge, traditions, values, and evolution that is difficult to codify and automate.’¹³ The paradox is an extension of the Moravec paradox that ‘high-level reasoning took relatively few computational resources to replicate, whereas low-level sensorimotor skills took far more.’¹⁴ In other words, it is somehow easier to computerise complex professional tasks (those of

¹² A. Turing, ‘Intelligent Machinery, A Heretical Theory’, in S. Shieber (ed.), *The Turing Test: Verbal Behavior as the Hallmark of Intelligence* (Cambridge, MA: MIT Press, 2004), 105–10.

¹⁴ Ibid.



stockbrokers, for example) than tasks that require a wide array of common-sense knowledge and an ability to navigate through the physical world (for example, activities related to building maintenance). These two paradoxes point to areas where humans could have an edge on computers, and yet they are being challenged by state-of-the-art machine self-learning.

But there are other problems. Early computers were confined to their housings. Their only interface with the world was a keyboard through which they would receive human input. Technology such as the Internet of Things¹⁵ is connecting sensors to computer networks. Cameras and microphones, too, are connected and are, metaphorically speaking, the hands and eyes of the networked computers. And then there is the content created by humans. People upload 300 hours of video to YouTube every minute,¹⁶ 300 million photos every day and half a million comments every minute.¹⁷ The possibilities for analysis and learning are endless.

The idea that computers are isolated from the real world and thus lack the Heideggerian 'being-in-the-world'¹⁸ could not be more wrong. They are more connected with the world than any human could possibly be. All this information has not been fully exploited yet.

Change is exponential, but this is not new

The progress of digitalisation is exponential. Every new generation of VW Golf cars is a few centimetres longer and a few kilograms heavier. And the square footage of the average home is growing by a few square metres every year. However, the capacities of devices are doubling on an annual basis. Brynjolf-

¹⁵ A form of technology that connects everyday objects to the Internet.

¹⁶ Fortunelords, '37 Mind Blowing YouTube Facts, Figures and Statistics – 2018' (March 2018).

¹⁷ Zephoria Digital Marketing, 'The Top 20 Facebook Statistics' (March 2018).

¹⁸ H. L. Dreyfus, *Being-in-the-World: A Commentary on Heidegger's Being and Time* (Cambridge, MA: MIT Press, 1991).



sson and McAfee¹⁹ compare this to the story about the reward the king promised to the inventor of chess. After some thinking, the inventor told the king that his reward should be the following: one grain of rice on the first square of the board, two on the second, four on the third, and so on for each of the 64 squares. The king was almost insulted, thinking the reward would be a sack or rice or so. It was not. It would be a supermarket package of rice by about the sixteenth square and a sack around the twenty-fourth.

The point to keep in mind is that when we talk about digitalisation we are still on the first half of the board. In 1998 Moravec predicted that in the 2020s affordable machines would have a capacity comparable to that of the human brain.²⁰ Kurzweil speculated that at some point in the third decade of our century, machine intelligence would surpass human intelligence, and that super-intelligent machines would then design a next-generation machine on their own, reaching the ‘Singularity’. After that, the world would be so different that no predictions are possible.²¹

We should avoid exaggeration. It is in our nature to exaggerate the magnitude of the changes we are subject to here and now, relative to what happened in the past. It is a past-oriented version of what behavioural economics calls ‘hyperbolic discounting’:²² the tendency for people to choose a smaller reward that will become available soon over a larger reward that will become available only after a period of waiting. The reason behind both hyperbolic discounting and the way in which present changes appear to be larger than those in the past is simple: what is near appears to be larger. Gains that are near in time appear to be greater than those in the future. Changes happening now appear to be bigger than those that happened in our grandparents’ time. And yet our great-grandparents and grandparents experienced the introduction of the railway, electricity, the motor car and radio, and the dissolution of age-old empires and disintegration of social structures. What Isaac Asimov was to our generation, Jules Verne was to theirs.

They, too, looked back on a past that seemed slower and more peaceful. For them, too, the rate of change in their own time was exponential. Kurzweil claimed that the accelerating speed of change is a feature of all evolutionary systems.²³ There are some hard numbers to back this up. The time it takes a

¹⁹ E. Brynjolfsson and A. McAfee, *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies* (New York: W. W. Norton & Company, 2014).

²⁰ H. Moravec, ‘When Will Computer Hardware Match the Human Brain’, *Journal of Evolution and Technology* 1 (1998), 10.

²¹ R. Kurzweil, ‘The Singularity Is Near’, in R. L. Sandler (ed.), *Ethics and Emerging Technologies* (New York: Penguin, 2016), 393.

²² A. Rubinstein, ‘“Economics and Psychology”? The Case of Hyperbolic Discounting’, *International Economic Review* 44/4 (2003), 1207–16.

²³ R. Kurzweil, *The Age of Spiritual Machines* (New York: Viking, 1999).



given technology to reach households is becoming shorter. For example, it took 75 years for car ownership in the US to rise from 10% of the households to 90%; but it only took seven and half years for the ownership of mobile phones to grow by this same amount.²⁴

While the speed of change is often considered to be a negative development, the opposite is true. In the case of the car, it took a country 75 years to minimise the inequality between the haves and have-nots. In the case of the mobile phone, the gap was closed in just seven and a half years. Viewed in this way, technology appears to be reducing inequality, not increasing it.

Technology does not determine who we are

Machines are becoming capable of interacting and interfering with the real world. Self-driving cars are close to being available commercially. On the one hand, computers have sufficient ‘understanding’ of the physical world to drive a car. On the other hand, they have the ability to self-learn chess beyond the grand-master level. Hardware prices are halving every two years or so. The assumption that machines will be able to do everything between driving a car and playing grand-master chess is well founded.

The results of all this progress are having an impact on our daily lives. Even quite unintelligent software programs such as Word and Excel, management information systems and AutoCAD drawing software have killed many routine white-collar jobs. We are our own typists and secretaries now. And the same trend is now relieving humans of routine work in increasingly complex professions.

All the same, the belief that technology (particularly where it is as dramatic as the technology described above) will change our lives completely²⁵ is exaggerated. Human nature has changed little since our hunter-gatherer days, and this will provide some stability and guidance for the turbulent times ahead.

²⁴ D. Thompson, ‘The 100-Year March of Technology in 1 Graph’, *The Atlantic*, 7 April 2012.

²⁵ M. R. Smith and L. Marx (eds.), *Does Technology Drive History? The Dilemma of Technological Determinism* (Cambridge, MA: MIT Press, 1994).

The future of work



‘Is the present time different?’ This question is often raised in discussions about the future of work. This is because fears that there will not be enough work have arisen in the past and have also been related to technological development. This section first puts current worries in perspective and then reviews four trends: the replacement of humans by machines, collaboration between people and machines, new ways of connecting the demand for and supply of work using information technology (IT), and work as a hobby. These trends are not mutually exclusive.

The short answer to the question ‘Is the present time different’ is ‘Yes and No’. What has changed very little is human nature. What will be very different is the kind of work that machinery and automation can do, the speed at which machines are introduced and how work is organised. Between the ‘Yes’ and the ‘No’ are situated the changed kinds of human–machine and human–human collaboration that will be addressed in the last four subsections below.

The past of the future of work

Human ingenuity has always tried to do more with less. Necessity may be the mother of invention, but laziness is its father.²⁶ Hunting-and-gathering was rendered obsolete by the invention of farming. Animals and crops were right there, in the backyard, without the need for anyone to hunt or gather them. Before the industrial revolution, 60%–70% of working people in Europe were involved in agriculture. In 1800, 60% of the French population worked in agriculture. In 2012, the figure was just 3%.²⁷ In the US between 1900 and 2000, the percentage of the population active in agriculture fell from 41% to 2%.²⁸ This caused changes in settlement patterns, increases in city populations, decreases in family sizes, and so on. New jobs were invented.

