DARON ACEMOGLU

Technology and inequality

in the past and the future

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ABSTRACT: Many industrialized nations, including the United States, built institutions and steered a course of technology development that helped them achieve economic growth that was broadly shared across many different demographic groups—including workers with less than a college degree. Central to this experience of shared prosperity was democratic participation, citizen and worker voice, and technologies that not only automated production, but also created new tasks for workers with diverse skills, so that workers were not sidelined. Over the last four decades, we have seen this model unravel: technology has gone much more into automation, without creating sufficiently many new tasks for workers, inequality has skyrocketed, and citizen and worker voices have been weakened. Artificial intelligence tools are deepening these worrying trends, as they are used for further automation and weakening democratic processes via surveillance and misinformation. If we do not get the direction of AI right, it will become much harder to build shared prosperity in the future.

KEY WORDS: artificial intelligence, technology, inequality, jobs, wages, productivity

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He is the author of five books, including New York Times bestseller *Why Nations Fail: Power, Prosperity, and Poverty* (with James A. Robinson), *Introduction to Modern Economic Growth, The Narrow Corridor: States, Societies, and the Fate of Liberty* (with James A. Robinson), *Economic Origins of Dictatorship and Democracy* (with James A. Robinson), and *Power and Progress: Our Thousand-Year Struggle Over Technology and Prosperity* (joint with Simon Johnson).

Daron Acemoglu's academic work covers a wide range of areas, including political economy, economic development, economic growth, technological change, inequality, labour economics and economics of networks. He has received the inaugural T.W. Shultz Prize from the University of Chicago in 2004, and the inaugural Sherwin Rosen Award for outstanding contribution to labour economics in 2004, Distinguished Science Award from the Turkish Sciences Association in 2006, the John von Neumann Award, Rajk College, Budapest in 2007, the Carnegie Fellowship in 2017, the Jean-Jacques Laffont Prize in 2018, the Global Economy Prize in 2019, and the CME Mathematical and Statistical Research Institute prize in 2021. He was awarded the John Bates Clark Medal in 2005, the Erwin Plein Nemmers Prize in 2012, and the 2016 BBVA Frontiers of Knowledge Award.

He holds Honorary Doctorates from the University of Utrecht, the Bosporus University, University of Athens, Bilkent University, the University of Bath, Ecole Normale Superieure, Saclay Paris, and the London Business School.

Foreword

IN RECENT DECADES, technology, including artificial intelligence (AI), has advanced astonishingly. AI and technological change bring attractive promises, some already evident in daily activities, of reducing menial work and introducing new tasks for people, beyond just workers, to learn and perform. It effectively reduces drudgery in many areas, with future benefits for education and research just beginning to emerge.

However, we are concerned that the bright promises—more meaningful and interesting work, increased voice for citizens and workers, shared prosperity across classes—marketed in the early days of AI may turn out to be somewhat darker if AI's direction is not channeled towards the greater good.

Here we have the write-up of a lecture by Daron Acemoglu, one of the world's leading economists in the the economics of technology, and what the effects of unprecedented technological change could have on economies, societies, industries, and people. He looks at the development of technological change—considering aspects such as history, democracy, economic growth, surveillance, employment, and gender.

I sincerely thank Daron for his thought-provoking, fact-rich lecture with suggestions for policy that could redirect technological change towards more socially and environmentally beneficial outcomes.

