The Great Decoupling: An Interview with Erik Brynjolfsson and Andrew McAfee

hbr.org/2015/06/the-great-decoupling

Amy Bernstein Anand Raman 01/06/2015

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Machines, it seems, can do almost anything human beings can. Now cars are even starting to drive themselves. What does that mean for business and employment? Will any jobs be left for people? Will machines take over not just low-skilled tasks but high-skilled ones too? If a man and a machine work side by side, which one will make the decisions? These are some of the questions facing companies, industries, and economies as digital technologies transform business.

Technological progress makes the world better but also brings new challenges, say Erik Brynjolfsson and Andrew McAfee, faculty members at the MIT Sloan School of Management, who have studied the impact of technology on economies for years. Their most recent book, The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies, took an upbeat view of the high-tech future. But since its 2014 publication, the two academics have been grappling with a problem whose dimensions surprise even them: why digital innovations are contributing to the stagnation in average incomes in the United States and to the disappearance of so many middle-level jobs.

In this interview with HBR editor Amy Bernstein and editor at large Anand Raman, Brynjolfsson and McAfee explain that while digital technologies will help economies grow faster, not everyone will benefit equally—as the latest data already shows. Compared with the Industrial Revolution, digital technologies are more likely to create winner-take-all markets. Brynjolfsson and McAfee also believe that despite the heady pace of technological development, business dynamism has dipped, and they worry that the policy response has been inadequate. They conclude that though no one knows what the future holds, the time to start tackling the economic downside of new technologies is now.

HBR: Your recent work has focused on the progress that digital technologies have enabled. But lately you've expressed concern that problems related to them are emerging quickly. What are you so worried about?

McAfee: Let's be clear about one thing: Digital technologies are doing for human brainpower what the steam engine and related technologies did for human muscle power during the Industrial Revolution. They're allowing

us to overcome many limitations rapidly and to open up new frontiers with unprecedented speed. It's a very big deal. But how exactly it will play out is uncertain.

Just as it took decades to improve the steam engine to the point that it could fuel the Industrial Revolution, it's taking time to refine digital technologies. Computers and robots will keep evolving and will learn to do new things at an amazing pace. That's why we're at an inflection point today, at the dawn of what we call the Second Machine Age.

This era will be better for the simple reason that, thanks to digital technologies, we'll be able to produce more: more health care, more education, more entertainment, and more of all the other material goods and services we value. And we'll be able to extend this bounty to more and more people around the world while treading lightly on the planet's resources.

Technologies have decreased the demand for low-skilled information workers but have increased it for highly skilled ones.

Brynjolfsson: But digitization has brought with it some thorny challenges. That shouldn't be a shock. Throughout history, positive economic developments have often had unpleasant side effects. For instance, the first Industrial Revolution created vast wealth but also brought us pollution and disease and the exploitation of child labor.

Digitization is creating new types of economic disruption. In part, this reflects the fact that as computers get more powerful, companies have less need for some kinds of workers. Even as it races ahead, technological progress may leave some people—perhaps even a lot—behind.

For other people, however, the outlook is bright. There's never been a better time to be a worker with special technological skills or education. Those people can create and capture value. However, it's not a great time to have only ordinary skills. Computers and robots are learning many basic skills at an extraordinary pace.

