The Global CIO Point of View

The New Agenda for Transformative Leadership: Reimagine Business for Machine Learning

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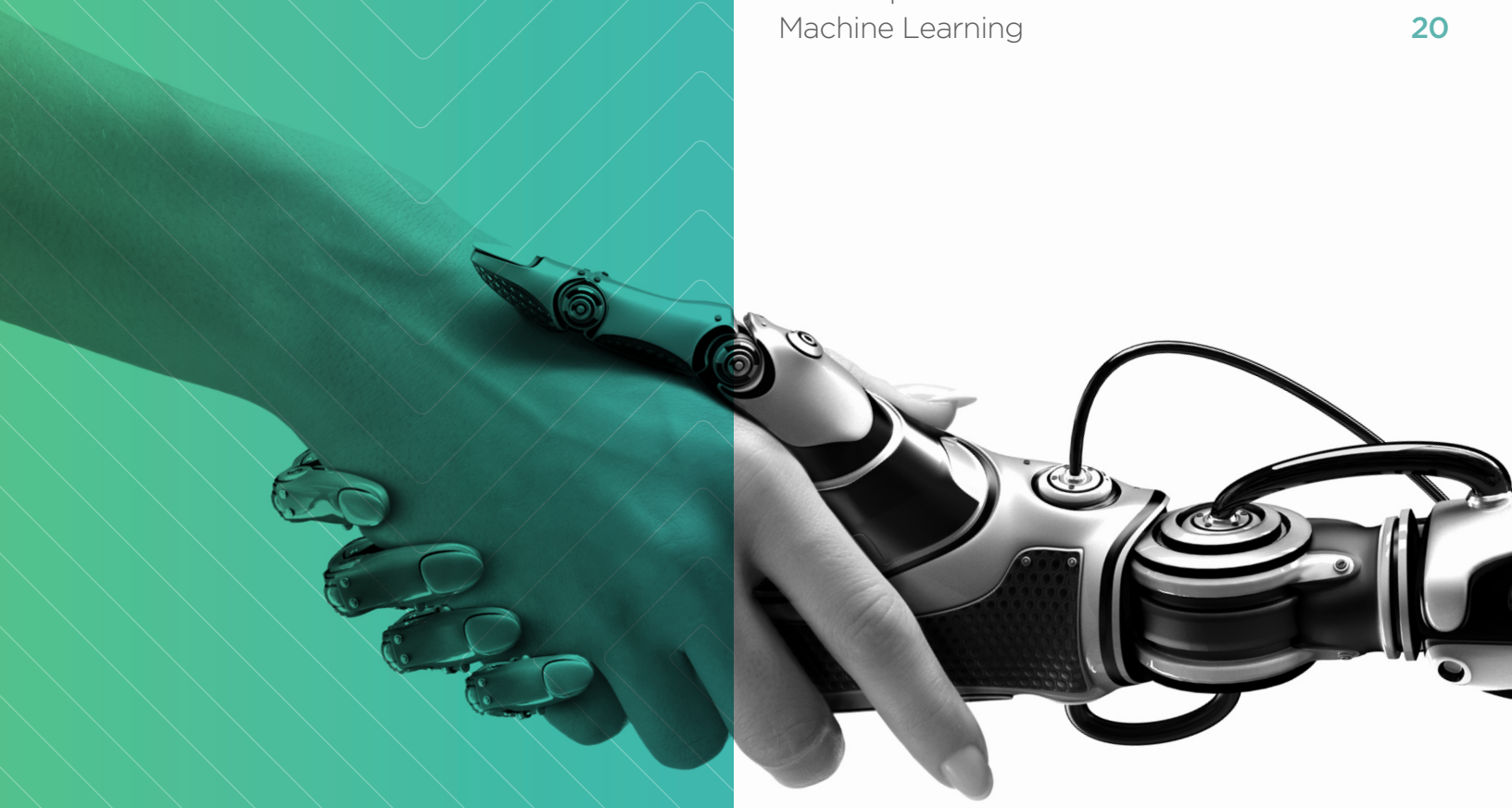


Executive Summary

Machine learning has arrived in the enterprise, and companies are eager to reap the competitive benefits the technology can provide. From automating processes that enable faster business operations to applying algorithms to improve accuracy, CIOs are adapting the technology for a wide variety of uses—and transforming the way we work.

To investigate the rise of machine learning, we worked with Oxford Economics to conduct a survey of 500 CIOs in 11 countries on three continents and across 25 industries, alongside in-depth interviews with leaders in the field. We found that CIOs are increasing their investment in machine learning, but must overcome several barriers to achieve their productivity, revenue, and innovation goals. Unless CIOs turn their attention to updating not just technology, but talent and business processes, the full value of machine learning cannot be realized.

The New CIO Agenda

Drive digital transformation
CIOs are leading digital transformation efforts, and machine learning is a strategic focus. They are also beginning to use machine learning to automate complex decision-making.

Expand workforce skills
CIOs are making substantive changes to processes or leadership to accommodate digital labor, including creating new jobs that focus on work with intelligent machines.

Redesign business processes
CIOs are developing new business processes to support decision automation. They also say that digitizing business processes will be important to their organization's success.

Address business challenges
CIOs cite data quality and outdated processes as substantial barriers to adoption, as well as lack of budget for new skills and technology.

Compete to lead
A small group of CIOs is outpacing peers in the use of machine learning. To achieve the same results, other CIOs must improve data quality, define future job roles, focus on the customer experience, and measure and report outcomes.

Among our top findings:

CIOs are adopting machine learning to advance digital transformation and reimagine the way the enterprise works.

- Almost three-quarters of CIOs surveyed (72%) are leading digitization efforts, and more than half (53%) say machine learning is a focus.
- Nearly 90% say greater automation will increase the accuracy and speed of decisions; more than half (52%) say they are advancing beyond the automation of routine tasks (e.g., security alerts) toward more complex automated decisions (e.g., how to respond to security alerts).
- Over two-thirds (69%) of CIOs say decisions made by machines will be more accurate than those made by humans.
- The number of respondents making at least some investments in machine learning will nearly double over the next three years to 64%.

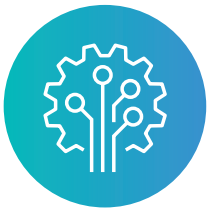
CIO who are at the forefront of adopting machine learning recognize the need for process and talent changes, but many cite challenges.

- About 40% have redefined job descriptions to focus on work with intelligent machines, and 27% have hired employees with new skill sets.
- CIOs cite data quality (51%) and outdated processes (48%) as substantial barriers to adoption.
- Lack of skills to manage smart machines is cited by 41% of CIOs, and lack of budget for new skills is cited as a challenge by 47% of those surveyed.

