Competing in the Cognitive Age

How companies will transform their businesses and drive value through advanced AI

Assessing the results of a global survey from Protiviti and ESI ThoughtLab

Internal Audit, Risk, Business & Technology Consulting

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Executive Summary

Advanced artificial intelligence (AI) may conjure up futuristic images along with hype and fear (see our definition of advanced AI on page 6). But the reality is much different. To understand where this technology is headed and how business leaders will apply it in the immediate future, Protiviti and ESI ThoughtLab conducted a global research study delving into where advanced AI stands today and what executives worldwide are planning for and expect to happen within two years.

The survey found that when it comes to advanced AI, most companies are still at the starting gate. Moreover, many non-technology executives still have a "show me" attitude about the value that advanced AI can deliver. But very soon, that picture is expected to change dramatically. A sizable majority of companies are fast tracking AI applications and expecting to see significant gains in profitability, productivity, revenue and shareholder value in as little as two years.

How they are going to reach their ambitious AI objectives and the hurdles they likely will face are among our key findings summarized below:

Businesses are shifting from neutral into high gear

Today, only a small minority of companies (16 percent) are gaining significant value from advanced AI. But within two years that number is expected to leap more than three-fold to a majority of firms worldwide. The march of AI is a global phenomenon and businesses in the Asia-Pacific region are adopting advanced AI faster than companies in the rest of the world. In fact, the Chinese government is currently implementing a national plan to make China the global leader in AI by 2030.

Around the world, companies are putting substantial investment behind their AI efforts. In the last fiscal year, businesses spent an average of $36 million, and they plan to boost their spending by nearly 10 percent over the next two years.

Today, most AI benefits are in operations — in two years, AI will drive revenue

Currently, the benefits of advanced AI are being realized in functions that use massive amounts of data and require judgment. The biggest impact is in IT and cybersecurity, strategy and planning, and operations. In two years, most businesses will apply advanced AI to practically every function, including risk management, marketing and customer experience, product development, and sales/business development.

Advanced AI is already creating demonstrable value in core business areas, including improved planning and decision-making, accelerated time-to-market, better risk management, reduced costs, increased customer retention, and improved employee engagement. In two years, businesses will use advanced AI to drive benefits in strategic and financial performance, scaling global business and growing market share, along with improvements in productivity, profitability, revenue growth and shareholder value.

Obstacles remain

There are obstacles, however, that companies confront on the road to achieving the gains that advanced AI adoption promises. Uncertainty about the return on investment (ROI) of AI is one of the largest barriers to progress. That uncertainty stems from companies applying less rigorous standards to AI business cases

than they do to other investments. Thus, CEOs, COOs and other non-technology executives remain skeptical about advanced AI. Compelling proofs of concept and pilots are essential to gaining their support.

Although advanced AI can help protect against cyberattacks, it also carries its own cybersecurity risks due to the greater access to sensitive and personal data. Regulatory uncertainty and securing the required AI talent are other challenges. Universities are not producing enough advanced AI specialists, which is creating a talent war.

To close the talent gap, businesses are partnering with consulting firms, developing internal talent, outsourcing, recruiting new talent and partnering with universities. Companies achieving the most success with AI are much more likely than others to develop talent in-house. In addition, when it comes to developing AI talent, the use of off-the-shelf or internally developed advanced AI tools with interfaces that most mathematically inclined managers can use may be the most effective strategy. It simplifies the training challenge and lessens the need for advanced AI specialists such as data scientists.

Culture and leadership matter

AI efforts are headed primarily by senior technology executives. But many experts believe AI should be the domain of the CEO or line-of-business head to ensure AI applications are tied closely to specific business outcomes. In addition, our research suggests organizations should adopt a model that combines a center of excellence with AI professionals housed in business units. Only a small percentage of firms completely centralize their AI professionals.

To spur corporate culture to embrace AI, the most important lesson to bear in mind is that executives need to understand AI and what it can do. In addition, management should allay the fears of employees concerned about, among other issues, obsolescence and job displacement. Fear and a pervasive lack of AI knowledge in an organization can retard progress and lead to a poor choice of applications.

"We are entering the cognitive age. Over the next 25 years, advanced AI will be the central element of digital transformation that fundamentally changes how businesses operate."

— Cory Gunderson, Executive Vice President, Global Solutions, Protiviti

Introduction: Artificial Intelligence Moves into the Fast Lane

AI may be the most important development of our era, poised to have a transformational impact on the world that may rival that of electricity, according to Dr. Andrew Ng, adjunct professor at Stanford and founder of the Google Brain deep learning project. For business, AI will be a major game changer. It will enable companies to take performance, decision-making and risk management to new heights across their enterprises. The AI revolution will change the course of business across all industries and turn data into the key driver of competitive advantage.

Today, businesses are trying to understand advanced AI and move their organizations to embrace it. Internal advocates more familiar with the latest technologies often pressure skeptical senior executives to pursue advanced AI (see our definitions of "advanced AI" on following page). However, advanced AI is changing industries rapidly, as well as the perspective of these executives. "By 2022, business leaders themselves will be demanding AI solutions to keep up with and/or beat their competitors," says Cory Gunderson, executive vice president in charge of global solutions at Protiviti. "We are entering the cognitive age. Over the next 25 years, advanced AI will be the central element of digital transformation that fundamentally changes how businesses operate."

To understand how companies will transform their businesses through AI and the benefits they will gain, Protiviti and ESI ThoughtLab conducted a global survey of 300 senior executives across functions, industries and company sizes (see page 7). According to our research, most companies are still in the early planning and implementation stages of AI development, with only a small minority today gaining significant value from advanced AI. But that number will swell to over half of all companies over the next two years as enterprises across industries and regions put advanced AI on the fast track.

In the process, however, organizations will need to address a tangle of challenges, from uncertain ROI and limited AI talent, to concerns about cybersecurity and regulatory compliance. Among the most daunting hurdles is the fear among rank-and-file staff that advanced AI will eliminate jobs instead of making them potentially more rewarding.

But a minority of companies have overcome these obstacles. These AI leaders populate all industries — from financial services to healthcare — and are by no means limited to the ranks of the digitally born. They are far ahead of their competitors in the use of AI and are far more likely to see the rewards in terms of productivity and profitability.

"Advances in AI are helping companies improve their business operations and drive business success," says Madhumita Bhattacharyya, managing director, artificial intelligence and machine learning at Protiviti. "Just as the Industrial Age transformed American society, AI will transform the way we do business and the way work gets done."

