

A HARVARD BUSINESS REVIEW ANALYTIC SERVICES REPORT



**Harvard  
Business  
Review**

# ARTIFICIAL INTELLIGENCE: DISRUPTING THE FUTURE OF WORK

Copyright © 2016 Harvard Business School Publishing

sponsored by



## ARTIFICIAL INTELLIGENCE: THE THIRD ERA OF AUTOMATION

Artificial Intelligence (AI) is the intelligence exhibited by computers and software representing the third era of automation. AI is currently used in analytics, robotics, machine learning, decision-support, and virtual personal assistance.

### THE THIRD ERA OF AUTOMATION

SOURCE HARVARD BUSINESS REVIEW

In the third era of automation machines will make decisions, thus supplanting some jobs from knowledge workers.

#### ERA ONE 19TH CENTURY



**MANUAL**  
Machine replaces manual tasks

#### ERA TWO 20TH CENTURY



**ROUTINE**  
Machine replaces clerical tasks

#### ERA THREE 21ST CENTURY



**DECISION-MAKING**  
Machine makes decisions

SOURCE HARVARD BUSINESS REVIEW

While some jobs will be lost to machines, there will be opportunity for knowledge workers.

### FIVE PATHS TO EMPLOYABILITY IN THE ERA OF AUTOMATION

1 ↑

#### STEP UP

**Go for higher intellectual ground**

Get that MBA or PhD, and constantly challenge yourself

2 →

#### STEP ASIDE

**Cultivate skills that machines lack, such as working well with others**

Develop multiple intelligences, and gain knowledge through apprenticeships

3 ↓

#### STEP IN

**Learn how to monitor and modify machines' work**

Pursue STEM education, and continuously update business expertise

4 ↖

#### STEP NARROWLY

**Find a specialty that is such a niche that it is not economical to automate**

Master a niche with focus and passion

5 ↓

#### STEP FORWARD

**Learn to program**

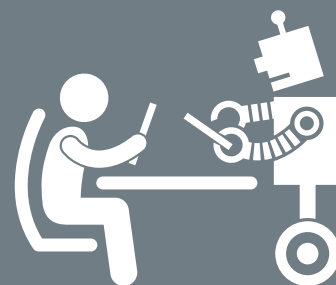
Stay at the cutting edge of computer science, artificial intelligence, and analytics

### AI'S UNIVERSAL ECONOMIC IMPACT

SOURCE TRATICA

Revenue in millions

REGION	2015	2024
North America	\$65	\$3,293
Western Europe	47	2,058
Eastern Europe	7	393
Middle East	10	551
Africa	3	148
Asia Pacific	66	4,419
Latin America	5	253
Total	\$203	\$ 11,115



Smart machines can be our partners in creative problem solving.

# ARTIFICIAL INTELLIGENCE: DISRUPTING THE FUTURE OF WORK

Artificial intelligence (AI) is growing increasingly sophisticated, enabling machines to perform some cognitive tasks as well as or better than humans, from assessing a loan application to writing stock performance reports.

To stay competitive, businesses are under pressure to reorganize to accommodate the pace of technological change and take advantage of new opportunities this new technology creates. This demands a rethinking of how work will be done—and who or what will do it.

Machines will replace some jobs, but how many? Where—and how—can humans be aided by intelligent technology? How should businesses think about their approach to human capital and investment? What impact will this have on labor markets and public policy? Governments, for their part, need to gauge and respond to the impact AI-enabled technology will have on their labor markets and prepare a new generation of workers with the skills and knowledge they need to be employable in a very changed landscape.

In a recent survey by the Pew Research Center, half the respondents said that by 2025, robots and other applications of AI will have replaced a significant portion of the workforce, including knowledge workers whose employment consists of more mental than manual work and requires decision making. The other half of respondents predicted a less dramatic change, but they too acknowledged that when machines can perform knowledge work, knowledge workers—lawyers, writers, managers, and executives are among their ranks—will be affected.

Amazing advances in AI technology have emerged over the past few years—cars that drive themselves, useful humanoid robots, speech recognition and synthesis systems, 3-D printers, and a *Jeopardy!*-champion computer. AI-enhanced computers now write about sports competitions and compose stock portfolio reports, even performing legal e-discovery work as they scan electronic documents for their relevance to a particular case.

To stay competitive, businesses are under pressure to reorganize to accommodate the pace of technological change and take advantage of new opportunities artificial intelligence creates.

“The second machine age will be characterized by countless instances of machine intelligence and billions of interconnected brains working together to better understand and improve our world.”