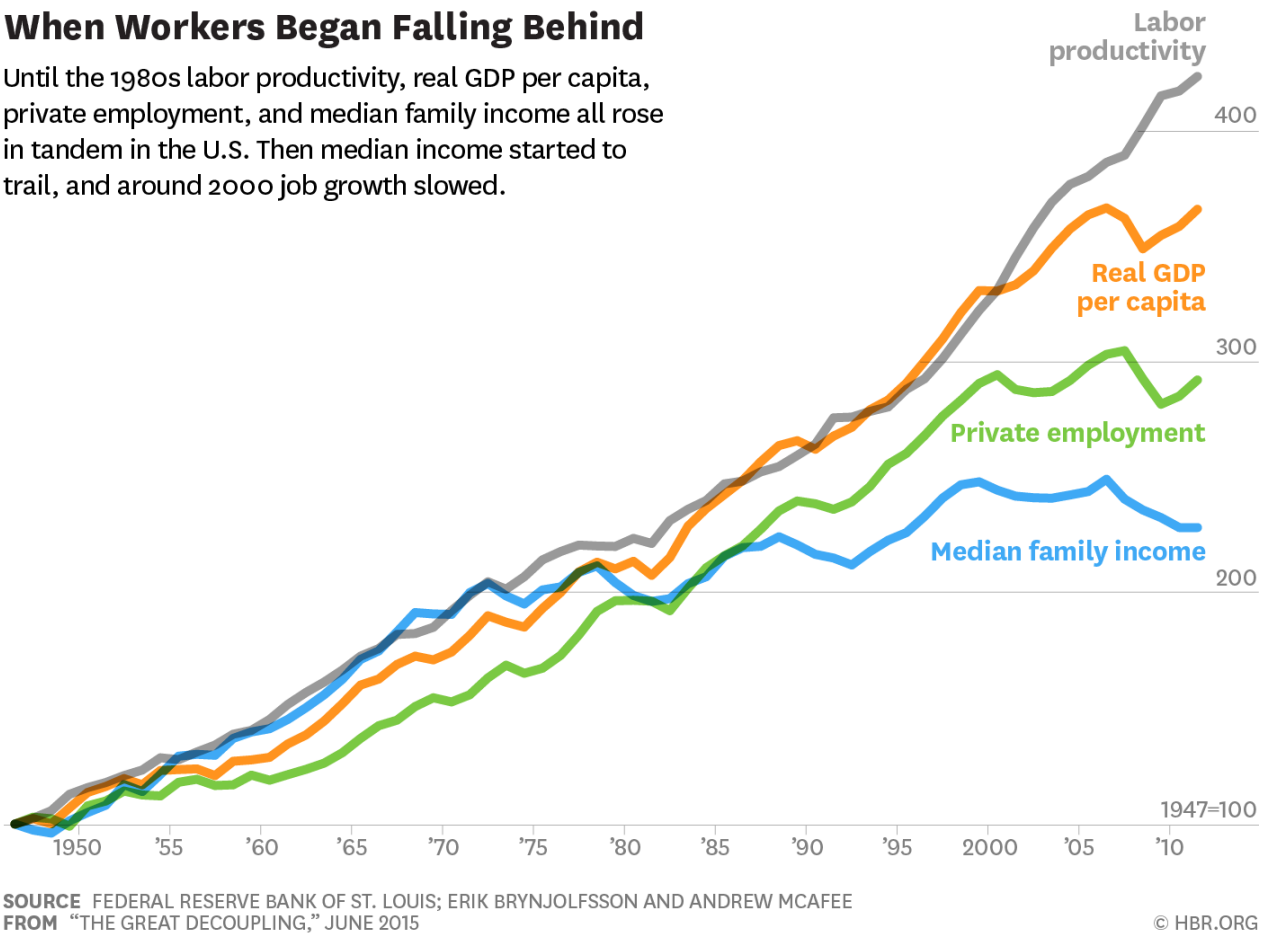
McAfee: There's no economic law ensuring that as technological progress makes the pie bigger, it benefits everyone equally. Digital technologies can replicate valuable ideas, processes, and innovations at very low cost. This creates abundance for society and wealth for innovators, but it diminishes the demand for some kinds of labor.

Disrupting the Cycle of Prosperity

According to the data, productivity is rising, but many Americans' incomes are stagnant or even falling. What do you make of that?

Brynjolfsson: Let's look at the four key measures of an economy's health: per capita GDP, labor productivity, the number of jobs, and median household income. When we studied the U.S. data on all those metrics, we turned up an intriguing story: For more than three decades after World War II, all four went up steadily and in almost perfect lockstep. Job growth and wage growth, in other words, kept pace with gains in output and productivity. American workers not only created more wealth but also captured a proportional share of the gains.

In the 1980s, however, the growth in median income began to sputter. In the past 15 years it's turned negative; once you adjust for inflation, an American household at the 50th percentile of income distribution earns less today than it did in 1998, even after accounting for changes in household size. Job growth in the private sector has also slowed—and not just because of the 2008 recession. Job gains were anemic throughout the 2000s, even when the economy was expanding. This phenomenon is what we call the Great Decoupling. The two halves of the cycle of prosperity are no longer married: Economic abundance, as exemplified by GDP and productivity, has remained on an upward trajectory, but the income and job prospects for typical workers have faltered.



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We haven't experienced anything quite like this before. Even though machines did more and more work and the population grew rapidly for almost 200 years, the value of human labor actually rose. You could see this in the steady increase in the average worker's wages. That fueled the notion that technology helps everyone. However, that kind of success is not automatic or inevitable. It depends on the nature of the technology, and on the way individuals, organizations, and policies adapt. We're facing a huge challenge.

