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GLOBAL EXECUTIVE STUDY AND RESEARCH PROJECT**

# Artificial Intelligence in Business Gets Real

Pioneering Companies Aim for AI at Scale

By Sam Ransbotham, Philipp Gerbert, Martin Reeves,  
David Kiron, and Michael Spira

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## AUTHORS

**SAM RANSBOTHAM** is an associate professor in the information systems department at the Carroll School of Business at Boston College, as well as guest editor for *MIT Sloan Management Review's* Artificial Intelligence Big Ideas Initiative. He can be reached on Twitter @ransbotham.

**PHILIPP GERBERT** is a senior partner and managing director at The Boston Consulting Group's Munich office. He is BCG's global topic leader for digital strategy and a BCG Henderson Institute Fellow for the Impact of Artificial Intelligence on Business. He can be reached at gerbert.philipp@bcg.com.

**MARTIN REEVES** is a senior partner and managing director at The Boston Consulting Group and the director of the BCG Henderson Institute, which brings ideas and inspiration to forward-looking leaders.

**DAVID KIRON** is the executive editor of *MIT Sloan Management Review*, which brings ideas from the world of thinkers to the executives and managers who use them.

**MICHAEL SPIRA** is a project leader in The Boston Consulting Group's Munich office. He is also a BCG Henderson Institute ambassador exploring the impact of AI on business and a core member of BCG's Energy practice.

## CONTRIBUTORS

Carolyn Ann Geason, Julia Kirby, and Allison Ryder

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# Artificial Intelligence in Business Gets Real

## Executive Summary

**E**xecutives in companies around the world are increasingly looking to artificial intelligence to create new sources of business value. This is especially true for leading adopters of AI — those that have invested in AI initiatives and seen impressive results. This small group of companies is doubling down on AI investments, building competencies, and working to take AI to scale. The opportunities and challenges these AI Pioneers face are the focus of the 2018 *MIT Sloan Management Review* and The Boston Consulting Group (BCG) Artificial Intelligence Global Executive Study and Research Report.

Continuing last year's analytical approach, our latest research combines a global survey of 3,076 business executives and 36 in-depth interviews with business executives. We classified the organizations surveyed into four groups based on respondents' responses to questions about their levels of AI adoption and AI understanding. Pioneers are enterprises that have extensive understanding of AI tools and concepts and significant levels of AI adoption; Investigators understand AI but have limited adoption; Experimenters have adopted AI but with limited understanding of it, and Passives have limited adoption and understanding of AI.

This report highlights four major patterns in the survey and interview data:

- 1. Pioneers are deepening their commitments to AI.** Is AI really taking off in business? In one respect, the percentage of Pioneers among survey respondents remained essentially the same as last year, at just under one-fifth of those polled. Yet the level of commitment to AI within the Pioneer group is striking: Fully 88% of Pioneers invested more in AI than in the previous year — in contrast to just 62% of Experimenters and Investigators. Pioneers continue to push forward.
- 2. Pioneers are eager to scale AI throughout their enterprise.** Typically, an organization that gained early success with AI did so because some AI-knowledgeable managers within a business unit spotted a problem that could be solved more effectively with, for example, natural language processing. Attacking such targets in isolation, they came up with impressive solutions. However, these point solutions left enterprises with no greater systemic capabilities than they had before. This year's research highlights a growing ambition in organizations to scale AI for enterprise-level advantage. As Ibrahim Gokcen, chief digital officer at Danish shipping company Maersk, puts it, "AI at scale is the next step of digital transformation." But how do you get beyond isolated AI point solutions? Many companies have discovered, often to their surprise, that it is easy to apply AI and get quick results. What is not so easy is building a system of AI applications along with associated data pipelines that interact and are reliable. Pioneers overwhelmingly see the need for an AI strategy: 85% agree they have an urgent need for an AI strategy, and 90% say they have a strategy in place already. Organizing AI for the entire enterprise requires a strategy.
- 3. Pioneers prioritize revenue-generating applications over cost-saving ones.** Which is more important to pursue with AI applications: new revenues or cost efficiencies? In the first wave of corporate AI adoption, many companies fo-

cused on making operational processes more efficient. Easily documented cost savings are a classic way of garnering support for further investment. But the finding here is that all but the most passive organizations anticipate AI will pay off most on the revenue-generating side. More sophisticated organizations expect more in this direction, as 72% of Pioneers say AI will deliver mainly revenue increases in the next five years, while only 28% of Pioneers expect mainly cost savings. For the Investigators group, the corresponding numbers are 59% and 41%. In the near future, AI initiatives will focus on generating revenues, not cutting costs.

- 4. AI is creating both fear and hope among workers.** How will AI affect individual workers? Popular societal debate evokes the specter of smart machines outperforming humans, making legions of workers redundant. Other research has found individuals are evenly divided on the question of whether AI will produce job losses or job gains overall.<sup>1</sup> Our survey echoes the ambivalence: 47% say their workforce will be reduced because of AI in the next five years. Yet a gulf opens when we consider the respondents' positions in their organizations. Lower-level operational and clerical workers are most concerned that layoffs are imminent, perhaps because these workers are less able to influence the course of events and thus feel particularly exposed. Chief executives are among those least convinced AI adoption will result in more overall job loss. Only 38% of surveyed CEOs expect workforce reductions due to AI. The effects of AI on the workforce won't be uniform. Managers need to address the concerns of their employees through reskilling, change management, and communication.

In addition, we conducted a separate survey of 300 executives in China. Findings from this survey contrast pioneering Chinese companies with companies based in other regions. Chinese AI Pioneers are investing more aggressively and report a greater focus on business model transformation. However, they may be held back by unclear business cases and shortfalls of techni-

cal capabilities. Other striking differences are Chinese companies' larger emphasis on using AI to achieve cost reductions versus revenue enhancements, and their greater expectations of job losses due to AI. Whether China's approach is successful or not, the determination of Chinese companies serves as a wake-up call for governments and other companies across the globe.

Overall, the second annual *MIT Sloan Management Review-BCG* research report tells a story of measurable benefits from current AI initiatives, increased investments, and determined efforts to expand AI across the enterprise.

## ABOUT THE RESEARCH

To understand the challenges and opportunities associated with the use of artificial intelligence in business, *MIT Sloan Management Review*, in collaboration with The Boston Consulting Group, conducted its second annual survey of business executives, managers, and analysts from organizations around the world, which this year included 3,076 participants.

The survey, conducted in the spring of 2018, captured insights from individuals working in organizations of various sizes, spread across 29 industries and located in 126 countries. More than two-thirds of the respondents were based outside the United States. The sample was drawn from a number of sources, including *MIT Sloan Management Review* readers and other interested parties.