Peter Henstock, machine learning and AI technical lead at Pfizer, agrees and points out that harnessing AI will be crucial for staying competitive in the healthcare industry. "Change in the healthcare industry moves slowly," he says. "It takes 12-plus years from start to end to bring a new drug to market. Many pharma companies are apprehensive because we do not yet have the AI talent, integrated data infrastructure or capability to effectively utilize AI well. The first company that figures out how to do it will have a huge advantage in everything, including making better, faster decisions that will completely change the field."

The stakes are too high for companies to sit on the sidelines. In our report, we provide actionable insights for organizations to secure their place in the coming cognitive age.

AREAS OF ADVANCED
ARTIFICIAL INTELLIGENCE
COVERED IN OUR RESEARCH

For the purposes of this study, we use the term "advanced artificial intelligence (AI)" as an umbrella term for several different technologies that allow computer systems to perform tasks that normally require human intelligence, such as visual perception, speech recognition and decision-making.

Machine Learning (ML): The use of statistical techniques to give computers the ability to "learn" with data without being explicitly programmed. ML can detect patterns or apply known rules to predict outcomes, detect anomalies and yield insights.
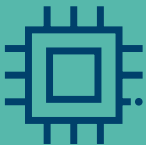
Deep Learning (DL): A higher form of machine learning that applies successive layers of representations to teach computers to learn by example and make decisions by themselves.
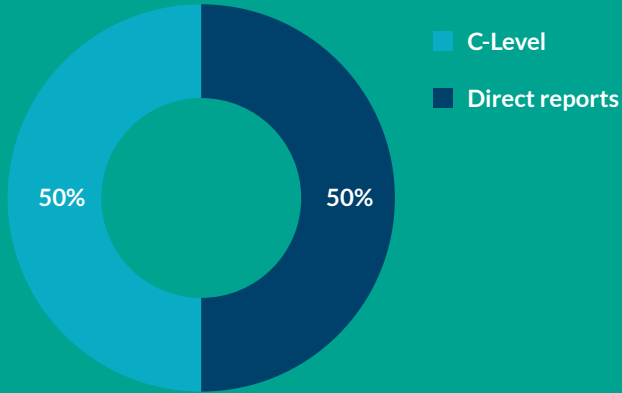
Natural Language Processing (NLP): The use of computational linguistics and artificial intelligence to enable computers to understand and to interpret human language, including speech and the written word.

ABOUT THE RESEARCH

ESI ThoughtLab conducted interviews by phone with 300 executives worldwide. The survey was fielded between August 20 and September 7, 2018. The study also included in-depth follow-up interviews with 13 executives and other experts in advanced AI.

Seniority

- C-Level
- Direct reports

50% — 50%

Industry sector

- Consumer
- Financial services
- Healthcare
- Technology

25% — 25% — 25% — 25%

Function

Technology/Innovation 25%	Marketing/Sales 12%	Operations/ Manufacturing 11%	Executive/ General Management 11%
Strategy 10%	Finance 9%	Risk 9%	Human Resources 5%	Legal/ Administration 4%	Analytics 4%

Region

North America 50%	Europe-Middle East-Africa 30%	Asia-Pacific 20%

Size

Midsize ($500 mil - $999 mil)	Large ($1 bil - $9.9 bil)	Very large ($10 bil - $49 bil)	Largest ($50 bil or more)
17%	33%	28%	22%
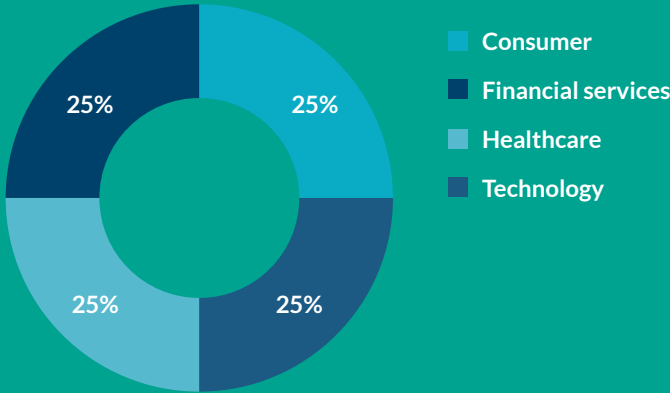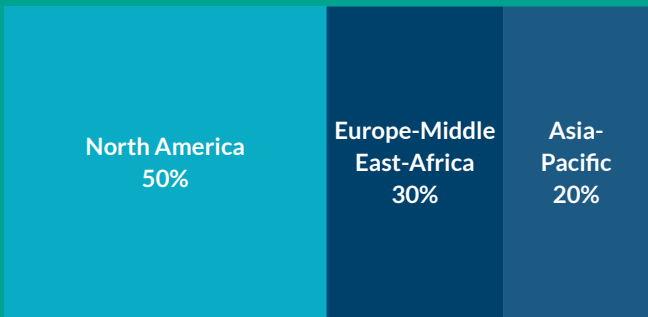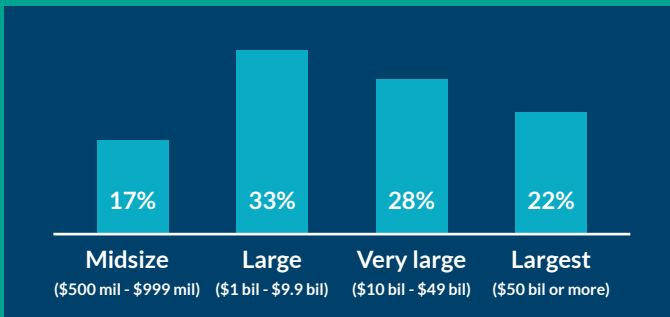
AI Now and in Two Years

01 Currently, only 16 percent of businesses are gaining significant value from advanced AI. But within two years that number is expected to more than triple.

02 Companies of all sizes and across industries are investing heavily in advanced AI — an average of $36 million was spent in the last fiscal year — and plan to increase their budgets by nearly 10 percent over the next two years.

03 Healthcare and technology companies are moving the fastest. Financial services and consumer products organizations are picking up the pace but are moving ahead a bit more slowly.

04 The Asia-Pacific region is poised to become the global innovation center of AI. Businesses in the region are adopting advanced AI faster than those in Europe and North America. The Chinese government is implementing a national plan to make China the global leader in AI by 2030.

"Many industry experts say that AI is going to be the next technological quantum leap," says Tyrone Canaday, Protiviti's head of global innovation. "It will provide one of the most important and transformational technologies going into the next era. As we transition into the fourth industrial revolution, AI is going to be a main driver."

