



Capitalizing on the promise of artificial intelligence

Perspectives on AI adoption from around the world

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Introduction

ARTIFICIAL INTELLIGENCE HAS evolved from an esoteric research topic—with its origins six decades ago in corporate and academic computer science labs—into a collection of powerful technologies with mainstream business promise and applicability. Deloitte’s global AI study finds that, in organizations adopting AI, more than eight in 10 leaders see AI as “very” or “critically” important to their business success in the next two years.¹ AI adoption and spending are surging globally. According to one report, 37 percent of organizations have now deployed AI—a 270 percent increase from four years ago.² Analysts project global spending on AI to top US\$35 billion in 2019 and more than double to US\$79.2 billion by 2022.³

What is driving this tremendous upswing? Many foresee AI helping to spur enormous productivity gains over the next decade, making it essential to the competitiveness of national economies.⁴ Some researchers even believe that AI is poised to become a “general-purpose technology”—one of only a couple dozen inventions in human history (including steam engines and the internet) to have pervasive effects across industries, spark complementary innovations, affect economies, and actually change societies.⁵ Technology giants with global reach are declaring “AI-first” ambitions and using AI innovations to reduce costs, increase productivity, and fuel new products and services. At the same time, nimble, AI-focused startups pose a competitive threat to traditional businesses.

Companies of all kinds across the globe increasingly regard the development of strong AI capabilities as essential to remaining competitive. National governments, too, are focusing on the economic potential of AI for their countries. Of course, AI technology adoption won’t necessarily materialize effortlessly into economic gains all around, and to fully capitalize on AI’s promise, leaders should strive to get execution and strategy right. They should first aim to understand the best use cases for their industry and particular circumstances, and then build from there. Leaders should also be aware of possible risks associated with AI and develop plans to manage them.

Recent research from Deloitte global member firms around the world—which we describe and excerpt in this report—looks at AI from a variety of perspectives. How is AI adoption playing out around the world, and how are adopters and governments viewing the potential—and risks—of AI technologies? What kinds of business benefits are adopters realizing? Are they using AI to keep up with the competition or to pull ahead? Are they using it to evolve their businesses—improving processes and products—or to transform their companies (and even industries) with innovative solutions? What are the challenges and risks that organizations confront as they create business value with AI?

Global perspectives

GIVEN AI'S TREMENDOUS potential to drive economic expansion and alter the nature of work, it's unsurprising that many nations are engaging in a new kind of space race to become AI leaders and reap the spoils. Twenty-six countries (and counting) have published national AI strategies or frameworks to foster growth, and many are backing up their ambitions by making investments, setting up programs, sponsoring research, and establishing partnerships.⁶ Many governments are also assessing how they can ensure privacy, safety, transparency, accountability, and control of AI-enabled systems without stifling innovation and the potential economic benefits.

A recent Deloitte report, *Future in the balance? How countries are pursuing an AI advantage*, provides a global view of AI early adopters, based on surveying 1,900 executive respondents from seven countries. These adopters are ramping up spending on AI technologies and reaping positive returns. They profess a growing belief that AI will be critically important to their business success—indeed, almost two-thirds of the executives report that AI technologies enable their companies to establish a lead over the competition.⁷

Globally, three-quarters of respondents agree that human workers and AI technologies will augment each other to produce new ways of working, and that AI empowers their employees to make better decisions. And augmenting and amplifying human intelligence is likely to be only the beginning: According to Deloitte Consulting's *AI-fueled organizations: Reaching AI's full potential in the enterprise*, AI is progressing toward autonomous intelligence, in which processes are digitized and automated to a level where machines and systems

can act directly upon the intelligence derived from them, without human involvement.⁸

Remarkably, a majority of early adopters within each country believe that AI will substantially transform their business within the next three years. However, as pointed out in *Is the window for AI competitive advantage closing for early adopters?*—part of Deloitte's *Thinking Fast* series of quick insights⁹—the early adopters also believe that the transformation of their industry is following close on the heels of their own AI-powered business transformation.¹⁰ Globally, there's a sense of urgency among adopters that now is the time to capitalize on AI, before the window for competitive advantage closes.

However, comparing AI adopters across countries reveals notable differences in AI maturity levels and urgency. While many nations regard AI as crucial to their future competitiveness, these comparisons indicate that some countries are adopting AI aggressively, while others are proceeding with considerable caution—and may be at risk of being left behind.

Consider Canada. At the national level, Canada is making efforts to boost the nation's AI prowess: In 2017, the government initiated its C\$125 million Pan-Canadian Artificial Intelligence Strategy to help drive research, talent development, and innovation.¹¹ Canada is home to world-class AI research institutes and thriving AI startups in cities such as Montreal and Toronto.¹² More broadly, though, at the company level, early AI adopters display a lack of urgency: Deloitte's global study found that only 5 percent of AI adopters in Canada rate AI as “critically important” to their business

today, and 27 percent expect it will be in two years—the lowest level among countries studied.¹³ Concerns around AI risks may be putting a damper on leaders' efforts; for example, 48 percent of early adopters from Canada cited “making the wrong strategic choice based on AI recommendations” as a top-three AI risk—highest among countries studied.

The recent Deloitte Canada report *Canada's AI imperative: From predictions to prosperity* highlights the importance of AI to that country's economic future and exhorts businesses to get off the sidelines. Why is there so much at stake even for a comparatively small economy such as Canada's? Because the country, the authors explain, has an opportunity to help shape the economic and social conditions surrounding AI and its applications. Canadian companies can either jump in now and help create the AI future—or wait for others to design that future to their own advantage. The report urges the nation not only to capitalize on its research, skill, and startup strengths but to begin establishing a world-class AI ecosystem.¹⁴

At the other end of the spectrum, China has a grand strategy to help build the AI future. Boldly declaring China's ambition to become the world's leading AI innovator by 2030, the Chinese government has published a national AI strategy and announced plans to invest tens of billions of dollars in AI research and development.¹⁵ In 2017, nearly half of global AI venture funding went to Chinese AI startups, outpacing US startups for the first time.¹⁶ China reportedly has the world's second-highest number of AI companies, nipping at the heels of the United States.¹⁷ According to the Deloitte global AI study, 54 percent of AI early adopters in China consider AI to be “very” or “critically” important to their business success, and that is expected to rise to 85 percent in two years—the highest level across countries studied. They are also more likely to believe AI is helping them open a sizable edge over their competition (55 percent, versus 37 percent globally).¹⁸

China faces speed bumps along its journey to AI leadership: As Deloitte's 2019 TMT Prediction *China inside: Chinese semiconductors will power artificial intelligence* explains, China is the world's leading consumer of semiconductors, but its domestic manufacturers can meet only a small portion of the nation's demand.¹⁹ Amid uncertainty brought on by international tension and worry about supply chain interruptions—and the increasing demand for specialized chips to run AI algorithms—China is making development of its own chip industry a strategic priority.²⁰ To help increase technological self-reliance and close the gap between Chinese manufacturers and global chip leaders, the Chinese government has established a state-backed semiconductor-focused fund, the “Big Fund,” which reportedly raised US\$29 billion in its second financing round in 2018, following an initial US\$21.8 billion round in 2014.²¹ Because chip industry development is a complex, deliberate process, some analysts caution that China's returns on AI investment may be lower and slower in the future.²²

Acting decisively on AI now, as some countries and early-adopter companies are, could be critical for future competitiveness. Leaders should aim to do so mindfully, balancing action with a suitable amount of caution. To capitalize on AI while also avoiding stumbling blocks, they should get two areas right: mastering execution and managing AI risks.

Mastering execution

To succeed with AI, getting execution right from a technology and organizational standpoint is critical, and mastery may take time and experience. Successful adoption requires pursuing the right use cases, developing a strong data foundation, and forging an AI strategy. Early adopters confront a set of challenges as they attempt to create business value with AI, including implementation and integration difficulties, data challenges, and

substantial shortages of AI skills. Indeed, more than two-thirds of executives who responded to the Deloitte global AI survey report moderate-to-extreme AI skill gaps.²³

Deloitte analysis has identified a group of companies that are having the most success with AI—and can provide guiding principles for other AI adopters to follow. Our report, *Seasoned explorers: How experienced TMT organizations are navigating AI*, presents a deep dive into US-based AI adopters from technology, media and entertainment, and telecommunications (TMT) companies.²⁴ Compared with their counterparts in other industries, TMT companies are spending significantly on AI technologies—and getting higher returns. Moreover, our analysis finds striking differences between a leading group of more mature AI adopters in the TMT industry—those that have implemented more AI systems and developed a high level of expertise—and those with less experience. Facing substantial job changes and a severe AI skills shortage, the “seasoned” adopters are vigorously training and educating their current workforce to succeed with AI, and seeking software developers, business leaders who can interpret AI results, and change management experts.

Curiously, the least experienced adopters, perhaps feeling that they need specialists to build every AI system from the ground up, are most eagerly searching for heavy-duty AI researchers. This is not unlike tasking oneself with designing and building an airplane before one can fly. Leaders should consider speed and ease of adoption.

With the window for competitive advantage closing quickly, not everyone has time or resources to build AI systems from scratch. Deloitte’s 2019 TMT Prediction *Artificial intelligence: From expert-only to everywhere* explains the growing popularity of AI-infused enterprise software and cloud-based AI services, both of which provide a way to develop and scale AI projects quickly, even without a strong IT infrastructure, extensive AI and data science

expertise, or deep pockets.²⁵ Large technology companies that have been at the forefront of the AI revolution are now competing with each other to make AI easier to use. In fact, cloud-based AI is beginning to democratize AI technologies, making capabilities and benefits available even to less-well-funded businesses and less-experienced adopters. This is paving the way for more widespread AI adoption. Less-experienced adopters and those still sitting on the sidelines should take note.

Managing risks

While offering the potential for great reward, emerging technologies also necessitate understanding and managing risks—and AI is no exception. Deloitte’s US-based report *State of AI in the Enterprise, 2nd edition: Early adopters combine bullish enthusiasm with strategic investments* examines potential AI risks that concern executives, including cybersecurity, legal and regulatory, and ethical risks.²⁶

There’s a growing awareness of the diverse ethical risks that AI may pose. Among the AI adopters surveyed, the top ethical worry is the power of AI technologies to help create or spread false information. A report from Deloitte Germany, *Cognitive artificial intelligence: The invisible invasion of the media business*, explains how AI technologies can themselves be used to combat textual “fake news” and violent or offensive images and videos faster and better than humans can.²⁷ Unfortunately, as *Deepfakes and AI: Questioning artificial intelligence ethics and the dangers of AI* explains, the power of AI can also be misused to create highly realistic fake images, audio clips, and videos—for example, convincingly manipulating authentic video to “put new words in someone’s mouth.”²⁸ Identifying deepfakes is currently difficult for both humans and AI, and although detection methods continue to improve, some AI researchers admit they’re currently “outgunned” in the battle.²⁹ With the potential for deepfakes to

affect elections, national security, financial markets, and even international relations, the stakes are enormous.

Another issue becoming an ethical concern for executives is the lack of explanation or audit trail for some AI-powered decision-making. Deloitte Netherlands takes a deep dive into this issue in *A call for transparency and responsibility in artificial intelligence*, advocating for “transparent AI.”³⁰ Why is it so crucial that AI results be “explainable”? For one, it allows humans to understand (and explain to others) why specific decisions have been made by AI and to assess whether they make sense. Second, explainable AI enables both technical staff and executives to understand how AI systems—which may be obtained externally, such as via open source or as a cloud service—arrive at decisions, therefore mitigating risk to the company.