Is the Great Decoupling happening only in the United States?

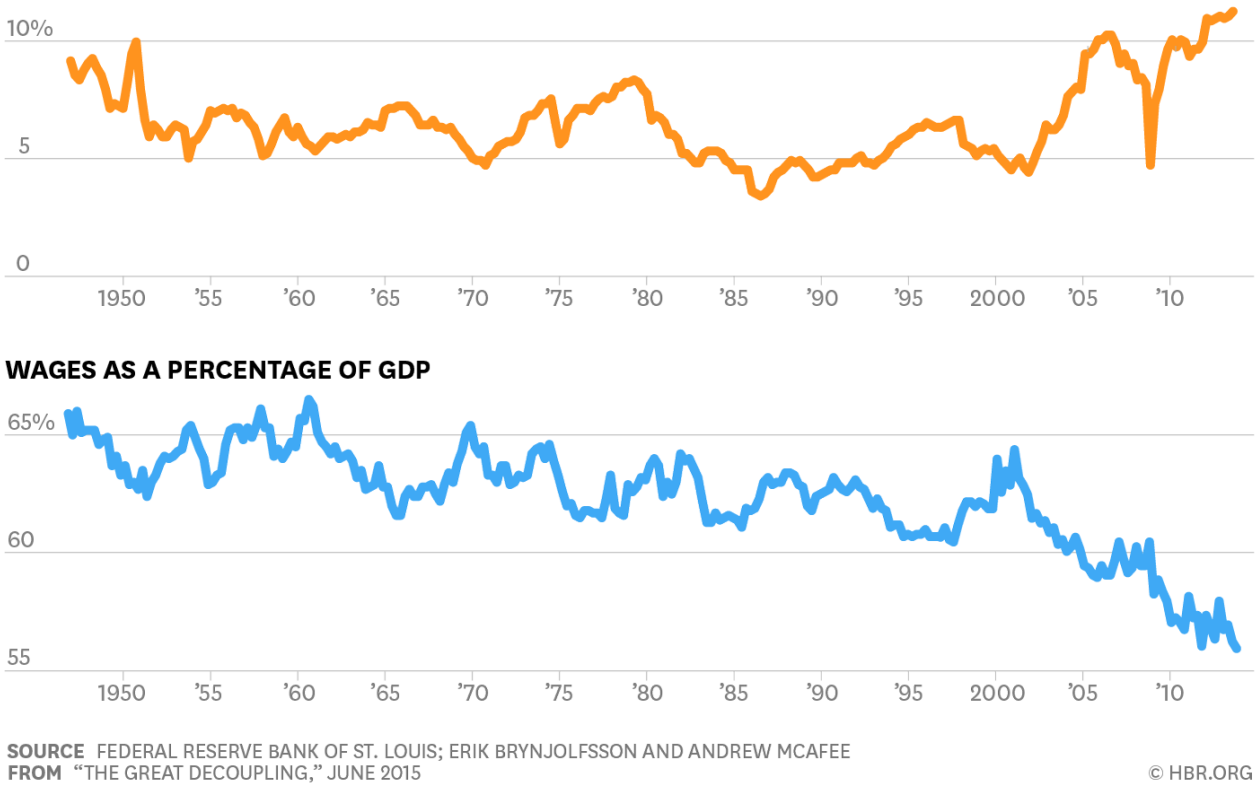
Brynjolfsson: No, similar trends are appearing in most developed countries. In Sweden, Finland, and Germany, for instance, income inequality has grown over the past 30 years, though not as high as it has in the United States.

The fact that the middle class has been hollowing out in country after country indicates that the decoupling isn't due solely to changes in the social contract. Germany, Sweden, and the United States all have different views about capitalism, about how people should be treated, and so on. We're not saying that social choices have no effect, and for that matter, we're not saying that globalization has no effect, either. However, there seems to be a common underlying force that's affecting all these countries. We think that force is technology.

McAfee: One gauge of workers' prospects is how much of GDP is paid as wages every year. Labor's share of GDP held steady for many decades in America, but since 2000 it has fallen sharply. Meanwhile, corporate profits were rising quickly before the Great Recession and recovered with remarkable speed afterward; now they're at their highest point since World War II.

As Profits Climb, Wages Plummet

In the U.S., corporate profits were rising before the 2008 recession and quickly recovered from it. In contrast, labor's share of GDP, which was healthy for many decades, has fallen sharply since 2000.