While only 16 percent of businesses worldwide currently gain significant value from advanced AI technologies, within two years that figure will more than triple to 52 percent of firms. The use of advanced AI will increase across all industries over the next two years. For example, 28 percent of technology companies already report gaining significant value from advanced AI and that figure will grow to more than 75 percent in two years. Healthcare organizations are also picking up the pace — currently, 15 percent are gleaning significant value from advanced AI and nearly 50 percent plan to do so in two years' time.

Financial services and consumer products companies are also moving ahead, albeit at a slower tempo. Currently, fewer than 10 percent of consumer products companies are gaining significant value from AI, though that number is expected to rise to 41 percent in two years. Just over 10 percent of financial services companies are garnering significant value from AI, and 40 percent expect to do so within two years.

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• • • Value from AI will leap over the next two years
(percentage of organizations reporting "high" or "very high" value)

Bar chart showing "Today" and "In two years" values:

Category		Today	In two years
	Total	16%	52%
INDUSTRY SECTORS	Consumer	9%	41%
	Financial	12%	40%
	Healthcare	15%	49%
	Technology	28%	76%
SIZE	Midsize	2%	20%
	Large	11%	30%
	Very Large	20%	64%
	Largest	29%	92%
AI MATURITY VS. COMPETITORS	Behind	0%	19%
	Average	3%	45%
	Ahead	47%	92%
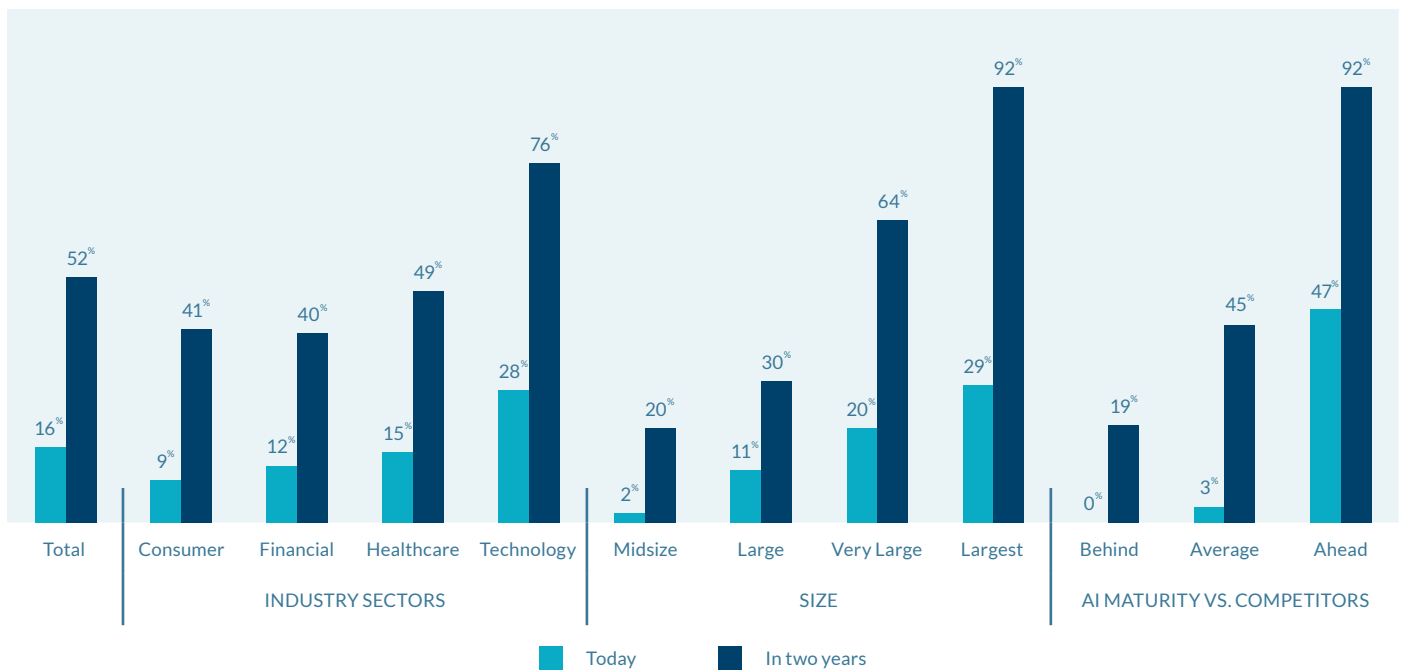
The larger the company, the greater the expected gains from AI in the future. For example, 20 percent of midsize organizations expect to derive significant value from advanced AI in the next two years, compared with 92 percent of companies with annual revenues above $50 billion. With greater amounts of data to manage and greater efficiencies to be made, it is not surprising that the largest companies in our sample are early AI adopters and already deriving value from it.

Currently, about one-third of executives believe that advanced AI is important for the future of their business. But the percentages are even higher for executives "in the know." As shown below, 81 percent of firms in the advanced stages of digital transformation see the importance of advanced AI, as do 43 percent of executives with very high AI knowledge and 42 percent of executives in technological roles. The significance of AI rises with the size of companies, with only 8 percent of midsize companies rating advanced AI as important, against 58 percent of the largest firms.

• • • How important is advanced AI to business leaders?
(important/very important by company size, level of digital maturity, knowledge of AI and role)