Other ethical risks that concern AI adopters include unintended consequences of AI decisions, misuse of personal data, and potential bias. A recent report from Deloitte US, *Can AI be ethical? Why enterprises shouldn't wait for AI regulation*, explores this thorny ethical landscape and calls for urgency in designing approaches and mechanisms to address these risks. The report also reviews how

technology vendors, corporations, academic institutions, and governments are already laying the groundwork for ethical AI use.³¹ *AI ethics: The next big thing in government*, a perspective from Deloitte Middle East, makes the case that ethics efforts need to transcend national borders. Because of AI's potential to affect billions of people globally, the authors advocate for a global AI ethics framework: While acknowledging the complexity of developing a code of ethics that's accepted globally, they believe responsible AI development and deployment will require an international regulatory model that smartly secures AI technologies' benefits for societies and economies.³²

Finally, *AI ethics: A new imperative for businesses, boards and C-suites*, a report from the Deloitte Risk & Financial Advisory practice and the Notre Dame Deloitte Center for Ethical Leadership, puts forward the point of view that everyone involved in advancing AI—from corporate boards and management, to researchers and engineers—shares responsibility for applying ethical constructs throughout the AI product life cycle. To that end, the authors offer a framework outlining four dimensions of ethical concern that leaders may consider as their organizations design and build AI systems.³³

Industry perspectives

AI HAS ALREADY begun to transform industries. In health care, providers are using AI technologies to review radiology scans and pathology samples more accurately, accelerate drug discovery, identify who may be at risk of developing a condition, and even detect diseases at earlier stages. In financial services, firms are using AI both in the back office (to reduce risk in credit underwriting and to detect possible fraud) and in the front office (for conversational banking and personalized customer experiences). In retail, AI technologies are transforming shopping via virtual assistants and customized recommendations. Manufacturers are using AI to optimize products and processes and detect potential problems before they occur, improving performance and uptime.

Several reports offer deep dives into the use of AI in various industries. The Deloitte Digital publication *From mystery to mastery: Unlocking the business value of artificial intelligence in the insurance industry* examines the use of AI in insurance, concluding that insurance is lagging behind other industries. The industry's recent focus has been on using AI to automate repetitive tasks, thereby contributing to improved operations and customer efficacy. However, the abundance of data in insurance holds great promise for insurers to use AI as a competitive differentiator, and the authors provide an extensive list of potential future use cases for AI technologies across the insurance value chain.³⁴

The new physics of financial services: How artificial intelligence is transforming the financial ecosystem, based on more than 200 interviews with global experts, describes the great upheaval that AI is causing in that industry—affecting

operating models, disrupting competitive dynamics and strategies, and raising public policy issues. Whereas economies of scale and standardized products used to give financial institutions an edge, in the AI era, highly customized products and interactions can drive revenue. Financial institutions should adapt to new ways of acquiring and retaining customers, as well as a changing competitive landscape.³⁵

Though government agencies are adopting AI less rapidly than private sector organizations, the public sector is employing AI technologies for use cases such as virtual assistants and airline flight tracking. According to the report *AI-augmented government: Using cognitive technologies to redesign public sector work*, AI is poised to transform not only how government employees do their work but the very nature of that work. According to the authors' analysis, the US federal government could free up hundreds of millions of working hours annually by automating public sector tasks.³⁶

Finally, *Intelligent IoT: Bringing the power of AI to the Internet of Things* explores the growing importance of AI to the Internet of Things (IoT), which has applicability in a wide range of industries, including manufacturing, transportation, automotive, utilities, government ("smart cities" initiatives), and even health care.³⁷ Machine learning, an AI technology, is being used to identify patterns and aberrations in the data generated by IoT sensors and devices, and can make predictions faster than was previously possible. Companies are also using other AI technologies such as computer vision and speech recognition to rapidly derive insights from IoT data. AI is thus acting as a "force multiplier" for IoT

products and deployments, helping companies make their operations more efficient, create new products and services, avoid unplanned downtime, and improve risk management.

The following excerpts from Deloitte Global member firms' recent research provide further

insights into the state of AI in the enterprise around the globe. Taken together, these reports suggest activities and strategies for organizations to consider as they aim to fully capitalize on the promise of AI.



Future in the balance? How countries are pursuing an AI advantage

Insights from Deloitte's State of AI in the Enterprise, 2nd Edition survey

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NOTWITHSTANDING INTENSE COMPETITION among countries and companies, AI shouldn't be considered a zero-sum game. All adopters can learn from one another, and early success will likely depend on getting the execution right—from choosing the right use cases, to preparing the workforce, to managing risks and challenges.

To better understand how early-adopter companies are navigating their AI journey and how they are beginning to transform, we surveyed 1,900 executives from around the world.

Taking the global pulse of AI

Almost two-thirds of early adopters say that AI technologies are “very” or “critically” important to their business success today, increasing to 81 percent in just two years. In fact, four in 10 believe that AI will be critically important within two years. Much like the governments of the countries in which they operate, a growing number

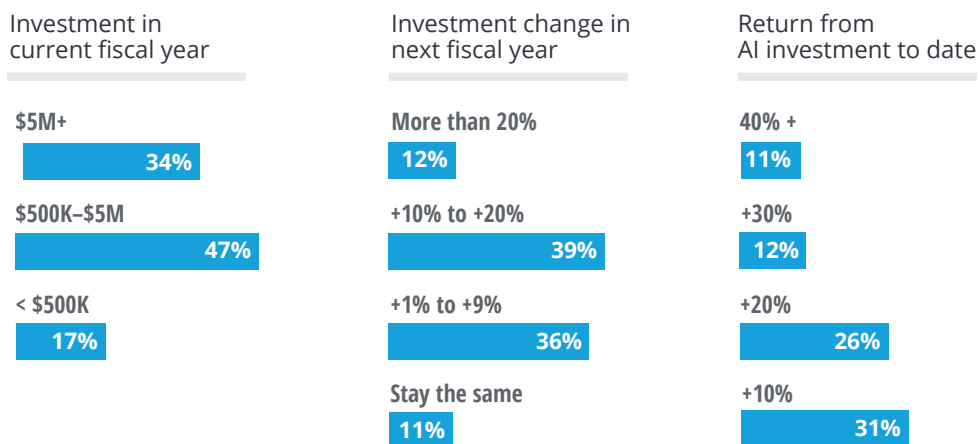
of organizations have strong feelings that AI will be essential to leading in the future.

AI early adopters are aiming to improve both their external and internal capabilities. The primary AI benefits they report are enhancing products and services (selected by 43 percent as one of their top-three benefits) and optimizing internal business operations (identified by 41 percent as a top-three benefit). Companies may choose an internal or external focus (or both), and many are pursuing a variety of use cases.

There are many estimates of total global AI spending, investment in AI startups, and the impact of AI technologies on the future economy.³⁸ Most assessments agree that the United States and China are investing the most, with members of the European Union looking to quickly catch up.³⁹ Rapid market growth is evident, and our respondents indicate they are increasingly spending on AI technologies and getting positive returns (figure 1). In fact, 51 percent expect to increase their AI investment by 10 percent or more in their next fiscal year.

FIGURE 1

Organizations are spending on AI technologies and seeing a return on their investment



Note: All dollar amounts are given in US dollars. Percentages may not total 100 percent due to not including all answer choices from all questions.

Source: Deloitte analysis based on Deloitte's AI in the Enterprise, 2nd edition survey of 1,900 AI early adopters in seven countries.

Even with a high level of excitement and willingness to invest in AI technologies, organizations are facing a set of interwoven challenges. Between 30 and 40 percent of our global sample identified the following challenges in their top three: integrating AI into roles and functions, data issues, implementation struggles, cost, and measuring the value of AI implementations.

Executives are also worried about broader vulnerabilities, with 43 percent saying they have major or extreme concerns about potential AI risks (figure 2). Topping the list are cybersecurity vulnerabilities (49 percent rated it as a top-three concern) and making the wrong decisions based on AI recommendations (a top-three concern for 44 percent). Additionally, 40 percent point to the

potential bias of AI decisions as a top-three ethical risk.

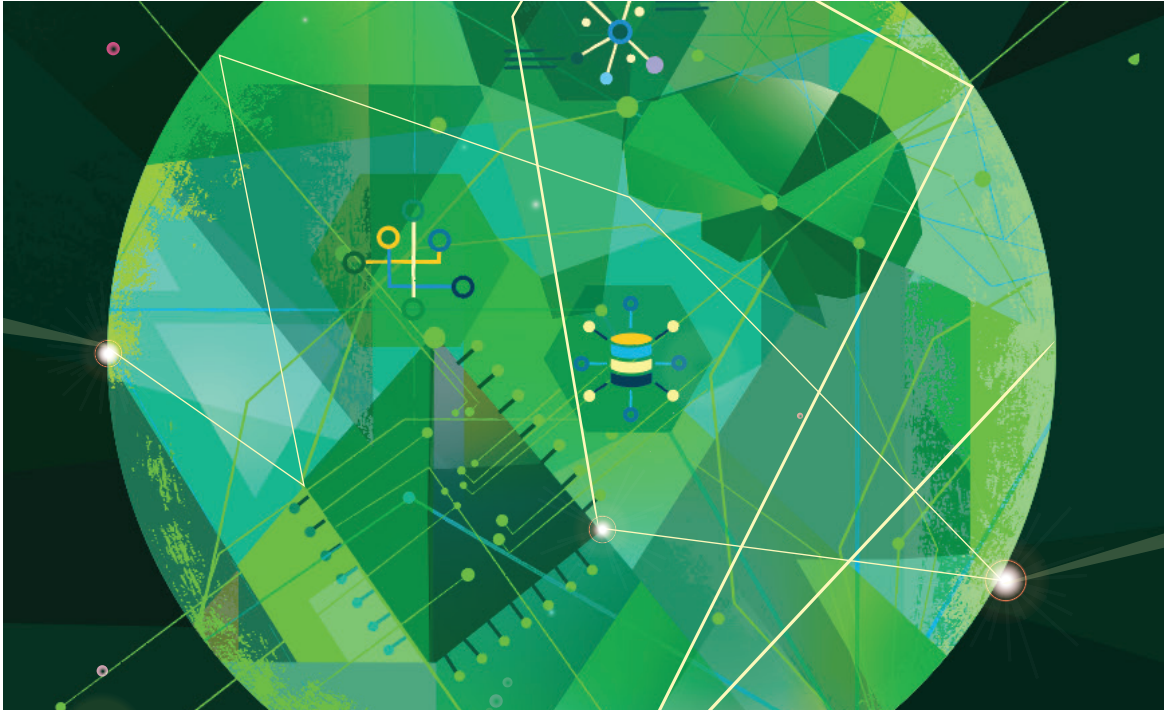
Finally, most organizations face AI skill gaps and are looking for expertise to bolster their capabilities. Sixty-eight percent of global respondents indicated moderate-to-extreme AI skills gaps, and the top-three roles needed to fill the gaps include AI researchers, software developers, and data scientists. Many companies are also looking beyond technical expertise, citing the need for business leaders who are able to interpret AI results and make decisions and take actions based on them. While organizations may believe that seeking the best external talent will provide an advantage, training their current workforce shouldn't be overlooked. AI will change the way people work, and a spectrum of skills will be needed to ensure success.

FIGURE 2

Regardless of country, many AI early adopters agree on the strategic importance of AI—and that skills gaps pose an issue

		Overall	Australia	Canada	China	France	Germany	United Kingdom	United States
Maturity	Percentage that are "Seasoned" AI adopters	21%	17%	19%	11%	16%	22%	15%	24%
	Have a comprehensive, companywide AI strategy	35%	34%	27%	46%	28%	26%	41%	37%
Urgency	Believe AI is very or critically important to company's success now	63%	56%	58%	54%	49%	46%	61%	69%
	Achieve strong competitive advantage with AI	37%	22%	31%	55%	27%	47%	44%	37%
	Believe AI will transform their business within three years	56%	51%	51%	77%	63%	60%	55%	55%
Challenges	Major or extreme concern about AI risks	43%	49%	44%	16%	48%	29%	35%	46%
	Cybersecurity vulnerabilities of AI are a top-three concern	49%	46%	42%	54%	49%	51%	44%	50%
	Moderate-to-extreme AI skill gaps	68%	72%	72%	51%	57%	62%	73%	68%

Source: Deloitte analysis based on Deloitte's AI in the Enterprise, 2nd edition survey of 1,900 AI early adopters in seven countries.