Kunal Sen

Director, UNU-WIDER
September 2023

Introduction

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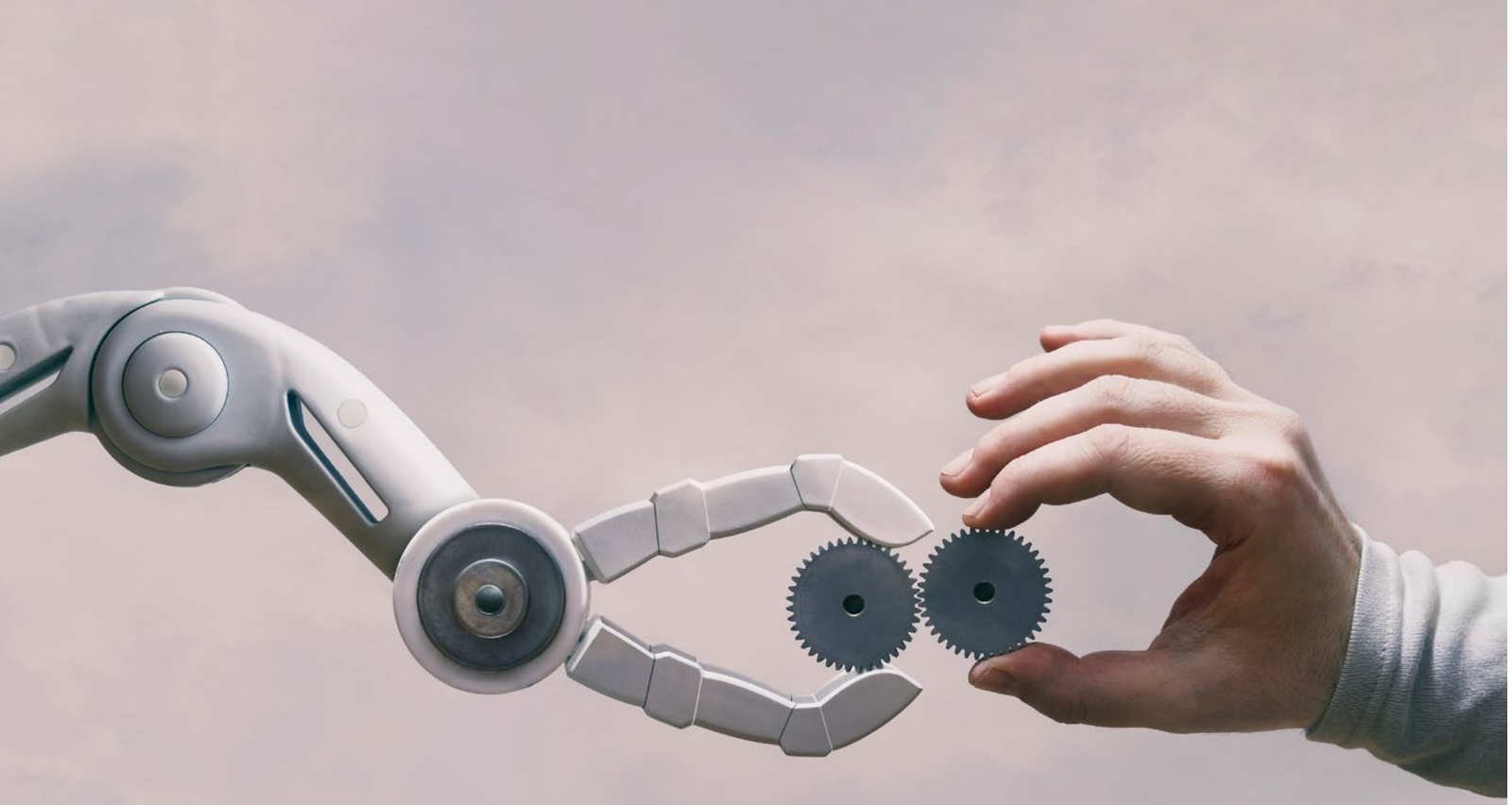
ARTIFICIAL INTELLIGENCE (AI) will not make human workers redundant in the near future, but the technology has already made enormous advances. Its proponents, and now even some previously skeptical experts, believe that it will revolutionize white-collar work, medicine, entertainment, transportation, and even scientific research. It can enable many new products and tools, and vastly increase the amount of information that governments and companies have about individuals (Brynjolfsson and McAfee 2014).

And yet, there are many reasons to be concerned. Digital technologies and AI, thus far, have boosted inequality and destroyed good jobs for workers from diverse skill sets (Acemoglu and Johnson 2023; Acemoglu and Restrepo 2022). AI applications have changed how we communicate, with clearly dangerous consequences, such as the manipulation of social media for the proliferation of misinformation, and magnified the ability of governments and companies to engage in surveillance.

All the same, AI is not the first technology with the potential to be transformative and at the same time increase inequality. If we learn from the past, we can shape the future of AI through a better understanding of how and why we have been successful in generating shared prosperity from other major technological breakthroughs.