²⁶ S. Shapiro, ‘Laziness Is the Father of Innovation’ (22 August 2012).

²⁷ M. Rosner, ‘Employment in Agriculture’ (n.d.).

²⁸ D. H. Autor, ‘Skills, Education, and the Rise of Earnings Inequality Among the “Other 99 Percent”’, *Science* 344/6186 (2014) 843–51.



Concerns about the future of work have also existed in the past. The most notorious example is the Luddite movement of the early nineteenth century. Textile workers were afraid that machinery would make their work obsolete, leaving them jobless. To prevent change from occurring, they destroyed weaving machinery—and in the process, they provided future generations with a term for labelling enemies of progress. The Luddite movement was actually just the culmination of protests against workers being put out of work by new inventions that had emerged during the industrial revolution. The movement was a reaction to a new socio-economic system, capitalism. Unlike the guilds, capitalism allowed competition and with it, technological progress. The result was the loss of many jobs that were no longer required. But they were replaced by new, better-paid ones. This was a period some call ‘the great enrichment’.²⁹

Not only were the jobs that had been lost replaced, but throughout the twentieth century, the employment-to-population ratio grew.³⁰ It grew throughout the 1960s, even though a scare much like the current one provoked *Time* magazine to run a story titled ‘The Automation Jobless’.³¹ It reported how, in the space of a few years industries such as those in the chemical, automotive, food-processing and agricultural sectors had increased production by 20%–50% while reducing the workforce by between 3% and 20%.

Some contemporary politicians proposed ‘massive Government—and industry—supported retraining programs as a cure-all’.³² This is reminiscent of ideas such as the National Education Service.³³ Just as interesting are the critiques of such programmes from those times. Michigan’s director of employment security cynically commented, ‘I suppose that is as good as any way for getting rid of the unemployed—just keep them in retraining.’³⁴ The director was worried about whether the unemployed would find a job after being retrained or whether retraining was just a way of giving them hope. Even the opinions of those in government were much like those of their present-day counterparts. A panel put together by US

²⁹ D. N. McCloskey, ‘The Great Enrichment: A Humanistic and Social Scientific Account’, *Scandinavian Economic History Review* 64/1 (2016), 6–18.

³⁰ D. H. Autor, ‘Why Are There Still So Many Jobs? The History and Future of Workplace Automation’, *Journal of Economic Perspectives* 29/3 (2015), 3–30.

³¹ *Time*, ‘The Automation Jobless’, 24 February 1961.

³² *Ibid.*

³³ The Labour Party, ‘Towards a National Education Service’ (September 2017).

³⁴ *Time*, ‘The Automation Jobless’, 24 February 1961.



President Lyndon Jonson concluded, ‘The basic fact is that technology eliminates jobs, not work.’³⁵ Is this still true some half a century later?

Future trend 1: replacement by machines

In the previous section we found some comfort in the fact that throughout the nineteenth and twentieth centuries, labour participation rates (that is, the percentage of people who are either employed or actively looking for work) rose steadily. However, the last 25 years have seen this rate decline in most developed economies.³⁶ In Italy the prime-age male labour participation rate has gone from 94% to 88%; in Finland, from 93% to 89%; in the US, from 93% to 88%; and in France, from 96% to 93%.

In the future these trends could continue at an even faster tempo. Frey and Osborne have studied the probability that the tasks performed in over 700 occupations will be automated and computerised.³⁷ They found that 47% of all US jobs are at risk. Particularly vulnerable are low-paying jobs and those held by people with low educational attainment. Jobs that are less susceptible to automation are those that involve the perception and manipulation of the environment (which requires finger dexterity, manual dexterity or the ability to work in difficult places), creative intelligence (which requires originality and even skills in the fine arts) and social intelligence (which requires social perceptiveness and the ability to negotiate, persuade, and assist and care for others).

The chart below (Fig. 1) summarises the findings of the study. Forty-seven per cent of the jobs have a 75% or higher probability of becoming computerised. Especially vulnerable are jobs in fields such as services, sales, office and administrative support, transportation, material moving and production. The safest jobs (with less than a 25% probability of becoming computerised) are those in management,

³⁵ H. R. Bowen, *Report of the National Commission on Technology, Automation, and Economic Progress*, vol. 1 (Washington: U.S. Government Printing Office, 1966).

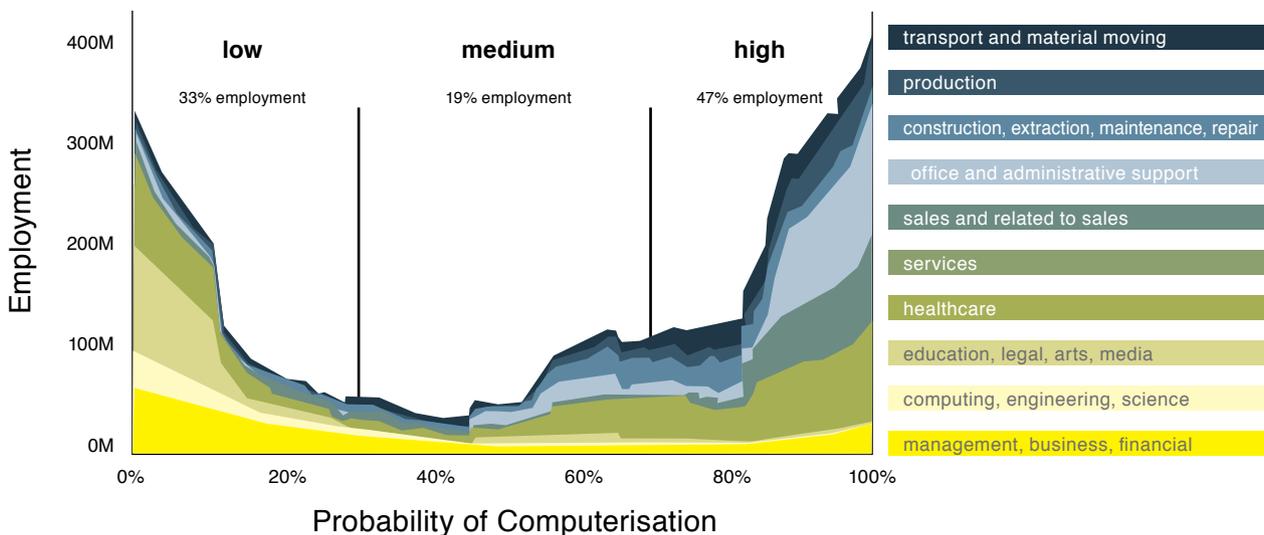
³⁶ OECD, ‘Labour Force Participation Rate’ (indicator), doi: 10.1787/8a801325-en (2018).

³⁷ C. B. Frey and M. A. Osborne, ‘The Future of Employment: How Susceptible Are Jobs to Computerisation?’, *Technological Forecasting and Social Change* 114 (2017), 254–80.



business and finance, the computer sector, education and healthcare. The authors expect that the replacement of jobs will happen in the right-to-left direction on the chart, starting relatively soon with the high-probability occupations, then levelling off until the engineering bottlenecks are overcome that are inhibiting the computerisation of jobs involving creative and social intelligence.