31%	8%	21%	34%	58%	4%	18%	81%	26%	43%	42%	26%
Total	Midsize	Large	Very Large	Largest	Behind Competitors	Average/ On Par	Ahead of Competitors	Moderately Knowledgeable	Very Knowledgeable	Tech Role	Non-Tech Role
		SIZE				DIGITAL MATURITY			AI KNOWLEDGE		TECH ROLE
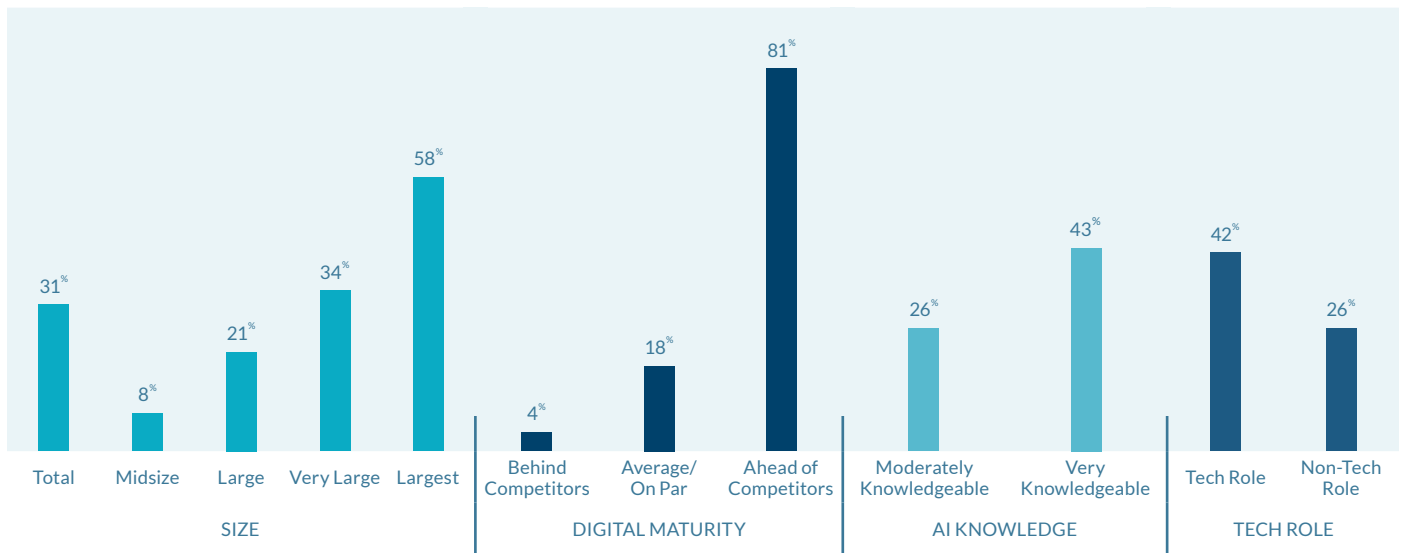
Companies across the board are investing heavily in advanced AI

To generate the value they anticipate, companies across industries and sizes are investing heavily in advanced AI, and plan to increase their budgets over the next two years. On average, businesses spent $36 million in the last financial year on AI, and they expect to boost their investments by 8 percent over the next two years.

Not surprisingly, the amount of AI investment rises with the size of the firm. Midsize companies spent about $600,000 in the last year, while the largest firms in our sample invested $93 million. Larger firms also plan to invest more heavily in advanced AI over the next two years, by as much as 12 percent.

Healthcare firms are currently spending the most on advanced AI ($51 million on average in the last year) and plan to increase their spending by 8 percent over the next two years. Interestingly, despite the many benefits of advanced AI to consumer products companies, they are spending the least on advanced
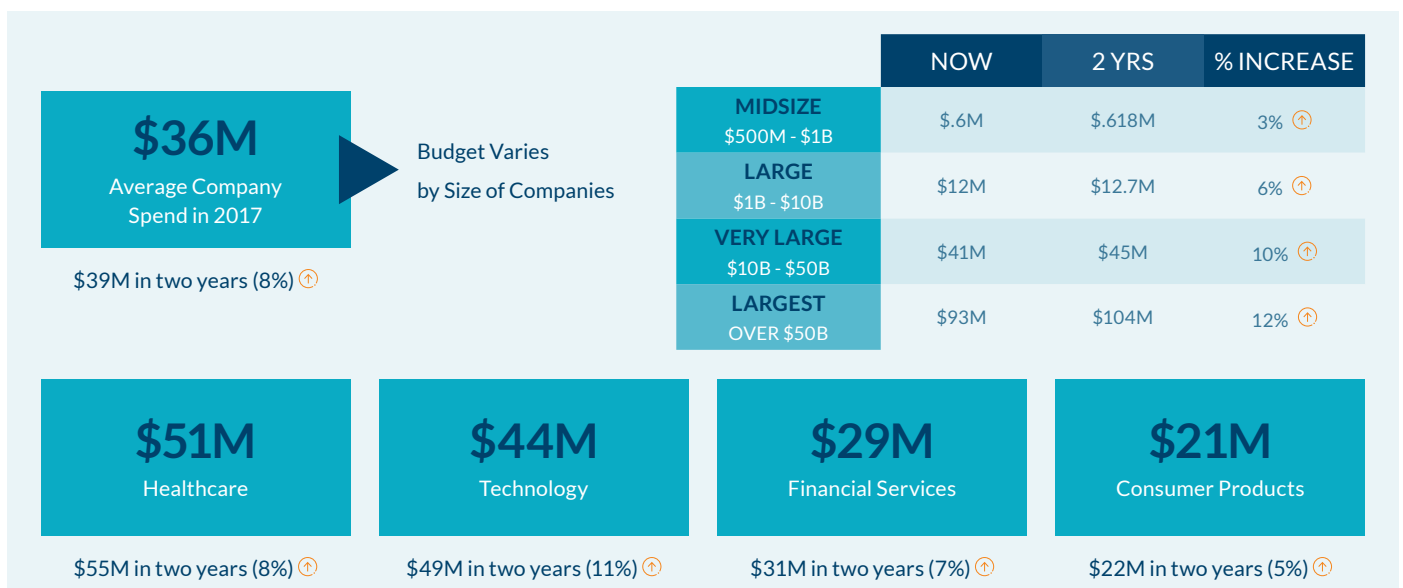
"Tools such as ML and DL make it possible for retail and consumer products companies to pinpoint not just what the customer wants today, but what they will want tomorrow."

— Shaheen Dil, Senior Managing Director, Protiviti

AI ($21 million last year) and only plan to raise their investments to $22 million in two years.

According to Shaheen Dil, senior managing director, advanced analytics at Protiviti, consumer products and services companies may have the most to lose if they do not adopt AI. "These companies are dealing with huge customer databases," she says. "It's not just about efficiencies, it's about analyzing and predicting customer preferences. Tools such as ML and DL make it possible for retail and consumer products companies to pinpoint not just what the customer wants today, but also what they will want tomorrow. The companies that do this right will become leaders and the others will fall behind."