In doing this, we have to bear in mind that the direction of AI development is not preordained. It can be altered to increase human productivity, create jobs and shared prosperity, and protect and bolster democratic freedoms. This process of redirection must start with a deeper understanding of why recent digital technologies have increased inequality and further empowered rich and already-powerful actors. We must then assess why AI is continuing this trend. The contrast to post-war history is telling in this respect. ■



Learning from the post-war era

2 **IN THE POST-WAR ERA**, industrialized nations experienced some of their best decades in terms of economic growth and social cohesion. Prosperity not only increased rapidly but was also broadly shared. For example, wages in the United States (US) grew rapidly for all workers, regardless of their education, gender, age, or race, during the first three decades after the Second World War (Acemoglu and Autor 2011; Goldin and Katz 2008). Of course, the post-war years also had their own major political problems, including discrimination against minorities and women (and mistreatment of billions of people in the developing world, especially when they demanded independence and democracy). Nevertheless, democracy and democratic participation deepened in much of the Western world. Democracy and shared prosperity were crucially synergistic as well.

This relatively successful shared growth experience came about in large part because of the trajectory of technological progress. John Maynard Keynes famously predicted future joblessness in 1929 (Keynes 2010). Keynes was optimistic about technological opportunities and anticipated, correctly, that labour productivity would continue to grow steadily throughout the 20th century. But Keynes was worried about automation—industrial machinery replacing human workers—which he viewed as an inevitable consequence of technological progress in industrial production. He wrote, 'We are being afflicted with a new disease of which … [readers]… will hear a great deal in the years to come—namely, technological unemployment.'

The next 50 years did not turn out as Keynes predicted, and demand for human labour grew steadily, together with wages, not just on average but for both high-skill and low-skill workers. This was not because Keynes was wrong about his prediction of rapid automation. Mechanization of agriculture substituted new harvesters and tractors for human labour, while industrial machinery simplified and replaced many tasks previously performed by humans on the factory floor (Olmstead and Rhode 1994).

Keynes's prediction was wrong because he did not anticipate a major counterbalancing force: the introduction of new tasks where human labour could be gainfully and productively employed (Acemoglu and Restrepo 2019).

To see evidence of new tasks, you need look no further than the occupational structure of modern industrialized nations. Most workers in these economies are engaged in occupations that did not exist when Keynes was writing, or they are performing completely new tasks in occupations that have the same title but are quite different in nature than what they were in the first half of the 20th century. One can see this clearly by considering the tasks involved in modern education, health care, communication, entertainment, back-office work, design, and technical work on factory floors. The modern service sector is an even better illustration. These new tasks were critical for the creation of good jobs—secure, meaningful and high-wage jobs—for workers with diverse skills (Acemoglu 2019).

Labour market institutions bolstering rent-sharing mattered greatly as well. Minimum wages, collective bargaining, and regulations introducing worker protection were critical for

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shared prosperity because they encouraged productivity increases by firms to be partly passed on to workers. Good jobs became plentiful, even for workers without much formal education. These good jobs lifted the real incomes of large portions of the population in many industrialized economies and made workers feel that they were benefiting from the overall system.

Labour market institutions empowering workers were critical. Nevertheless, without the more human-friendly aspects of technological change, these institutional structures would not have generated broad-based wage growth. If there were rapid advances in automation technology and no new tasks counterbalancing their effects, minimum wages and collective wage bargaining would not have created good jobs. Rather, they would have been an additional impetus for more automation. It was the combination of technological effort toward creating more human-friendly technologies and labour market institutions supporting better rent-sharing that generated good jobs. This is for understandable reasons; employers are keener to build long-term relationships with workers and pay them high wages when they are rapidly becoming more productive. They are also induced to invest in good jobs when labour market institutions rule out the low-wage path. Hence, the synergy between new tasks and labour market institutions protecting workers was at the root of shared prosperity (Acemoglu 2001).