Figure 1 Low, medium and high probability of replacement by automation



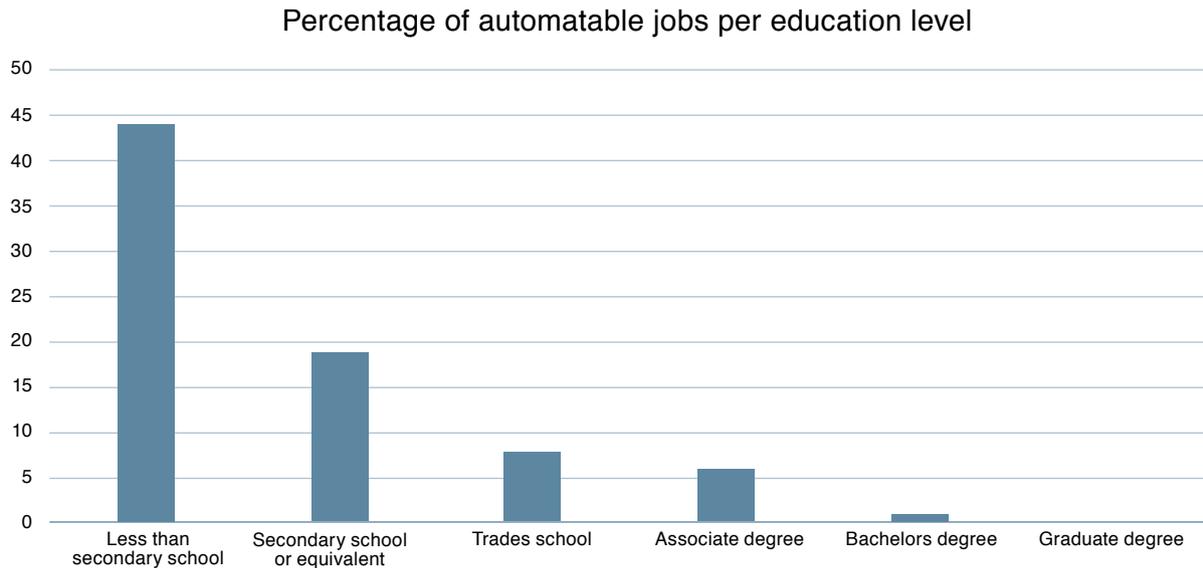
Source: Adapted from C. B. Frey and M. A. Osborne, 'The Future of Employment', 37.

The third great job extinction will differ from that of the mid-nineteenth century (which motivated the Luddites) and that of the mid-twentieth century (which prompted the response by President Johnson cited above). The industrialisation of the eighteenth and nineteenth centuries replaced skilled workers and artisans with assembly-belt workers who were organised to do smaller, simpler tasks. The automation of the twentieth century hollowed out middle-income jobs: those of secretaries, clerks, draughtsmen and so on. The coming wave of automation will destroy low-paying, low-skill jobs, preserving those that require creative or social intelligence.



The probability that a job paying less than \$20 per hour will be automated is 83%. For jobs paying \$20–\$40, the figure is 31%, while high-paying jobs with hourly rates of over \$40 have a 4% probability of becoming automated.³⁸ The chart below (Fig. 2) shows how the vulnerability of jobs is linked to the level of education each job requires:

Figure 2 Percentage of automatable jobs



Source: Adapted from M. Arntz T. Gregory, and U. Zierahn, *The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis*, OECD Social, Employment, and Migration Working Papers no. 189 (2016), 11.

This could lead to the job market becoming polarised, with rather safe, high-income cognitive jobs on the one hand and low-income occupations involving person-to-person interaction and manual work on the other.

³⁸ US Bureau of Labor Statistics, 'Occupational Employment Statistics' (30 March 2018).



Based on what has been said thus far, Table 1 below summarises the impact of automation on jobs, according to whether they are manual or cognitive, routine or non-routine.

Table 1 Impact of automation on jobs

Kind of job	Manual	Cognitive
Routine	Unsafe due to automation and replacement by robots	Unsafe due to computerisation and replacement by software
Non-routine	Rather safe because of AI's lack of real-world interface	Rather safe but human-machine collaboration may provide a winning formula

A recent McKinsey Global Institute³⁹ study took an approach which differs from that adopted by Frey and Osborne.⁴⁰ The authors looked into how much of the work within a job is automatable. They found that almost half of the 2,000 work activities across 800 occupations have the potential to become automated through the adaptation of current technology. But only 5% of all occupations can be automated entirely. Sixty per cent of all occupations are such that 30% of their activities could be automated. The authors conclude that most occupations will change rather than be automated away.

Their analysis concurs with the conclusions of other studies. They find that the highest potential for automation is in sectors such as accommodation and food services, manufacturing, agriculture, transportation and warehousing, retail trade and mining. The lowest potential for automation is in sectors such as education, management, information technology and healthcare.

This subsection has looked at a major national economy and the global averages. We should not forget that countries have different economic structures: the percentages of jobs that are safe and of those that are endangered will differ from country to country. Therefore, countries differ significantly in the extent to which they are being affected by automation. Needless to say, the hardest hit countries will be those that compete on the global market with low-skilled, low-paid, routine manual work and those that insource routine cognitive tasks, such as data entry and routine information analysis.

³⁹ McKinsey Global Institute, *A Future that Works: Automation, Employment, and Productivity* (January 2017).

⁴⁰ C. B. Frey and M. A. Osborne, 'The Future of Employment', 45.



Future trend 2: man–machine teamwork

The narrative that should ease fears about ‘machine induced human redundancy’ or ‘technological unemployment’, which were discussed in the previous subsection, has been that of man–machine collaboration: humans have one set of strengths, machines have another and the two sets of skills can be complementary.

A well-publicised example is freestyle chess. After chess software had regularly been beating humans, it was found that even better chess could be played by a team consisting of a human player and computer software.⁴¹ In the words of Gary Kasparov, ‘The teams of human plus machine dominated even the strongest computers. The chess machine Hydra, which is a chess-specific supercomputer like Deep Blue, was no match for a strong human player using a relatively weak laptop. Human strategic guidance combined with the tactical acuity of a computer was overwhelming.’⁴²

The *Harvard Business Review* wrote that Kasparov had discovered a new business model.⁴³ Complex deep thinking⁴⁴ is an area where humans should maintain an edge for quite some time. According to a study by Deloitte,⁴⁵ connectivity and cognitive technology is changing the nature of work in the direction of an ‘augmented workforce’. The latter consists of workers whose capacities are augmented by AI, robotics and cognitive tools. The augmentation of workers with better tools, rather than their replacement by robots and AI, is a less bitter pill to swallow.

In this new way of working, the fundamental elements are no longer jobs, but tasks which are aggregated into jobs and roles. Automation ceases to be a purely efficiency-based process. Deloitte warns that ‘organizations that automate manufacturing plants and that do not clearly give people opportunities for reskilling and new positions, may see their brand suffer, and to some extent may also

⁴¹ T. Cowen, *Average Is Over: Powering America Beyond the Age of the Great Stagnation* (New York: Penguin, 2013).

⁴² G. Kasparov, *Deep Thinking: Where Machine Intelligence Ends and Human Creativity Begins* (London: Hachette UK, 2017).

⁴³ A. McAfee, ‘Did Garry Kasparov Stumble into a New Business Process Model?’, *Harvard Business Review*, 18 February 2010.

⁴⁴ G. Kasparov, *Deep Thinking*.

⁴⁵ B. Walsh and E. Volini (eds.), *Rewriting the Rules for the Digital Age* (Deloitte University Press, 2017).



feel pressure from the social and political environment'.⁴⁶ Good practices are emerging in Europe.⁴⁷ Businesses such as Siemens, Bosch, Adidas, SAP and Nokia are taking an active role in addressing the replacement of their human workers with machines. This includes retraining and reskilling their employees.

Man–machine teamwork seems to be the new normal. Skills such as creative and ethical thinking are expected to remain the domain of humans while routine tasks can be carried out by machines. Recognising the difference between human-exclusive skills and automatable tasks is what management should be involved with in the future.

In short, automation also complements human labour and contributes to higher productivity. For some tasks it leads to a higher demand for labour and will require adjustments in the supply. IT-augmented workplaces will add disabled and older workers to the workforce since smart machines will compensate for their deficiencies. Digitalisation and networking are making working from home possible. Technology will spawn all kinds of new artisans, artists and creatives in both the digital and the material spheres. As Eric Schmidt of Google has said, 'Your future is you with a computer, not you replaced by a computer'.⁴⁸

⁴⁶ Ibid.