• • • Levels of AI investments

$36M
Average Company Spend in 2017

$39M in two years (8%) ⬆

Budget Varies by Size of Companies

	NOW	2 YRS	% INCREASE
MIDSIZE $500M - $1B	$.6M	$.618M	3% ⬆
LARGE $1B - $10B	$12M	$12.7M	6% ⬆
VERY LARGE $10B - $50B	$41M	$45M	10% ⬆
LARGEST OVER $50B	$93M	$104M	12% ⬆

$51M
Healthcare

$55M in two years (8%) ⬆

$44M
Technology

$49M in two years (11%) ⬆

$29M
Financial Services

$31M in two years (7%) ⬆

$21M
Consumer Products

$22M in two years (5%) ⬆

Asia-Pacific will become the hub of AI innovation

Companies in the Asia-Pacific region (APAC) have jumped ahead of their overseas competitors with advanced AI. Companies in Greater China and Japan are heavily focused on AI, putting the Asia-Pacific region far ahead of North America and Europe. Our survey shows that 43 percent of Asia-Pacific firms see AI as important to their business's future, versus 33 percent of firms in North America and just 18 percent in Europe. Asia-Pacific also has the highest concentration (48 percent) of businesses reporting that their use of AI is far ahead of their competitors.

The Chinese government is making AI leadership a national imperative. In 2017, it announced that it plans to reach parity with the United States in AI capabilities by 2020. By 2025, China wants to be a major source of breakthrough innovations to put the country on the path to be the world's AI leader by 2030.
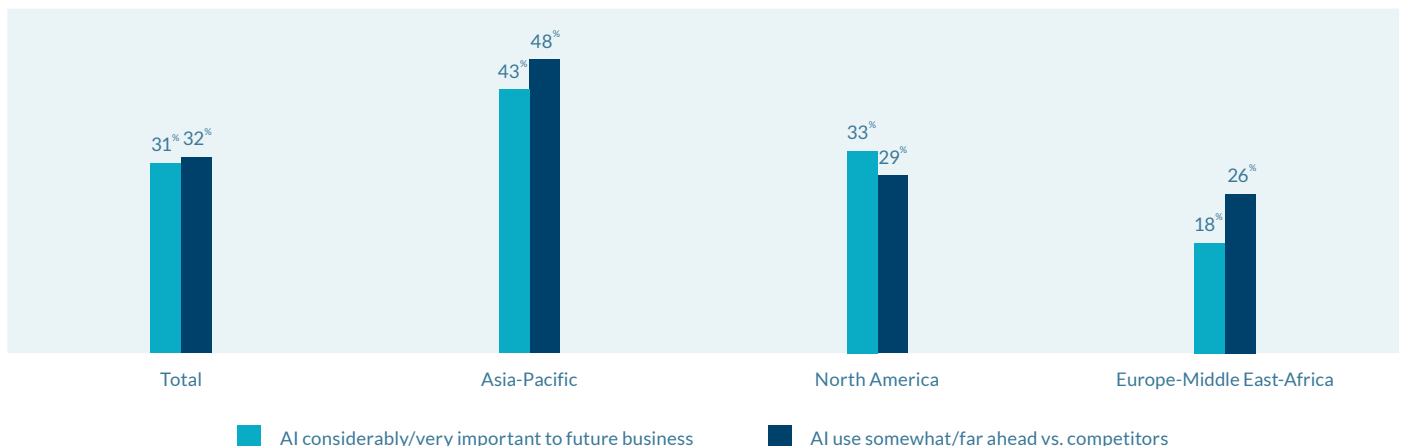
BBVA Bancomer is investing heavily in AI investment funds, an example of which is its investment in Sinnovation VC fund in China, and is closely following start-ups whose solutions can be leveraged by their bank. "I recently spent two weeks in China visiting a number of different start-ups," says Carlos Lopez-Moctezuma, head of innovation for BBVA Bancomer. "I am amazed with what they are doing. They are developing expertise that will be invaluable to banking and most other sectors as well."

Chinese businesses have some distinct advantages over companies in Western countries. The financial services industry, for instance, is much less regulated in China, leaving these institutions with significantly lower compliance costs and thus greater resources to invest. Moreover, compared with other regions, shareholders in China exert far less pressure on companies to produce short-term results and encourage them to make investments for the future.

The Asia-Pacific region will make significant progress in AI in the next two years even though North American companies are projected to gain a slight lead, with 60 percent of North American companies expecting to garner high value from AI, compared with 55 percent of Asia-Pacific organizations. Europe will continue to lag, with only 35 percent of companies expecting to derive significant value from AI within two years.

• • • **APAC companies are more likely to see AI as important to their business's future and are ahead of competitors**
(percentage of organizations reporting considerably/very important; somewhat/far ahead)

	Total	Asia-Pacific	North America	Europe-Middle East-Africa
AI considerably/very important to future business	31%	43%	33%	18%
AI use somewhat/far ahead vs. competitors	32%	48%	29%	26%

- AI considerably/very important to future business
- AI use somewhat/far ahead vs. competitors

Businesses across the Asia-Pacific region are already ahead of or equal to the rest of the world in their stages of advanced AI adoption. Of the companies in Asia-Pacific, 22 percent are at advanced stages of machine learning against 7 percent in Europe and 11 percent in North America. Firms in Asia-Pacific are much farther ahead in deep learning and natural language processing, as well. And they expect to maintain their lead. In two years, more Asia-Pacific companies will be at advanced stages than businesses in other parts of the world: machine learning (48 percent in Asia-Pacific, 29 percent in Europe and 34 percent in North America); natural language

processing (22 percent in Asia-Pacific, 10 percent in Europe and 19 percent in North America); and deep learning (65 percent in Asia-Pacific, 33 percent in Europe and 35 percent in North America).

Faster AI adoption is already triggering productivity gains in the region. Nearly all APAC organizations achieved productivity gains of 4 percent to 6 percent in the past year from the use of advanced AI compared with just 28 percent of companies globally. AI will further enhance the cost-competitiveness of companies headquartered in the Asia-Pacific region.