Technological change bolstered shared prosperity and enabled earnings growth for workers of all skill levels because it expanded the tasks that workers could perform and increased their productivity in the tasks in which they were already employed. But why did technological change go in this direction? Existing evidence points to several forces. In the decades following the Second World War, US businesses operated in a broadly competitive environment. The biggest conglomerates of the early 20th century had been broken up by Progressive Era reforms, and those that became dominant in the second half of the century, such as the telecommunications company AT&T, faced severe antitrust action. In this competitive environment, businesses invested heavily in technology. But it was not just businesses. Technological progress also benefited from government research support. Most important was the US government's role as a funding source, major purchaser of new technologies, and director and coordinator for research efforts. The National Science Foundation, the National Institutes of Health, the Department of Defense, and corporate research and development tax credits all played a meaningful role in this process (Lerner 2009; Mazzucato 2015).

Economics cannot be separated from politics, and shared prosperity is not just an economic achievement—it is a political achievement as well.

Economics cannot be separated from politics, and shared prosperity is not just an economic achievement—it is a political achievement as well. Most Western nations became more democratic during this period. In the US, for example, reforms during the Progressive Era and the New Deal reduced the direct control of large corporations and wealthy individuals over the political process (McGerr 2005). Local politics were also transformed, with the several-decades-long process of rooting out the worst types of corruption in several American cities (Brown and Halaby 1987; Reid and Kurth 1992). The most non-democratic aspect of US politics was its race relations, and this started changing too, especially with the civil rights movement. Although the US was not a fully democratic country in the decades that followed the Second World War, many started seeing it as a model for a functioning democracy. The political scientist Robert Dahl set out to investigate 'who governs' local politics in New Haven, Connecticut. He concluded that politics was not dominated by any one of the two parties or some well-recognized elites. Local politics were pluralistic, with heavy involvement and empowerment of regular people (Dahl 2005).

Democracy and shared prosperity bolstered each other during this epoch. Democratic politics strengthened labour market institutions protecting workers and efforts to increase worker productivity, and shared prosperity increased the legitimacy of the democratic system.

Despite myriad cultural and institutional differences, Canada, Japan, and Western Europe followed remarkably similar trajectories to the US's, based on rapid productivity growth, shared prosperity, and democratic politics. ■

The automation turnaround

3 **THE LAST FOUR DECADES** of the 20th century look very different from this picture of shared prosperity. Average and median wage growth since the late 1970s has been much slower than during the previous three decades. Worse, it has powerfully contributed to rising inequalities. Most notably, wages for workers at the very top of the income distribution (for example, those with specialized skills or postgraduate degrees) have continued to grow rapidly. But in stark contrast, workers in the middle of the distribution and those at the bottom of the wage scale have seen their earnings stagnate or even decline in real terms (Acemoglu and Autor 2011).

The erosion of the real value of the minimum wage has been a contributing factor, but mostly for those at the bottom of the wage distribution. Equally or even more important has been the declining role in the power of labour unions. The China shock'—that is, the huge rise in imports from the People's Republic of China—has been equally consequential. It pushed many businesses into bankruptcy and caused large job losses in low-tech manufacturing, such as textiles, apparel, furniture, and toys (Autor, Dorn, and Hanson 2013).

My research shows that the most important factor, however, has been the shift in the direction of technological change. Industrial technology that focused on both automation and the creation of new tasks in the decades following the Second World War changed direction around 1980 and started prioritizing automation ahead of everything else (Acemoglu and Restrepo 2019). New production techniques primarily automated the more routine tasks in clerical occupations and on factory floors (Autor, Levy, and Murnane 2003). This meant that the demand for, and wages of, workers specializing in blue-collar jobs and some clerical functions declined, while those in managerial, engineering, finance, consulting, and design occupations flourished because these professionals were critical for the success of new technologies and, thanks to automation, got to work with abundant, cheaply supplied complementary tasks. As automation gathered pace, wage gaps between the top and the bottom of the income distribution magnified (Acemoglu and Restrepo 2019).

The rapid automation of routine jobs—which was first achieved with the application of computers, databases, and electronic communication in offices, and with the rollout of numerical control in manufacturing industries—continued and picked up speed with the introduction of industrial robots and more powerful digital technologies (Acemoglu and Restrepo 2020). Now it is set to accelerate again with AI.