⁴⁷ European Round Table of Industrialists, 'Building and Transforming Skills for a Digital World' (September 2017).

⁴⁸ B. Wang, 'The Future of Work Is You with a Computer, Not You Replaced by a Computer', *NextBigFuture.com* (17 June 2017).



Future trend 3: digitally enabled independent work

Stable nine-to-five jobs for a big employer may have peaked in the twentieth century. In earlier times many people worked on their own farm or in the family craft. A McKinsey study estimates that in the US and the EU, 20%–30% of the working-age population are currently engaged in independent work in one way or another.⁴⁹ Zysman claims that as much as 40% of the US workforce works on a contingent basis.⁵⁰

This shift from stable occupations in relatively large organisations to contingent, independent work is both directly and indirectly the result of technological developments. Indirectly it is a result of low-tech forms of IT such as spreadsheets and mobile phones. It has become much easier to find a worker on a part-time or per-project basis. Previously, a firm would ensure access to the workforce by directly employing people. Now companies can go online or to an agency to find the workers it needs. These low-tech tools have contributed to the far greater part of the shift from stable to contingent occupations.⁵¹ High-tech platforms such as Uber represent only a small part of the whole phenomenon. But this may change in the future.

The ‘platform economy’, pioneered by the likes of Etsy, Amazon, Ebay, Salesforce, Facebook, Uber and Airbnb, uses smart devices and social media technology to connect people: not socially but in their roles as customers and workers. Uber connects people needing a ride and those offering transportation. Airbnb links people needing a place to stay and those who can provide such a place. Fifteen per cent of all independently carried out jobs are currently done on (or with the aid of) digital platforms, but it is the fastest growing segment of this kind of work. On New Year’s Eve 2017 three million people stayed in Airbnb accommodations. Eight years ago his figure was only 1,400.

⁴⁹ J. Manyika, *Technology, Jobs, and the Future of Work*, McKinsey Global Institute (December 2016, updated February 2017).

⁵⁰ M. Kenney and J. Zysman, ‘The Rise of the Platform Economy’, *Issues in Science and Technology* 32/3 (2016), 61.

⁵¹ L. F. Katz and A. B. Krueger, *The Rise and Nature of Alternative Work Arrangements in the United States, 1995–2015*, National Bureau of Economic Research paper no. 22667 (2016).



Furthermore, talent platforms such as LinkedIn and TaskRabbit are improving the matching-up of workers and work. Technology for finding the right person for the job is rapidly improving. This results in vacancies being filled with workers who are more suitable and more likely to be satisfied with their jobs. Job hunting has become easier, which could result in the rise of shorter-term employment and project-related or even independent work. Technology is creating a new breed of workers: digital nomads. They use IT to work remotely for anyone in the world. Labour legislation, however, often stands in the way of this sort of flexibility and fails to support workers in contingent work.

Future trend 4: work as a hobby

A wide array of platforms are not economically feasible in the strict sense. Nevertheless, they connect people around a common project by creating a virtual company, or connect performers/suppliers (programmers, writers and musicians) with customers (software users, readers and listeners). One such platform is Wikipedia, where the common goal is to create an encyclopaedia. Blogger, Medium and WordPress are used by people who want to publish and read blogs. Artists, scholars, educators, entertainers and others share video content on YouTube. Mozilla is a non-profit organisation that is developing a web browser. GitHub is a platform on which software is developed and shared collaboratively. High-quality photographic work is shared on 500px and Flickr.

Several of these platforms either do not offer monetisation or offer opportunities for monetisation that are limited or not of central importance to the platform providers or users. Nevertheless, they allow people to work and to be rewarded for their work—perhaps not with money but with other kinds of recognition. They demonstrate that an ‘economy’ is possible where money is not the measure of things and where the goal of work is not subsistence.

This rapidly growing ecosystem has many key elements: the Internet as an inter-network; cloud storage; payment systems; content hosting services; and higher-level infrastructure services such as Google Search, email and social media networks.



Why work?



‘Laziness may appear attractive, but work gives satisfaction’, wrote Anne Frank.⁵² Not everyone agrees, and this section will discuss two ways of framing the issue of the future of work in a political manner. One sees work as something to be reduced and eventually eliminated—for it, ‘laziness is attractive’. The other sees value in work and working, and agrees that ‘work gives satisfaction’. The first is associated more with the political left; the second, with the political right.

Working to live is not right

Particularly on left, one finds many thinkers who see the current technological revolution as a tool for the creation of a utopian heaven on earth. In a nutshell, the idea is as follows. Human labour will no longer be needed; work will be done by AI and robots. As there will be no more work, work will not determine people’s social status. All people can be equal only if we find a way to distribute the value created by machines in a ‘fair’ way. On the left, there has historically been no shortage of ideas about how to redistribute the benefits ‘fairly’.

McKelvey explains how Marx saw automation as something positive for the exploited worker.⁵³ It should free humans from work in its conventional form and create the foundation for the fifth stage in human history: socialism. Automation would provide for the ‘efficient satisfaction of human needs, by creative work, and by the reduction of labour time’.⁵⁴

In the 1930s, Keynes called technological unemployment an ‘efficient satisfaction of human needs’.⁵⁵ He was convinced that we would run out of work ‘due to our discovery of means of economizing the use of labour outrunning the pace at which we can find new uses for labour’.⁵⁶ This did not happen, and Mar-

⁵² *The Diary of Anne Frank: The Critical Edition* (Viking, 1989), 684.

⁵³ C. McKelvey, ‘Marx on Automated Industry’, *Global Learning*, 13 January 2014.

⁵⁴ *Ibid.*, 1.

⁵⁵ J. M. Keynes, ‘Economic Possibilities for Our Grandchildren’, *Essays in Persuasion* (London: Palgrave Macmillan, 1930), 358–73.

⁵⁶ *Ibid.*



cuse offered an explanation: capitalists created ‘false needs’ to promote consumerism.⁵⁷ Instead of the technology of the 1960s satisfying all the needs of the 1930s in a fraction of the time, capitalists made workers want more stuff. It has been calculated that in 2015 an average US worker would have had to work just 17 weeks per year if she had been happy to live at the income level of an average worker in 1915.⁵⁸ Ferriss laid out a blueprint for a four-hour work week, in part by focusing work on what counts and needs on what matters.⁵⁹

In his bestselling book *The End of Work*, Rifkin is clear about how machines will destroy work: work done by machines is the equivalent of slave labour.⁶⁰ One cannot compete with slave labour without accepting the economic logic of slave labour. ‘[T]he need for human labour is disappearing’, he wrote.⁶¹ ‘Technological innovations and market-directed forces are moving us to the edge of a near workerless world . . . Work is not only a historically dated word or notion, but also an invented reality, constructed by the European 18th century.’⁶² The choice he sees is between forced unemployment and voluntary leisure.

The left’s ‘end of work’ narrative has been spelled out most clearly by André Gorz.⁶³ He claims that the ‘work based society’ is dead. This is a society in which a person’s position, future, security and usefulness is determined by the work he does and how he performs it. It is dead, Gorz holds, because the production of goods that satisfy both necessary and superfluous demands requires less and less work and pays out less and less in wages. The actual problem is not a shortage of work but ‘how to distribute the wealth which is now produced by capital employing fewer and fewer workers’.⁶⁴

⁵⁷ H. Marcuse, *One-Dimensional Man* (Boston: Beacon Press, 1964).

⁵⁸ D. H. Autor, ‘Why Are There Still So Many Jobs?’

⁵⁹ T. Ferriss, *The 4-Hour Work Week: Escape the 9–5, Live Anywhere and Join the New Rich* (New York: Random House, 2011).