As a starting point for this report's analysis, the total survey population was divided into four subgroups based on the relative AI maturity of respondents' organizations, combining levels of understanding of AI tools and concepts and levels of adoption of AI applications. To indicate overall understanding, respondents rated their organization's understanding of nine areas, ranging from familiarity with the technological state of the art to challenges of AI application development to organizational behavior implications. Based on their level of adoption and understanding, we divided survey respondents into these four groups:

- **Pioneers (18%):** Organizations that both understand and have adopted AI. These organizations are on the leading edge of incorporating AI into both their offerings and internal processes.

- **Investigators (33%):** Organizations that understand AI but are not deploying it beyond the pilot stage. Their investigation into what AI may offer emphasizes looking before leaping.
- **Experimenters (16%):** Organizations that are piloting or adopting AI without deep understanding. These organizations are learning by doing.
- **Passives (34%):** Organizations with no adoption or much understanding of AI.

"Artificial intelligence" is a term that can refer to various technologies. It is often used loosely, and it can mean different things to people in different groups. Participants in this study were made aware of the definition of artificial intelligence in the *Oxford English Dictionary*: "AI is the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages."

To gain context and a deeper understanding of survey findings, the research team interviewed 36 executives. All of the interviewees are experienced managers, representing a variety of industries and types of organizations.

## Introduction

At Allianz, the Munich-based insurance giant, CEO Oliver Bäte outlined a Renewal Agenda for the company in 2015. He wanted Allianz to energetically pursue higher levels of value creation through the kind of digitalization that he saw transforming economies and economics.<sup>2</sup> Gemma Garriga, global head of AI and advanced business analytics at Allianz, says that agenda lit a fire under her group's efforts to identify new AI applications. Garriga's team has since deployed an array of AI-based solutions, from initial customer personalization to final claims automation. She says most of these projects are delivering exciting results.

One improvement came, for example, when Allianz's underwriting process identified fraud in online insurance applications. The problem is that when users provide information, there is a possibility that they are not being truthful with the data Allianz needs to calculate the right pricing. Car owners might exaggerate their no-claims bonus level or input a false postcode in order to reduce the cost of the insurance. This, naturally, leads to higher costs for other customers as risks aren't calculated correctly and distributed fairly.

To address that problem, Garriga's team developed AI models that calculate in real-time both the probability that an application is accurate — giving it a so-called Anti-Fraud Underwriting Score — as well as the potential future costs of accepting the application. The models were put into production about two years ago and promptly “increased fraud detection by around 50%.” The new system benefits both Allianz and its customers by enabling the company to better calculate risks and premiums, and more fairly distribute costs.

***Pioneers may be pulling further away from their investigating, experimenting, and passive peers.***

This example illustrates many of the key findings from the *MIT Sloan Management Review-BCG 2018 Artificial Intelligence Global Executive Study and Research Report*. As a leader in its information-based industry, Allianz, though not yet an AI powerhouse, is boldly building AI capabilities and determined not to lag behind more aggressive AI adopters, such as Chinese insurer Ping An Insurance (see the *MIT SMR-BCG 2017 Artificial Intelligence Global Executive Study and Research Report*<sup>3</sup>).

We find many companies like Allianz — those experiencing positive outcomes from early AI applications — are looking to invest even more in their AI efforts. The most ambitious of those companies, the Pioneers, have resolved to take their AI advantages to scale. Pioneers not only believe AI will generate a wide range of opportunities but are creating strategies for prioritizing them and building platforms to encourage AI's use throughout the enterprise. At the same time, Pioneers are discovering the challenges inherent in the scaling effort. They are highly attuned to the workforce implications of corporate-wide adoption of AI and the need to lead and manage organizational change. They describe their efforts with humility and call it “early days,” but they fully expect substantial business value from the implementation of AI.

## Pioneers Are Deepening Their Commitments to AI

Has artificial intelligence finally reached the point where it is a practical technology for business use? One indication of commercial viability would be if early adopters were not quietly shelving their projects and backing off their investments but instead actively following up with more applications. This is precisely what the 2018 research reveals: Today's AI Pioneers are deepening their AI commitments.

As an example, consider Chevron. In a joint interview, CIO Bill Braun and Margery Connor, Chevron fellow at the Modeling and Analytics Center of Excellence, described an impressive range of

AI applications already delivering value at the energy giant — from diagnosing machinery performance and predicting maintenance needs to strengthening cybersecurity. One particularly clever solution uses text analytics to review contracts with subcontractors, compare them with invoices and payments, and zero in on any “spend leakage.”

Connor’s group scored so many victories that, in 2017, it started sending “data science of the month” write-ups to Chevron’s senior leadership. “Just like when an executive picks up the magazine on a flight, reads something, and says, ‘Hey, what are we doing about this?’ we’re trying to cause that same reaction widely across the company,” says Braun. It gets more colleagues “connecting the dots,” not only to spot more immediate use cases but to see why they should back projects that require more patient investment. For example, “Sensorization and mobility are also going to add a lot of value to us,” Braun says, “but those are a little bit longer plays than just harnessing the power of the data that we already have.”

Survey data reveals the same finding at many other companies. Asked if they had increased their level of investment in AI in the past year, the majority of respondents said yes — but Pioneers were far more likely than others to say they had. (See Figure 1.)

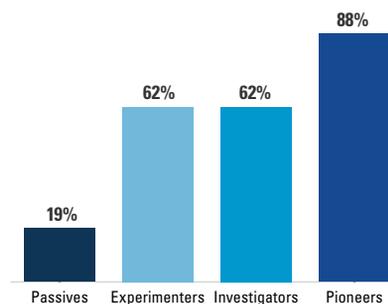
More specifically, a significant majority of Pioneers reported investing more in the past year than in prior years in AI talent (81%), AI technology (86%), the data required to train AI algorithms (79%), and the processes required to train the algorithms (80%). This is not a given by any means; Pioneers might have just as easily decreased their investment relative to prior years, but their results with AI have emboldened them to go further.

However, compared with last year, the actual percentage of Pioneers did not grow. The excitement around AI notwithstanding, the distribution of our survey respondents across the four maturity groups (Pioneers, Investigators, Experimenters, and Passives) in 2018 is comparable to what it was in 2017. In the 20% that are Pioneers, only the top five percentage points of respondents indicated that they

## FIGURE 1: GOOD MONEY AFTER GOOD

Pioneers are far more likely to have increased their AI investment levels in the past year, suggesting that early initiatives have been encouraging.

How is AI investment changing?

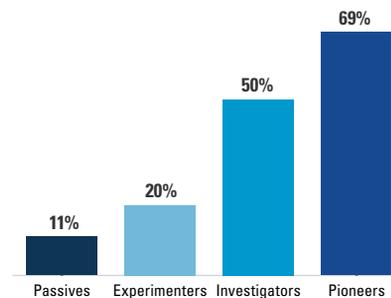


Percentage of respondents with an increased investment in AI in the past year

## FIGURE 2: THE SMART GET SMARTER

Committing to a new technology is as much about learning as it is about investing. Respondents assessed growth in their understanding of AI over the past year, not their current state of understanding.