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FROM "THE GREAT DECOUPLING," JUNE 2015

Workers' prospects are deteriorating in the developing world, too. A recent study by Loukas Karabarbounis and Brent Neiman found that labor's share of GDP had declined in 42 out of 59 countries, including China, Mexico, and India. The researchers concluded that as advances in information technology caused the price of plants, machinery, and equipment to drop, companies shifted investment away from labor and toward capital.

Brynjolfsson: Over the past 30 years, as American companies moved production overseas to lower costs, manufacturing employment in the United States fell. Our MIT colleague David Autor and his coresearchers David Dorn and Gordon Hanson estimate that competition from China can explain about a quarter of the decline in manufacturing employment in the United States. But both American and Chinese workers are being made more efficient by automation.

Not all types of jobs are disappearing, are they? Why are some affected more than others?

McAfee: Technologies such as payroll-processing and inventory-control software, factory automation, computer-controlled machining centers, and scheduling tools have replaced workers on the shop floor and in clerical tasks and rote information processing. By contrast, big data, analytics, and high-speed communications have enhanced the output of people with engineering, creative, and design skills and made them more valuable. The net effect has been to decrease the demand for low-skilled information workers while increasing the demand for highly skilled ones.

Brynjolfsson: This trend has been documented in dozens of studies by economists—Autor, Lawrence Katz, Alan Krueger, Frank Levy, Richard Murnane, and Daron Acemoğlu. Papers I've published with Tim Bresnahan, Lorin Hitt, and others have documented it too. Economists call it skill-biased technical change. By definition, it favors people with more education, training, or experience.

A paper written by Autor and Acemoğlu highlights the effects of skill-biased technical change. Before 1973, American workers all enjoyed brisk wage growth; the rising tide of productivity increased everyone's income regardless of educational level. Then the 1973 oil shock and recession reversed the gains for all groups.

After that, we began to see a growing divide. By the early 1980s, people with college degrees saw their wages rising again. Meanwhile, most workers without college degrees faced a less attractive job market. Their wages stagnated or, if they were high school dropouts, usually fell. It may not be a coincidence that the PC revolution started in the early 1980s.

The story becomes even more striking when you consider that the number of people enrolled in college more than doubled from 1960 to 1980—from about 750,000 to over 1.5 million. The flood of graduates should have pushed down their relative wages, but it didn't. The combination of higher pay and growing supply suggests that the relative demand for skilled labor increased faster than the supply did.

At the same time, even though the ranks of people who hadn't finished high school were thinning, the jobs available to them were decreasing even faster. The lack of demand for unskilled workers helped push their wages ever lower. This increased income inequality.

McAfee: Meanwhile, technology kept evolving. Another study by Autor and Dorn concluded that from 1980 to 2005, computerization was a prime force reshaping jobs and wages. It also noted that the occupations intensive in tasks that could easily be computerized were usually in the middle class. The hollowing out of the middle class is a major reason why median income has fallen. The Second Machine Age is playing out differently than the First Machine Age, continuing the long-term trend of material abundance but not of ever-greater labor demand.

Winners and Losers

Do digital technologies create winner-take-all economies?

Brynjolfsson: Digital technologies allow you to make copies at almost zero cost. Each copy is a perfect replica, and each copy can be transmitted almost anywhere on the planet nearly instantaneously. Those were not characteristics of the First Machine Age, but they are standard for digital goods, and that leads to some unusual outcomes, such as winner-take-most markets.

In many industries, the widening wage gap between people with and without a college education has been dwarfed by bigger changes among the highest income brackets. From 2002 to 2007, the top 1% reaped two-thirds of all the gains from the growth in the U.S. economy.

Where are the 1%? Well, they aren't all on Wall Street. The University of Chicago economist Steve Kaplan has found that they're also entrepreneurs, senior executives, and the icons of media, entertainment, sports, and law. If the top 1% are stars of a sort, they look up to superstars who have seen even bigger increases. While the top 1% earned about 19% of all income in the United States, the top 0.01% saw their share of national income double, from 3% to 6%, from 1995 to 2007. It's hard to get reliable data at income levels higher than that, but the evidence suggests that the divergence in incomes continues to grow with a fractal-like quality, with each subset of superstars watching an even smaller group of uber-superstars pulling away.