⁶⁰ J. Rifkin, *The End of Work: The Decline of the Global Labor Force and the Dawn of the Post-Market Era* (New York: G. P. Putnam’s Sons, 1995).

⁶¹ *Ibid.*, 236

⁶² *Ibid.*, xvi.

⁶³ A. Gorz, *Reclaiming Work: Beyond the Wage-Based Society* (Cambridge: Polity Press, 2005).

⁶⁴ *Ibid.*



And what is this future society that will replace the work-based society? According to Gorz,

the remedy for this situation is clearly not to 'create work', but to distribute optimally all the socially necessary work and all the socially produced wealth. . . . The right to a sufficient, regular income will no longer have to depend on the permanent occupation of a steady job. The need to act, strive and be appreciated by others will no longer have to take the form of paid work done to order Let us make no mistake about this: wage-labour has to disappear and, with it, capitalism.⁶⁵

The abolition of capitalism is the ultimate goal in the 'end of work' narrative of the progressive left. They see progress in computerisation as an opportunity to link technological modernisation with social progress. Not needing to work to live should, in their view, be a human right. Anyone not promising free lunches, paid for by a robotic workforce, is considered a backward conservative.

Living to work is right

That work is not an eighteenth-century European social construct is demonstrated by very old texts that capture and describe the innate moral value of work. 'Anyone who does not provide for their relatives, and especially for their own household, has denied the faith and is worse than an unbeliever' (Timothy 5:8). Paul's second letter to the Thessalonians is clear: 'If anyone is not willing to work, let him not eat' (3:10). As Peterson argues,⁶⁶ these ancient texts should not be understood as fanciful prescriptions; rather, they capture and encode innate morals of humanity.⁶⁷ Europeans have preserved these values. The 2012 Eurobarometer reports that 'an absolute and increasing majority of Europeans are opposed to giving more importance to leisure than to work'.⁶⁸ In this survey, 41% of Europeans agreed with the statement that 'more importance should be given to leisure than to work', and 54%

⁶⁵ Ibid., 72–3.

⁶⁶ J. B. Peterson, *Maps of Meaning: The Architecture of Belief* (London: Routledge, 1999).

⁶⁷ Ibid.

⁶⁸ European Commission, *The Values of Europeans, Standard Eurobarometer 77* (2012).



were opposed to it. The differences among countries were quite large, however, with work being more important in the Netherlands (68%), Lithuania (63%), Germany (62%) and France (61%) and leisure being considered more important in Estonia (63%), Slovakia (62%), Finland (61%), Malta (56%), Slovenia (56%) and Austria (55%).

As Weaver discovered, times are changing.⁶⁹ Today the individual is being told that the world owes him a living. And he draws the lesson that ‘work is a curse, which he will avoid as far as possible until science arrives with the means for its total abolishment’.⁷⁰ In Weaver’s view, which contrasts with Gorz’s position, the consequences are not very favourable:

Men no longer feel it laid upon them to translate the potential into the actual; there are no goals of labour like those of the cathedral-builders. Yet, unless man sees himself in relation to ordinances such as these, what lies ahead is the most egregious self-pampering and self-disgust, probably followed by real illness. With religion emasculated, it has remained for medical science in our age to revive the ancient truth that labour is therapeutic.⁷¹

In that short passage, the three roles of work—beyond putting the food on the table—are apparent. First, work builds relations between workers and customers. Second, work is a method of self-realisation. Work gives life meaning. Maslow invented a pyramid of human needs. At the bottom are the physiological needs (for air, water and food) and the need for safety.⁷² At the top are esteem and self-actualisation. They too result from work, valuable work: work that is rewarded by something like a salary. We all know how good it feels when a piece of work is finished and how good one feels after a good day at work. Taking this away from people in exchange for food stamps or other forms of universal income would lead societies into uncharted waters. It is possible that people will find self-realisation and self-esteem in activities that are not paid work. However, experiences with pockets of societies that are supported to survive without working speak against this idea. Take as examples some of the reservations where Native Americans live; certain Pacific islands whose inhabitants receive rent in exchange

⁶⁹ R. M. Weaver, *Ideas Have Consequences: Expanded Edition* (Chicago: University of Chicago Press, 2013).

⁷⁰ *Ibid.*

⁷¹ *Ibid.*, 116.

⁷² A. H. Maslow, ‘A Theory of Human Motivation’, *Psychological Review* 50/4 (1943), 370.



for allowing the military to set up bases; and the long-term unemployed. Social degradation, alcoholism and high criminality rates that negatively impact the quality of life of the inhabitants are frequently found in these places.⁷³

Third, work is a tool for building just, meritocratic societies. Relations among people in such a society are largely determined by the work they do. Apart from the people we contact when we waste time on social networks, all the contact we have with people concerns those who work for us or for whom we work. Hierarchies are based on success at work.

There is nothing wrong with living to work, though this idea is harder to sell politically than the idea of free lunches delivered by robots.

⁷³ O. Laughland, 'Liquid Genocide: Alcohol Destroyed Pine Ridge Reservation – Then They Fought Back', *The Guardian*, 29 September 2017.

The scenarios



In this section four scenarios of how the future may look are presented. They do not describe the immediate future, and nor are they realistic. Rather, they take us far into the future and sketch exaggerated portraits of the possibilities, almost caricatures. More often than not they focus on the negatives. The goal is to illustrate possible developments and to provoke reflection on the direction in which policies related to the future of work should take us. Each scenario starts with a short story and ends with an explanation.

In the 'New Richmond' scenario, technological progress leads to extreme inequalities between rich and poor, and people start a revolution. In the 'Palo Mas Alto' scenario, equality is maintained, people are taken care of and it is possible to spend a lot of time online. In the 'Garden City' scenario, people choose not to compete with the rest of the world, with the result that the rate of progress becomes slower. People eat a lot of healthy food. Finally, in the 'Neu-Alpbach' scenario, some people work while others do not. Women prefer staying home and baking cookies.

The future will not be like the situation depicted in any one of these scenarios. It will most likely involve elements of all four. Will it be a combination of their best or of their worse features? This will depend on which policies are selected now.

New Richmond

Diana and David are dirt poor. She used to be a journalist; he, a stockbroker. Those were the good old days. Then the algorithms took over. They started to write stories instead of Diana; and to be fair, they were more objective and to the point than Diana had ever been. David thought he had a good feel for stocks, but he was no match for the algorithmic trading that took over Wall Street. From time to time David gets to work in one of those precarious arrangements where the rich look for human servants. It is not that robots cannot do the job, but it is somehow more fun if a human drives you somewhere or polishes your self-driving vehicle. It has become fashionable among the rich elite to employ humans to do rather unnecessary work—much like the rich kept horses in the twentieth century. Not that the horses were needed to work the land or pull carts: they were kept for fun. And for a similar reason, poor people are employed by the rich. This does not make for much of a life. Diana and David gave up the idea of



having children. They used to have a dog. He made it easier to appeal to people's sense of pity when they were begging on the streets. But dog food was an expensive luxury item that they could not afford. It could have turned out so very differently.

One of David's colleagues at the brokerage house, Richard, was smart enough to invest money in Robot Blockchain Intelligence while he still had a job and some savings. This was a start-up that promised to make robots smarter while keeping them on a leash (a chain, in fact). It was a success. Early investors now own most of the robots. It is a bit like owning an army of slaves who earn money for you. Richard is set for life and will never have to work again.

The big differences caused problems. People asked for a fairer distribution of the wealth. What they got instead were food stamps and re-education programmes. Diana was first retrained to be a robot instructor, then a waitress and then a nurse. But everybody was retrained for these same jobs, and the government programmes were always behind the curve—training people for a job that would either disappear or be flooded with eager candidates. But at least Diana had something to do during the day, and her life was not totally empty. David chose to join a social liberation movement. The idea was that robots should have human rights as well. This would be a way to make life harder for the owners of robots and create some demand for human labour. The movement did not have much success. Policing was done by robocops, and they were well programmed. Blockchain made hacking into the system and a revolt by the robots against their masters impossible. But the struggle continues.