How much are organizations learning about AI?



Percentage of respondents whose understanding of AI has changed a lot or to a great extent in the past year

have extensively incorporated AI in processes and offerings — a result that also remains unchanged from 2017.

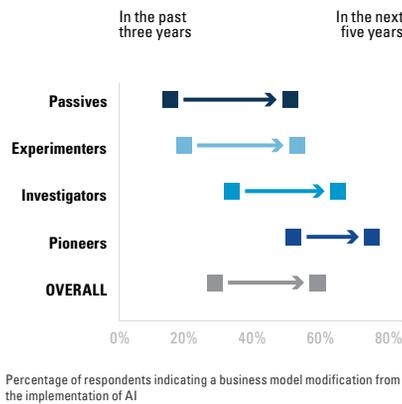
These Pioneers, however, may be pulling further away from their investigating, experimenting, and passive peers. For example, in terms of their organization’s understanding of AI over the past year (see Figure 2), Pioneers reported greater growth than other groups. Whereas enterprises in the Passive category reported scant gains on average, more than two-thirds of Pioneers believe their organization has added “a lot” to their AI understanding since 2017.

An organization can improve its overall understanding of artificial intelligence in many ways. Direct experience working with AI tools and techniques on actual business problems is one approach. An-

**FIGURE 3: AI SHIFTS BUSINESS MODELS**

Looking ahead to the next five years, a majority of companies expect AI to spur business model change.

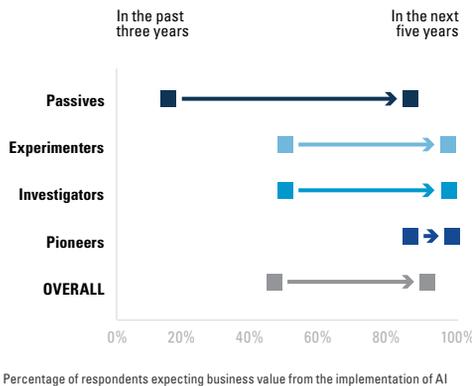
How does AI affect business models?



**FIGURE 4: GREAT EXPECTATIONS FOR AI**

Overall, 91% of survey respondents expect new business value from AI implementations in the coming five years. Even among Passives — which today primarily experience the benefits of AI-based products indirectly — 81% expect to derive value directly from AI within five years.

How does AI impact business value?



other is to hire new people with AI expertise. At Swiss specialty chemical provider Clariant, executive committee member Britta Fuenfstueck says the company has tripled the size of the team working on AI projects. Providing formal education and training of existing talent is another way to build organizational understanding of AI. Tassilo Festetics, vice president of global solutions at Anheuser-Busch InBev, took his entire extended team to the University of California, Berkeley, for a weeklong intensive immersion in AI. “It is important for the team to understand the basics of machine learning and AI to be able to identify game-changing opportunities for the company, be it for commercial, supply, logistics, or employee-related topics,” he says. “We consider it a long-term investment, since this is an investment into capabilities of the future that will be needed in all departments.” These approaches to building organizational understanding of AI are complementary and cross-functional.

Pioneers also differ in their perceptions of whether AI represents opportunity or risk: More than any other group, Pioneers see the opportunity and appear confident that they can reap the benefits before competitors or new entrants do. Many respondents also expect change in terms of business models — a more exciting prospect than using tools merely to improve performance within existing models. (See Figure 3.)

Overall, a surprising number of respondents (28%) say AI solutions have already led to business model change in their organization. In the case of Pioneers, a majority make this claim. The majority of *all* organizations (58%) foresee modifications of their business models due to AI within five years. This is true across all levels of AI maturity and across a variety of industries. These results suggest that organizations don’t expect AI to merely help improve current business operations; they widely expect AI adoption to change business models. What’s more, nine out of 10 respondents believe AI will create new value for their business in the next five years. (See Figure 4.)

Data can be the key to success or failure in AI. Not surprisingly, Pioneers are more mature than other respondents in their management of this fundamental

## CHINA'S BIG PUSH INTO AI

In the spring of 2018, The Boston Consulting Group and *MIT Sloan Management Review* conducted a separate survey of Chinese executives in an effort to address other big questions: How are companies based in China — home of digital giants Alibaba, Tencent, and Baidu — progressing in their adoption of AI for business purposes? How does their progress compare with companies in other regions? To investigate, we translated our global survey into Chinese and surveyed 300 executives across industries in China. For the Pioneers, we then compared their responses with the non-Chinese respondents from our global survey.<sup>1</sup> Three findings are especially noteworthy:

**Chinese companies are aggressively investing in AI business applications** relative to their counterparts in other parts of the world. Buoyed by the Chinese government's recent five-year plan calling for businesses to achieve leadership in artificial intelligence, Chinese companies report greater increases in AI investment than companies in other regions. Their approach to data also appears advantageous. Because AI engines learn by ingesting training data — the more the better — companies should centralize the housing and governance of data, and Chinese Pioneers do this particularly well. For example, 78% maintain their corporate data in centralized data lakes, compared with only 37% and 43% of European and U.S. pioneers, respectively.

And 83% of Chinese AI-leading companies surveyed manage corporate data centrally, while only 39% of European Pioneers and 40% of U.S. Pioneers do so.

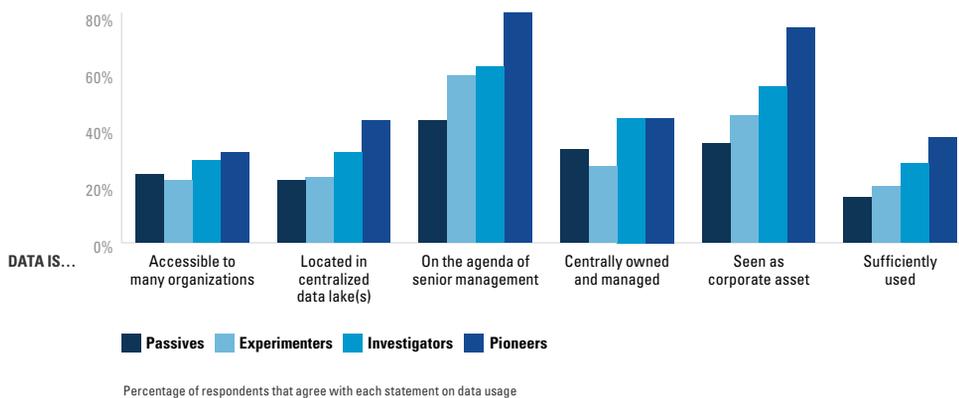
**Chinese companies face their own challenges** in their ambitious push into AI. For example, nearly half of Chinese Pioneers say the business case for AI is unclear or missing — a potential impediment to determining appropriate levels of investment. The barrier Chinese Pioneers report most often is a lack of talent in AI. Nearly six in 10 Pioneers in our China sample say constraints in technological talent are holding them back, far higher than in the United States and Europe. Chinese companies also report that they are focusing on using AI to cut costs and putting less emphasis on using the technology to generate new revenue streams. Finally, and perhaps as a result of the cost focus, they have more people-related concerns and changes. More than two-thirds of Chinese Pioneers (68%) say AI deployments are likely to reduce the size of their workforce. In Europe and the United States, just 32% and 50% of Pioneers, respectively, share that concern.