AI-fueled organizations: Reaching AI's full potential in the enterprise

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THE AI-FUELED ORGANIZATION trend is the latest in a series of technology-driven transformations that have delivered quantum leaps in productivity. At the dawn of the new millennium, cognitive technologies such as AI, machine learning, and robotics began augmenting and amplifying human intelligence, a transformation that continues to disrupt operational models and illuminate new opportunities.⁴⁰

Today, the possibility of achieving the next quantum leap in productivity propels our march toward autonomous intelligence—in which processes are digitized and automated to a degree whereby machines, bots, and systems can directly act upon intelligence derived from them.⁴¹ The human brain can decipher and derive meaning from large volumes of data, but this unique ability is limited by the amount of data our brains can absorb at any moment. Unlike the human brain, AI has no such limitation, which has the net effect of turning a trickle of business insights into a raging river of strategic possibilities. More and better insights delivered autonomously can lead to increased productivity, greater efficiency, and lower operational costs. Yet in the context of AI, these three may prove to be low-hanging fruit. Consider how autonomous AI could fuel other opportunities, including:

- **Enhanced regulatory compliance.** Despite companies' best efforts, regulatory compliance remains a moving target, due largely to the pervasive nature of human bias. While subjective opinions and differing worldviews make for interesting conversation, they also make it challenging for any two (or more) people to interpret laws and regulations the same way. This is why we have judges. Algorithms, by contrast, do not have fluid thought processes: They always interpret and execute according to the literal letter of the laws with which they're set up. By intelligently

automating compliance functions in IT systems, companies can leave human cognitive maneuverability to machine-based robotic execution, which is, ideally, free of subjectivity, bias, and mood.⁴²

- **“Mass personalization” of products and services.** Today content, products, and services are largely designed for mass consumption. In the near future, they will likely be customized based on individual users' personas, needs, wishes, and traits—an approach known as mass personalization. What's more, this degree of personalization will take place both statically and dynamically. Some companies are already working toward this goal. In the media sector, for example, Netflix is developing an AI platform that creates personalized movie trailers based on the streaming histories of individual viewers. This is one element in the company's larger content strategy for using data to inform creative decision-making around genre, casting, and plot development.⁴³
- **Asset intelligence.** Today, companies rely heavily upon human intelligence to interpret, anticipate, and intuit information in ways that machines cannot. That's about to change. In the future, the intelligence generated by data from company assets—infrastructure, IT systems, and inventory, for example—may surpass human insights as organizations' most mission-critical business intelligence. Sensors embedded in vast IoT networks, computer vision, and machine learning will feed data into analytics systems in real time. AI tools, acting autonomously on the resulting insights, can reconfigure dynamic pricing on store shelves, recalculate warehouse staffing projections, calibrate manufacturing machines, and optimize supply chains.

Indeed, organizations are using AI in innovative ways, but as the *AI-fueled* trend progresses, more companies will evolve, moving from using the technology in isolated pilots to deploying larger AI systems.



Is the window for AI competitive advantage closing for early adopters?

AI early adopters believe industry transformation is close on the heels of their own AI-powered business transformation

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IN AN ERA when everyone seems to be jockeying for an edge and looking for ways to ward off disruption, AI can be a powerful tool. Indeed, according to a recent [Deloitte global study of AI early adopters](#), almost two-thirds of executives believe AI technologies are enabling their companies to break away from the competition: Twenty-eight percent report that AI helps them “edge ahead,” while 37 percent say AI helps them “widen a lead” or even “leapfrog” ahead.⁴⁴

Perhaps it’s not surprising, then, that 57 percent of these executives believe that AI will *substantially transform* their businesses within three years (figure 3).

However, they take a more measured view of industry transformation, with 38 percent projecting that AI will substantially transform their industries within the same timeframe. AI early adopters surveyed believe time is short before industry competitors cut into the lead they’ve carved out through their AI adoption.

Do the increasingly crowded playing field and narrowing window for competitive differentiation mean that companies have missed the boat if they’re not already using AI? Not at all. In fact, cloud-based software and products and services with embedded AI are making it easier to adopt AI—even if organizations are short on funding and AI expertise.⁴⁵ Emerging tools and frameworks are helping to automate AI processes that previously required intensive efforts by AI specialists, such as machine learning model selection, configuration, tuning, and deployment.⁴⁶

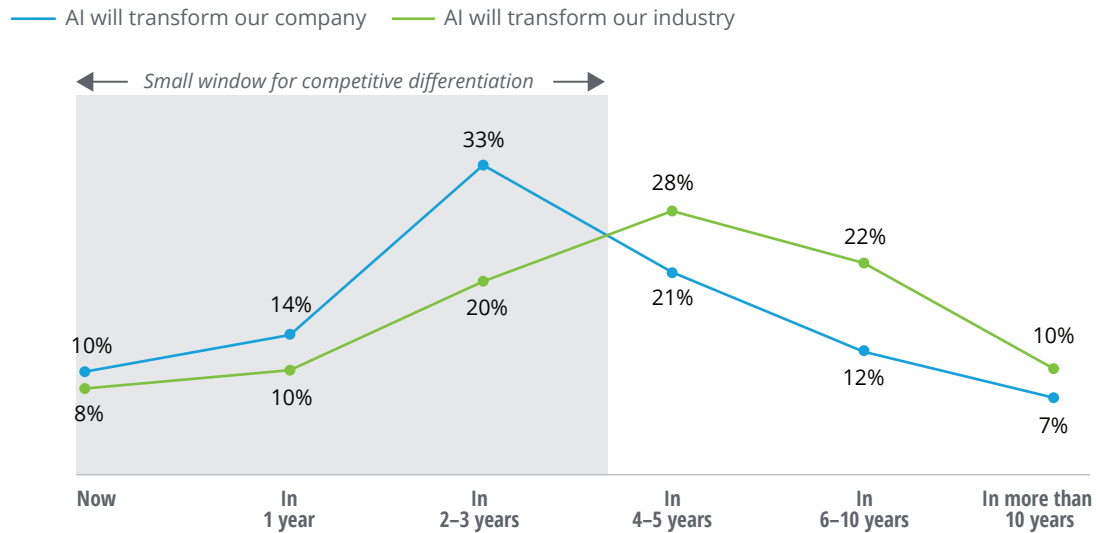
Companies already in the AI game are likely feeling a heightened sense of urgency, too: Two-thirds believe AI will transform their industry within five years. They may be able to extend their window for AI competitive advantage if they build upon their early successes, hone their execution, and scale their efforts. Early adopters should consider strengthening their AI foothold by:

- Building a solid data foundation for their company’s AI adoption—with high-quality, curated data that can be shared across initiatives
- Devising a repeatable process for moving from experimentation to full-scale AI production systems
- Expanding to other use cases. For example, if they’ve focused on optimizing internal processes, they may want to branch out to personalizing their customer experiences or enhancing their products and services with AI
- Developing an AI strategy that’s comprehensive and companywide
- Staying abreast of, evaluating, and adopting promising new AI tools and platforms as they emerge

Savvy early adopters may be able to keep their competitive momentum going, even as the AI playing field levels.

FIGURE 3

AI early adopters indicate the window for AI competitive advantage may be closing



Note: Percentages may not total 100 percent due to a small number of respondents who answered, "Don't know."

Source: Deloitte analysis based on Deloitte's State of AI in the Enterprise, 2nd edition survey of 1,900 AI early adopters in seven countries.



Canada's AI imperative

From predictions to prosperity

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AS CANADIANS, WE have the opportunity—and the responsibility—to get AI adoption right. AI adoption is expected to mark a sea change in how our economy and society operate. For government and business leaders, it's a once-in-a-generation change management exercise.

If used effectively, AI can be a tool to make progress on some of society's most persistent challenges... If left unchecked and ungoverned, AI is likely to create new problems and exacerbate others.

The race to be a leader in AI is heating up

The best way to cope with the future is to create it. Today, companies and countries that have the deepest datasets and most extensive AI infrastructures stand to surge ahead in the AI game—reaping the associated financial rewards and arguably redefining the world order. They have an opportunity to set the rules as well.

As a result, leading businesses and governments around the world are racing to capture the value that AI technologies are expected to generate. They know, based on lessons from past transformative technologies such as the development of open internet standards and connectivity standards in the mobile technology field, that early leaders shape their industries. For example, US leadership in shaping the development of 4G technology directly led to billions of dollars in economic benefit for American companies through patents and rights fees, and forced strategic competitors such as China to essentially follow the rules of engagement set by the United States.⁴⁷

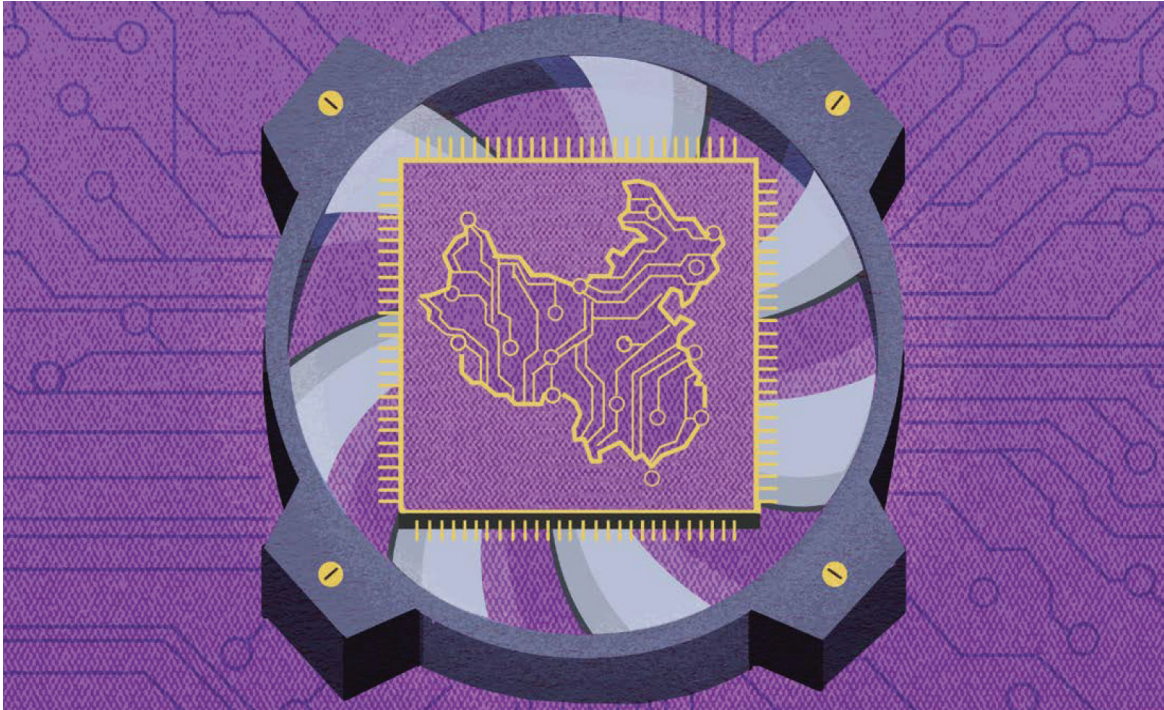
In addition to standard-setting, the uniquely data-heavy nature of AI means that being a first mover matters. Effective AI applications require large pools of data. The earlier an organization starts collecting data, the deeper its data pool becomes, which in turn results in more accurate algorithms

and better data predictions than those of its competitors.⁴⁸ This can lead to significant barriers to entry for followers as first movers may be driven to rapidly collect—and then hoard—data in specific application sectors such as search optimization, autonomous driving, or disease diagnosis.⁴⁹

All of these fields are increasingly dominated by tech giants in two countries—the United States and China—and backed by increasingly nationalistic governments.⁵⁰ If countries such as ours aren't able to step up to the plate to encourage standards and practices that favor global collaboration, it's likely the drive to hoard data will win out, stifling innovation and consumer choice over the long term. Also, if the AI field is dominated by a few select companies around the world, it's likely that Canada will miss out on the high-skilled jobs that AI will create.

Ultimately, early leaders in AI will begin carving a path toward one of two futures. One uses AI to foster unprecedented innovation, creating new discoveries, inventions, medical breakthroughs, and business use cases we can scarcely begin to imagine. The other future is one of protectionist data-ownership practices and the domination of global corporate giants that may result in unexpected consequences that governments and society may have difficulty dealing with.

In short, a great deal is at stake and Canadian companies can't afford to sit on the sidelines. As a small, open economy, our national interest lies in supporting fair competition on a global playing field with common standards that support innovation and uphold humanistic values. Having a strong voice will allow us to set the precedent for whether data is shared freely in a collaborative environment or whether it's hoarded to pit one country against another. Many have also argued that Canada—with its strong commitment to freedom, fairness, and multiculturalism—has something to offer on issues of privacy, inclusion and bias, and consumer protection.⁵¹



China inside: Chinese semiconductors will power artificial intelligence

TMT Predictions 2019

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ADVANCES IN AI are one of the driving forces for the global semiconductor industry, with an anticipated 5–6 percent growth rate over the next two decades.⁵² Computation itself is undergoing more specialization to meet the needs of AI. These trends are coming together with China's strategic efforts to develop semiconductor independence and move AI into the center of its economic future.