Several factors seem to be at work, including the rise of enormous companies that give their top executives enormous compensation, as well as tax cuts in the United States and other countries that allow people with higher pay to keep more of it. The tech sector has created many wealthy entrepreneurs and investors too. My research with Heekyung Kim has found that companies that use IT more intensively also tend to pay their CEOs more, perhaps because technology amplifies the effects of their decisions. Superstar-biased technological change appears to be an increasingly important trend.

What would you say to economists who are skeptical about the ability of digital technologies to boost productivity?

Brynjolfsson: When the U.S. enjoyed a jump in labor productivity growth in the mid-1990s, economic research we and others did concluded that IT drove that growth. However, it didn't last long; by the mid-2000s labor productivity growth had slowed down to pre-1996 levels, and it has stayed relatively low since then.

The recession of 2008 obviously was a factor recently. After all, productivity is, essentially, GDP divided by hours

worked, so when GDP drops sharply, productivity also tends to drop.

But another piece of the puzzle is that many aspects of digital progress aren't counted in GDP. For instance, Wikipedia, unlike the old print version of Encyclopaedia Britannica, is free. That means that unlike the Britannica, it isn't included in GDP calculations, even though it adds value for far more people.

Even more important, there's a lag between the development of new technologies and the time when benefits start showing up in statistics. This just means that recent technological breakthroughs haven't had their full impact on productivity—yet. We've seen this pattern before. U.S. labor productivity growth was low from 1906 to 1928, just when business first adopted powerful new technologies like electricity and the internal combustion engine. In later decades, as we learned how to use these technologies more effectively, productivity soared.

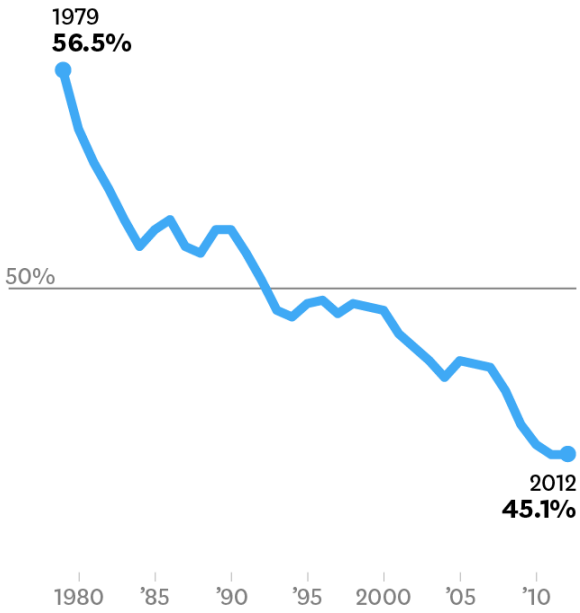
McAfee: We haven't yet seen what the latest crop of technological breakthroughs can do. Let's keep in mind that products like the iPhone are just eight years old. Autonomous cars first drove on American highways five years ago. And only recently, artificial intelligence systems showed that they could master unfamiliar tasks—such as categorizing images or playing video games—without programmers' teaching them any rules. Just last year the Baylor College of Medicine announced that it had used IBM's Watson technology to generate hypotheses about proteins and cancer growth, many of which proved to be correct.

All of these are significant advances, but none of them will spread through the economy on its own. Instead, they'll all combine and recombine with each other and with previous generations of technology. As that happens, productivity growth will climb. In fact, we're both confident that digital technologies are going to produce greater prosperity than the engines of the First Machine Age did.

The Disappearing Middle Class

The share of working-age U.S. households earning a middle-class income has declined significantly in recent decades.

PERCENTAGE OF HOUSEHOLDS AGES 25 TO 64 EARNING WITHIN 50% OF THE MEDIAN INCOME



Note Income measure includes both earned and unearned income.

Source Analysis based on current population survey data extracts produced by the Center for Economic Policy Research in 2014. This chart was originally published in "As Income Inequality Rises, America's Middle Class Shrinks," by Keith Miller and David Madland, The Center for American Progress (americanprogress.org), December 18, 2014.

FROM "THE GREAT DECOUPLING," JUNE 2015 © HBR.ORG

Brynjolfsson: You could break the Second Machine Age into stages. In stage II-A, humans teach machines what we know painstakingly, step-by-step. That's how traditional software programming works. Stage II-B is when machines learn on their own, developing knowledge and skills that we can't even explain. Machine learning techniques have had some success doing that in areas as diverse as understanding speech, detecting fraud, and playing video games.

Is there a third stage?