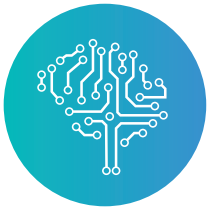
A select group of CIOs, whom we call "first movers," is outpacing their peers in their use of machine learning.

- Roughly 80% have developed methods to monitor machine-made mistakes vs. 41% of others.
- Half of them say automating routine processes will be key to their business's success compared with 33% of others.
- More than 70% have developed a roadmap for future business process changes compared with just 33% of others.
- More than three-quarters have redefined job descriptions to focus on work with machines compared with 35% of others.
- Almost 90% of first movers expect decision automation to support top-line growth vs. 67% of others.

DEFINITIONS



Machine Learning
Software that promises to analyze and improve its own performance without direct human intervention, giving it the ability to make increasingly complex decisions as it learns.



Artificial Intelligence (AI)
Software that mimics human perception and is capable of interacting with its environment; AI is an outcome of machine learning.

Digital Labor
Work done by machines that is carried out in concert with humans or as a replacement for human efforts.

Introduction

The long-promised age of machine learning is finally underway. Businesses have been waiting for decades for computer science to catch up to the hype around machines that emulate human intelligence. Now, the technology occupies the peak position of Gartner's Hype Cycle for Emerging Technologies, indicating that it has matured enough to spur wide interest.

Algorithms allow people to make meaning from data faster and with more accuracy than ever before. At JPMorgan Chase & Co., for example, computers can quickly interpret loan agreements that until recently required 360,000 human hours per year to parse.[1] In the near future, machines will be able to make or influence business decisions based on similar inputs. As businesses gain confidence in the software, spending on artificial intelligence and machine learning is expected to grow rapidly from less than $8 billion in 2016 to $47 billion by 2020, according to IDC, including the rise of machine learning as a service for industries as diverse as healthcare and discrete manufacturing.[2]

One important driver of machine learning adoption is digital transformation—a business imperative for all enterprises today and one for which 72% of CIOs in our survey have responsibility. In fact, IDC predicts that 40% of digital transformation initiatives will be supported by machine learning and artificial intelligence by 2019.[3] Moreover, 53% of CIOs from our survey say machine learning is one of their core priorities as their role expands from traditional IT operations to business-wide strategy.

Our survey explores the strategies CIOs are adopting to realize value from machine learning, and the competitive advantage for organizations that are advancing to decision automation.

72%

of CIOs are now leading digitization efforts.

53%

of CIOs say machine learning is a focus area.

Our survey of 500 CIOs shows that many businesses are preparing for the widespread adoption of machine learning to automate decision-making.

- Chris Bedi, CIO, ServiceNow

Machine Learning is a Catalyst for Digital Transformation

Computers are getting smarter and CIOs are ready to put them to work. Over two-thirds (69%) of CIOs surveyed say decisions made by machines will be more accurate than those made by humans, and more than half say complex decision-making by machines will be highly important to the success of their organization over the next three years. Most expect decisions made by machines to improve the speed of business as well.

This is beginning to change the way organizations operate, enabling the transition to the digital enterprise. "The whole area around AI, robotics, and machine learning is firmly centered in our strategic plan," says Matt Potashnick, CIO at AXA UK, the British subsidiary of the $150 billion French insurer. "In terms of underwriting and pricing capabilities, we are moving away from traditional ways of building models and utilizing machine learning to really enhance that."

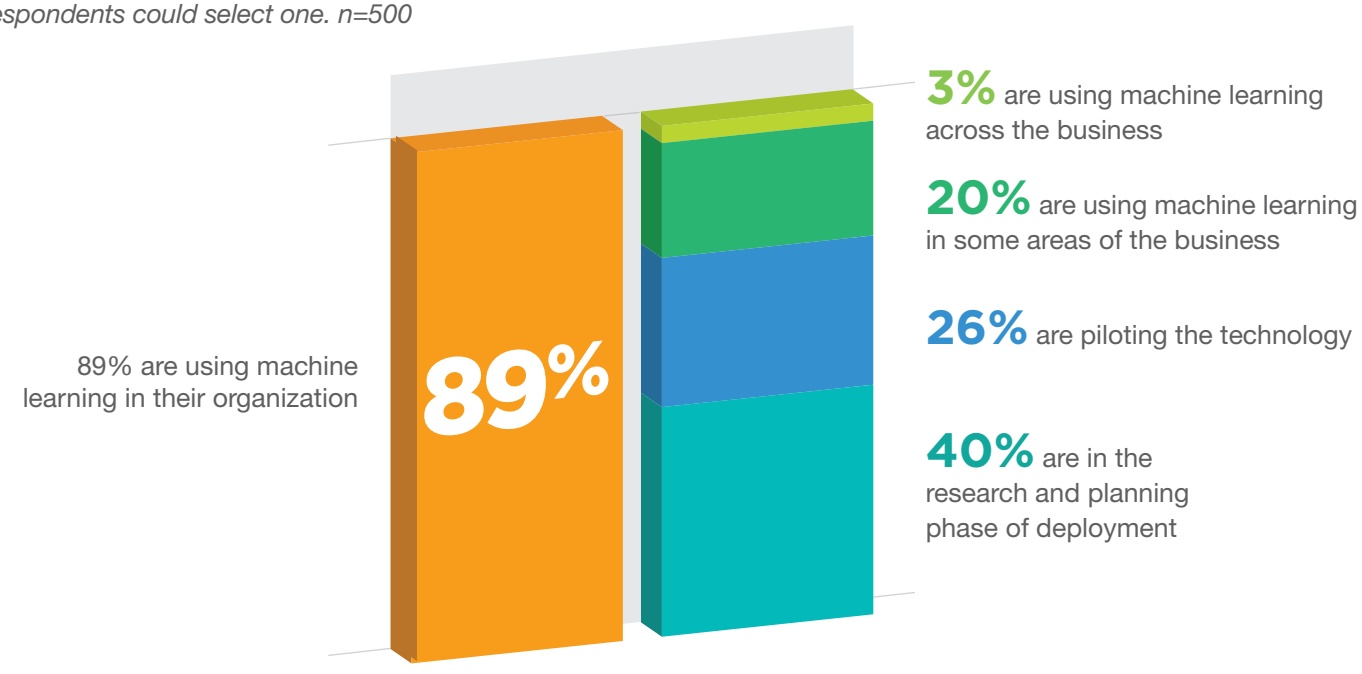
Nearly 90% of CIOs are using machine learning in some capacity; most are still developing strategies or piloting the technology, while just 11% say they have no plans to use it.