Many of China's largest companies are hoping to win an edge in the market for AI. Baidu, Alibaba Group Holding Ltd., and Tencent (collectively known as BAT) have a combined market capitalization of over US\$1 trillion, fielding global operations in numerous lines of business. They have invested billions in other companies, both domestically and overseas.⁵³ Indeed, the trio holds positions in more than half of China's 124 unicorn startups, including SenseTime, the world's most valuable pure-play AI company.⁵⁴ In some ways, the very existence of the BATs should be proof enough that the country can scale its technology companies to be globally competitive.

Perhaps unsurprisingly, each of the BAT entities is bringing AI capabilities into its own product and service lines.⁵⁵ Increasingly, each is making or planning to make its own custom chips for AI. Alibaba has announced a plan to build custom AI chips for inference at the edge, supporting its Internet of Things business lines in autonomous driving, smart cities, and logistics.⁵⁶ This builds on its acquisition of Chinese chipmaker C-SKY Microsystems. For its part, Baidu's Kunlun multicore chip solution is a field-programmable

gate array chipset built specifically to support its expanding cloud computing platform.⁵⁷ The chipset will likely find its way into Baidu's ambitious autonomous driving platform, Apollo. Notably, Baidu isn't getting its chips from China, at least not yet; it's using Samsung's 14 nm process.⁵⁸

In June 2017, China's State Council published the Next Generation Artificial Intelligence Development Plan, which states China's aim of becoming the world leader in AI by 2030. Along the way, the road map aims for parity with Western capabilities by 2020 and seeks major breakthroughs in AI by 2025.⁵⁹ The plan appears to be well aligned with the agendas of China's top companies, the goals of some of its largest investment vehicles, and the aims of many of its municipal projects.⁶⁰

Ultimately, for China, technological independence is about self-determination. Only a few decades ago, China was regarded as little more than the world's cheap manufacturing and assembly hub, and considered a somewhat minor global player. Since then, it has steadily moved up manufacturing's value chain. By learning from decades of manufacturing and by supporting its strongest digital businesses, China has bootstrapped its capabilities to produce some of the world's largest companies and most advanced products. It still faces considerable uncertainties due to the shifting winds of macroeconomics and the very real challenges at the edge of Moore's Law. And yet, it's harder now than ever to doubt China's potential.



Seasoned explorers: How experienced TMT organizations are navigating AI

Insights from Deloitte’s State of AI in the Enterprise, 2nd Edition Survey

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AMONG RESPONDENTS TO our State of AI in the Enterprise, 2nd Edition survey, we uncovered a group of “Seasoned” adopters in the technology, media & entertainment, and telecommunications (TMT) industry possessing both significant AI expertise and a comparatively large number of production deployments.

They recognize the potential transformative impact of AI on their workforce. More of the experienced organizations feel that AI is already shifting job roles and skills in their company, and they are addressing the changes. The vast majority feel that AI will improve decision-making, enhance job performance and satisfaction, and produce a more synergetic relationship between humans and technology.

Preparing the crew

Inadequate talent and skills often hinder AI adoption. It’s clear that the Seasoned, with their greater overall maturity, have had some success in developing an AI-savvy staff. Despite this, the Seasoned are still twice as likely as the other segments to report a severe AI skills gap. Nearly half of the Seasoned report a major or extreme skills gap in meeting the needs of their AI initiatives, compared with only a quarter of the Skilled and Starters (the less experienced adopters). It appears that the more AI projects the Seasoned undertake, the more acutely they feel the need for AI-related skills.

Companies need a broad range of skills to implement their AI initiatives, and groups at different points in their journey need different kinds of skills. The No. 1 role that Seasoned adopters seek is software developers. This is followed closely by a need for business leaders who

can interpret AI results and take actions based on them, and by change management experts who can implement strategies to help people adapt to the organizational changes that AI is bringing. This suggests that Seasoned adopters are turning their attention to integrating AI solutions fully into their business.

The Skilled group is still focused on the technical aspects of AI, looking most for software developers and project managers. And the Starters are seeking AI researchers to invent new kinds of AI algorithms and systems. Less mature adopters may feel as though they need to build every AI project from the ground up using AI specialists. However, they could do well to look at AI-enabled enterprise software that they can deploy out of the box, as well as cloud-based AI services, both of which could allow them to do more with their current workforce.

There is little doubt that AI is already causing significant workforce changes in AI-savvy companies, and that these changes are likely to sweep through more companies as AI adoption grows. Six in 10 of the Seasoned report that AI has already substantially changed job roles and skills at their companies, while just four in 10 Skilled and two in 10 Starters say the same. Despite the potential disruption, the majority believe that AI technologies will have a positive effect on employees and newly added talent.⁶¹

Seasoned executives in particular are overwhelmingly optimistic: Ninety-two percent agree that AI empowers their employees to make better decisions, 96 percent believe AI will enhance employee job performance and satisfaction, and 90 percent say that human workers and AI will augment each other, encouraging new ways of working.

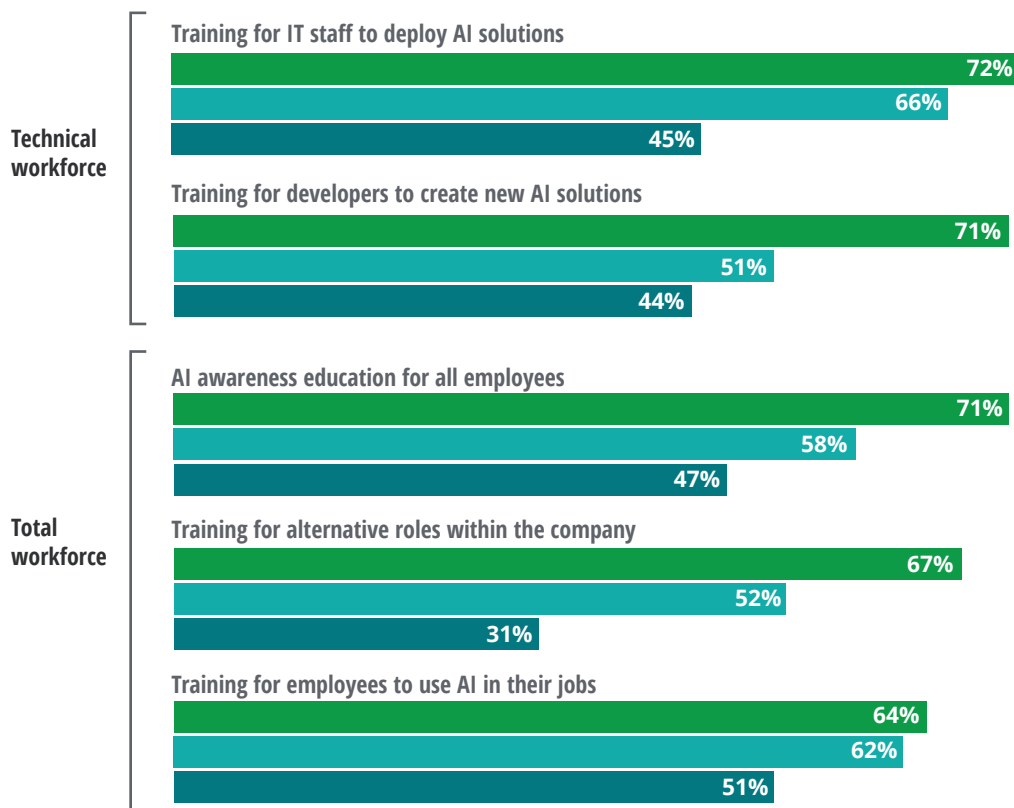
A recent Deloitte human capital trends report notes that, despite increasing clarity around the skills needed in a world where humans work side by side with machines, roughly half of respondents have no plan in place to cultivate these skills.⁶² There are some strong indications that the TMT AI adopters are approaching workforce training seriously and taking action (figure 4). Seven in 10 of the

Seasoned organizations are training their developers to create new AI solutions, and also training IT staff to deploy those solutions. The Seasoned organizations are aggressively educating their nontechnical workforce as well—two-thirds are training employees to take on alternative roles within the company, and nearly two-thirds are showing employees how to use AI in their jobs.

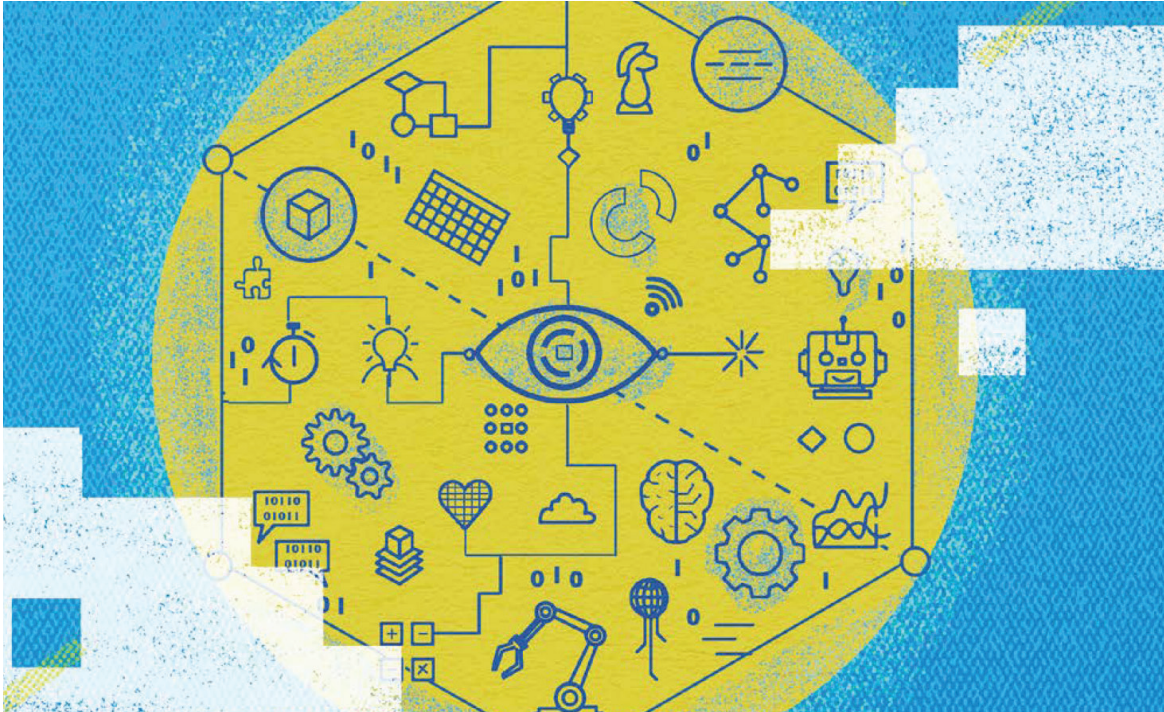
FIGURE 4

The Seasoned are focused on training for a world in which humans work side by side with AI

■ Seasoned ■ Skilled ■ Starters



Source: Deloitte analysis based on Deloitte’s State of AI in the Enterprise, 2nd Edition survey. N = 266 respondents who represent US TMT companies adopting AI.



Artificial intelligence: From expert-only to everywhere

TMT Predictions 2019

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A I'S INITIAL BENEFITS have accrued mainly to pioneers with the required technical expertise, strong IT infrastructure, and deep pockets to acquire scarce and costly data science skills—most notably the global “tech giants.”⁶³ They have the resources to engage in bidding wars for increasingly expensive AI talent.⁶⁴ They have also invested billions in infrastructure, including massive data centers and specialized processors.

The few are bringing AI to the many

These tech giants are using AI to create billion-dollar services and to transform their operations. We see Amazon, Google, Microsoft, and China’s BATs launching AI development platforms and stand-alone applications to the wider market based on their own experience using them. Joining them are big enterprise software companies that are integrating AI capabilities into cloud-based enterprise software and bringing them to the mass market. A host of startups is also sprinting into this market with cloud-based development tools and applications.