**China's rapid rise in AI has been a wake-up call** for nations, industries, and corporate executives globally. Indeed, many recent national programs to advance the development of artificial intelligence refer to China as a competitive threat.

## FIGURE 5: DATA MATURITY DRIVES AI

Pioneers are far more likely to see data as a corporate asset and report that data issues are on the agenda of senior management.

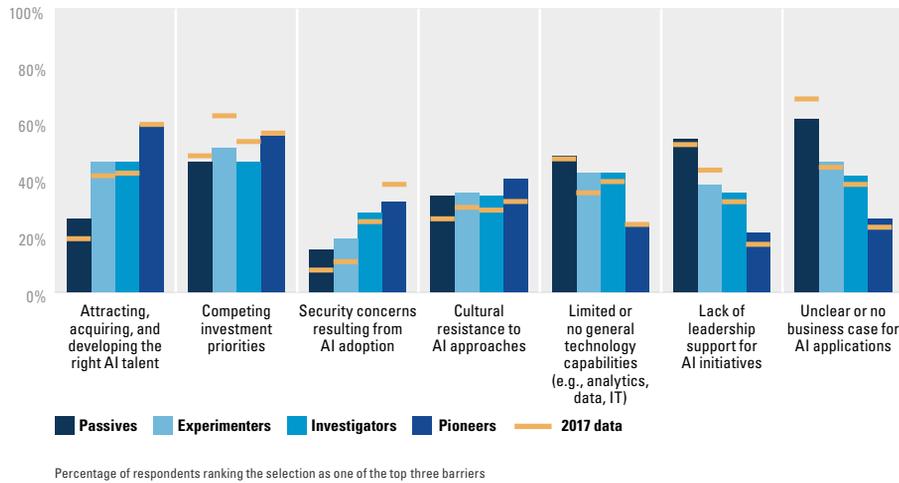
### How does data affect AI?



**FIGURE 6: COMMON AND UNCOMMON BARRIERS TO AI**

Respondents ranked top barriers to AI adoption in their companies for the second year in a row.

**What gets in the way of AI adoption?**



asset. Pioneers are more likely than their less sophisticated peers to have strong, company-wide data governance systems and centralized data lakes. Their management teams are cognizant of data issues and view data as a corporate asset. (See Figure 5, page 7.) (Respondents to the Chinese survey centralize data even more. See sidebar, “China’s Big Push Into AI,” page 7.) Committing thoroughly to the application of AI means devoting more attention to data issues.

Our interviews with individual business executives included numerous discussions of data issues, especially in companies that have been in business a long time and grew through mergers and acquisitions. While several interviewees noted the “treasure troves” of data they could draw on for AI applications, some reported frustration with even simple projects. At Anheuser-Busch InBev, for example, Festetics acknowledges, “I wish we would have looked at data quality much earlier. We used to spend a large amount of time on getting data and making it ready.” But the experience caused the company to change its approach for the better: “We felt everything we had was no longer upgradeable, so we looked at data from this perspective: How would we enable data for analytics if we were to start the company today?” he

says. “This allowed us to make data more readily available to run algorithms to gain insights into consumer preferences, optimize our offerings for customers, and produce our product with reduced energy and waste.”

Festetics’ comment points to an advantage many Pioneers enjoy: robust data capabilities. Consider a large insurance company like Allianz or Netherlands-based Nationale-Nederlanden (NN) Group, for example.<sup>4</sup> As CEO of NN Group’s home market, David Knibbe is responsible for about two-thirds of the company’s operations, which include 18 countries. He notes the company started in 1845, “and I’m not

saying we have all the data since then, but we have enormous amounts of data.” As an insurance provider with a strong background in actuarial science, the company is more comfortable than many other businesses when it comes to creating models for data-driven decision-making. The same is true of Chevron, where subsurface operations have long relied on high-performance computers. “Back in the early days of the Cray [supercomputer], it was us and the government that were the biggest consumers of CPU,” Chevron’s Braun notes, “and for decades that was true.” Given that Chevron engineers and scientists are “really good at applying this kind of technology,” he says, “letting the machines help with more data-driven decisions — it’s going to be very natural to them.”

Pioneers also have more top management involvement in and commitment to AI initiatives compared with other groups. In identifying the top three barriers to AI adoption in their organization, relatively few Pioneers said they feel constrained by “lack of leadership support” or an “unclear business case” for AI-related efforts. (See Figure 6.) As is the case with many business initiatives requiring new investment, leadership support and a business case are critical. Asked to name what spelled the difference between

successful and unsuccessful projects he had seen, Harald Rudolph, head of Daimler strategy, didn't hesitate: "Next to fostering an understanding of AI throughout the entire organization, it is important to get the top management's attention and make them aware of and excited about the potential of this set of technologies."

Looking deeper into the data, we find that Pioneers are the least likely to be held back by a lack of leadership support. Whether early successes led to that support or, conversely, leadership support was a critical factor in achieving those first, case-making victories, top management attention is another advantage Pioneers hold.

Will the pursuit of artificial intelligence prove to be another situation where leading enterprises, having established a healthy head start, increase the gap between themselves and their less mature peers? At the moment, this is an open question. With rapidly evolving and unfamiliar technology, "fast-following" *might* work, whereby followers let others forge ahead with experiments and learn from their successes and failures. But those hoping to fast-follow others' pioneering work without taking risks themselves should beware: Pioneers, by deepening their commitments to AI, are establishing positions in both customer and labor markets that may make it hard for others to draft off of their hard work. The many advantages reported by Pioneers suggest that early AI movers may be especially hard to catch.

## Pioneers Are Eager to Scale AI Throughout Their Enterprise

NN Group's Knibbe is one CEO directing his personal attention to his organization's AI agenda. Even in a situation that would distract most CEOs — managing a recent major acquisition (of Delta Lloyd Group, previously one of NN's main competitors) — he stays on top of AI developments. "You don't have the capacity during such a large-scale integration to bet on

***"Next to fostering an understanding of AI throughout the entire organization, it is important to get the top management's attention and make them aware of and excited about the potential of this set of technologies."***

— Harald Rudolph, head of Daimler strategy, Daimler

a lot of things," he says. But as one of his "big bets" for the combined entity's future, AI remains a personal focus of his.

Long before AI technology found its way into much practical business use, Knibbe was confident that it would prove valuable: "It is, for us, very clear that there should be a lot of benefits, given where the math and the science already is. It seems that all of that is way ahead of business application. So, I was convinced that there would be a lot of reasons to invest in this, whether it's in process improvements, customer analytics, customer behavior." NN Group's first, small-scale experiments made rapid progress, and the company moved ahead with implementing various solutions — and "what we've seen is, where we did it, it worked well," he says.