Investment on the rise

The impact of machine learning is set to grow as CIOs plan to increase investment in the technology. The sharp growth projected for spending will be driven largely by first-time buyers. Roughly two-thirds of respondents will make at least some investments within three years, while one-third do so today, and the number making substantial or major investments is set to rise from 5% to 16% in that time. Current spending on machine learning still trails, by a wide margin, spending in other areas of modern computing. For example, 52% are making substantial or major investments today in analytics and 36% in cloud compared with 5% in machine learning. However, some of that spending is necessary preparation to support machine learning, as both computing power and cutting-edge applications increasingly live in the cloud. PwC's 2017 Digital IQ Study shows that many organizations are still working to integrate foundational technologies into their business operations, even as pressure to adopt emerging technologies builds.[4]

Fig. 1: Almost 9 out of 10 CIOs are using or planning to use machine learning

Q: Which best describes your organization's use of machine learning?
Respondents could select one. n=500



Automation promises faster, more accurate decisions

Investments in machine learning are starting to pay off in the automation of decisions. Over half (52%) of respondents say they are advancing beyond the automation of routine tasks and moving toward more complex automated decisions—think of the difference between routing emails in response to a security threat and recommending ways to mitigate that threat. With 57% saying even routine decision-making takes up a meaningful amount of employee and executive time, the potential value of automation is high.

Most CIOs expect payoffs in the next three years: When we asked respondents to rate the value of decision automation to their business, 87% reported "substantial value" or "transformative value" to the accuracy of decisions—the top two responses in our five-point scale, rather than "no value," "minimal value," or "some value." Another 83% reported substantial or transformative value for speed of decisions. Darren Ghanayem, CIO of WellCare Health Plans, a $14 billion Florida-based insurance services company, says his firm has already seen improvements in accuracy.

> "We have proven that machine learning can discover flaws in our own thinking. The subject-matter experts aren't always right."
>
> *—Darren Ghanayem, CIO, WellCare Health Plans Inc.*

Different functional areas of companies are automating decisions at their own pace according to their own needs. CIOs are most likely to expect value in the next three years from decision automation in areas that involve very large amounts of data, like security operations or intensive analytics, such as IT and strategy. But companies are looking for ways to improve decisions across functions. For example, the high-end trucks produced by Navistar International Corporation, the $8 billion manufacturer based in Illinois, are highly customized for individual purchasers. Terry Kline, CIO of Navistar, says the company may use machine learning in the future to make recommendations about customizing its vehicles and even which trucks to buy.

While machine learning can improve the way organizations work and operate, its development is also creating new market opportunities for companies to drive revenue. As a result, CIOs expect decision automation to contribute to their organization's top-line growth (69%) and competitiveness (64%). For instance, Navistar can now build and market self-driving vehicles to replace the fleets of trucks clients have previously purchased.

"We're going to see revenue generated from machine learning," says Kline. "That's what autonomous is all about—the machine getting smart enough to drive the vehicle." He says the ability to add safety features and improve service for connected, autonomous vehicles will create additional revenue streams. "I don't think we have started on what we can do with machine learning."

87%

of CIOs reported that machine learning provided "substantial value" or "transformative value" to the accuracy of decisions.

MACHINE LEARNING ADOPTION VARIES BY REGION

North America
CIOs surveyed in the North America are more confident than their peers in other regions in their capabilities in a range of technologies, including machine learning. They also are more likely than others to expect value from machine learning and decision automation across a range of business areas, including overall strategy (72%, vs. 61% in Asia Pacific and 58% in Europe); sales and marketing (63%, vs. 47% and 38%); procurement (50%, vs. 34% and 34%); product development (48%, vs. 29% and 29%); and human resources (26%, vs. 13% and 17%).

Asia Pacific
CIOs surveyed in Australia, New Zealand, and Singapore lead peers in Europe in driving digital transformation through machine learning, yet they lag respondents in North America, particularly in technology investments and managing the consequent risks of relying more on machines. The biggest area of improvement for CIOs in these countries is talent. They are least likely to say they have recruited employees with new skill sets (21%, vs. 29% in Europe and 30% in North America).

New Zealand is behind other countries in the region. CIOs in this country are less likely to say they are making organizational changes for machine learning (36% vs. 57% in Australia and 50% in Singapore), and less likely to have redefined job descriptions to focus on work with machines (27% vs. 43% in Australia and 52% in Singapore).

Europe
CIOs in Europe see machine learning as an important technology to drive digital transformation, yet they are not investing as much as global peers, are slower to automate tasks, and have slightly lower expectations for how machine learning could improve their business. Less than half (47%) of European CIOs say their company has set up programs to expand employee skill sets (vs. 51% in Asia Pacific and 48% in North America); and 37% have developed a roadmap for future process changes (vs. 32% in Asia Pacific and 46% in North America).

Within the region, CIOs in France and Germany are the most enthusiastic and best prepared for machine learning. CIOs in the Netherlands and Sweden are slower to commit to changes to advance this technology.

72% IN NORTH AMERICA

61% IN ASIA PACIFIC

58% IN EUROPE

expect value from machine learning and decision automation to their company's overall strategy.