These innovators are making it easier for more companies to benefit from AI technology even if they lack top technical talent, access to huge datasets, and their own massive computing power. Through the cloud, they can access services that address these shortfalls—without having to make big upfront investments. In short, the cloud is democratizing access to AI by giving companies the ability to use it now.

The easy path: Enterprise software with an AI infusion

Deloitte’s global survey of AI early adopters showed that the most popular path to acquiring AI capabilities is also the easiest: enterprise software with integrated AI. Overwhelmingly, this software is cloud-based, either through public or private cloud deployments. Fifty-eight percent of our survey respondents globally are currently using this approach. Deloitte Global estimates that by 2020, about 87 percent of AI users will get some of their AI capabilities from enterprise software with integrated AI (figure 5).⁶⁵

On the one hand, companies don’t need to worry about whether a use case exists; the AI they buy has been developed specifically to address specific business functions. On the other hand, these solutions offer limited customization.

AI development services: A faster track to customized solutions

That’s where cloud-based AI development services come in.⁶⁶ These include services for creating new AI applications, selecting the right models, and for getting a head start on higher-order AI technologies such as natural language processing and computer vision.

Unlike enterprise software that has AI “baked in,” AI development services require companies to have in-house technical talent, such as AI programmers and data scientists. These services can help companies get the most out of their technical talent

by providing access to tried-and-true models and by accelerating key processes. In other words, they allow companies with some technical AI expertise—but not enough to develop their own AI services, or to develop them fast enough—to create a higher volume of AI services, and at scale.

Deloitte Global predicts that companies will accelerate their use of cloud-based AI software

and services, and estimates a penetration rate of 83 percent among AI-adopting companies by 2020 (figure 5).

We'll see the democratization of AI capabilities—and benefits—that had heretofore been the preserve only of businesses with substantial resources.

FIGURE 5

Early adopters have their heads in the cloud

Cloud enterprise software + AI



Cloud AI development services



Source: Deloitte analysis based on Deloitte's State of AI in the Enterprise, 2nd Edition survey of 1,900 AI early adopters in seven countries.



State of AI in the Enterprise, 2nd Edition

Early adopters combine bullish enthusiasm
with strategic investments

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To maximize value, early adopters should become risk and change management experts

Executives from Deloitte’s State of AI in the Enterprise, 2nd Edition Survey of 1,100 AI early adopters in the United States are concerned about a host of risks associated with AI technologies (figure 6).

Cyber risk

Chief among the AI risks that concern executives are cyber risks, which ranked as a top-three concern for half of our survey respondents. In fact, 23 percent of respondents ranked “cybersecurity vulnerabilities” as their No. 1 overall AI/cognitive concern. This apprehension is probably well placed: While any new technology has certain

vulnerabilities, the cyber-related liabilities surfacing for certain AI technologies seem particularly vexing.

Researchers have discovered that some machine-learning models have difficulty detecting adversarial input—that is, data constructed specifically to deceive the model. This is how one research team fooled a vision algorithm into classifying as a computer what appeared to be a picture of a cat.⁶⁷ The process of training machine-learning models can itself be manipulated with adversarial data. By intentionally feeding incorrect data into a self-learning facial recognition algorithm, for instance, attackers can impersonate victims via biometric authentication systems.⁶⁸ In some cases, machine-learning technology may expose a company to the risk of intellectual property theft. By automatically generating large numbers of interactions with a machine learning–based system and analyzing the patterns of

FIGURE 6

Cybersecurity heads the lists of AI-related concerns

Potential AI risks of top concern to companies: Ranked 1–3, where 1 is greatest concern

	Ranked 1	Ranked 2	Ranked 3	Ranked top three
Cybersecurity vulnerabilities of AI	23%	15%	13%	51%
Making the wrong strategic decisions based on AI	16%	13%	14%	43%
Legal responsibility for decisions/actions made by AI systems	11%	15%	13%	39%
Failure of AI system in a mission-critical or life-or-death context	13%	14%	12%	39%
Regulatory noncompliance risk	12%	15%	10%	37%
Erosion of customer trust from AI failures	11%	11%	11%	33%
Ethical risks of AI	10%	12%	10%	32%

Source: Deloitte analysis based on Deloitte’s State of AI in the Enterprise, 2nd Edition survey. N = 1,100 AI early adopters in the United States.

responses it generates, hackers could reverse-engineer the model or the training data itself.

Executives are commonly concerned about the safety and reliability of AI systems as well. Forty-three percent of respondents rated “making the wrong strategic decisions based on AI/cognitive recommendations” as a top-three concern. Nearly as many cited failure of an AI system in a mission-critical or life-or-death situation. Placing strategic decisions or mission-critical actions entirely in the hands of an AI system would certainly entail special risks. Entrusting AI systems with such responsibilities remains rare today, however. A prominent exception is the use of AI in autonomous vehicles: The technology has been implicated in several accidents, some fatal, during testing.⁶⁹

Another element of cyber risk that companies should consider is how much data—and what kind of data—they are willing to put into public cloud environments, allowing them to use cognitive technologies to analyze much larger datasets than private clouds.

Legal and regulatory risks

Four in 10 survey respondents indicate a high degree of concern about the legal and regulatory risks associated with AI systems. Because not all methods of validating AI systems’ accuracy and performance are reliable, companies will need to manage the legal, regulatory, and operational risks associated with these systems. Complicating matters are questions surrounding who can be held liable in the event of an AI-related crime or mishap. How liability is assigned in these cases is a topic of ongoing discussion.⁷⁰

Two themes are particularly salient when it comes to AI and regulatory risk: privacy and “explainability.” Because data is so critical to AI, companies seeking to apply the technology are

often hungry for the stuff. Privacy regulations governing personal data may dampen their appetite, though: The General Data Protection Regulation (GDPR), which has recently come into force in Europe, sets privacy rules that require careful implementation. GDPR also mandates that companies using personal data to make automated decisions affecting people must be able to explain the logic behind the decision-making process.⁷¹ Guidance published by the US Federal Reserve (SR 11-7) affects US banking similarly: It requires that the behavior of computer models be explained.⁷² What makes these regulations challenging for some AI adopters is the growing complexity of machine learning and the increasing popularity of deep-learning neural networks, which can behave like black boxes, often generating highly accurate results without an explanation of how these results were computed. Many tech companies and government agencies are pouring resources into improving the explainability of deep-learning neural networks.⁷³

Ethics and reputation

In a deeper look at potential ethical risks, surveyed executives revealed a wide range of concerns. At the top of the list is AI’s power to help create or spread false information. This may be due to the attention that social-media-driven “fake news” received in the 2016 US elections.

There is one concern that has achieved special prominence in recent years, and ranked second among our respondents’ ranking of ethical risks: bias. Today, algorithms are commonly used to help make many important decisions, such as granting credit, detecting crime, and assigning punishment. Biased algorithms, or machine-learning models trained on biased data, can generate discriminatory or offensive results. For example, one study found that ads for high-paying jobs were shown more often to men than to women.⁷⁴



Cognitive artificial intelligence: The invisible invasion of the media business

Fight against fake news and offensive content

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FAKE NEWS AND offensive content (for example, violence and nudity) continue to be topics of great relevance for most media companies. Fake news has become such a concern for society that, for example, Facebook launched a national print advertising campaign against fake news in the United Kingdom and other European countries to educate the public ahead of political elections.

The problem arises when too much information is shared at a high frequency through the internet, thereby not leaving enough time for a manual review. As a result, and in absence of working and mature content monitoring solutions, companies such as Facebook hire more and more employees to review and fact-check content to prevent inappropriate information from going viral and avoid punitive fines. This is, however, not a long-term solution because, as the volume of data grows rapidly, the manual handling of misinformation and inappropriate content would at some point become prohibitively expensive. Manual fact-checking also introduces bias into the screening process, as it is nearly impossible to prevent personal views, opinions, and beliefs of team members influencing their judgment. In addition to fake news, there is also the fight against offensive material posted on social media and manually flagged and reported by users.

Currently, it takes quite a long time until these items are removed. However, pressure is building. The German parliament for instance recently adopted the “Netzwerkdurchsetzungsgesetz,” or “Facebook law,” as it is commonly called, which introduces fines of up to 50 million euros if problematic content is not removed fast enough.

Cognitive AI can assist with ensuring data veracity, identifying fake news, and automating the censorship or deletion of such content intelligently. In the digital era, not only social media companies, but also traditional (news) media companies can use cognitive technologies to detect inappropriate

content, helping them remain credible and trustworthy.

AI-based solution

With cognitive technology, media companies can more effectively identify fake news and content displaying violence or nudity.

1. One can start by using natural language processing (NLP) techniques to extract information from a text, be it an article or a post on a social media platform. A classification model helps identify the general topic(s) a text is about and whether or not a text is clickbait. The latter would work similar to how spam mail is identified. Other techniques can be used for information extraction, which is basically about extracting structured data from a text.

There are many different techniques for performing text classification. A simple one would be an unsupervised machine learning technique called k-means clustering applied to a collection of sample texts, which would then group those texts that are most similar into distinct groups. As this is a technique for unsupervised learning, the engineer would have to look at the resulting groups and assign them names (for example, appropriate and not appropriate). The resulting model can then be used to classify new text. Of course, this is a very limited approach; much better yet more complex methods exist.

2. In case a text comes with a picture or video, which technically is just a sequence of pictures, one can use a model for image classification to identify its content. Facebook, for instance, uses neural networks to add tags about the content of a photo to every photo that is uploaded. If a tag is regarded as problematic, the photo/video can simply be removed. To build such a model, one would first have to

create a database containing many labeled pictures which actually contain the unwanted content. Using machine learning, these can then be used to train a model (for example, a neural network), which screens every picture posted on a website. The same principle applies to videos but requires much more data processing power.

3. In a next step, the information extracted from the content in previous processing steps can be used for fact-checking, which could be simply done by comparing the now structured information with information from fact databases or comparing the information with information extracted from reliable sources.

The use of cognitive AI allows media companies to fight fake news and violent content more effectively and with higher reliability. It can support editors and journalists in making informed decisions about publishing a specific piece of content, as it has the power to cope with the vast amount of data and search the whole internet for proof to verify a piece of content, while also eliminating political and emotional judgment human beings have on certain topics. The main benefits of cognitive AI in the fight against fake news come mainly in two forms: (1) cost saving from eliminating time-consuming fact checks, so editors and journalists can focus on their main work, and (2) higher trustworthiness.



Deepfakes and AI

Questioning artificial intelligence ethics and the dangers of AI

[Download the publication >](#)

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A I IS GETTING easier for nonexperts to use. Some AI services and apps now feature intuitive user interfaces and drag-and-drop functionality—a far cry from hard-core coding. These innovations put powerful capabilities in the hands of companies and are contributing to the increase in AI pilots and implementations.⁷⁵

There's a downside to the spread of these tools, however. Humans have a knack for using technology for ill, as well as good. This is certainly true of AI. Using open source AI tools, anyone can make “deepfakes”—highly realistic fake images and videos—with a few mouse clicks. Whether for mischief or malice, it's easy to create a video in which a corporate executive or politician appears to say something inflammatory. Realistic video forgeries can take “fake news” to new levels of believability and viral reach.

According to Deloitte's [State of AI in the Enterprise Survey, Second Edition, 2018](#), executives who understand AI best—early adopters—believe that the use of AI to create falsehoods is the top ethical risk posed by the technology.