The challenge, as Knibbe sees it now, is to take his company's use of artificial intelligence to scale. And in this respect, he is typical of many respondents from Pioneer companies. Certain about the promise of AI, he wants to go beyond point solutions and pursue AI systematically, as an overall source of competitive advantage.

What does scaling require? Many efforts simultaneously: creating a strategic vision, taking stock of current capabilities, building AI-supporting processes and platforms, instilling AI understanding into the business, and cultivating AI-related activities. It's a complex undertaking. Most executives have yet to consider, at a deep level, how to scale AI in their business. "People don't really understand what enterprise AI is," says Inderpal Bhandari, global chief data officer at IBM. "They do have a good sense of it in the consumer context, and they

also had a good sense of AI in the context of point solutions like facial recognition and stuff like that. But they don't really understand from an enterprise context exactly what that could look like."

**No Scale Without Strategy**

A company cannot successfully deploy AI throughout the enterprise unless management has a strategy. Pioneers are more likely to recognize the need for such a strategy. (See Figure 7.) At Daimler, for example, Rudolph says coming up with an AI strategy has been his priority. "We are developing clear target pictures for each and every function, making sure that they have ambitious but achievable targets and a clear roadmap leading to them," he says. Having a strategy in place, Rudolph believes, is "the key lever to implement AI technologies to improve existing processes along the entire value chain as well as developing new products and services to delight our customers. For us, this is of utmost importance."

**Taking Stock of Activity**

Another important step toward managing AI at scale is simply getting a handle on all of the AI activity going on in a sprawling enterprise. As an example, consider Mayo Clinic. The health care organization has about 65,000 employees spread across five U.S.

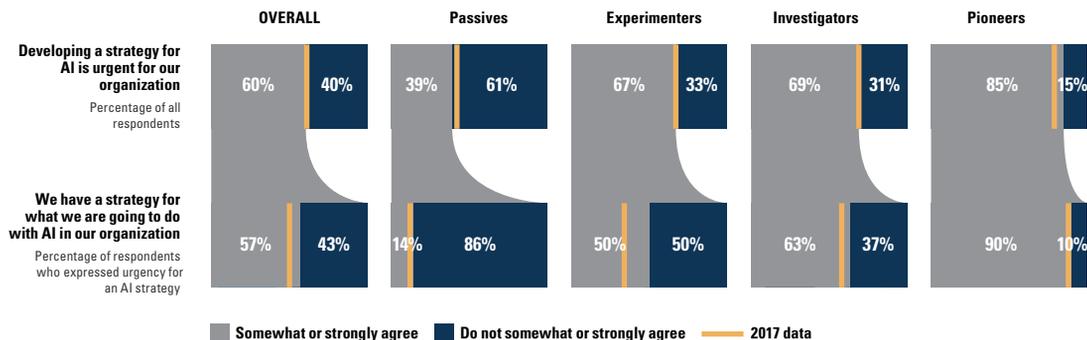
states. Its operations include major destination medical centers in three different states and the Mayo Clinic Health System, which has many practices in a 120-mile radius around Rochester, Minnesota. There is also the Mayo Clinic Care Network, an affiliated practice network that spans 50 sites across the country and beyond. Clark Otley, MD, described an ongoing effort by his colleague Wyatt Decker, MD, an emergency medicine physician who is now CEO of Mayo Clinic in Arizona and leading artificial intelligence efforts across the whole organization. "What Dr. Decker is trying to do is catalog and get a handle on all the different efforts that are going on across the institution," Otley reports. "In the preliminary assessment, he collected evidence that there are probably about 250 ongoing artificial intelligence initiatives, projects, and research programs, very disseminated across the entire enterprise." The challenge, Otley says, is to "take an enterprise approach to this so that we develop artificial intelligence in a way that synergizes across our campuses rather than causing redundancy or confusion across the geographic distribution."

Peter Batt, IT undersecretary at the German Federal Ministry of the Interior, explains how his office took stock of where German government agencies are

**FIGURE 7: AI REQUIRES STRATEGY**

Pioneers are most likely to see the need for an AI strategy as urgent and have one in place already.

How are organizations planning for AI?



## **Scaling AI in the enterprise demands new ways to engage business experts with technology.**

currently leveraging algorithm-based decision-making processes:

*The wide-ranging feedback was a big surprise to us. There are AI applications, albeit some are still early stage, across many institutions, such as the German Patent and Trade Mark Office, German Archaeological Institute, Federal Police, Federal Office for Information Security, Federal Institute of Sport Science, Federal Statistical Office of Germany, Federal Criminal Police Office, Federal Agency for Cartography and Geodesy, Federal Ministry of Justice, Federal Ministry of Finance, not to mention Defense, the Federal Ministry of Health, Robert Koch Institute, and more. And the technology is used to improve the service for society.*

### **Building Processes and Platforms for AI at Scale**

Gorkem Koseoglu, global head of robotics and artificial intelligence at Dutch bank ING, is particularly thoughtful about how the company will take its AI capabilities to scale, even as he acknowledges there is a long way to go: “For each of these areas, gradually we’ll move to more standardized models. As a bank, obviously we are not a greenfield technology company, so we don’t have the luxury to say, ‘OK, I’m going to go back and work on a universal banking model that will solve everything — and it will take me five years.’ But in a typical two-speed process, while we are meeting current business needs, we at the same time are trying to converge into these core models.”

What kinds of processes is Koseoglu envisioning? He says an example is “trying to build what could be the core models when it comes to price — as in, what could be the core model that we can use across the segments that will give us the capabilities to do lending pricing for all our customers in a smart way?” Such models must be built “with the idea that they become our core components of the company, and we’ll keep on investing in those as core capabilities,” he adds. “Not as a project, but they are basically our core skills, and we will dedicate resources to continuously improve them. That is the vision. We also realize that it’s an evolution.”

Lu Hao, a former Google research scientist and now chief innovation officer at Chinese AI innovator YITU Technology, says that because of YITU’s AI focus, a core part of his job is to ensure that all of the infrastructural elements are in place for AI development to proceed smoothly. YITU is an exception, however. It is still rare for companies to have built platforms for their AI application development in the way that AI-driven companies have. More typical is the situation at Spain-based Amadeus IT Group. Marion Mesnage, who is in charge of the company’s research, innovation, and ventures, says the company “ultimately wants to standardize AI systems and platforms” to ensure that it is getting the most from its AI investments. “It starts with having good data platforms,” she notes, which is the current focus. Pioneers are starting to develop standards for what protocols should be used, what processes should be followed, and how processes should be documented.