• • • **APAC businesses are moving the fastest**
(percentage of organizations at a maturing or advanced stage in different advanced AI technologies)

Legend:
- Machine learning (ML) today
- Machine learning (ML) in two years
- Natural language processing (NLP) today
- Natural language processing (NLP) in two years
- Deep learning (DL) today
- Deep learning (DL) in two years

Total: 12%, 35%, 3%, 17%, 22%, 41%
North America: 11%, 34%, 4%, 19%, 15%, 35%
Europe-Middle East-Africa: 7%, 29%, 1%, 10%, 19%, 33%
Asia-Pacific: 22%, 48%, 2%, 22%, 45%, 65%
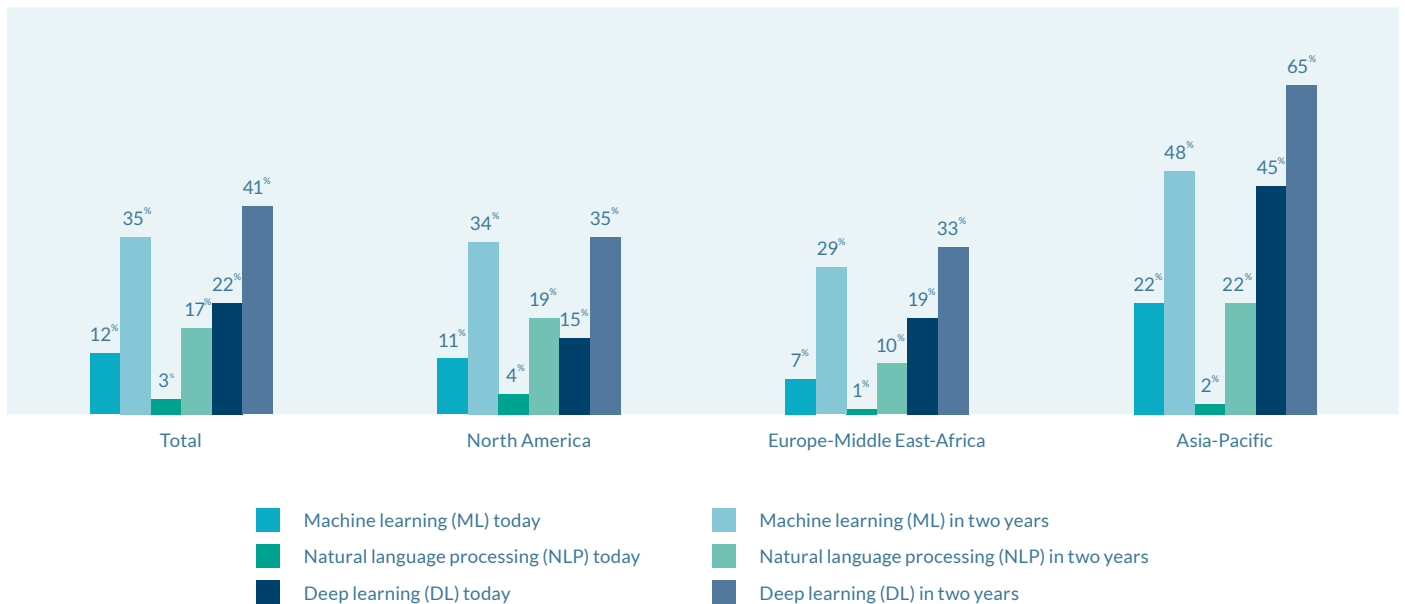
The Value from AI Will Soar

WHAT YOU SHOULD KNOW:

01 Advanced AI is already creating measurable value in essential areas of business, including improved planning and decision-making, accelerated time-to-market, better risk management, reduced costs, increased customer retention and improved employee engagement.

02 Within two years, businesses expect to derive major gains from advanced AI in strategic and financial performance, ability to scale global business and greater market share, along with improvements in productivity, profitability, revenue growth and shareholder value.

03 The benefits of advanced AI are coming from several business functions, especially those that use massive amounts of data and require judgment. Businesses are seeing the greatest impact today in IT and cybersecurity, strategy and planning, and operations.

04 In the coming years, most businesses will be applying advanced AI to practically every function, including risk management, marketing and customer experience, product development, and sales/business development.
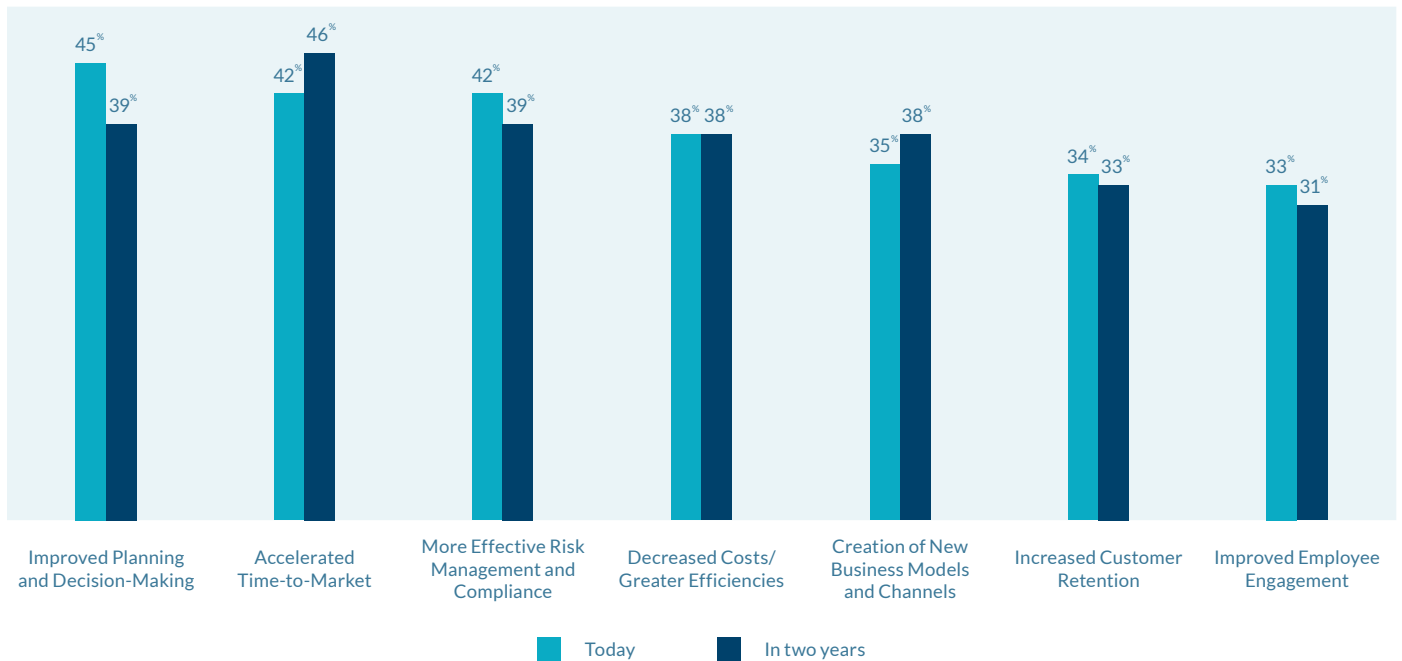
Advanced AI is already producing measurable value for companies globally in several essential areas of business, across all industries. "AI will redefine the very nature of business," says Ron Lefferts, managing director and leader of Protiviti's global Technology Consulting practice. "This advanced technology holds real promise of increased business value and greater global economic impact, especially as companies begin to recognize its importance and start using it to find innovative solutions to their strategic business challenges."