My recent book with Simon Johnson, *Power and Progress: Our Thousand-Year Struggle over Technology and Prosperity*, explores the causes of this turnaround. With breakthroughs in digital technologies, automation may have become technologically easier. Changes in the institutional and policy environment have been crucial as well. Government funding for research, especially the type of new, open-ended research leading to the creation of new tasks, became much scarcer. At the same time, with less voice for workers, there was little institutional resistance to a direction of technological change disempowering labour. Equally important, a handful of companies with business models focused on automation came to dominate the economy. In the meantime, other aspects of government policy, especially the taxation of capital and labour income, started favoring capital and automation (Acemoglu, Manera, and Restrepo 2020). Whatever its exact causes, technology became less favorable to labour and more focused on automation.

What started with the digital technologies of the 1980s became exacerbated with AI. Most economists and computer scientists now expect that the majority of occupations will be transformed or eliminated by AI in the next few decades (Brynjolfsson and McAfee 2014; Frey and Osborne 2017). Many even expect AI to replace skilled workers in accounting, finance, medical diagnoses, and mid-level management (Webb 2019). ■

Politics of digital technologies

4 **POLITICS WAS CRITICAL** for the shared prosperity of the post-war era. It has also been critical in its unwinding. To put it bluntly, Western democracy is in peril today (and, of course, these problems are not confined to developing economies and can be seen in the emerging world as well). Let us focus on the US again for specificity.

Most importantly, US politics have become unrecognizably polarized. US politicians used to work with lawmakers from the other party on important bills. This has all but ceased over the last few decades (McCarty, Poole, and Rosenthal 2017). As a result of extreme polarization, bipartisan legislation has become impossible. Worse, polarization now affects all of US society, not just lawmakers.

Polarized politics in an era witnessing the end of shared prosperity was bound to be bad news for the health of democracy. But then another set of factors made matters worse, much worse: digital technologies' impact on democratic discourse. To start with, the traditional media model, with trusted and mostly balanced sources, has all but completely receded. Cable news networks and online news sources have fuelled further polarization or even hatred of different viewpoints (DellaVigna and Kaplan 2007; Sunstein 2018). Then things reached a boiling point with social media.

All this has played out against the background of a perennial problem of US politics: the richest Americans and the largest corporations are disproportionately influential in shaping policy via lobbying efforts, campaign contributions, their connection to politicians, and perhaps, most importantly, via their impact over traditional and social media (sometimes as owners, sometimes as experts) (Bartels 2008; Gilens 2012).

AI has played a major role in this polarization. AI-based social media media, such as Facebook and Twitter, have transformed political communication and debate. AI has enabled these platforms to target their users with individualized messages and advertising, and, even more ominously, social media has facilitated the spread of disinformation, contributing to polarization, a lack of trust in institutions, and political rancor. The Cambridge Analytica scandal illustrates the dangers of AI-based social media. Cambridge Analytica acquired the private information of about 50 million individuals from data shared by around 270,000 Facebook users about themselves and others. It then used these data to design personalized political advertising in the Brexit referendum and the 2016 US presidential election. Many more companies are now engaged in similar activities, with more sophisticated AI tools (Coppins 2020). Recent research suggests that standard algorithms used by social media sites such as Facebook reduce the exposure of individuals to posts from different points of view, further contributing to the polarization of the American public (Levy 2021).

Other emerging applications of AI may be even more threatening to democracy and liberty around the world. Basic pattern-recognition techniques are already powerful enough to enable governments and companies to monitor individual behavior, political views, and communication. They have been used extensively by several companies and countries. For example, the Chinese Communist Party has long relied on similar techniques for combating online dissent and opposition through mass surveillance. As Edward Snowden's revelations showed, the US government eagerly used similar techniques to collect massive amounts of data from the communications of both foreigners and American citizens. Spyware programmes such as Pegasus, developed by the Israeli firm NSO Group, and the Da Vinci and Galileo platforms of the Italian company Hacking Team, enable users to take control of the data of individuals thousands of miles away, break encryption, and remotely track private communications (Kushner 2016; Wolff 2019). Facial recognition applications of AI are potentially even more dangerous (Bughin et al. 2017). Much of the demand for this technology originates from mass surveillance programmes of governments, but corporate surveillance is also contributing (Devlin 2019; Graham and Wood 2003; Metz 2019a; Zuboff 2019).