Joseph Sirosh, CTO of AI in Microsoft’s WW Commercial Business group, says the software company is “building a complete AI platform that allows it to build and operate ‘systems of intelligence.’” The platform includes “components to ingest data to build AI models, to deploy them in production, to manage them, monitor them, report on how they are performing using dashboards, take in feedback from the actions being taken, learn from that, and continue that cycle — the iterative learning loop,” he says. Sirosh contends that it is “incredibly important for enterprises to not just look at the first phase of AI, which is taking data, analyzing it, creating predictions using AI methods — which is, in fact, one of the easier parts of enterprise deployment — but translating that into operational deployment with the ability to debug and test such models in production and the ability to roll back and substitute new models if the older model doesn’t work and so on.” For Sirosh, AI taken to scale means “the enterprise has an AI-oriented architecture capable of constantly running AI experiments reliably, with continuous integration and deployment, and then learning from those experiments and continuing to improve its operations.”

**Driving AI Understanding and Action Into the Business**

In some organizations, one approach to uniting disparate AI activities is to centralize expertise in order to decentralize AI understanding and action. A colocated group of professionals well-educated in basic AI technologies can develop and maintain standards and help educate business professionals throughout the organization about AI. Efforts to scale AI systems and initiatives are more likely to succeed at organizations that are full of people who understand the promise of AI and know something about what effective AI deployments require.

Several business leaders we interviewed described efforts to bring nontechnical employees in the organization to a new level of awareness and enthusiasm. At ING, Koseoglu says, “We are investing a lot on the training of the businesspeople because one thing we learned is, actually, it’s not only about getting more data science resources but, more importantly, what we call the *translators* — in our case, the product owners.” His group is training businesspeople

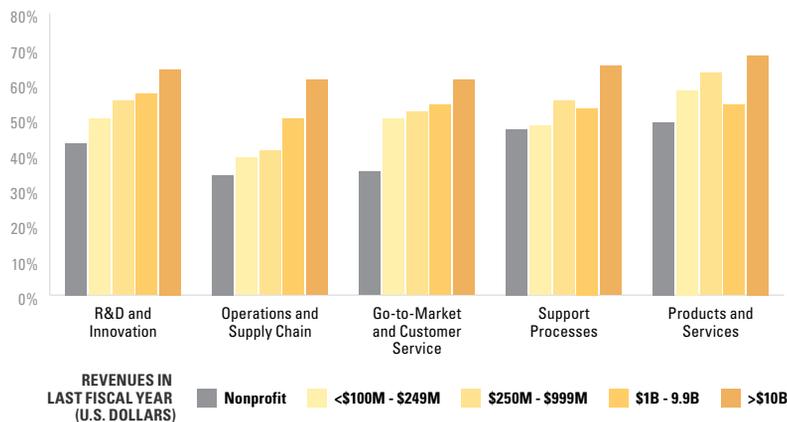
to think about potential use cases for AI, and also about the change management that should go along with the solutions they develop. “We have a plan to train more than 3,000 people in the coming two years in the organization, and those may be — well, those are the critical people for scaling up.” Raphael Micha, head of corporate strategy development at Bosch, advocates for “transforming business with AI following a bottom-up and top-down approach.”

At Pfizer, Julie Schiffman, vice president of business analytics, developed the Interactive Analytics Studio, which is designed to engage business colleagues in thinking about the potential of AI. “We’ve actually taken a conference room and converted it into a lab where we bring cross-functional teams together to look at data in real time using interactive screens and systems,” she explains. “What we are finding is that has completely changed the game for how we drive insights across the scientific and commercial community.” Compared with the traditional “PowerPoint culture,” she says, sessions like these help her team “beat our own cycle

**FIGURE 8: AI IS PREDICTED TO AFFECT ALL AREAS**

Among the highest expectations for AI in the next five years is that it will bring new levels of intelligence to product and service offerings, but companies of all sizes also see ways to use AI to enhance internal business processes.

Which functional areas will AI impact?



Percentage of respondents expecting AI to change each area in their organization in the next five years

time for driving insights. By bringing colleagues together in one room from multiple disciplines to review and test initial hypotheses, team members develop new questions that we have an opportunity to answer in real time.” Schiffman believes that this active, get-up-out-of-your-chair approach to engagement has helped the pharmaceutical company evolve and make AI and advanced analytics “not as much of a black box.” She is convinced that great projects start when her analytics experts sit down with colleagues who have deep business domain experience and good data is brought into the equation that they can review together. “When you pull that recipe together,” she says, “some magic can happen.” A common theme among all of these examples is that scaling AI in the enterprise demands new ways to engage business experts with technology.

## Pioneers Prioritize Revenue-Generating Applications Over Cost-Saving Ones

How should executives prioritize business operations that could be improved with AI? Judging from our survey results and interviews with business leaders, many executives believe their choices are almost unlimited. As Mayo Clinic’s Otley puts it, “I don’t know that there’s the sweetest spot for artificial intelligence. I think it’s going to be broadly applicable across everything we do.” Survey respondents anticipate opportunities to apply AI to all five functional areas we asked about. (See Figure 8, page 12.)

Clariant’s Fuenfstueck has a disciplined view about how to prioritize projects when so many operations could benefit from AI’s vast potential. With new AI capabilities, she says, “we are sure that almost everything you can touch, you can optimize. If you take a process that is very complex but repeats itself all the time and has varying outputs, you can always observe which input parameter yields which output and develop machine learning algorithms based on that.” So far, Fuenfstueck claims, “almost every

topic that the team has touched has benefited.” At the same time, she is clear on the point that choices about where to use AI must be made strategically. In Clariant’s case, she explains, “the team has to touch what they consider to have the highest yield or the highest benefit for putting effort into it.”

Fuenfstueck makes a compelling argument that this highest benefit will come from revenue-focused initiatives rather than in efforts to improve the efficiency of internal processes. This is “because any NPV [net present value] of an external business by far outperforms any internal one.” She points out that failing to jump on an internal process improvement opportunity means “you just miss out on a year of EBITDA [earnings before interest, taxes, depreciation, and amortization] improvement.” A much higher penalty is incurred by missing an opportunity in the external market. “If you were late with a new business model, somebody else will have driven it and you will have lost your chance forever,” Fuenfstueck says. “So, this has to be the rule of prioritization.”

While Clariant first developed its familiarity with AI by applying it to cost-saving opportunities — for example, by optimizing yields and reducing energy costs in large chemical plant production processes — Fuenfstueck stresses that Clariant quickly moved to revenue-boosting opportunities with AI. Among the examples she mentioned are complex pricing applications, churn analysis in the customer portfolio, new delivery forms that significantly speed up Clariant’s ability to meet customer demand, and even a new service line operating on a wholly different business model. In that second wave of AI projects, she says, Clariant was “taking this knowledge of being able to optimize processes within the company and bringing it now to our customers to help them optimize their processes.” Creating an AI solution that provides “add-on value that allows us to differentiate in a classic chemical-selling business is for us priority No. 2,” she says. An even lower priority is “just bringing something offline to online.” For Clariant, those types of projects aren’t worth devoting scarce resources to. “Priority No. 1,” she says, is coming up with “completely new business models and really new services, just based on digital.”