Brynjolfsson: Maybe. It might be when machines understand emotions and interpersonal reactions, an area where humans still have the edge. If you visit the folks at the MIT Media Lab, though, you'll find that they're working on robots that can pick up on emotions, in some cases analyzing facial expressions better than you and I can.

Nothing is sacrosanct: Machines are making inroads with creativity, dexterity, and emotional perceptiveness.

As the Second Machine Age progresses, will there be any jobs for human beings?

McAfee: Yes, because humans are still far superior in three skill areas. One is high-end creativity that generates things like great new business ideas, scientific breakthroughs, novels that grip you, and so on. Technology will only amplify the abilities of people who are good at these things.

The second category is emotion, interpersonal relations, caring, nurturing, coaching, motivating, leading, and so on. Through millions of years of evolution, we've gotten good at deciphering other people's body language…

Brynjolfsson: …and signals, and finishing people's sentences. Machines are way behind there.

The third is dexterity, mobility. It's unbelievably hard to get a robot to walk across a crowded restaurant, bus a table, take the dishes back into the kitchen, put them in the sink without breaking them, and do it all without terrifying the restaurant's patrons. Sensing and manipulation are hard for robots.

None of those is sacrosanct, though; machines are beginning to make inroads into each of them.

McAfee: We'll continue to see the middle class hollowed out and will see growth at the low and high ends. Really good executives, entrepreneurs, investors, and novelists—they will all reap rewards. Yo-Yo Ma won't be replaced by a robot anytime soon, but financially, I wouldn't want to be the world's 100th-best cellist.

Business's Response

How well do you think business is coping with these rapid advances in technology?

Brynjolfsson: The technologies continue to race ahead, but there has unfortunately been a drop in business dynamism. This is an opportunity for entrepreneurs to think of ways of using humans in new applications, combining them with technology. We call that racing with machines as opposed to racing against them. For some reason, business hasn't been creating new jobs as effectively as in the past.

McAfee: The best way to respond to change is with flexibility, fluidity—to roll with the punches. Instead, we're seeing this decrease in business dynamism and in labor fluidity. That's a dire trend, and it will keep us from responding properly to the coming technological surge.

Brynjolfsson: The sclerosis seems to be widespread. On average, rates of entrepreneurship, despite what we see in Silicon Valley, are going down in the U.S.

The intellectually easy thing to do is to look at an existing process and say, How can I have a machine do part of that job? It does take a certain amount of creativity and a little bit of work to do that, and it does create value. However, it takes a lot more creativity to say, How can I have this machine and this human work together to do something never done before and create something that will be more valuable in the marketplace?

What kind of economic environment would make the best use of the new digital technologies?

McAfee: One that's conducive to innovation, new business formation, and economic growth. To create it, we need to focus on five things:

The first is education. Primary and secondary education systems should be teaching relevant and valuable skills, which means things computers are not good at. These include creativity, interpersonal skills, and problem solving.

The second is infrastructure. World-class roads, airports, and networks are investments in the future and the foundations of growth.

Third, we need more entrepreneurship. Young businesses, especially fast-growing ones, are a prime source of new jobs. But most industries and regions are seeing fewer new companies than they did three decades ago.

A fourth focus is immigration. Many of the world's most talented people come to America to build lives and careers, and there's clear evidence that immigrant-founded companies have been great job-creation engines. The current policies in this area are far too restrictive, and our procedures are nightmarishly bureaucratic.

The fifth thing is basic research. Companies tend to concentrate on applied research, which means that the government has a role to play in supporting original early-stage research. Most of today's tech marvels, from the

internet to the smartphone, have a government program somewhere in their family tree. Funding for basic research in America, though, is on the decline: Both total and nondefense federal R&D spending, as percentages of GDP, have declined by more than a third since 1980. That must change.

Brynjolfsson: Our one confident prediction is that digital technologies will bring the world into an era of more wealth and abundance and less drudgery and toil. But there's no guarantee that everyone will share in the bounty, and that leaves many people justifiably apprehensive. The outcome—shared prosperity or increasing inequality—will be determined not by technologies but by the choices we make as individuals, organizations, and societies. If we fumble that future—if we build economies and societies that exclude many people from the cycle of prosperity—shame on us.

Technological progress is an extraordinarily powerful force, but it's not destiny. It won't lift us into utopia or carry us into an unwanted future. The power to do that rests with us human beings. Technologies are merely our tools.

A version of this article appeared in the June 2015 issue (pp.66–74) of *Harvard Business Review*.