And these are not the crowning achievements of the computer era—they are the warm-up act, says Andy McAfee, author of *The Second Machine: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. “As we move deeper into the second machine age, we’ll see more and more such wonders, and they’ll become more and more impressive as predictive analytics enables vast quantities of data to be analyzed, taking decision making to new levels and easily besting any human’s processing capability,” says McAfee.

Without knowing exactly what new insights, products, and solutions will arrive in the coming years, McAfee says AI development will boost human progress. Historically, businesses have used technology to advance their productivity and efficiency by automating work previously performed by human hands, he says. Now “The second machine age will be characterized by countless instances of machine intelligence and billions of interconnected brains working together to better understand and improve our world.”

That lens is crucial for understanding the workplace of the future. “As machines today take on more and more cognitive work, some human jobs will be replaced by machines,”

say Tom Davenport, President’s Distinguished Professor at Babson College, and Julia Kirby in their article “Beyond Automation” in *Harvard Business Review*. But that doesn’t mean that companies and policymakers should think of the future job market as the human worker versus machines, they say.

## COMPLEMENTARITIES ALLOW SUPERIOR RESULTS

Rather than ask what work will be performed better by machines or by machines instead of people, Davenport and Kirby suggest there is another framework for the future. “What new feats might people achieve if they had better-thinking machines to assist them? Instead of seeing work as a zero-sum game with machines taking an ever greater share, we might see growing possibilities for employment,” they say.

Look beyond automation to see the possibilities of augmentation. Automation replaces human thought and labor; augmentation signals that machines can enhance them. That is to say, AI and human intelligence can be complementary.

“The complexity of knowledge and its volume are too much for humans to keep up with,” Davenport says. “For instance, there are more than 400 types of cancer and 75 drugs for breast cancer alone. That is too much data for a human to process.”

AI can keep all that straight, but ultimately it is the physician who relies on many years of training and experience to determine the treatment plan. Many electronic health records now have evidence-based practice guidelines embedded in them. Say the physician orders a medication

---

### THREE ERAS OF AUTOMATION

If this wave of automation seems scarier than previous ones, it’s for good reason. As machines encroach on decision making, it’s hard to see the higher ground to which humans might move.

#### ERA ONE

Machines take away the **dirty and dangerous**—industrial equipment, from looms to the cotton gin, relieves humans of onerous manual labor.

19TH CENTURY

#### ERA TWO

Machines take away the **dull**—automated interfaces, from airline kiosks to call centers, relieve humans of routine service transactions and clerical chores.

20TH CENTURY

#### ERA THREE

Machines take away **decisions**—intelligent systems, from airfare pricing to IBM’s Watson, make better choices than humans, reliably and fast.

21ST CENTURY

---

that the practice guidelines do not specify. The doctor has the final say, but there is an alert that the medication may not be appropriate, potentially preventing medical error and a malpractice suit.

Or consider the popular product TurboTax, with algorithms that guide users in preparing their tax returns. TurboTax by itself cannot fill out those forms. It makes decisions, yes, but only with human input and judgment.

## STRATEGIES FOR MANAGING THE DISRUPTION

AI's augmentation of human labor and thought can be to knowledge workers' advantage if they keep their skills relevant to the changing workforce's needs. Davenport and Kirby propose five strategies knowledge workers can pursue to stay employable and organizations can use in thinking about their human capital management in the years to come:

- **Step Up:** Go for higher intellectual ground
- **Step Aside:** Cultivate skills that machines lack, such as working well with others
- **Step In:** Learn how to monitor and modify machines' work
- **Step Narrowly:** Find a specialty that is such a niche that it is not economical to automate
- **Step Forward:** Learn to program

### Step Up

Davenport and Kirby say that there will always be jobs for big-picture thinkers who can work at a higher level of abstraction than machines can attain. In essence, this strategy is about ceding less cognitively challenging work to a machine in order to free oneself to engage with higher-level concerns.

They cite the example of pharmaceutical start-up Berg, which uses high-throughput screening to identify potential drugs. From trillions of data points, patterns will emerge that suggest a certain molecule has potential. From that point, a biochemist takes over to test its viability as a pharmaceutical, applying higher-level cognitive skills than the data-crunching computer can manage.

To implement this employment strategy, consider completing a master's degree or a PhD. A long, deep education

provides a distinct edge. After being hired, cultivate the broad-based knowledge and creative thinking that will allow you to contribute to your organization's strategic planning and innovation efforts.