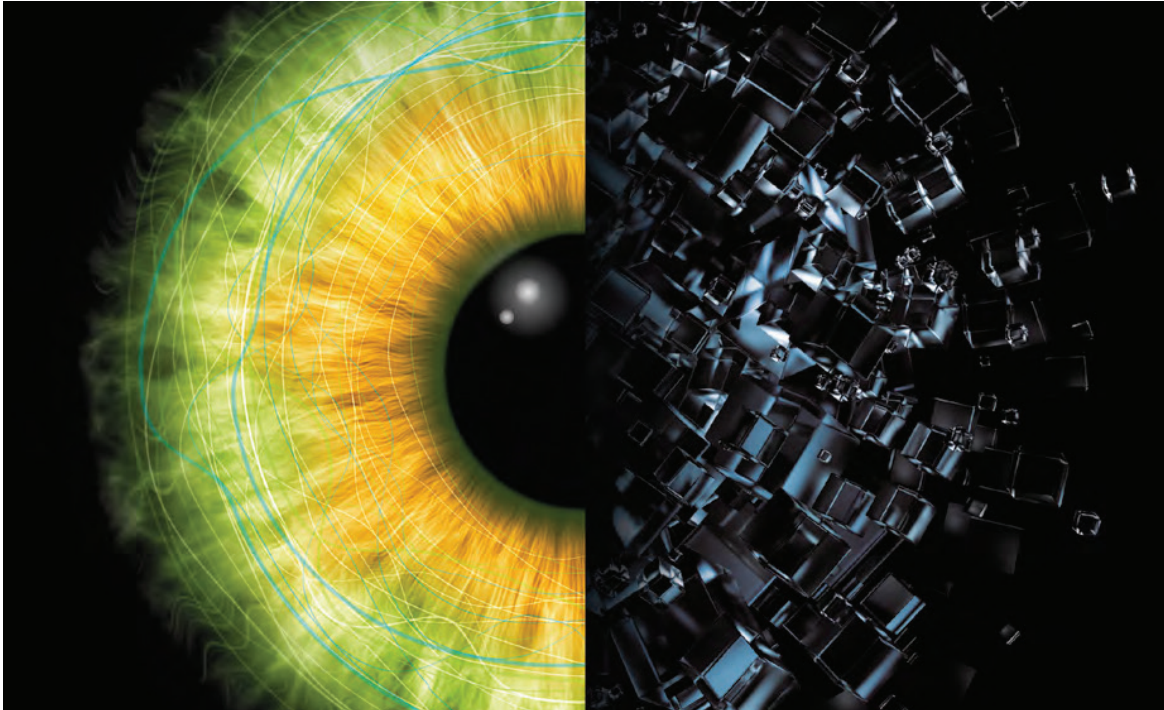
We have seen numerous examples of how *authentic* videos of executives and employees behaving badly can harm a company's public perception and stock price. One can imagine the negative impact when deepfake videos, which are *designed* to provoke anger and derision, go viral.

There is also legal liability to consider. Tech and media companies could be held responsible for “fake news” and other purposely misleading content by governments.⁷⁶ Fearing censorship, many citizens want tech companies rather than governments to take the lead in fighting fake news.⁷⁷ In fact, it may take a partnership between the two. Social networks and search firms have signed a “code of conduct” developed by the European Commission, pledging to detect and remove false information.⁷⁸ This can be tricky, especially with deepfake videos.

The Eagles once proclaimed, “There ain't no way to hide your lyin' eyes.” Indeed, new approaches are emerging that can separate fact from fiction. Using deep learning, researchers have found a method of detecting when an image has been manipulated. On most deepfake videos, the subject does not blink his or her eyes as frequently as a person normally would. An algorithm can be used to determine whether a person in a video blinks normally, and to weed out the fakes.⁷⁹

“Similar to how venom is used to produce an anti-venom, AI can be used to combat the misuse of AI,” notes Paul Silverglate, partner, Deloitte & Touche LLP's Advisory leader for Technology, Media & Telecommunications.

Undoubtedly, deepfakers will soon find new ways to mask their venomous methods. It will likely be up to AI to continually unmask them, so the public can see the truth.



A call for transparency and responsibility in artificial intelligence

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ONE REASON WHY people might fear AI is that AI technologies can be hard to explain, says Evert Haasdijk, a senior manager at Deloitte Netherlands with more than 25 years of experience in developing AI-enabled solutions. But AI doesn't have to be as opaque as it may seem. The proverbial "black box" of AI can be opened, or at least, it is possible to explain how AI models get to a decision. The point of transparent AI is that the outcome of an AI model can be properly explained and communicated, says Haasdijk. "Transparent AI is explainable AI. It allows humans to see whether the models have been thoroughly tested and make sense, and that they can understand why particular decisions are made."

There are a couple of reasons to pursue transparent AI. An important one is that companies need to understand the technologies they use for decision-making. As obvious as this sounds, it is not always a given. "The boardroom and higher management of a company are often not really aware what developers in the technical and the data analytics departments are working on," says Haasdijk. "They have an idea, but they don't know exactly. This causes risks for the company."

Paradoxically, as open source AI models are becoming more user-friendly, there might be more AI applications built by people who do not completely understand the technology. "There are open source models that are very easy to use. Someone might feed it with data, and get a result, without really understanding what is happening inside the model and comprehending the possibilities and limitations of the outcomes," says Haasdijk. "This can cause a lot of problems in the near future. A risk of AI becoming more user-friendly and more widely available is that someone in a company might be using AI irresponsibly, and not be aware of it—let alone their bosses knowing about it."

It can be hard for companies to keep track of all the AI models that are used within their organization,

says Haasdijk. "A bank recently made an inventory of all their models that use advanced or AI-powered algorithms, and found a staggering total of 20,000." Some of these algorithms, such as capital regulation models, are under strict scrutiny from regulators. But in most cases, advanced or AI-powered algorithms are not subject to any kind of external and internal regulation—think of algorithms used in marketing, pricing, client acceptance, front office, or automated reports. "Transparent AI can help companies to regain control over the variety of AI models that are deployed in their organization," Haasdijk says.

Transparent AI can give organizations more insight into when and why AI algorithms make mistakes, and on how to improve their models accordingly. "AI models do make mistakes—in many instances they make fewer mistakes than humans, but still, you want to know when and why that happens," says Haasdijk. "Take the example of the self-driving car that hit a lady who was walking with her bike, because the algorithm misjudged the situation. It is essential that companies understand when and why mistakes like these happen, to avoid similar accidents in the future."

Finally, transparent AI can help organizations to explain individual decisions of their AI models to employees and customers. And that's not all that customers expect from the organizations; with the GDPR ruling that recently came into force, there is also regulatory pressure to give customers insight into how their data is being used. "Suppose a bank uses an AI model to assess whether a customer can or cannot get a loan," says Haasdijk. "If you deny a loan, the customer probably wants to know why that decision has been made, and what they need to change in order to get the loan. That means the bank must have a thorough understanding of how their AI model reaches a decision, and to be able to explain this in clear language. 'Computer says no' is not an acceptable answer."



Can AI be ethical?

Why enterprises shouldn't wait for AI regulation

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GOVERNMENTS, TECHNOLOGY VENDORS, corporates, academic institutions, and others have already started laying the foundation for ethical AI use.

Many of the technology vendors creating AI tools and platforms are also at the forefront of ethical AI development efforts. Major technology companies including Google and IBM have developed ethical guidelines to govern the use of AI internally as well as guide other enterprises.⁸⁰ For instance, while releasing its ethical guidelines, Google pledged to not develop AI specifically for weaponry, or for surveillance tools that would violate “internationally accepted norms.”⁸¹ Additionally, many technology vendors have launched or open-sourced tools to address ethical issues such as bias and lack of transparency in AI development and deployment. Examples include Facebook’s Fairness Flow, IBM’s AI Fairness 360 and AI OpenScale environment, and Google’s What-if tool.⁸²

Governments and regulators have already begun to play a crucial role in establishing policies and guidelines to tackle AI-related ethical issues. For instance, the European Union’s General Data Protection Regulation (GDPR) requires organizations to be able to explain decisions made by their algorithms.⁸³ This is just an example from the growing list of national governments—such as the United States, the United Kingdom, Canada, China, Singapore, France, and New Zealand—that have released AI strategies, road maps, or plans focusing on developing ethical standards, policies, regulations, or frameworks.⁸⁴ Other notable government initiatives include setting up AI ethics councils or task forces, and collaborating with other national governments, corporates, and other

organizations.⁸⁵ Though most of these efforts are still in initial phases and do not impose binding requirements on companies (with GDPR a prominent exception), they signal growing urgency about AI ethical issues.

Universities and research institutions are playing an important role as well. Not only do they educate those who design and develop AI-based solutions—they are researching ethical questions and auditing algorithms for the public good. A number of universities, including Carnegie Mellon and MIT, have launched courses dealing specifically with AI and ethics.⁸⁶ MIT also created a platform called Moral Machine⁸⁷ to crowdsource data and effectively train self-driving cars to respond to a variety of morally fraught scenarios. Indeed, ethics was a central theme at the recent launch of MIT’s new Schwartzman College of Computing.⁸⁸ Moreover, academics are getting seats on AI governance teams at many technology companies and other enterprises as external advisers to help guide the responsible development of AI applications.⁸⁹

Consortia and think tanks are bringing together technology companies, governments, nonprofit organizations, and academia to collaborate on a complex and evolving set of AI-related ethical issues, leverage each other’s expertise and capabilities, and simultaneously build the AI ecosystem. One such consortium is the Partnership on AI, which counts 80-plus partner organizations.⁹⁰ Companies across sectors are working to adopt ethical AI practices such as establishing ethics boards and retraining employees, and professional services firms are guiding clients on these issues.⁹¹



AI ethics: The next big thing in government

Anticipating the impact of AI ethics within the public sector

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Is a global AI ethics framework the solution?

AI will radically transform and disrupt our world, but right ethical choices for AI can make it a force of good for humanity. Until governments, business sector, and academics start thinking about bringing codes of ethics into the AI discussion, there is no anchor for the AI disruption. We think there is a need for setting up global AI ethics standards. Codes of ethics for expert bodies have broader national or global context. An international regulatory model is essential for the responsible design, development, and deployment of AI. For instance, there are global health standards such as Health Level Seven that provide a wider context for policies around health standards. AI posits challenges that have the potential and breadth to affect the lives of billions of people around the world. The current challenge is to build a code of ethics for AI that has global reach and is acceptable internationally. The complexity of such a task goes without saying.

Currently, we do not have a mature, global-standards body to help shape global governance of AI. Given that public sector organizations are aligned on the “common good” principle, these entities are best placed to come up with standards of ethics for AI that are beneficial for all. At the same time, no single organization or institution is capable of shaping the governance guidelines for AI, given that we also have to consider ethics that are sensitive to local variations. This is why the role of a global consortium, comprising multiple

government entities, will be essential to provide a global reference for AI ethics.

Finally, there are three principal policy recommendations for developing an effective global code of ethics for AI:

Building relationships with the AI stakeholder community. No single organization or policymaking entity can address issues around AI ethics. Governments and public sector organizations have to reach out to external AI stakeholders—i.e., other governments, institutions—to build partnerships for developing effective codes of ethics.

Utilizing existing governance levers. Governments and public sector organizations are well advised to acknowledge the fact that standard professional ethical codes are limited to address matters around AI governance. Public sector policymakers have a range of strategic tools available to integrate AI ethics into existing governance structure, including explicitly making AI code of ethics and standard setting part of business process improvement and extending governance platforms by including AI stakeholders and practitioners in the governance bodies.

Creating AI awareness at institutional level. There is a general lack of awareness at all levels about how AI will affect our lives and work. Governments have to play an active role in creating institutional awareness around AI, focusing on technology, governance, legal aspects, and value at stake for AI.



AI ethics

A new imperative for businesses, boards,
and C-suites

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Considerations for carrying out AI ethics

Conceptually, AI ethics applies to both the goal of the AI solution, as well as each part of the AI solution. AI can be used to achieve an unethical business outcome, even though its parts—machine learning, deep learning, NLP, and/or computer vision—were all designed to operate in an ethical way. For example, an automated mortgage loan application system might include computer vision and other tools designed to read handwritten loan applications, analyze the information provided by the applicant, and make an underwriting decision based on parameters programmed into the solution. These technologies do not process such data through an ethical lens—they just process data. Yet if the mortgage company inadvertently programs the system with goals or parameters that discriminate unfairly based on race, gender, or certain geographic information, the system could be used to make discriminatory loan approvals or denials.

In contrast, an AI solution with an ethical purpose can include processes that lack integrity or accuracy toward this ethical end. For example, a company may deploy an AI system with machine learning capabilities to support the ethical goal of nondiscriminatory personnel recruiting processes. The company begins by using the AI capability to identify performance criteria based on the best performers in the organization's past. Such a sample of past performers may include biases based on past hiring characteristics (including discriminatory criteria such as gender, race, or ethnicity) rather than simply performance. In other words, the machine learns based on the data that it processes, and if the data sample is not representative or accurate, then the lessons it learns from the data will not be accurate and may lead to unethical outcomes.