The application of machine learning requires a human touch

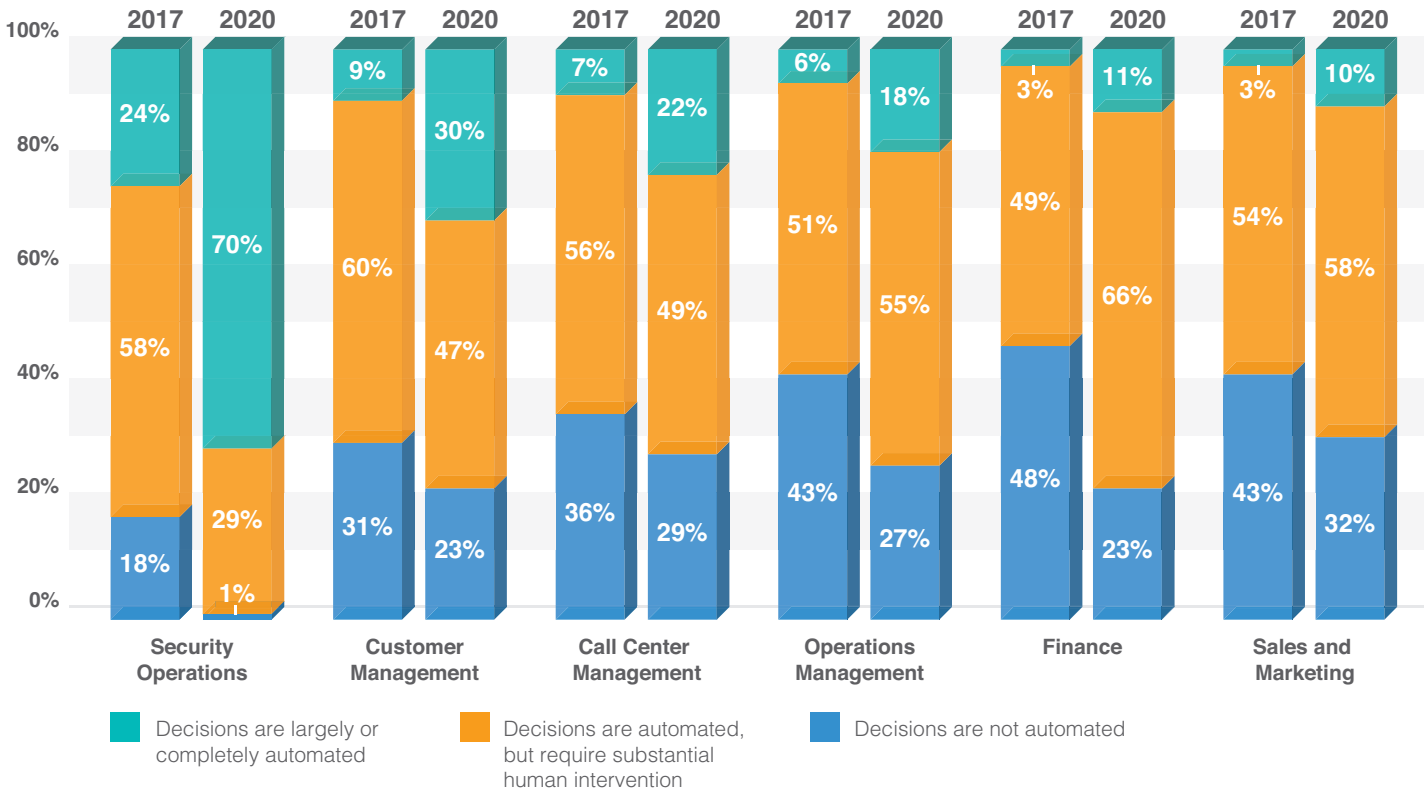
Most business decisions still require human input (see figure 2). After all, just 8% of respondents say their use of machine learning is substantially or highly developed. Even in security operations, by far the most advanced functional area, three-quarters of decisions require substantial human intervention or are not automated at all. Our Global CISO Point of View shows that just one-third of respondents currently automate at least 40% of their security tasks, a number that is expected to rise to two-thirds by 2020.[7]

Ghanayem says decision-making is an evolving art, with machines currently advising people but not yet making final decisions. "The automation we are doing now is in predicting outcomes from prior events," he says. "We are not actually making transactional decisions—it's now on an informing basis that is getting more and more influential because our predictions are getting more and more accurate. But we still count on nurses and care practitioners to make the final recommendations and the final decisions, so that is still very much in human hands."

Overall, the rate of decision automation is projected to grow sharply across functions within three years, with over half of decisions made at least partly by machines.

Fig. 2: Most decisions still require human intervention

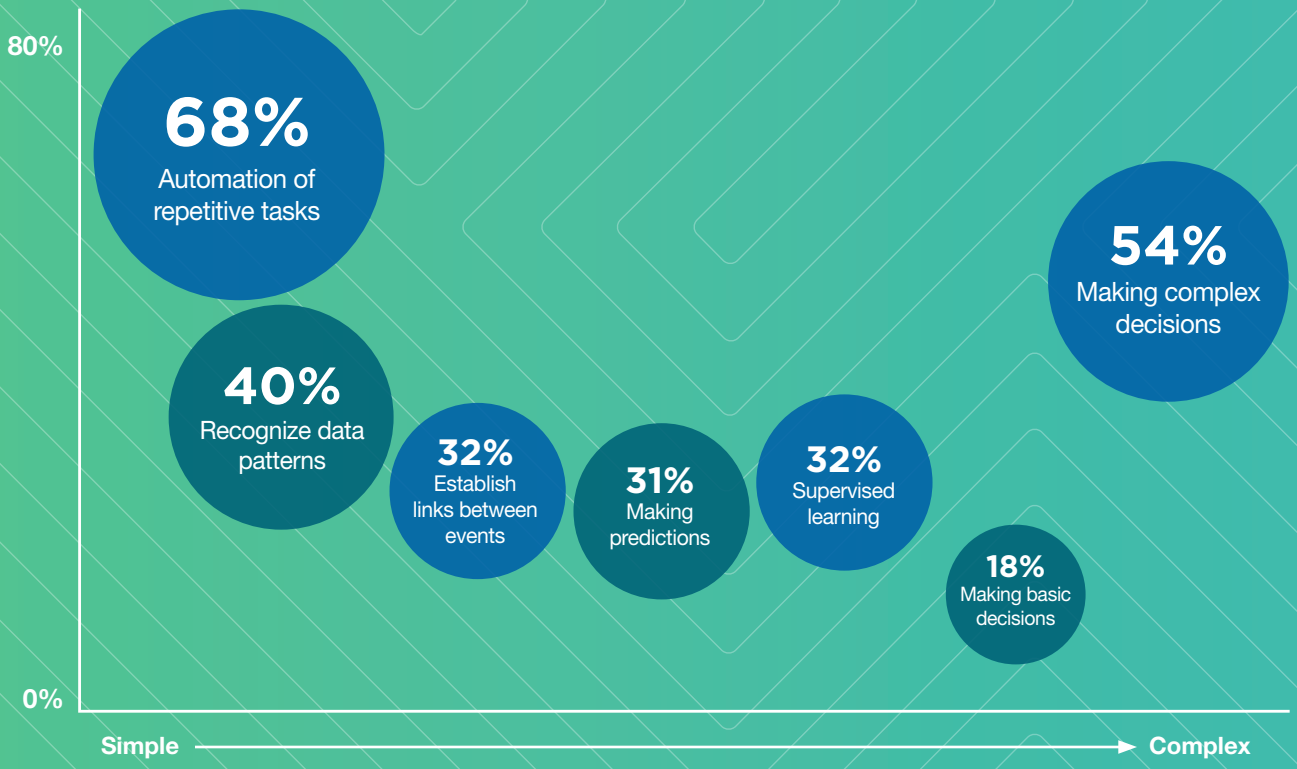
Q: To what extent, if any, does your organization automate decisions for the following tasks? *n=500*