According to Henstock of Pfizer, AI is transforming how decisions and plans are made in the healthcare industry. "All of what we do in science is basically data-driven decision-making. Can we look at thousands of different clinical records and find some pattern in them? We combine the genomic data, the gene expression data, the human data and the clinical trial data to decide what to do next. With AI, there's a huge opportunity to do all of this better."

Dr. Roy Smythe, chief executive officer at SomaLogic, agrees, citing Zipnosis, a virtual healthcare platform, as a case in point. "Physicians can go online and answer a number of questions about their patient's condition," he says. "Zipnosis will then send a tentative diagnosis to the clinician with an assessment and plan which the doctor can accept or not. They accept the overwhelming majority of the time."

• • • Benefits of AI today and in two years
(organizations selecting each of the following benefits of AI)

Benefit	Today	In two years
Improved Planning and Decision-Making	45%	39%
Accelerated Time-to-Market	42%	46%
More Effective Risk Management and Compliance	42%	39%
Decreased Costs/ Greater Efficiencies	38%	38%
Creation of New Business Models and Channels	35%	38%
Increased Customer Retention	34%	33%
Improved Employee Engagement	33%	31%

Today   In two years

For 42 percent of companies, a major benefit of advanced AI is accelerating time-to-market. Lucas Lau, Protiviti's director of machine learning/deep learning, notes that consumer goods companies are using AI to analyze trends and demand patterns to meet rapidly changing consumer demands and tastes.

Advanced AI is also a boon for risk management and compliance, according to 42 percent of executives, and for driving cost efficiencies, according to 38 percent of respondents. Dil of Protiviti gives an example of the huge compliance efficiencies that advanced AI can create. "In the U.S. and abroad, we now have new lease accounting guidelines that are very complex and very difficult to undertake manually," she says. "But through ML you can cut the time by an order of magnitude. Instead of taking six hours to review a single lease, you can bring it down to under two minutes for the parts which are standard, reducing the need for manual review and cutting the overall time by half."

More than one-third of companies have used advanced AI to create new business models or channels. About one-third of companies are also using advanced AI to increase customer retention. According to Lopez-Moctezuma of BBVA Bancomer, the Mexican bank has combined natural language processing with advanced algorithms to drive its chatbot. Customers can use the bot to reach the bank and its services 24/7 via Facebook Messenger, Slack, WhatsApp and

Apple's Siri. The AI-powered bots improve not only customer engagement, but also customer retention. "By analyzing customer data from the chatbot, we are able to understand their needs and expectations," says Lopez-Moctezuma. "We are becoming more relevant to our customers. We are able to target messages, products and services with accuracy, which improves customer satisfaction and retention."
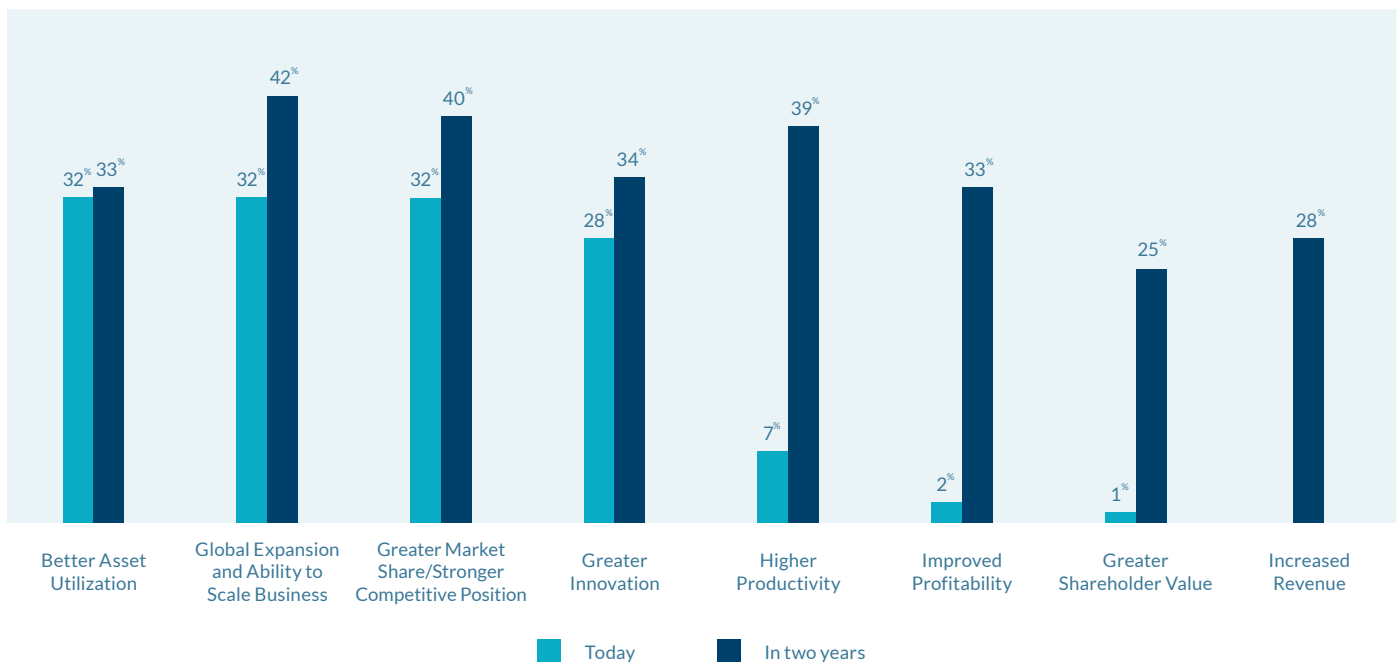
Performance benefits will leap in only two years

Within two years, businesses expect their investments in AI to drive substantial gains in strategic and financial performance. Benefits are already evident today, but these will increase in two years' time. They include the ability to scale global business (42 percent) and gain greater market share (40 percent), along with improvements in productivity (39 percent), profitability (33 percent), revenue growth (28 percent) and shareholder value (25 percent).

"Over the next few years, AI will have a massive impact on how businesses drive value. It will enable companies across industries to be more competitive, cost-efficient, profitable and innovative. From self-driving cars to medical diagnostics, the combination of people and machines will drive better performance outcomes than either could achieve separately."