### Step Aside

Some things machines are not suited to do, such as demonstrate compassion, read the social cues in a business meeting, or make a sale. David Autor, an economist at the Massachusetts Institute of Technology, observes that the challenges of programming machines to perform work requiring adaptability, common sense, and creativity are significant and will not be easily overcome, if they ever will.

The Step Aside employment strategy demands developing and demonstrating your "uncodifiable strengths"—such as uniquely human traits as adaptability, artistic taste, empathy, and persuasion. Let machines do mundane work in order to free up more time for you to hone the skills and intelligences they cannot master.

### Step In

AI can do a lot, but sometimes it is just smart enough to make errors that require a human to jump in and make a correction. Davenport and Kirby cite the experience of Ben Bernanke, former chairman of the U.S. Federal Reserve, when he applied for a mortgage after leaving government service. Even though he had a long, stellar employment history and a million-dollar book deal, his application was rejected. Why? The system was just intelligent enough to recognize that his work on the lecture circuit would not bring in a steady, predictable income, and thus it rejected him for a mortgage. Human intervention was required to right the computer's wrong.

Knowing how to monitor and modify a computer's work is central to the Step In strategy. Examples include accountants who pick up where tax preparation software leaves off, correcting mistakes that the system or the client inadvertently create. Complementarity is key to stepping in; human and machine support each other—"the human ensures that the computer is doing a good job and makes it better."

### Step Narrowly

Some niches are so narrow that they are not economical to automate. Consider a man who acts as a broker

Stepping forward is about creating the next generation of computing tools that will create the next breakthroughs across industry.

between buyers and sellers of Dunkin' Donuts franchises, say Davenport and Kirby. He is hugely successful, having brokered half a billion dollars' worth of deals. Although software could capture his deep savvy, the payoff would not be worth it. Another example the authors cite is a woman with an encyclopedic knowledge of paper—by examining and touching it, she can identify its provenance and age, making her invaluable to preservationists and art historians.

Education is important for this strategy, but so too are on-the-job knowledge and deep focus. Companies can focus on these niches, and their workers can develop a reputation for going a mile deep into an area of knowledge an inch wide.

### Step Forward

Stepping forward is about creating the next generation of computing tools that will create the next breakthroughs across industry. Training in computer science, AI, and analytics is critical. But visionary thinking and an eye for opportunity are important for organizations and for workers as well.

“Someone has to build the next great automated insurance underwriting solution,” write Davenport and Kirby by way of example. “Someone intuits the human need for a better system; someone identifies the part that can be codified; someone writes the code; and someone designs the conditions under which it will be applied.”

### REASONS FOR OPTIMISM

Technological advances have historically been net creators of jobs, and Davenport, Kirby, and other experts predict the AI revolution can do the same. Humans will adapt to these technological advances by inventing new types of work and exploiting those capabilities that are uniquely human. “The strategies and mind-set that organizations, policymakers, and workers use during the transition into this new era are critical,” says McAfee.

“Governments,” he says, “need to create a climate where entrepreneurs can flourish, because new ventures create new jobs.

“The answer to the new and growing workforce of robots is not to slow the pace of technological progress but to speed up our institutions so that entrepreneurs, managers, and workers alike can thrive,” says McAfee.

“Technology-fueled capitalist creative destruction is a messy and uneven process, and there will be twists and turns. The droids are taking our jobs, but focusing on that fact misses the point entirely. The point is that then we are freed up to do other things, and what we’re going to do, I am very confident, is reduce poverty, and drudgery, and misery around the world. I’m very confident we’re going to learn to live more lightly on the planet, and I am extremely confident that what we’re going to do with our new digital tools is going to be so profound, and so beneficial, that it’s going to make a mockery of everything that came before.”

## **ABOUT THE SUMMIT**

The World Government Summit is the primary global forum dedicated to shaping the future of government worldwide. Each year, the Summit sets the agenda for the next generation of governments with a focus on how they can harness innovation and technology to solve universal challenges facing humanity.

The World Government Summit is a knowledge exchange platform at the intersection between government, futurism, technology, and innovation. It functions as a thought leadership platform and networking hub for policymakers, experts, and pioneers in human development.

The Summit is a gateway to the future because it functions as an analysis platform for the future trends, issues and opportunities facing humanity. It is also an opportunity to showcase innovations, best practices, and smart solutions to inspire creativity to tackle these future challenges.

[hbr.org/hbr-analytic-services](https://hbr.org/hbr-analytic-services)