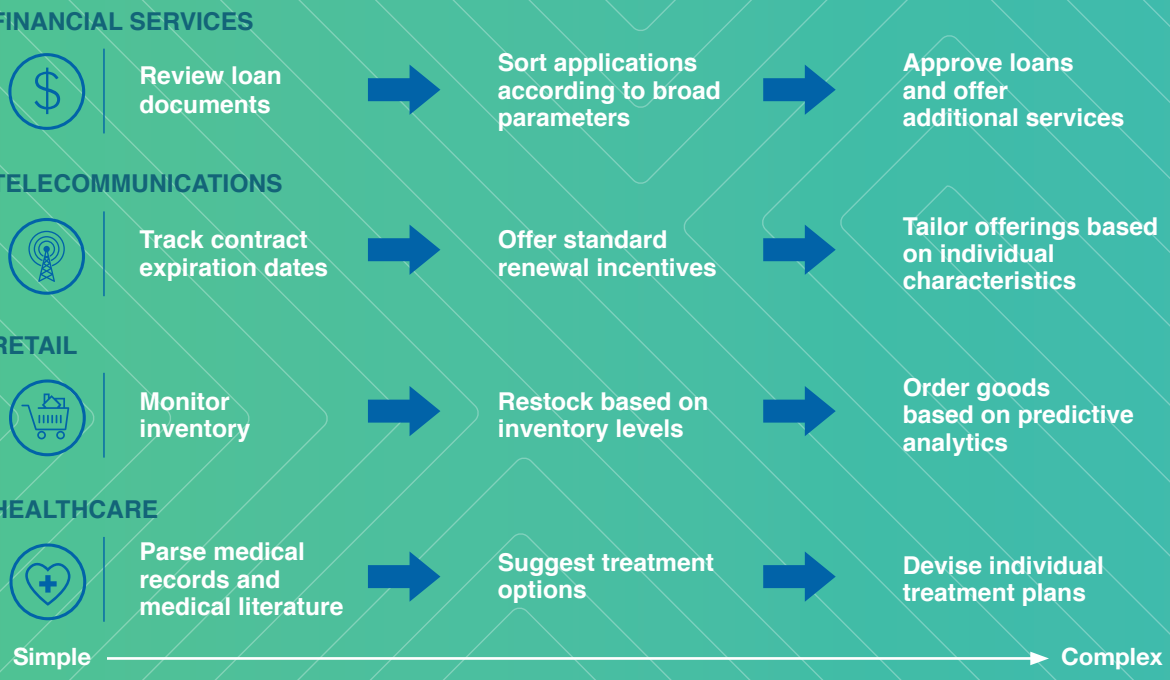
CIO Plans for Machine Learning Are Increasingly Ambitious

As machine learning becomes more sophisticated, its most complex capabilities are gaining credibility and favor among CIOs.

Fig. 3: CIOs rank top three important capabilities of machine learning



Industry examples:



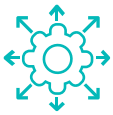
The CIO Perspective: TRANSFORMATIVE LEADERSHIP

In addition to a survey of 500 CIOs, we conducted in-depth interviews with a select group of CIOs who are transforming their enterprises with new digital strategies and advancing the adoption of machine learning. These conversations shed light on the new CIO agenda, including necessary changes to talent strategy, business processes, and technology application.

People

"The biggest challenge is to bridge the gap between the data scientists and the clinicians in terms of the language and the style in which they speak. We need the trainers we put in place to bridge that barrier...We've actually had to hire nurses to be involved in some of our projects."

Darren Ghanayem
CIO, WellCare Health Plans Inc.



Process

"Using machine learning means changing the mindset of the business, saying there is a different and a new way of doing things. It is the transformation involved in saying if we remove these old, complex systems, this is the direction and scope in which we can empower the business."

Matt Potashnick
CIO, AXA UK

WellCare Health Plans Inc. provides Medicare and Medicaid managed care health plans to nearly 4 million members.

Industry: Insurance
Location: Tampa, Florida, US
Revenue: $14 billion
Employee count: 6,000

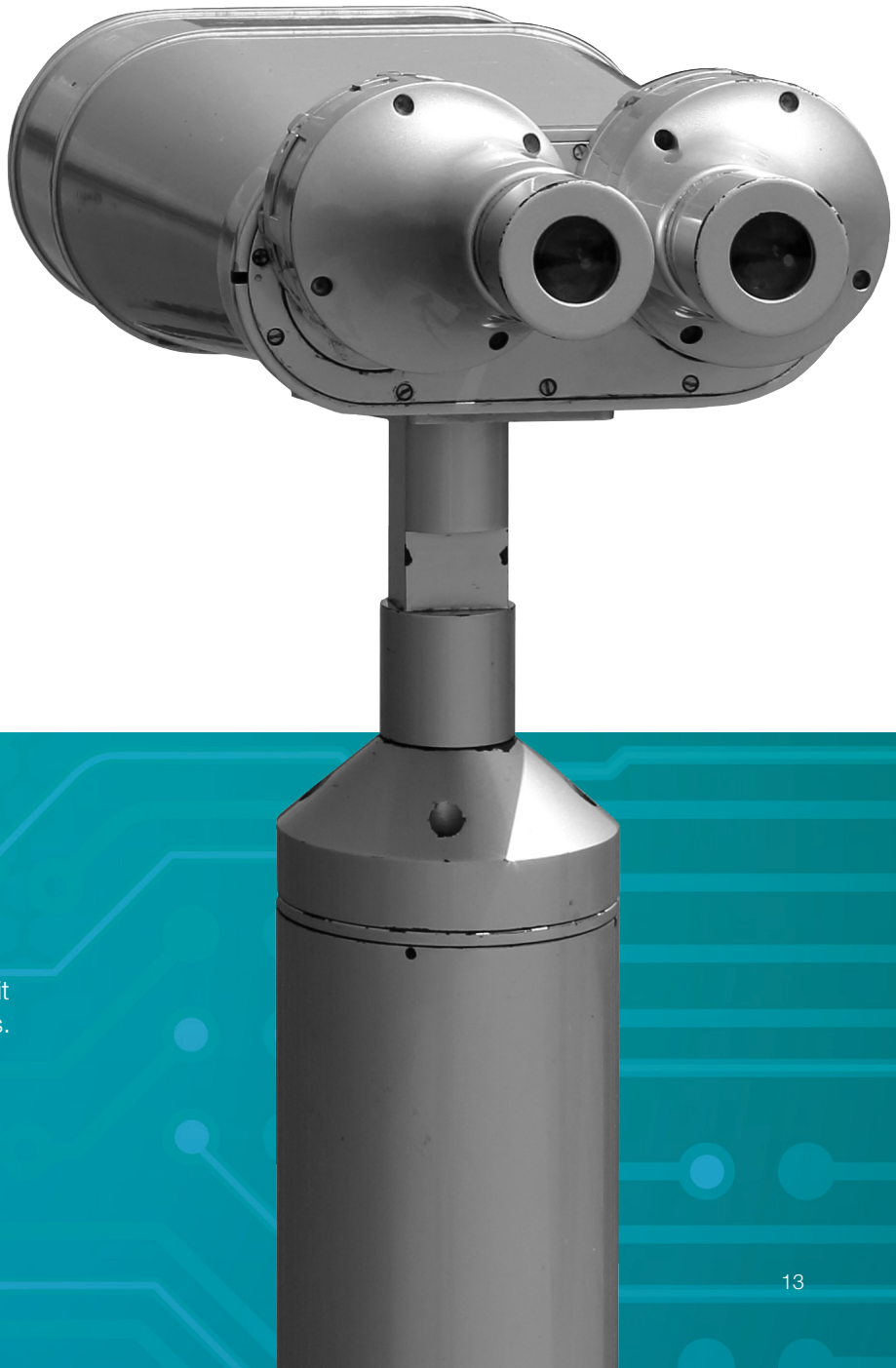
AXA UK provides general and health insurance in the UK and around the world.