With AI-powered technologies for collecting information about individual behavior, tracking communications and recognizing faces and voices, it is not far-fetched to imagine that many governments will be better able to control dissent and discourage opposition. These technologies will not just deter dissidents (though they will certainly do that). They will also change the nature of political discourse. Most importantly, recognizing that their every behavior is being monitored, individuals will be discouraged from voicing criticism. Then, even worse, they will be discouraged from thinking critically.
If, as I have argued, individual dissent is the mainstay of democracy and social liberty, then these potential developments and uses of AI technology should alarm everybody (Acemoglu and Robinson 2019). ■

An alternative path for future technologies

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THERE IS NOTHING INEXORABLE about the future of technology. AI can be used for creating new tasks and empowering workers and citizens. It would be a failure of science, politics, and economics if it does not do so.

What are the alternatives? Let us start with workers in the production process. Even though the majority of AI research has been targeted towards automation, there are plenty of new pastures where AI could complement humans and powerfully increase human productivity by creating new tasks and activities for workers. Let me give a few examples.

Take the education sector. Current developments, such as they are, go in the direction of automation—for example, automated grading or online resources to replace teachers. But AI can also revolutionize education by empowering teachers to adapt their material to the needs and attitudes of subsets of students in real time (Hao 2019; Singer 2017). Existing evidence suggests that what works for one individual may not work for another, and different students find different aspects of a subject more challenging (Honey and Mumford 1986; Ramírez and Castañeda 1974; Muralidharan, Singh, and Ganimian 2019). AI in the classroom can make teaching more adaptive and student-centered, generate distinct new teaching tasks, and, in the process, increase the productivity of and the demand for teachers. The situation is very similar in health care, to the extent that AI could personalize care, improve diagnostic tools, and empower nurses and technicians to provide better service and care. Nevertheless, there have been few attempts to use AI to provide new, real-time services to students in classrooms or to patients by nurses, technicians, and doctors.

AI can also be combined with augmented and virtual reality to provide new productive opportunities to workers in blue-collar and technical occupations, for example, enabling them to achieve a higher degree of precision so that they can collaborate with robotics technology and perform integrated design tasks (Kellner 2018; Ong and Nee 2013).

AI in the entertainment sector can go a long way towards creating new productive tasks for workers (Metz 2018; Robitzski 2018). Though there have been more advances in this domain, the prevailing approach has again been one based on digital ads and manipulative uses of AI.

AI can also facilitate human learning and training. There is a growing need for flexibility and continuous learning in most occupations and fields by making adaptive technical and contextual information available on demand. This is because the economic environment has become more dynamic, necessitating greater adaptation and sometimes changes in tasks in occupations. It is also because people are now living longer, healthier lives than before, and thus continuous learning makes more sense.

In all these areas, AI can be a potent tool for deploying the creativity, judgment, and flexibility of humans rather than just automating their jobs.

We can also use AI to develop better technologies to protect privacy and freedom. AI tools—including differential privacy, adversarial neural cryptography, secure multi-party computation and homomorphic encryption—can protect privacy. They can also be utilized for detecting security threats, surveillance, and snooping. Although these areas have become more important over time, they are not where the majority of research dollars are spent within the tech community. ■

Regulating artificial intelligence

6 **WE HAVE TO REGULATE** AI and its future path. This must start with an understanding of what determines the current direction of research. Today, AI is controlled by a few tech companies and their powerful executives. Think of the influence of Google (Alphabet), Facebook (Meta), Amazon, Microsoft, Netflix, Ali Baba, and Baidu, which account for the majority of money spent on AI research; according to a recent McKinsey report, these companies collectively account for about USD 20–30 billion of USD 26–39 billion of total global AI research (Bughin et al. 2017). Government funding for AI is tiny compared to the budgets of these companies (NITRD 2019).

The same corporations now also set the agenda for academic research. This is a consequence of declining government support and the increasing clout of these companies (Gruber and Johnson 2019). It is exacerbated by the revolving door between the tech sector and universities (Metz 2017, 2019b). For example, these companies use both their research departments and philanthropic activities to cultivate research direction in line with their business model and encourage students to prioritize corporate needs in their studies (Bertrand et al. 2018). They are also highly influential in policymaking and funding decisions.