**“I think this is one of the most exciting, value-added, and competitive parts of our business for the future.”**

— Bill Braun, CIO, Chevron

Our survey shows that Pioneers (and Investigators) heavily emphasize using AI to develop new revenue-generating offerings and capabilities. In comparison, Experimenters and Passive enterprises focus more on AI applications that reduce costs. (See Figure 9.) In the future, a larger percent of all maturity groups expect AI to produce cost savings.

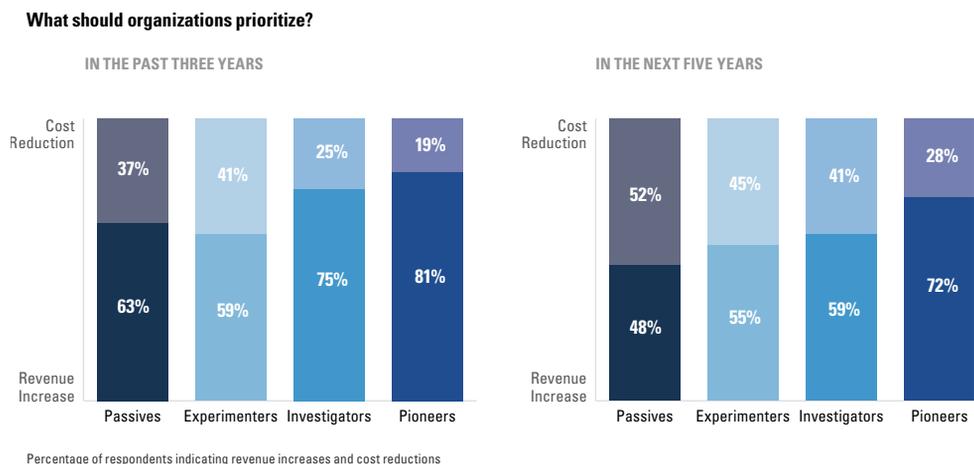
For managers in young enterprises or new ventures within old organizations, using AI to increase revenues (or, in the case of social enterprises, to achieve their fundamental purpose) is an obvious priority. They do not have long-established, internal processes that need to be integrated with new AI applications and systems. For example, in our interviews with Theresa Johnson, product manager at

Airbnb, and Yufeng Zhang, vice president of global business at China-based Horizon Robotics, there was little mention of resources going to improve the efficiency of legacy processes — few legacy processes exist to improve. Or consider OPTTEL, a Canadian technology company with a mission to build a sustainable world through smarter supply chains. Using end-to-end traceability systems based on advanced AI, OPTTEL connects the various segments of the supply chain and provides much-needed visibility over the path of products in a wide range of industries. The company helps fight problems such as counterfeit medicines, unsafe or fraudulent food items, and unnecessary waste. As OPTTEL’s president, Louis Roy, puts it, “For an organization like ours, the use of AI is the key to fulfilling our core value proposition to customers *and* humanity. Without it, we can’t achieve our goal.”

Our survey results and executive interviews suggest that managers recognize both the opportunities as well as the risks of using AI — to different degrees. Asked whether they perceive AI as a strategic opportunity or a risk to their organization, respondents could choose one answer or the other, or both. In

**FIGURE 9: PIONEERS FOCUS ON REVENUE-GENERATING OPPORTUNITIES**

In the recent past, most businesses have used AI to increase revenues. In the future, more managers expect AI to reduce costs.



2017, 83% answered that it was either pure opportunity (50%) or a combination of opportunity and risk (33%). This year, optimism was even higher, with 88% giving one of those answers. Interestingly, however, there was a six percentage point jump in the subset who saw AI as a mixed blessing (39%). This may reflect a dawning recognition that the same AI advantage a company is excited to pursue becomes a risk if a competitor acts faster and deploys first. As Chevron's Braun says, "I think this is one of the most exciting, value-added, and competitive parts of our business for the future, and so we are passionately going to apply this and use it as part of our differentiation. I think it does give us the ability to outcompete. But if we are lagging on it, it gives our competitors the ability to do that to us."

## AI Is Creating Both Fear and Hope Among Workers

What will be the effects of artificial intelligence on the workplace? Our survey respondents expect AI will have a large impact on the skills employees will need on the job. (See Figure 10.) At the same time, they remain cautiously optimistic about AI's overall effect on the workforce.

An overwhelming percentage of respondents (82%) believe AI will help their organization improve productivity. Despite those expectations, managers' opinions about the prospect of labor reductions from AI-related productivity improvements are decidedly mixed. In fact, they are almost exactly evenly split: 47% agreed with the statement "Our organization's workforce will be reduced" because of AI in the next five years.

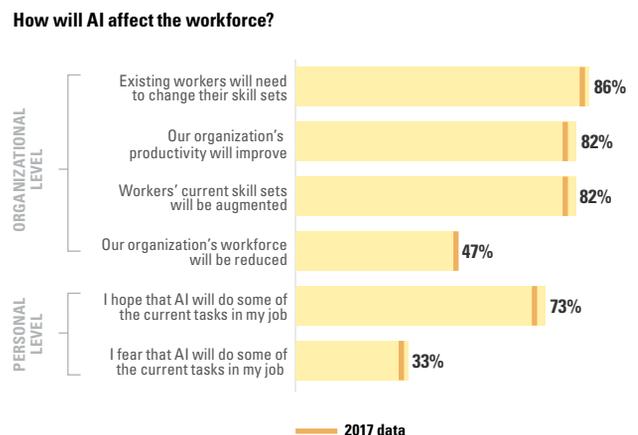
Some employees worry that the age of artificial intelligence will mean reductions in the workforce. Rudolph says Daimler takes those concerns seriously and that organizations should take a proactive approach. "We are in a very lucky position," he says, in that "our company is operating in a global growth industry. Therefore, we are in a much better position to handle any changes on the employment side."

Rudolph notes that, in his strategic role thinking about the company's use of AI, he gets asked, "How many people will we have to replace? How many will we have to lay off?" And he understands that his answer needs to be "not a diplomatic one but a very serious one: No one, at this point, can be entirely sure how AI is influencing the overall workforce. New products are being and will be developed, demanding new skills and probably also creating new job opportunities. We need to look at the processes one by one and understand that artificial intelligence will surely change the way we work but not necessarily lead to workforce reduction."

Rudolph's level of uncertainty about the future of any given job at Daimler mirrors the survey results overall. The uncertainty around workforce reductions results from the clash of two perspectives. On one hand, past experience with automating technologies might reassure workers that, at least at some point, the result will be not fewer but rather more job opportunities. On the other hand, given that machines are already doing knowledge work, workers might

### FIGURE 10: WORKFORCE UNCERTAINTY ENDURES

Another year of AI experimentation and learning has left opinions unchanged about workforce impacts — and still sharply divided on the topic of workforce reductions.