Industry: Financial services
Location: London, UK
Revenue: $5.7 billion
Employee count (AXA Global): 166,000

Technology

"We have this significant amount of data and we are building models that we wouldn't have normally thought of, and a lot of machine learning scripts around everything from warranty to supply chain items."

Terry Kline
CIO, Navistar International Corporation



NAVISTAR®

Navistar International manufactures commercial trucks, school and commercial buses, and more; it also provides parts and services for diesel engines.

Industry: Manufacturing
Location: Lisle, Illinois, US
Revenue: $8.1 billion
Employee count: 12,400

The Road to Decision Automation

Getting real value from machine-made decisions will demand more than technology. Organizational and process changes, including approaches to talent, IT management, and risk, are essential.

At WellCare, Ghanayem is changing the way people work to get the most out of machine learning. “I have to pivot my organization a bit,” he says. One strategy he uses for projects involving predictive analytics and artificial intelligence is colocation, or putting members of different teams in the same physical space. “Colocation is very successful when it comes to these types of projects. I encourage teams that are going to be assembled to solve a particular problem with data analytics and predictive analytics and artificial intelligence to sit together in the same space. They have to be in an environment that encourages innovation.”

“We just don’t always have the data available by which we can prove our predictions.”

—Darren Ghanayem, CIO, WellCare Health Plans

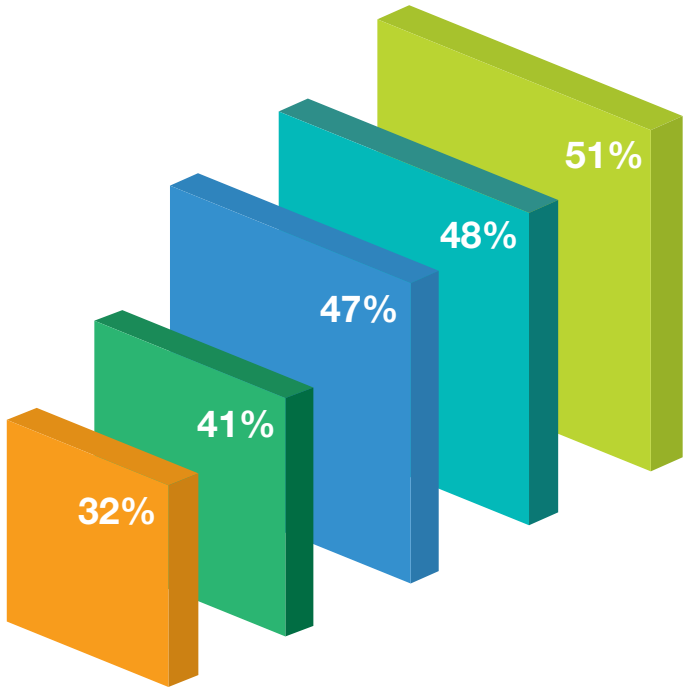
Technology is not the problem

Machine learning technology has matured to the point that it is not the primary obstacle to automation. CIOs are more likely to cite a lack of good data (51%), outdated processes (48%), and lack of funding for technology and skills (47%) as barriers to successful adoption. Just 32% cite lack of complex decision-making ability by machines as a roadblock.

Data shortfalls may occur when information is siloed across an organization, or data are not recognized yet as relevant to the sometimes mysterious decision-making processes of machines. “We just don’t always have the data available by which we can prove our predictions,” says Ghanayem. However, he expects that to change quickly. “We see growth in making more correlations than we make today. Instead of just looking at what happens from a medical event or transaction, we can correlate more environmental data, for example, with a probable outcome—correlations we haven’t really thought of today. I see us expanding the amount of data and then correlating things we do not yet consider.”

Fig. 4: Factors hindering decision automation

Q: To what extent do the following factors interfere with the adoption and maturation of automated decisions at your organization? "*A substantial barrier*" and "*A complete roadblock*" *responses combined are shown here. n=500*



Spotlight on Financial Services

Financial services firms traditionally lead other industries in technology adoption. In fact, many banks and insurers already use machine learning to analyze documents, detect fraud, and more. Financial services firms in our survey are ahead of respondents from other industries in terms of machine learning adoption. However, even these leaders still have work to do in critical areas like risk management and process change.

CIOs from financial services:

- Are more likely to say their company is moving from the automation of simple decisions to the automation of increasingly complex decisions (68%, vs. 52% of others).
- Are making substantial investments in the foundational technology for machine learning, including analytics (72%, vs. 49% of others), mobile (56% vs. 39%), IoT (48% vs. 32%), and social/collaboration (44% vs. 29%).
- Are more likely to have made organizational changes to accommodate digital labor, including redefining job descriptions to focus on work with machines (62% vs. 36%), developing a roadmap for future process changes (52% vs. 35%), and recruiting employees with new skill sets (42% vs. 25%).
- Still have work to do to improve risk management for machine learning—something that will be critical as machines take over increasing amounts of work previously done by employees. While 50% (vs. 44% of others) have developed methods for monitoring mistakes made by machines, just 18% have addressed the legal risk of mistakes made by machines, such as an algorithm that makes a wrong decision that breaks a regulation.

Automation changes business processes by definition as jobs once done by people are performed by machines, and these changes ripple across the organization. At AXA, an automated portal now provides clients with information formerly dispensed via telephone. That alters the workflow of contact center employees and brokers, upends old methods of account maintenance and reporting, and so on. These changes are managed by a specialized team that focuses on customer experiences. "It's a cultural thing inside AXA," says Potashnick. "We look at our products and we look at our online journeys and our back-office processes to continually optimize them."