Of course, there is a growing movement against the power of these companies and many students and academics take a very different approach. Arguably, however, these companies are more powerful in terms of influence over academic studies and research than any other corporations have been in history. ■

Ideas for redirecting artificial intelligence

7 **WE NEED A THREE-PRONGED APPROACH** for redirecting AI. These three prongs are well illustrated by past successes in redirecting technological change towards socially beneficial areas. In the context of energy generation and use, there have been tremendous advances in low- or zero-carbon emission technologies, even if we are still far away from stemming climate change (IRENA 2019; Ritchie, Roser, and Rosado 2022). First, these advances owe much to government policies that developed a measurement framework for the amount of

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carbon emitted by different types of activities and for determining which types of technologies were clean. Based on this measurement framework, government policy (at least in some countries) started taxing and limiting carbon emissions, and then, even more consequentially, governments used research funding and their intellectual leadership to redirect technological change toward clean sources of energy—such as solar, wind, geothermal—and innovations directly controlling emissions of greenhouse gases. Second, there was a concurrent change in norms. Households became willing to pay more to reduce their own carbon footprint, for example, by purchasing electric vehicles or using clean sources of energy themselves. They also started putting social pressure on others to do likewise. Even more consequential was public demand for employers to limit pollution. Third, all of this was underpinned by democratic oversight and pressure. Governments acted because voters insisted that they act; companies changed (even if in some instances these changes were illusory) because their employees and customers demanded change, and because society at large turned the spotlight on them.

The same three-pronged approach can work in the area of AI. Government policy, funding, and leadership are critical. A first step is removing policy distortions that encourage excessive automation and generate an inflated demand for surveillance technologies. Governments are the most important buyers of AI-based surveillance technologies. Even if many security services are unwilling to relinquish these technologies, democratic oversight can force them to do so. As I already noted, government policy may also be fuelling the adoption and development of new automation technologies. For example, the US tax code—by imposing high taxes on labour while providing effective subsidies on the purchase of machines and software—encourages firms to adopt machines that automate work rather than engage human labour (Acemoglu et al. 2020). Removing these distortionary incentives would go some way toward refocusing technological change away from automation, but it will not be enough. We need active government involvement to support and coordinate research efforts towards the types of technologies that are most socially beneficial and that are most likely to be undersupplied by the market.

In the field of AI, we need to focus on measuring and determining what types of AI applications are most beneficial and what types are less so. For surveillance and security technologies, it is feasible, if not completely straightforward, to define which technological applications will strengthen the ability of companies and authoritarian governments to snoop on people and manipulate their behaviour. It may be harder in the area of automation—how do you distinguish an automation application of AI from one that leads to new tasks and activities for humans? For government policy to redirect research, these guidelines need to be in place before the research is undertaken and before technologies are adopted. This calls for a better measurement framework—a tall order, but not a hopeless task. Existing theoretical and empirical work on the effects of automation and new tasks shows that they have very distinct effects on the labour share of value added (meaning how much of the value added created by a firm or industry goes to labour) (Acemoglu and Restrepo 2018). Greater automation reduces the labour share, while new tasks increase it (Acemoglu and Restrepo 2020; Graetz and Michaels 2018). Measuring the sum of the work-related consequences of new AI technologies via their impact on the labour share is therefore one promising avenue. Based on this measurement framework, policy can offer more support to technologies that tend to increase the labour share rather than those that reduce it.

In the field of AI, we need to focus on measuring and determining what types of AI applications are most beneficial and what types are less so.

Second, in the same way that millions of employees demand that their companies reduce their carbon footprint, and that many nuclear physicists would not be willing to work on developing nuclear weapons, AI researchers should become more aware and more sensitive to the social consequences of their actions. But the onus is not just on them. We, as a society, need to identify and agree on what types of AI applications contribute to our social ills. A clear consensus on these questions may then trigger self-reinforcing changes in norms as AI researchers and firms feel social pressure from their families and friends and society at large.

Third, all of these need to be embedded in democratic governance. It is easier for the wrong path to persist when decisions are made without transparency and by a small group of companies, leaders, and researchers not held to account by society. Democratic input is vital for breaking that cycle.

We are nowhere near a consensus. Nor are changes in norms and democratic oversight around the corner. Nonetheless, such a transformation is not impossible. A first step is to recognize the problem and articulate how a coordinated change in politics and economics is necessary and possible to recreate a new era of shared prosperity and democracy.

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