Percentage of respondents who somewhat or strongly agree with each statement

reasonably doubt that many higher-level tasks will be left for humans to do. (In China, such skepticism is not uncommon.)

Linda Jojo, chief digital officer at United Airlines, summarizes the tension perfectly: “History shows that there’s always a fear of new technologies, whether it was the word processor or the computer replacing the typewriter, through to tablets versus laptops,” she says. “The result people feared doesn’t tend to happen. It’s usually that people just do different and higher-valued tasks and jobs, supported by the technology, or jobs that no one even envisioned because the technology then enabled them. I believe that will happen over time. But right now, that unknown makes it a difficult concept.”

On the topic of AI’s likely effect on jobs, this year’s survey results and the sentiments expressed in our executive interviews are similar to last year’s. Even with a year of additional experience and understanding about AI, these unknown aspects still make it difficult to project forward.

How exactly these effects of AI on the future of work will come together is an important unknown aspect. For example, while most respondents believe AI will require other existing workers in their organization to change their skill sets in the coming five years, relatively few are fearful that AI will take away some of their own tasks in that time frame. In fact, more than twice as many are *hopeful* that AI would do so, no doubt picturing AI taking over the parts of their jobs that are mundane and repetitive so that they can instead work on more creative tasks.

This mix of hope and fear contributes to the uncertainty. In roles that involve a healthy dose of both menial and strategic or creative tasks, the hope is that AI will take over the menial tasks, creating more time to focus on more interesting work. Garriga of Allianz believes “the moment when people realize that this is a productivity gain and that they can focus more on non-menial, value-adding tasks, the resistance comes down. Then it’s a gain, and it’s not about AI replacing humans. It’s about making people more efficient and letting them focus on

the really important tasks for our customers.” At the Mayo Clinic, Otley says the philosophy is to “automate the easy” and “augment the hard.” That is, tasks that people find mind-numbingly dull are fair game for AI solutions — but so are tasks they find mind-bendingly difficult. His strong belief is that humans will still be integral to the work that goes on in medical settings, not just in terms of patient care, but also to the process of interpreting large masses of data.

Analyzing the survey results by job type helps clarify some of the unknowns. For example, office and operations workers, along with business analysts, are most likely to agree that “AI will cause us to reduce our workforce within five years.” Experts and specialists, followed by business analysts, are most fearful that AI will take over some of their own job tasks. According to Bonny Simi, president of JetBlue Technology Ventures, the corporate venture arm of the airline, this same expectation is driving much investment in AI companies by venture capitalists, who are gravitating to enterprise solutions that automate the kinds of repetitive, internal work processes that all companies tend to have. Advancing AI, Simi is convinced, will mean that some people’s jobs go away. “You’ll always have controllers and accountants,” she allows, “but now you won’t have as many data entry people and so on. It’s the lower-level positions that will be automated, and retraining will be needed to up-skill workers to fill demand for higher-skilled roles.”

That scenario isn’t hypothetical; it is a reality in some organizations. At ING, for example, the deployment of AI applications in the area of back-office data entry led to the replacement of 400 full-time employees. According to ING’s Koseoglu, the company taught software how to handle back-office data entry tasks that the workers and others had been doing.

## Conclusion: Dying Myths, Emerging Realities

The MIT SMR-BCG 2018 Artificial Intelligence Global Executive Study and Research Report makes

the case that, as a subset of businesses around the world succeed in securing business value from artificial intelligence, their pioneering efforts are encouraging them to go further. Having experimented with point solutions and seen impressive results, they now aspire to scale up and build systemic competitive advantages with AI.

Today, companies are taking many approaches to adopting AI. Christian Guttman, executive director of the Nordic Artificial Intelligence Institute, says he has observed a “huge variation” in how leaders are starting to deal with AI’s opportunities and challenges. With high-profile cases driving new levels of enthusiasm, the next five years will see increased investments in pursuit of AI-enabled advantages. As a result, Guttman sees “enormous need by leaders of large corporations, as well as the government entities, to make sense of all of this.”

One way to think about the findings of this report is in terms of what myths the research serves to disprove. It may be that some commonly held notions about business uses of AI have outlived their usefulness.

**Myth:** The benefits of AI are perpetually just out of reach.

**Reality:** AI is currently providing real value in real organizations, not just lab demonstrations in technology organizations.

**Myth:** Widely available sophisticated AI tools will level the playing field.

**Reality:** Pioneers are increasing their investment in AI, widening the gap with others.

**Myth:** Companies that see success with AI flourish via small-scale experiments.

**Reality:** AI leaders are increasing their investments in AI and creating strategies for taking AI to industrial scale.

**Myth:** The greatest promise of enterprise artificial intelligence is the ability to take mundane knowledge work and automate it, yielding unprecedented operational cost savings.

**Reality:** Keenly aware of competitive dynamics, leaders are applying AI to develop new offerings that focus on revenue creation.

**Myth:** Senior managers view AI as a tool that will help them achieve workforce reductions.

**Reality:** The higher the manager’s role in the corporate hierarchy, the less likely he or she will see AI as a cause of job losses.

Early AI adopters in business have seen their pioneering efforts rewarded and are pushing forward, having gained both competence and greater perspective on the possibilities. Based on the benefits of early applications, we heard great enthusiasm — but also clear-eyed appreciation of the challenges of increasing AI investments and realizing value at scale. We also heard many open questions: Do Pioneers already have an unassailable advantage? What is the effect of aggressive AI adoption in China on the rest of world? How will AI affect economic growth? What are the implications of AI on the future of work?

As Chevron’s Braun told us, “It’s springtime for AI, and we’re anticipating a long summer.” We look forward to revisiting this research in 2019 and reporting on emerging patterns.

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### REFERENCES

1. See, for example, A. Smith and J. Anderson, "AI, Robotics, and the Future of Jobs," Pew Research Center, Aug. 6, 2014, [pewinternet.org](http://pewinternet.org).
  2. "Allianz Capital Markets Day: Renewal Agenda — Bringing Skills to Scale," Allianz, Nov. 24, 2015, [allianz.com](http://allianz.com).
  3. S. Ransbotham, D. Kiron, P. Gerbert, and M. Reeves, "Reshaping Business With Artificial Intelligence," MIT Sloan Management Review and The Boston Consulting Group, September 2017, [sloanreview.mit.edu](http://sloanreview.mit.edu).
  4. The insurance industry has other Pioneers, too, that see AI as a critical element in the digital transformation of their businesses. In last year's report, we featured the story of Ping An Insurance, the second largest insurer in China. See Ransbotham, "Reshaping Business With Artificial Intelligence."
- i. P. Gerbert, M. Reeves, S. Ransbotham, D. Kiron, and M. Spira, "Global Competition With AI in Business: How China Differs," MIT Sloan Management Review, July 24, 2018, [sloanreview.mit.edu](http://sloanreview.mit.edu).

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**Bonny Simi**, president, JetBlue Technology Ventures  
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