A new approach to organizational design and talent is required

By automating routine tasks, machine learning will allow humans to do higher value work, and thus extend the capabilities of our workforce. However, in order to achieve this benefit, significant organizational design efforts must be undertaken.

Only

16%

have set plans for workforce size and role changes to accommodate machine learning.

In addition to these organizational changes, firms will need to attract new skills in areas such as coding, analytics, and management. But changing talent requirements remain very much a work in progress. Nearly one-third (31%) of our respondents have made no substantive changes to process and leadership. More specifically, less than half have set up programs to expand employee skill sets; 39% have redefined job descriptions to focus on work with machines; and only about one-quarter have recruited employees with new skill sets. Just 16% have set plans for workforce size and role changes, and even fewer have addressed future compliance and labor issues.

Some companies are making moves to reskill their workforces to deal with the next wave of technology. Navistar's CIO, for example, created a training course to help employees become data scientists who will be able to work more closely with intelligent machines—nearly 500 people across the company have already participated in the program. "You learn how to make data come alive and become actionable by taking these [data science] courses," says Kline. Still, in-house skills are in short supply at most companies; over half (56%) of responding companies use third parties to develop machine-learning capabilities, while 17% rely on their regular IT process. Only one-quarter have specialized teams within their organizations—generally understood to be the most effective approach—to handle development.

Spotlight on Healthcare

Machine learning will have a substantial impact on the healthcare industry, as intelligent machines promise to remake the way patients are diagnosed and treated. Healthcare CIOs are enthusiastic about the potential of machine learning and have made it a strategic focus. They lead other sectors in preparing their organizations for its adoption by optimizing business processes, updating IT structures, and enacting risk-management procedures (e.g., accounting for machine-made errors).

Yet most CIOs in this industry remain cautious. They are less likely to use machine learning across the organization and less likely to say the technology will have a positive impact on top-line growth, competitiveness, or reducing risk.

CIOs from healthcare:

- Say decisions made by machines will be more accurate than those made by humans (70% vs. 69% of others), which could change the nature of care by physicians.
- Are less likely to say their use of analytics (50% vs. 66%), mobile (32%. vs. 54%), IoT (24% vs. 36%), and process automation software (12% vs. 32%) is mature—all technologies that will be vital to using data to better diagnose and treat patients.
- Are less likely to expect value from decision automation in a number of functional areas, including security (70% vs. 80%), operations (46% vs. 58%), risk and compliance (36% vs. 58%), sales and marketing (24% vs. 45%), procurement/supply chain (12% vs. 38%), and product development (16% vs. 32%).
- Are more likely than others to say they have developed a roadmap for future process changes (44% vs. 35%)—perhaps a sign that they will catch up to other industries in the coming years.

Time to rethink business processes and risk management

Machine learning will require—and enable—new approaches to business processes that increase efficiency and improve performance. As H. James Wilson, Allan Alter, and Prashant Shukla write for the *Harvard Business Review*, "Algorithms aim to redesign business processes just like humans did during the original re-engineering movement."[8]

For example, the finance function is incorporating predictive analytics into the management of assets and other routine jobs, while marketing might build natural-language processing of social media into its next campaign. Yet most companies are just beginning this journey—36% of CIOs have developed a roadmap for future process changes, according to our survey.

Machines offer great opportunities but also introduce or magnify risks. A mistake in a routine automated process might lead to loan approvals for risky applicants, for example, with potentially disastrous effects. At a more sophisticated level, "overfitting" by machine-learning algorithms could yield inaccurate predictions on market trends or investment strategy.[9]

Still, more than one-third of our respondents have made no substantive changes to risk management policies to accommodate machine learning. Less than half have developed methods for monitoring mistakes made by machines, 38% have addressed the operational impact of such mistakes, and just 17% have addressed the legal risks of this type of error. Less than 20% have developed policies to ensure the accuracy of data. Change may be mandated: The EU, for example, is considering ethical and safety rules for robotics and artificial intelligence.[10]

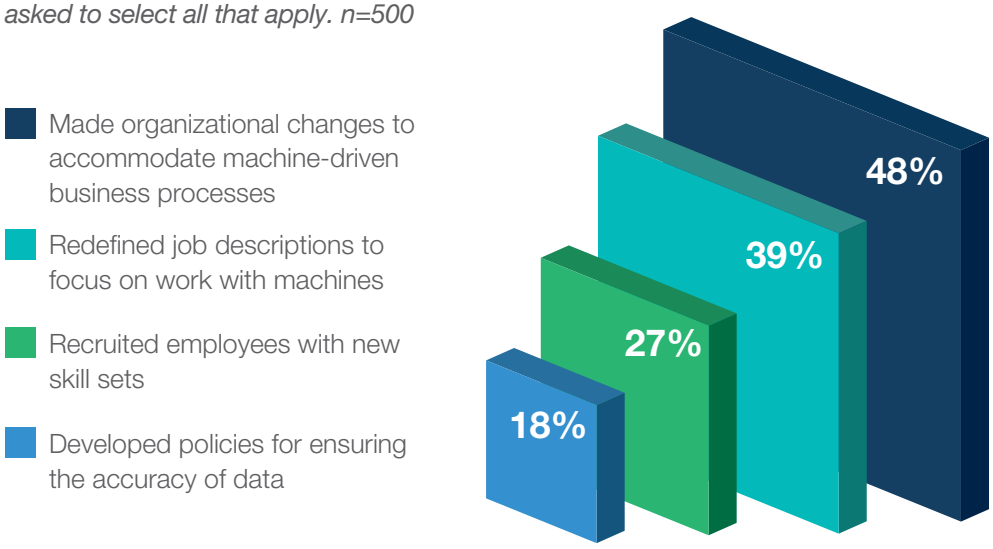
The amount of work left to be done to capture the value of automated decisions may be daunting, but should not be discouraging. These are, after all, early days. Moreover, there are technology solutions that can help companies move toward their goals. Already, a select group of companies—the first movers—are showing the way forward.

36%

of CIOs have developed a roadmap for future process changes.

Fig. 5: Machine learning requires talent and process changes

Q: Which changes, if any, has your organization made? *Respondents were asked to select all that apply. n=500*



MEET THE FIRST MOVERS

We isolated a group of respondents—just under 10% of our survey sample—who are ahead of their peers in spending on machine learning, automating business processes, making organizational changes to support digital work, and updating business processes and talent strategy. Their plans and actions provide a useful guide for CIOs to advance machine learning in their own companies.