To understand where ethical issues could arise and how in the future of work those issues might be avoided, it helps to organize AI along four primary dimensions of concern (figure 7):

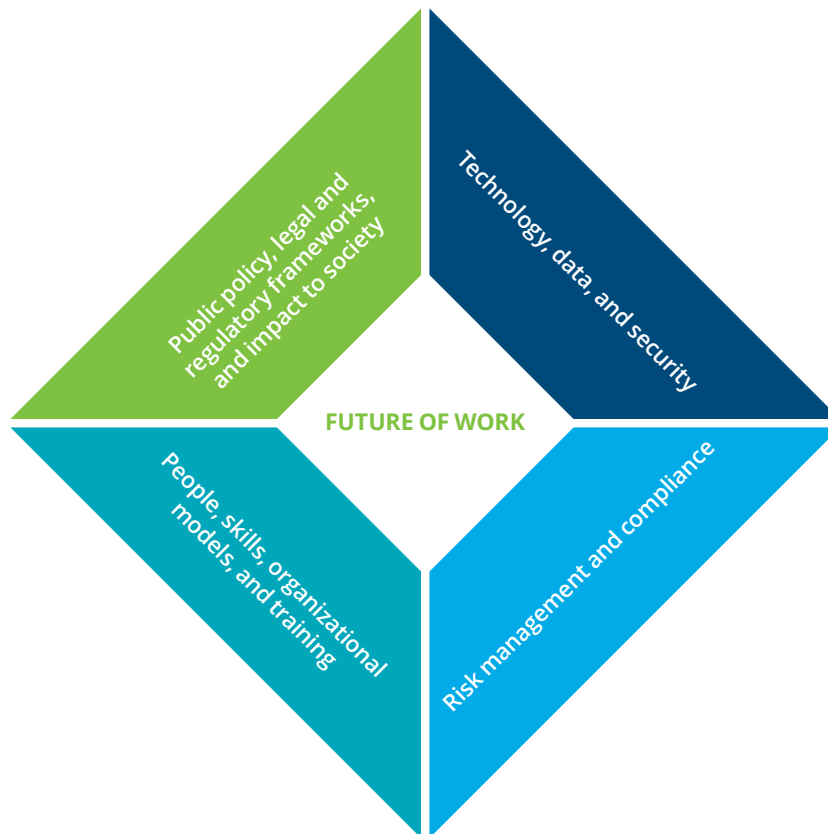
1. **Technology, data, and security.** Look at the organization's approach to the AI life cycle from an ethical perspective, including the ways it builds and tests data and models into AI-enabled solutions. Leadership in this dimension comes from the organization's information, technology, data, security, and privacy chiefs.
2. **Risk management and compliance.** Find out how the organization develops and enforces policies, procedures, and standards for AI solutions. See how they tie in with the organization's mission, goals, and legal or regulatory requirements. The heads of risk, compliance, legal, and ethics play a role in this dimension.
3. **People, skills, organizational models, and training.** Understand and monitor how the use of AI impacts experiences of both employees and customers. Continuously assess how operating models, roles, and organizational models are evolving due to the use of AI. Educate all levels of the workforce and implement training initiatives to retool or up-skill capabilities. Establish protocols to incentivize ethical behavior and encourage ethical decisions along the AI life cycle. In this dimension, the human resources function shares responsibility with learning and development teams, ethics officers, and broader executive leadership.
4. **Public policy, legal and regulatory frameworks, and impact to society.** Finally, develop a sense of AI's place in the

business environment. This includes the level of acceptance AI has in government and culture. It also includes the direction that laws and regulations are taking with regard to AI. Apply this information to the effect AI is likely to have over time in terms of education, employment, income, culture, and other aspects of society.

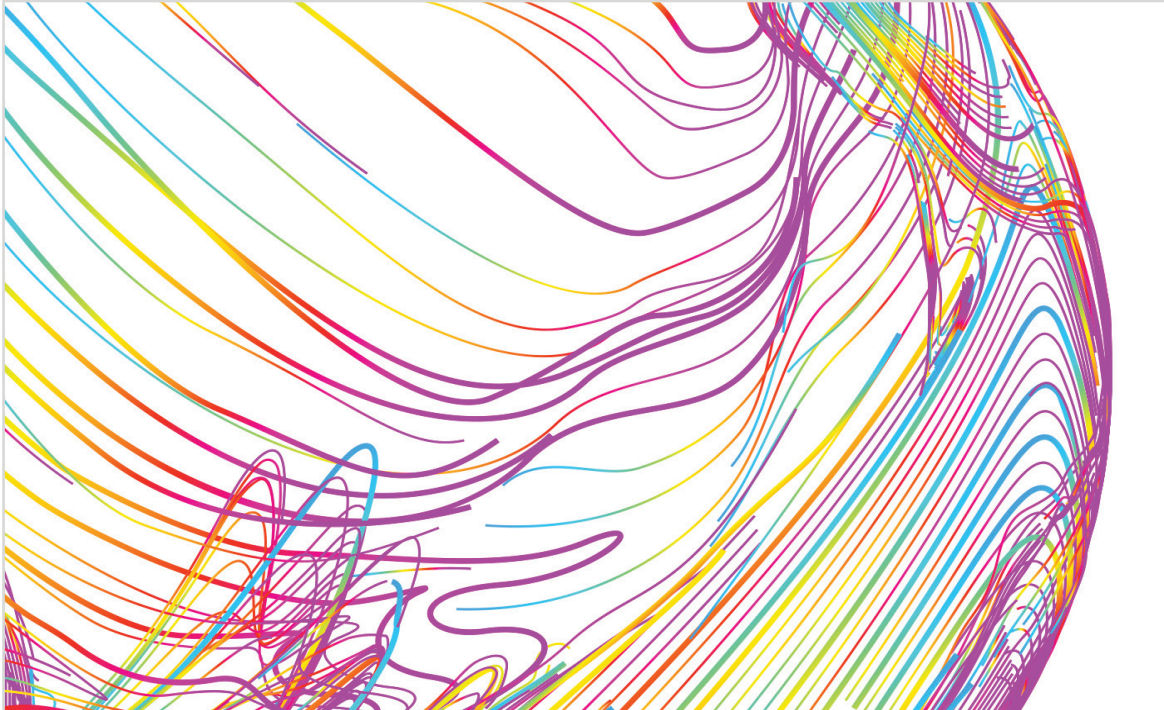
The CEO, CRO, CCO, and CFO have leadership roles across the first three dimensions, while the fourth dimension relies on leadership from politicians, regulatory agencies, and other policymaking bodies.

FIGURE 7

Four dimensions are vital to the implementation of AI ethics



Source: Deloitte analysis.



From mystery to mastery

Unlocking the business value of artificial intelligence in the insurance industry

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The future is now: Technology-enabled innovation in insurance

Digital technologies enable practitioners to rethink the 300-year-old insurance industry at every level, from business model to value chain, and from customer interaction to automation. In reshaping the industry's data-hungry and mostly standardized processes as well as the resource-intensive handling of their customer relationships, one technology stands out as particularly promising for insurers: artificial intelligence. Ninety-five percent of insurance executives intend to start or continue investing in AI capabilities in the future,⁹² while investments in AI have already increased by 69 percent between 2011 and 2014, totaling a staggering USD 5B in 2014.⁹³

In view of the fact that businesses across industries are reaping real benefits from AI, it is uncontested that AI will also be a key enabler for insurance businesses to equip themselves for the challenges and opportunities of their digital future. High labor costs, regulatory requirements, intensifying competition with InsurTech startups, and changing customer expectations are just some of the issues that can be addressed by leveraging AI. Yet, the insurance industry is lagging behind tapping into AI's potential compared to other industries such as life sciences, retail, and manufacturing. By looking at the insurance value chain, it becomes clear that there are numerous entry points and possibilities.

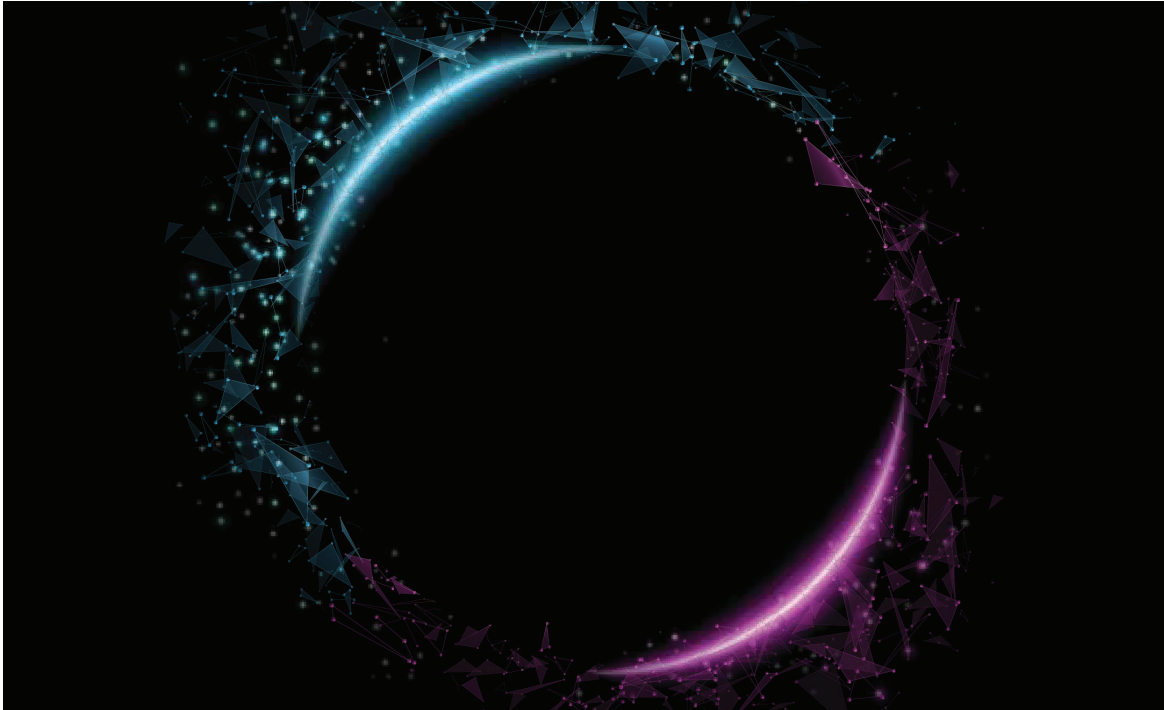
Recent efforts by insurers to implement AI have been focused on automating repetitive tasks, yielding both top- and bottom-line improvements. Consequently, leading insurers are already achieving operations and customer efficacy through the application of AI.

EXHIBIT: FUKOKU LIFE

In February 2017, Japanese Life Insurer Fukoku Mutual Life announced that it had introduced an AI application based on IBM's Watson explorer to boost its operations efficacy in medical claims processing. The application is tasked with calculating accurate payouts based on details of the administered procedure, period of hospitalization, medical history, and insurance conditions. The application thus accesses medical certificates, hospital bills, and internal claims history files, and scans the insurance contract for special coverage clauses to prevent payment oversights. The accurate payout is calculated and is submitted to a member of staff who approves and then releases the payout.

The application increased productivity by 30 percent and yielded improvements in accuracy of payouts. Fukoku Life expects to see a return on investment in under two years, realized through annual savings of JPY 140M. Additionally, the insurer aims to increase customer satisfaction scores through reduced lead time of payouts.

Among the most mature applications of AI in insurance is the automation of claims handling processes. Traditionally, the claims processing department is the most labor-intensive and therefore the largest cost center for insurers. Meanwhile, work in claims processing is highly standardized and repetitive—and therefore extremely eligible for automation through AI. Typically, insurers' legacy systems are already capable of (partially) automated processes in quotation, contract, and claims. However, the modern AI applications can improve content recognition, prioritize more intelligently, and even increase customer satisfaction by significantly reducing response time. The case study of Fukoku Mutual Life serves to illustrate.



The new physics of financial services

How artificial intelligence is transforming the financial ecosystem

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ADVANCES IN AI are rapidly changing what it takes to build a successful business in financial services.