In this scenario technology is used to benefit the few. They become robot owners. A mutiny by the robots is unlikely. The poor try to rebel but are not very successful. Richmond was the capital of the Confederation in the US Civil War.

Palo Mas Alto

Sally and Harry are a young couple. They live in a nice suburban house. They have a daughter, Lucy, and a dog, Fido. The dog is a robot. This is nice because Fido does not have to be walked when it rains, and when they go on holiday, he can be put into hibernation mode and stay at home.



Lucy is a real human child. Each morning Lucy is picked up by a self-driving mini-car and taken to the kindergarten. The mini-car is just big enough for one child. In remote areas and where the traffic is a problem, the government also uses drones to transport children to day-care centres. At Lucy's kindergarten various devices and robots take care of the children. It is important that they can socialise with one other, and perhaps even more important that they socialise with robots. It has been predicted that when they grow up, most children will live with or in close proximity to humanoid robots. Thus, it is important to get acquainted with them early in life.

Lucy is in day care so that Sally and Harry can pursue their careers. Of course, they do not need to work for a living because automated machines and robots provide all the food, clothing, energy and devices. There is a well-organised system that dispenses all goods in a just way to all the inhabitants, based on the 'citizen star rating'. More points are given to good citizens: those who separate the rubbish, exercise a lot and, most importantly, radiate positive energy. Citizens who are less diligent in these matters receive fewer points, but no one is actually starving.

Sally is working as an influencer. Every day she posts poems and motivational sayings on social networks. This not only helps her earn citizenship points but also makes her life fulfilling. Occasionally she also posts photographs of food and clothing. Harry has an even more fulfilling job, though some have complained it is overly gender stereotyped. He is one of the more useful members of the team that is defending planet Earth against aliens. There are no real aliens, of course—it is just a video game. But he takes it very seriously and can be quite exhausted in the evening. Nothing like a good day at work, he likes to say when he gets back from the virtual-reality battlefield.

In this scenario, technology benefits all people. Each person receives benefits according to their contribution of positive energy to society, because work-based rewards are obsolete. Palo Alto is in the heart of Silicon Valley. 'Mas Alto' means 'highest'.



Garden City

Marie and Petra are a young couple. They live in the Green Republic of Tungusia. The name should not be confused with the term 'People's Republic', which was something entirely different. They do not have children because people are in fact an ecological disaster. The carbon footprint of one human being, from childhood through to age, is bigger than that of a large dirty truck!

They work on a farm. In fact, machinery, robots and genetically engineered crops had been feeding the world. However, that was not organic farming, and nor did it provide jobs for the people. Therefore, in 2028 the Green Republic created a law to the effect that to use any inventions, patents or genetically modified crops from after 2020, one would need a special government permit. Why? In 2026 the first general-purpose robots came to market. These robots could, in a matter of hours, learn the work done by almost any person just by looking at her. People became very angry. Violence erupted and protesters started to smash not only the robots but the entire computing and energy infrastructure that powered them. The riots only stopped when the government promised to ban the use of the general-purpose robots. Industry then tried to get around the new law by building the new capabilities into specialised devices. Once again the people rioted, and this led to the ban on things invented after 2020.

Life was good in the Green Republic as everyone had a job. The goal was to be self-reliant in food, and since they did not have modern machinery, it took many hands to reach this objective. Family life was very much like it had been in the early 2000s. Of course, exports and imports were heavily regulated. The Green Republic joined the Slow Progress Union whose member nations collaborated to fend off competition from those countries that were blindly racing ahead with technological progress. They agreed that one cannot solve the problem of increasingly rapid technological change with even more and faster change. They chose not to take part in the madness and hit the brake pedal. As some people became unhappy when they compared the goods available to them with those available to people in other countries, the Slow Progress Union closed all borders and shut down all international communication. After all, the happiness of its people is the most important goal of any government.



In this scenario a country gives up the race for faster and faster progress. Its people slow down. They stop competing with others. They try not to be compared with others. They find ways to employ a lot of people to produce what is needed. Garden City was the utopian city of the English intellectual Ebenezer Howard.

Neu-Alpbach

Monica and Tom are a young couple. They live in a nice suburban house with their daughter, Lisa, their son, Jack, and their dog, Sultan. Monica's mother, Theresa, also lives with them. Her health is not the best, but instead of going into a retirement home, she lives with them. Monica does not have a job. She stays at home, takes pride in caring for her mother and making sure Jack gets to school and back every day. Lisa is home schooled. After all, it is not very likely she will need to work. When robots started to take over in the mid-twenty-first century, women increasingly preferred staying at home.

Even though Tom works just five hours a day, five days a week, he makes enough for them to live on. The necessities of life are quite inexpensive because production has been robotised. Luxury goods are pricier but not really necessary. Spending time with family is worth something as well.

With plenty of spare time, the ladies of the family are in the business of selling home-made cookies. They are made according to an old recipe that has been in the family for generations. Although mass produced cookies are dirt cheap and, frankly, just as good, the ladies take pride in making them the old way. And they have a loyal customer base: those who put tradition first.

Tom, of course, is not involved in the ladies' activities. He splits his free time between the pub, football and the garden. And this, after all, is what he thinks a man should do. He has all kinds of gadgets, though no robot mowers. A man should mow his own lawn, he likes to say. And he does it the traditional way, with a vintage petrol-powered lawnmower.

In this scenario a family tries to slow down: to work less and spend more time with each other. Society enables them to do this. They value old recipes and old values. Women choose to stay at home. In real-life, Alpbach is perhaps the most idyllic Austrian village.

Conclusions and policy recommendations



Remain ambitious, value work

In the early twentieth century, horses were replaced by motor vehicles. Horses did not stand a chance. They could pull carts and ploughs and that was it. Humans are not like horses. There are many different things that we can do. We can learn. We can adapt. But more importantly, we are not only workers. We shape our desires and ambitions. We can invent new demands. We can choose to better our lives and the lives of others. And bringing this about requires work: not only machine production but also human effort.

Desires and ambitions are shaped by our culture and values. We need to preserve the values and the culture that have brought humanity to a state of prosperity where the lack of work and the abundance of everything could appear to be problems. Appreciating the local and the particular requires more work than finding satisfaction in the global and the general. We need to preserve the innate feeling that humans like to deal with humans! And we need to reward people's desire to be useful. Being useful to one's fellow man creates the interdependencies and the fabric of human society. The issue is not so much work as it is being of use to others.

Be the leader, not a follower

Technological development will only accelerate. Some will create it, others will lag behind. Yes, the answer to ever-faster progress is to be the one that speeds it up. We in Europe want to be the ones accelerating the change and not the ones whose jobs and lives are being destroyed by the acceleration brought about by others.

Even though computerisation appears to be killing jobs, Europe should be at the forefront of this development. Substantial automation has already taken place, and the numbers suggest that it pays to be in front of the wave. Countries such as Japan, Germany and the US are leading in the use of modern technology, the deployment of robots and the penetration of IT. Nevertheless, their economies are enjoy-



ing close to full employment. Their automation is killing jobs elsewhere while giving their own workforces an opportunity to work alongside robots and automated machinery.

Those in business and in politics who are leading the change will discover how to use networked teams of computers, workers and customers to improve productivity. Leaders will create novel products and services, and will reap the benefits of winning on a global scale. Losers will have problems locally. A McKinsey study estimates that there is a 2.2 percentage point difference in GDP growth between ‘automation resistant’ countries, which follow automation trends, and ‘automation innovator’ countries, which set the trends.⁷⁴ Countries that are only ‘automation efficiency leaders’ will see a rise in GDP but in unemployment as well. However, countries that are ‘automation innovators’ will see unemployment reduced. The message is clear: it is not enough to implement the latest technology; one must design both the technology and the social ecosystem around it!