To qualify as a "first mover," a company must be making substantial or major investments in machine learning in the next three years, and be largely or completely automating at least three of six key areas: security operations; technology vendor management; supply chain management; call center management; operations management; and customer management.

Prioritize Talent

They are more likely to have redefined job descriptions to focus on work with machines (76% vs. 35% of others); set plans for workforce size and role changes (30% vs. 15%); and to have a specialized team for developing machine learning (33% vs. 25%).

Have Better Business Processes

More have developed a roadmap for future process changes (72% vs. 33%), developed methods of monitoring mistakes made by machines (80% vs. 41%), and implemented policies for ensuring the accuracy of data (28% vs. 17%).

Think Ahead

They are concentrating on innovation (70% vs. 54%) and say automating routine processes (50% vs. 33%) and digitizing business processes (46% vs. 27%) will be important to their organization's success over the next three years.

Build Strong Technology Foundation

They report higher levels of maturity in the use of foundational technologies, including analytics (93% report substantially or highly developed capabilities in this area vs. 62% of others), cloud (96% vs. 53%), mobile (70% vs. 50%), and IoT (70% vs. 31%).

Expect Results

A large majority, 87%, expect decision automation to support top-line growth vs. 67% of others.

STEPS to Achieve Value from Machine Learning

Getting value from machine-learning investments will require substantial planning and disciplined follow-through—all while adjusting to rapid, ongoing changes in technology. Following the broad steps outlined here will ease the transition.

The role of the CIO is expanding to a strategic leadership position with the rising importance of digital transformation to enterprise competitiveness. Yet this transition leaves the CIO with a considerable to-do list. As CIOs embark on the machine learning journey, they should take the following five steps to maximize their investments.

1 **Build the foundation and improve data quality.** Our survey shows that one of the top barriers to machine learning adoption is the quality of data. If machines make decisions based on poor data, the results will not provide value and could increase risk. Given the scale of this problem, CIOs must utilize technologies that will simplify data maintenance and the transition to machine learning. For example, the mapping of business processes can, itself, be automated. Consolidating redundant, legacy, on-premises IT tools into a single data model is a good first step.

Questions CIOs need to answer at the beginning of this journey include: Have you digitized your processes so that you can capture the right data to feed machine learning algorithms? Have you identified data outside your enterprise that can enhance the quality of business decisions? CIOs must also ensure that a strong data management strategy is in place across silos of data. These first steps are critical to creating a pool of higher-quality data that machines can leverage.

2 **Prioritize based on value realization.** When building a roadmap, focus on those services that are most commonly used, as automating these services will deliver the greatest business benefits. At a high level, where are the most unstructured work patterns that would benefit from automation? What would be the productivity gains from increased automation? Where are the customer pain points? Commit to re-engineering services and processes as part of this transformation, and not simply lifting and shifting current processes into a new model.

3 **Build an exceptional customer experience.** Most companies focus on automation as a way of boosting operational efficiency and on machine learning as a means to automate. However, a core benefit of increasing the speed and accuracy of decision-making lies in creating an exceptional internal and external customer experience. That means thinking not in terms of individual interactions with customers, but the entire customer journey from beginning to end.

When creating a roadmap to implement machine learning capabilities, imagine the ideal customer experience and prioritize investment against those goals. For example, machine learning allows organizations to personalize call center interactions—and to predict what customers may want next.

4 **Attract new skills and double down on culture.** CIOs must identify the roles of the future and anticipate how employees will engage with machines—and start hiring and training in advance. The skill sets required in the machine learning enterprise are diverse and involve multiple disciplines, including engineering, data science, math, critical thinking, and problem-solving. However, the organizational changes could be uncomfortable for some. CIOs must build a culture that embraces a new working model and skills. That means establishing guidelines for executives, engineers, and front-line workers about their work with machines and the future of human-machine collaboration.

5 **Measure and report.** The benefits of machine learning may be clear to CIOs, but other C-level executives and corporate boards often need to be educated on its value. CIOs must set expectations, develop success metrics prior to implementation, and build a sound business case in order to acquire and maintain the requisite funding. For example, CIOs monitor the IT percentage of revenue, but the promise of an automated enterprise will allow them to focus on margin contribution as a measure of success. Moreover, while customer satisfaction may be measured with a net promoter score today, it may be measured more accurately by the percentage of cases that are resolved through automation and self-service in the metrics of tomorrow. Similarly, the "run vs. grow" metric used to track productivity should evolve to a percentage of work eliminated or fully automated. CIOs should also consider building automated benchmarks against peers in their industry and other companies that are of similar size.

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References

1. JPMorgan Software Does in Seconds What Took Lawyers 360,000 Hours, Bloomberg, July 2017 https://www.bloomberg.com/news/articles/2017-02-28/jpmorgan-marshals-an-army-of-developers-to-automate-high-finance
2. Worldwide Semiannual Cognitive/Artificial Intelligence Systems Spending Guide, IDC, October 2016. http://www.idc.com/getdoc.jsp?containerId=prUS41878616
3. IDC Sees the Dawn of the DX Economy and the Rise of the Digital-Native Enterprise, IDC press release, November 2016. http://www.idc.com/getdoc.jsp?containerId=prUS41888916
4. 2017 Global Digital IQ® Survey: 10th anniversary edition, PwC, 2017. http://www.pwc.com/us/en/advisory-services/digital-iq/assets/pwc-digital-iq-report.pdf
5. Singapore will spend $107m to be a force for AI in the next 5 years. It's just in time., Tech In Asia, May 2017. https://www.techinasia.com/singapore-aisg-startups
6. Robots and artificial intelligence: MEPs call for EU-wide liability rules, European Parliament News, February 2017. http://www.europarl.europa.eu/news/en/press-room/20170210IPR61808/robots-and-artificial-intelligence-meps-call-for-eu-wide-liability-rules
7. Global CISO Point of View, ServiceNow, 2017. https://www.servicenow.com/c-suite/ciso.html
8. Companies Are Reimagining Business Processes with Algorithms, Harvard Business Review, February 2016. https://hbr.org/2016/02/companies-are-reimagining-business-processes-with-algorithms
9. The Problem of Overfitting, Andrew Ng, Stanford University lecture, 2017. https://www.coursera.org/learn/machine-learning/lecture/ACpTQ/the-problem-of-overfitting
10. Robots and artificial intelligence: MEPs call for EU-wide liability rules, European Parliament News, February 2017. http://www.europarl.europa.eu/news/en/press-room/20170210IPR61808/robots-and-artificial-intelligence-meps-call-for-eu-wide-liability-rules

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