To get an idea of how profound this change is, consider the old paths to industry dominance. Large assets provided economies of scale. Physical locations and standardized products drove cost-effective revenue growth. Direct access to markets and connections to investors discouraged competition. It was difficult to switch providers, so customers tended to stay. At the same time, process efficiency was a function of human labor and know-how.

Eventually, AI will transform every one of these building blocks. Technology will make operations efficient enough that asset size, although still important, will no longer be sufficient on its own to build a successful business. As a result, competition to achieve scale of data flow-through will be more important to sustain cost advantages. Meanwhile, revenue will come not from standardization but from the highly customized products and personalized interactions that AI makes possible. Neither will exclusive relationships be a differentiator; in a digitized world, providers will be known for their ability to create well-matched connections. Customers will stay with an institution, not because it's hard to walk away but because their benefits are better there than anywhere else. Process efficiency will result from the interplay of human and artificial strengths.

From these new building blocks, an unfamiliar environment will appear, one that has been reassembled to:

- **Reshape operating models.** Financial institutions will become leaner, highly networked, and more specialized. They'll also become more dependent on the capabilities of large technology players.
- **Upend competitive dynamics.** Data-sharing will become critical to competitive success. The advantage will go to first movers and large-scale players in an increasingly bifurcated market.
- **Take public policy into uncharted territory.** AI will raise questions that challenge government and society, prompting the need for a new set of norms to protect humans, regulate machines, and remake the financial infrastructure.

The result? A great upheaval—of capabilities, resources, relationships, and potential. Old bonds will break. New ones will form in unexpected ways. The center of gravity will shift, and where it comes to rest depends on the choices that stakeholders make today.

Value creation

AI is changing how financial institutions get and keep customers. Even as it commoditizes traditional points of differentiation, AI offers the opportunity for significant market innovation. The one certainty is that firms must adapt their products and services for the day when AI automates customers' financial lives—or much of it, anyway—and improves their financial outcomes.

Historically, financial institutions have relied on price, speed, and access as ways to attract customers. But online platforms are making it easier for customers to compare prices. Emerging

technologies are reducing instant product and service delivery to a basic expectation. And thanks to digital distribution, there's less need for intermediaries in the course of doing business.

As the old levers become less effective, new ones are coming up in their place. They include:

- Customization of offerings to customers' specific financial needs and objectives
- Engagement through ongoing and integrated interactions beyond financial services (such as offering forecasting services to merchants or booking repairs for auto damage)
- Curated ecosystems based on data from consumers, corporate clients, and third parties

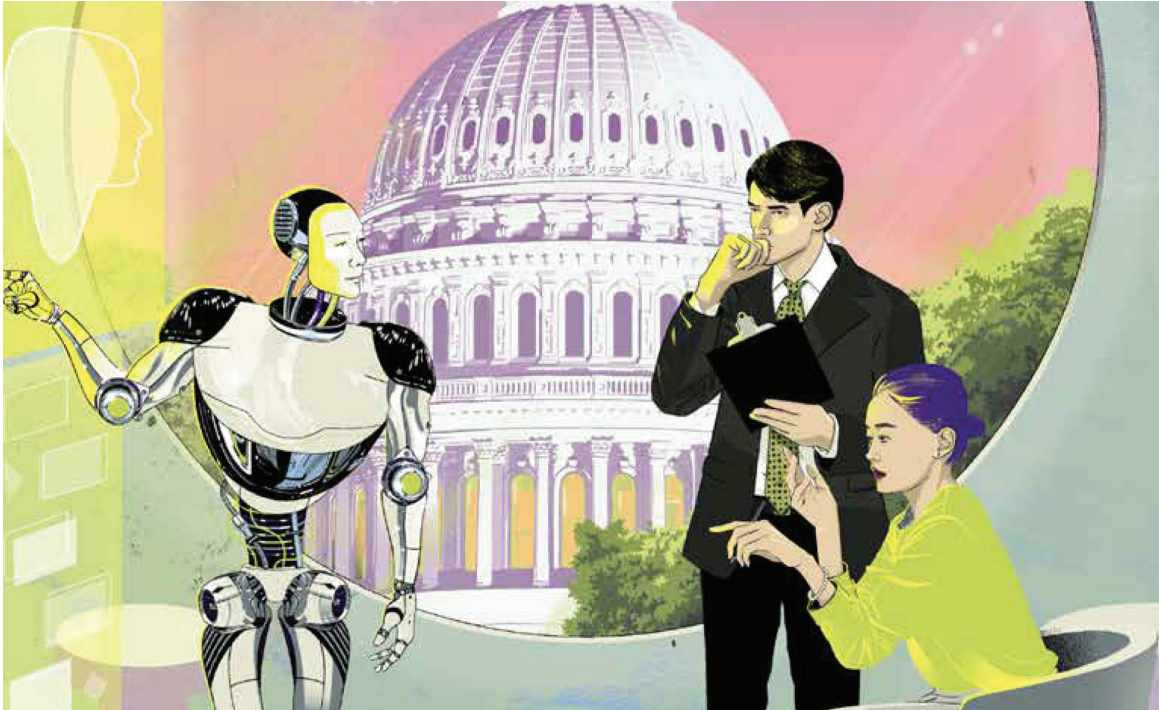
These levers will provide stronger ways for financial institutions to compete on value, retain customers, offer differentiated advice, and provide one-stop solutions. They're becoming possible because AI breaks the tradeoffs between better service and cost.

EXAMPLES

Integrated services beyond financial products. RBC is piloting a forecasting tool for car dealers to predict demand for vehicle purchases based on customer data. By offering this tool alongside their lending solutions, RBC motivates auto dealers to offer RBC lending products more frequently.⁹⁴

Ecosystem curation. Lloyds Banking Group committed US\$4.1 billion a year in a digital strategy that positions the company to combine banking and insurance services and pursue new API-enabled propositions. The aim is to be an ecosystem provider and a "trusted guardian of data" in the age of many providers.⁹⁵

Data and insight at scale. Ping An's suite of finance, medicine, cars, and housing apps has attracted more than 880 million users, 70 million businesses, and 300 partners. The firm uses the data they generate to close service gaps and improve the overall quality of offerings.⁹⁶



AI-augmented government

Using cognitive technologies to redesign public sector work

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THE PUBLIC SECTOR is seeking—and finding—applications to improve services; indeed, cognitive technologies could eventually revolutionize every facet of government operations. For instance, the Department of Homeland Security’s Citizenship and Immigration and Services has created a virtual assistant, EMMA, that can respond accurately to human language. EMMA uses its intelligence simply, showing relevant answers to questions—almost a half-million questions per month at present. Learning from her own experiences, the virtual assistant gets smarter as she answers more questions. Customer feedback tells EMMA which answers helped, honing her grasp of the data in a process called “supervised learning.”⁹⁷

While EMMA is a relatively simple application, developers are thinking bigger as well: Today’s cognitive technologies can track the course, speed, and destination of nearly 2,000 airliners at a time, allowing them to fly safely.⁹⁸

Over time, AI will spawn massive changes in the public sector, transforming how government employees get work done. It’s likely to eliminate some jobs, lead to the redesign of countless others, and create entirely new professions.⁹⁹ In the near term, our analysis suggests, large government job losses are unlikely. But cognitive technologies will change the nature of many jobs—both what gets done and how workers go about doing it—freeing

up to one-quarter of many workers’ time to focus on other activities.

Today, the typical government worker allocates her labor among a “basket” of tasks. By breaking jobs into individual activities and analyzing how susceptible each is to automation, we can project the number of labor hours that could be freed up or eliminated. Our analysis found that millions of working hours each year (out of some 4.3 billion worked total) could be freed up today by automating tasks that computers already routinely do. At the low end of the spectrum, we estimate, automation could save 96.7 million federal hours annually, with potential savings of \$3.3 billion; at the high end, this rises to 1.2 billion hours and potential annual savings of \$41.1 billion. An in-depth look at our data analysis can be found [here](#).

Cognitive technologies are already having a profound impact on government work, with more dramatic effects to come. AI-based applications could potentially reduce backlogs, cut costs, overcome resource constraints, free workers from mundane tasks, improve the accuracy of projections, inject intelligence into scores of processes and systems, and handle many other tasks humans can’t easily do on our own, such as predicting fraudulent transactions, identifying criminal suspects via facial recognition, and sifting millions of documents in real time for the most relevant content.



Intelligent IoT

Bringing the power of AI to the Internet of Things

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WITH A WAVE of investment, new products, and enterprise deployments, AI is making a splash in the Internet of Things (IoT). The powerful combination of AI and IoT technology is helping companies avoid unplanned downtime, increase operating efficiency, enable new products and services, and enhance risk management. Companies crafting an IoT strategy, evaluating a potential new IoT project, or seeking to get more value from an existing IoT deployment may want to explore a role for AI.

AI provides the ability to wring insights from IoT data more quickly and accurately than traditional business intelligence tools. Using the two technologies to complement one another can provide significant advantages for businesses, such as:

Avoiding costly unplanned downtime.

Predictive maintenance—using analytics to predict equipment failure ahead of time in order to schedule orderly maintenance procedures—can mitigate the damaging economics of unplanned downtime. Because AI technologies can help identify patterns and anomalies, and make predictions based on large sets of data, they are proving to be particularly useful in implementing predictive maintenance.

Increasing operational efficiency. Machine learning can generate fast, precise predictions and

deep operational insights. Other AI technologies can automate a growing variety of tasks. Companies such as Hershey and Google have used AI in combination with IoT sensor data to significantly cut operational costs.

Enabling new and improved products and services. IoT technology coupled with AI can form the foundation of improved and eventually entirely new products and services. For instance, for GE’s drone and robot-based industrial inspection services, the company is looking to AI to automate both navigation of inspection devices and identification of defects from the data captured by them. This could result in safer, more precise, and up to 25 percent cheaper inspections for the client.

Enhancing risk management. A number of applications pairing IoT with AI are helping organizations better understand and predict a variety of risks as well as automate for rapid response, enabling them to better manage worker safety, financial loss, and cyber threats.

For enterprises across industries, AI has the potential to boost the value created by IoT deployments, enabling better offerings and operations to give a competitive edge in business performance.

Conclusion

RESEARCH FROM DELOITTE global member firms suggests that AI holds enormous promise to transform businesses and entire industries. We've seen that many countries and companies believe AI is essential to their future competitiveness. With AI use on the rise globally, early adopters are already feeling that their industry competitors are starting to catch up, and with easier, cloud-based ways to develop AI solutions growing in popularity, the competitive pressure will likely keep building.

On an increasingly crowded AI playing field, which adopters will be most successful in capitalizing on the promise of AI and maintaining a competitive edge? We see some signs in our research. Organizations should strive to:

- **Develop a strategy.** Only 35 percent of early adopters have a comprehensive, companywide AI strategy.¹⁰⁰ Without a strategic road map, how will a company get from “here to there” with AI, or even know what “there” is?
- **Be clear on goals and use cases.** Some companies may choose to focus on cost, aiming to improve productivity or efficiency. Others may emphasize value creation, seeking fresh revenue opportunities through new products or markets. Ultimately, the right goals and use cases depend on a company's industry and circumstances.
- **Excel at execution.** Beyond developing a strategy and pursuing well-chosen use cases, it's important to build a strong data foundation. Can the company access quality data to fuel its AI efforts? Does it have the capabilities to

manage that data—curating, cleaning, and integrating it? Does the company have the right blend of skills for its AI efforts—data scientists, software engineers, AI researchers, and business leaders who can translate the organization's business problems into solutions and interpret the recommendations of AI systems? Is there an effective hiring or training plan to address skill gaps?

- **Master integration.** Developing structured ways to integrate AI into roles and functions is a top challenge for AI initiatives. Find the right balance between using AI technologies to automate tasks and to augment the capabilities of the workforce. Plan for this balance to evolve over time as AI capabilities improve.
- **Manage risk proactively.** Companies should be aware of the potential risks associated with AI—from cybersecurity, to legal and regulatory issues, to ethical challenges—and develop plans to manage them.

Ultimately, success will likely depend on each organization determining how AI can improve its operations, the way humans and machines collaborate, and what it sells. It's not just companies that should formulate strategies for using AI. Nations should decide their AI approach as well, lest they find themselves in a future designed and created by others.

Will AI transform industries and form the basis for economic competitiveness in the future? Nothing is certain, but many countries and companies are building AI into their future.

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