If the recommendations of this paper could be reduced to a single message it would be the following: Do not let politics stand in the way of progress and change. Schumpeter was right in claiming that economic development does not slow down or stop because people run out of ideas but because existing businesses and social players want to preserve the status quo.⁷⁵ Such forces seem to be in play in the attempts by the European institutions to make life difficult for certain Internet companies. As if preventing platforms from operating in this or that region could protect old and uncompetitive business models. As if fines and court rulings could help domestic companies come up with competitive services. There are other areas where government could be effective: education, reskilling, supporting innovation and setting proper social policies—but not in preventing innovation.

Use technology for the social good

Technology is reducing inequality. This may not make much of a difference to the amount of money people have or the value of material property. But free and advertising-supported services offer both the

⁷⁴ McKinsey & Company, *Digitally-Enabled Automation and Artificial Intelligence: Shaping the Future of Work in Europe's Digital Front-Runners* (October 2017).

⁷⁵ J. A. Schumpeter, *Capitalism, Socialism, and Democracy*, 3rd edn. (New York: Harper, 1962).



rich and the poor equal access to the same high-quality services. Services such as Google or Wikipedia are the same for a millionaire's daughter in Paris or a poor Roma child from the outskirts of Bucharest. During the time spent on YouTube, Google Drive, Pinterest or Twitter, the rich and the poor have an equivalent experience.

Faster technological progress further reduces inequality. There are two measures of inequality: one concerns differences in wealth; the other, differences in the time it takes to achieve equal wealth. Inequality in wealth measures the differences in income or property between rich and poor. The result is expressed in euros, percentages or Gini coefficients. Time inequality measures how long it would take for the poor to be able to afford what the rich have today. Fast technological development reduces inequalities measured in time. For example, it reduces the time it would take a poor child from India to obtain a tablet that is just as good as the tablet the richest child in California can afford today—so that the Indian child, too, could use all the services mentioned in the paragraph above.

Thanks to open-source operating systems such as Android, this is now measured in years, not decades or centuries. The poor will get the devices only a few years after the rich. Slowing down progress hurts the poor, not the rich, because it extends the time it takes the former to catch up. Technology can be used for the social good without policies that would encourage laziness.

Provide the best innovation infrastructure

The EU and its member states should provide the infrastructure for curiosity, creativity, empathy and community-building: technological infrastructure; human–human networking; up-to-date legislation on intellectual property rights; flexible employment mechanisms; and a social safety net. This will allow people to experiment with new ideas.

Innovation should be permission-less. Institutions and legislation from the past should not stand in the way of inventing new ways of working. Legislators should not waste their time and ours trying to



determine whether, for example, blogs are more like newspapers or locker room discussions, and then regulating them as one or the other. WordPress, YouTube, Twitter, Facebook and Uber are something new and special. They should not be forced into old moulds.

Technical infrastructure is important as well. The EU was a leader in mobile networking and remains a leader in wireless access to the Internet. The EU should be the first to roll out 5G and then 6G. Higher networking layers are important as well. The innovators in the EU should be able to build on whatever is state of the art globally. Self-sufficiency may make sense in agriculture; it does not make sense in technology. Europe should not create an alternative to Amazon or Apple. Rather, it should create the next Amazon or Apple—which will not be an online merchant or computer manufacturer.

Overhaul education

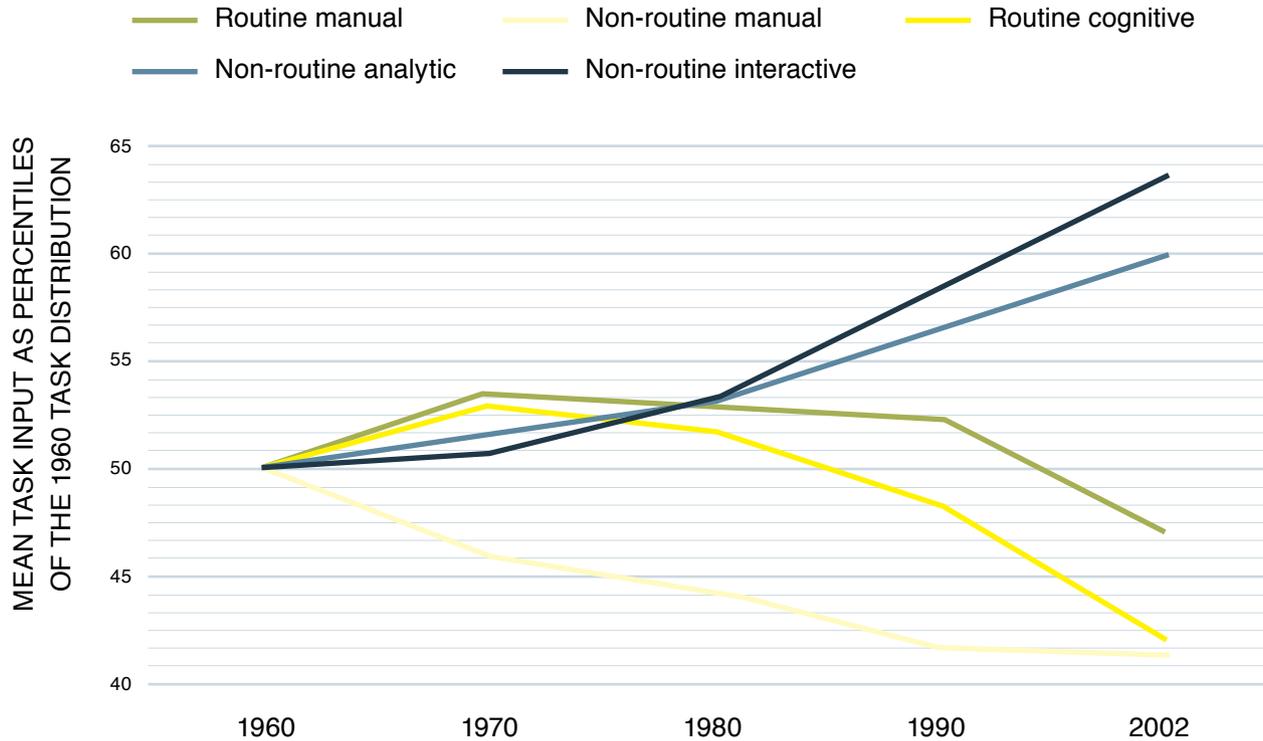
Intuitively it seems true that better skilled people could be a match for harder problems. And we make them skilled by education. But how are we to make them better? What skills will be needed in the future? In this paper we have made a case for human–machine teamwork and for workplaces that are augmented with technology. Education needs to develop the skills which complement the capabilities of machines or which machines do not have. Frey and Osborne write that ‘as technology races ahead, low-skill workers will reallocate to tasks that are non-susceptible to computerisation—i.e., tasks requiring creative and social intelligence. For workers to win the race, however, they will have to acquire creative and social skills.’⁷⁶

The demand for skills is already changing. Autor and Price have plotted how the demand for different tasks has changed over the last 50 years (Fig. 3).

⁷⁶ C. B. Frey and M. A. Osborne, ‘The Future of Employment’.



Figure 3 Demand for routine work is decreasing



Source: Adapted from D. H. Autor and B. Price, 'The Changing Task Composition of the US Labor Market: An Update of Autor, Levy, and Murnane (2003)', unpublished manuscript.

Our education systems have changed little since the industrial revolution. Education systems are not responsive to changing contexts; rather, they are entrenched in tradition.⁷⁷ Currently, schools ignore or even suppress the essential features that make us human and different from machines. We learn how to

⁷⁷ E. Lidstrom, *Education Unchained: What It Takes to Restore Schools and Learning* (Maryland: Rowman & Littlefield, 2015).



be like machines: we memorise facts, learn mathematical equations and process formulae. As Andreas Schleicher from the OECD likes to point out,⁷⁸ these are easy to teach in class and easy to test in exams. But, unfortunately, they are also easy for machines to learn.

Instead, learning should encourage us to preserve and grow in what makes us human: curiosity, creativity, empathy, comprehension, persuasion, negotiation—and, most importantly, social interaction, which is needed for the building of communities and institutions.

Education will have to be less about just-in-case topics—learning something in school in case we might need it later in life—and more about just-in-time matters—learning while working. Education should be less about how to serve machines and computers and more about how to control machines and program computers. It should focus less on how to answer questions and more on what questions should be asked; less on how to solve problems and more on how to define problems; less on how to comply with decisions made by others and more on how to make decisions; less on how to make things and more on how to sell them; less on machine skills and more on people skills; less on how to be smart and more on how to be good; less on how to treat people like objects and more on how to treat people like human beings.

This calls for a major overhaul of pedagogy and school curricula, but it would take at least 15 years for this to have an effect. Therefore, a major effort is required to improve lifelong learning and to provide opportunities for experimenting with creative ideas. However, in preaching that education will solve the future of work problem, a caveat is necessary. Placing the jobless in massive government reskilling programmes⁷⁹ may be just an expensive way (1) to keep them busy and (2) to offer them a light at the end of the tunnel.

This is not to say that education should not be made available. But the private sector should take the initiative both in providing education and in assessing the needs. Lidstrom has made a strong case for privately run education, arguing that it would be more innovative and more responsive to labour-market needs than what governments can offer.

⁷⁸ A. Schleicher, 'Educating for the 21st Century', *Big Think*, 15 April 2014.

⁷⁹ J. Corbyn, 'Education is a Collective Good: It's Time for a National Education Service', *LabourList*, 27 July 2015.



There are untapped opportunities in the private sector to drive training and retraining. We have already mentioned the efforts of Bosch, Siemens and others. Technology can be used to provide on-line courses for self-learning, distance-learning courses and personalised education. Platforms can connect people to knowledge and to people who are willing to teach or tutor. Human capital will be increasingly important. Increasing it should be a matter for individuals and not only for governments and big companies.

Not even everyone on the left considers education a panacea. Rifkin warns that retraining those who now work in manufacturing and services to become engineers or computer programmers ‘seems at best a pipe dream, and at worst a delusion’.⁸⁰

Modernise welfare policies and employment regulations

States should put in place a responsive market economy that will recognise and reward those who are successful in developing permission-less innovation. It is not likely that politicians and civil servants will find a solution to the problems related to the future of work. But people will, both as providers (with tempting offers) and as customers (with fresh demands). The role of the state is to provide an infrastructure for innovation and for the generation of ideas, and then to identify and reward the winners.

By ‘innovation’ we mean not only technical innovation but also innovation in business, institutional and social models. The role of the EU is not to impose on member states—from the top down—a new social model for the digital age. The civil service in Brussels is unable to invent such a model. Instead, Brussels should allow states to experiment with different solutions and then encourage best practices to spread.

⁸⁰ J. Rifkin, *The End of Work*, 288.



We are currently witnessing, in the EU in particular, increases in the labour market and in the segmentation of the welfare state. There are unfair differences between those that have traditional nine-to-five jobs and the growing number of those that work in other ways. Interestingly, this segmentation is much greater in countries with a rigid labour market where the older workforce has steady jobs while women and the young suffer in jobs that are unstable and temporary.

The solution is not to prohibit or even discourage jobs that are not steady. Instead, social insurance, health insurance, unemployment insurance and taxation systems should work equally well for regular jobs and contingent work. All work should be treated equally, and people with one kind of contract should have no financial or competitive advantage over those with another kind.

Many opportunities remain untapped. One can improve employment agencies, deploy big data technology to match supply and demand, digitise human resource management and so on. The trend towards ever shorter working hours will most likely continue without a loss in per-person–per-year productivity, as it did throughout the twentieth century. Penalising overtime work when others are unemployed may be a viable policy. Increasingly people may also choose to work part-time, so that they can spend more time with their families, contribute to everyone’s well-being at home or become involved in unpaid voluntary work, hobbies and so on.

Platforms will be an important element of this new ecosystem as they will be able to provide flexible working arrangements while efficiently linking workers to customers. Many people may find it more convenient to work by means of such platforms: those who are not working otherwise, those looking for additional income, people looking for flexible hours, seniors and minorities. As the platform-based workplace is computerised, this could open up new opportunities for the disabled or impaired. The Germany company SAP is using technology to help people with autism become gainfully employed. For Uber drivers, being deaf is not a handicap as all communication is handled through a computerised platform. A traditional taxi driver is expected to be able to hear the passenger. Similarly, technology can assist in complementing the knowledge of the service provider. For example, a taxi driver without any knowledge of foreign languages can drive foreigners with the help of an automated translation system in his car. Indeed, these new entrants to the labour market may be willing to work for less, which would make some services cheaper and thus available to more customers. It is therefore



vital that taxation and social insurance policies do not make such contingent work less financially attractive.

The concept of a universal basic income is often discussed in the context of the reform of the welfare state. While it has some merits as a simplification of welfare handouts, it should be approached with caution. A scenario where people receive a universal basic income but then 'give something back' to society by providing 'free' voluntary or community work is not acceptable. It is one of those elements that Gorz calls a 'path out of capitalism'. He suggests that we should 'widen as far as possible the gap between society and capitalism' and introduce mechanisms 'which allow modes of life, co-operation and activities to emerge that lie outside the power apparatuses of capital and the state'.⁸¹

⁸¹ A. Gorz, *Reclaiming Work*.

Final words



The best of what technology will bring us is yet to come. Progress will continue to be exponential, which means that it will be difficult to respond to progress and even more difficult to predict it. Therefore, we should be setting up flexible, responsive social structures and institutions that can respond quickly and autonomously, adapting to change and encouraging businesses to be flexible and innovative.

There is no need to be afraid of technological determinism: the belief that technology will change society. Human nature cannot be changed overnight. We were shaped as hunter-gatherers, and deep down inside we will remain that even if we have robot assistants. If, on the other hand, we start believing in free lunches, vast swaths of Europe will increasingly look like Native American reservations in the US where people live on subsidies.

As long as humanity is ambitious, as long we want to live meaningful lives, as long as we want to leave the world a better place for our children—then work, human work, will be needed. Automation and technological development bring opportunities and threats. In summary, the policies that will allow us to reap the opportunities and mitigate the challenges are the following:

- Put the EU at the forefront of technological innovation even if it kills jobs. Leaders will be better off than laggards.
- Reject biased political or business interests that would stifle innovation and prevent competition under the pretext of saving jobs or creating work.
- Embrace change in labour arrangements and build on the opportunities it offers. Support it by modernising the welfare state, not by stifling the Internet economy.
- Provide top-notch technological infrastructure. Europeans should be able to use and build on the best infrastructure in the world, regardless of who provides it.
- Support investment in human resources by states, businesses and individuals. Use technological and institutional opportunities to overhaul education.

And finally, and perhaps most importantly, we should not be satisfied with how we live, how our



children will live and what kind of life our neighbours in Africa and Asia will have. There are diseases to be cured; ecosystems to be cleaned; planets to be explored; and cathedrals, schools and houses to be built. Life could be even better, and it will not get better without work.

While it is tempting to portray the world as a place of abundance—from the perspective of political marketing in particular—the fact is that we still live in a world of scarcity. We should be concerned about, not the redistribution of the results of work, but the creation of wealth.



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