— Cory Gunderson, Executive Vice President, Global Solutions, Protiviti

Strategic and financial benefits are on the rise
(percentage of organizations deriving the following benefits from AI now and in two years)

Category	Today	In two years
Better Asset Utilization	32%	33%
Global Expansion and Ability to Scale Business	32%	42%
Greater Market Share/Stronger Competitive Position	32%	40%
Greater Innovation	28%	34%
Higher Productivity	7%	39%
Improved Profitability	2%	33%
Greater Shareholder Value	1%	25%
Increased Revenue		28%

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"Over the next few years, AI will have a massive impact on how businesses drive value," says Protiviti's Gunderson. "It will enable companies across industries to be more competitive, cost-efficient, profitable and innovative. From self-driving cars to medical diagnostics, the combination of people and machines will drive better performance outcomes than either could achieve separately."

According to Gurjeet Singh, CEO of AI software provider Ayasdi, assessing whether your company is an AI leader over the next few years will come down to one metric: "What percentage of your employee base and your customer base are affected by your AI algorithms? For a company like Google, the answer is 100 percent." For successful cognitive firms of the future, the use of AI will be ubiquitous. "It is going to be built into your Salesforce work, your CRM, your customer care experience and your front-line call rep. For financial firms, it will be built into how you price and approve your loans. For hospitals, it will impact how quickly patients fill out medical forms, get diagnosed and treated, and ultimately are released from the ER," says Singh.

INDUSTRY LENS:
WHICH SECTORS ARE SEEING THE MOST VALUE?

Today, more efficient risk management (47 percent of respondents), improved planning and decision-making (43 percent) and decreased costs (43 percent) top the list of benefits for financial services organizations. Using AI to develop risk models combines the power of more effective risk management and cost reduction, according to Ayasdi's Singh. "In financial services companies, these models assess credit and other risks among customers," he says. "The models can take up to 6,000 man-hours to develop and are often designed for data scientists. Advanced AI software geared toward general business users can reduce the time and cost dramatically."

For healthcare companies, accelerated time-to-market (60 percent of respondents) is the biggest current advantage, along with decreased costs (48 percent) and improved planning and decision-making (47 percent). Two years hence, global expansion (45 percent) and greater market share (42 percent) will rank among the top advantages.

According to Pfizer's Henstock, pharmaceutical companies are using advanced AI to step up research processes to develop new treatments. "AI tools allow us to identify patterns within data years before they are actually formally identified," he says. "If we can make a connection to a disease or a gene, we can have a five-year head start."

Consumer products companies are also reaping accelerated time-to-market as a top benefit (44 percent), along with improved planning and decision-making (42 percent) and increased customer retention (41 percent). Decreased costs (35 percent), global expansion (45 percent), creation of new business models (44 percent), greater market share (41 percent) and higher productivity (28 percent) will also rise to the top ranks of value within two years. According to Protiviti's Canaday, companies on the retail side, particularly in China and the United States, are using AI to create new business models. Canaday offers Amazon Go as a case in point. These convenience stores are leveraging AI to eliminate cash registers and check-out lines. Customers use an app to identify themselves when they enter the store. Cameras and advanced AI tools can recognize people and objects, track what customers take and automatically charge their Amazon accounts.

For technology companies, improved planning and decision-making is the biggest current benefit (47 percent). In two years, many technology firms expect to see a performance burst in accelerated time-to-market (51 percent), higher productivity (49 percent), greater market share (45 percent) and stronger profitability (44 percent).

One reason that technology companies expect to jump ahead of other industries in driving value from AI is their innovation culture. Product management in technology firms is a good example, whereby a product manager takes difficult technologies and makes them simple enough for a very large audience to use.

● ● ● Where different industries see value from AI
(percentage of organizations reporting high or very high value for each of the following)

	Consumer products	Financial services	Healthcare	Technology
Now	Time-to-market **44%**	Risk and compliance **47%**	Time-to-market **60%**	Planning/decision-making **47%**
	Planning/decision-making **42%**	Planning/decision-making **43%**	Decreased costs **48%**	Time-to-market **43%**
	Risk and compliance **42%**	Decreased costs **43%**	Planning/decision-making **47%**	Decreased costs **39%**
In two years	Planning/decision-making **46%**	Risk and compliance **44%**	Time-to-market **51%**	Time-to-market **51%**
	Global expansion **45%**	Time-to-market **42%**	Decreased costs **48%**	Productivity **49%**
	New business models **43%**	Productivity **42%**	Global expansion **45%**	Market share **45%**

How are organizations deriving benefits?

Any function, operation or business that relies heavily on data and requires analytical insight and judgment is a prime candidate for advanced AI. These technologies are already having major beneficial effects across enterprises.

IT and cybersecurity lead the list, with 75 percent of respondents seeing a moderate or significant positive impact. In two years, 94 percent expect this level of impact. With its ability to spot trends and outliers within massive amounts of data, AI is an ideal technology for detecting and protecting against cyber risks. "You've got millions of things happening in large companies around cybersecurity. It is beyond the capacity of a human to look at all that and determine if the firm has been hacked," says Protiviti's Gunderson. "If you can build strong algorithms and have a machine working 24/7, then you can spot those things faster and shut them down."

Strategy and planning is the second highest function seeing a positive impact: 63 percent of companies at present, rising to 92 percent in two years. Not only are strategy teams drawing on AI to analyze and predict business trends, but they also are actively thinking through the impact of advanced AI on business strategies, processes, products and market outreach. One telling statistic: 21 percent of chief strategy officers believe AI will be important to the future of their businesses versus 8 percent of CEOs. According to Dr. Bulent Kiziltan, formerly head of deep learning at Aetna and astrophysicist at Harvard University, companies need to incorporate AI into their business plans now. "AI will be part of almost everything. If the

company wants to remain relevant in five to 10 years, it must have short-term, mid-term and long-term strategic plans."

AI is also having a significant impact on **operations** for 47 percent of organizations. That number will jump to 82 percent in two years. The value of AI in automating and streamlining most operational processes is well understood by executives seeking to drive greater productivity and cost savings.

Protiviti's Lau recommends that companies take three steps for finding the right AI solutions for operational improvements. "First, work with business users to clearly define the business problem that you are trying to solve. Second, identify the data needed to solve the business problem through AI. And third, confirm the data is available for the technical solution." According to Lau, the most important part is implementing the solution closely with the operations team. "When there's a new solution rollout, how can the operations people support, utilize and analyze the process change along the way?"
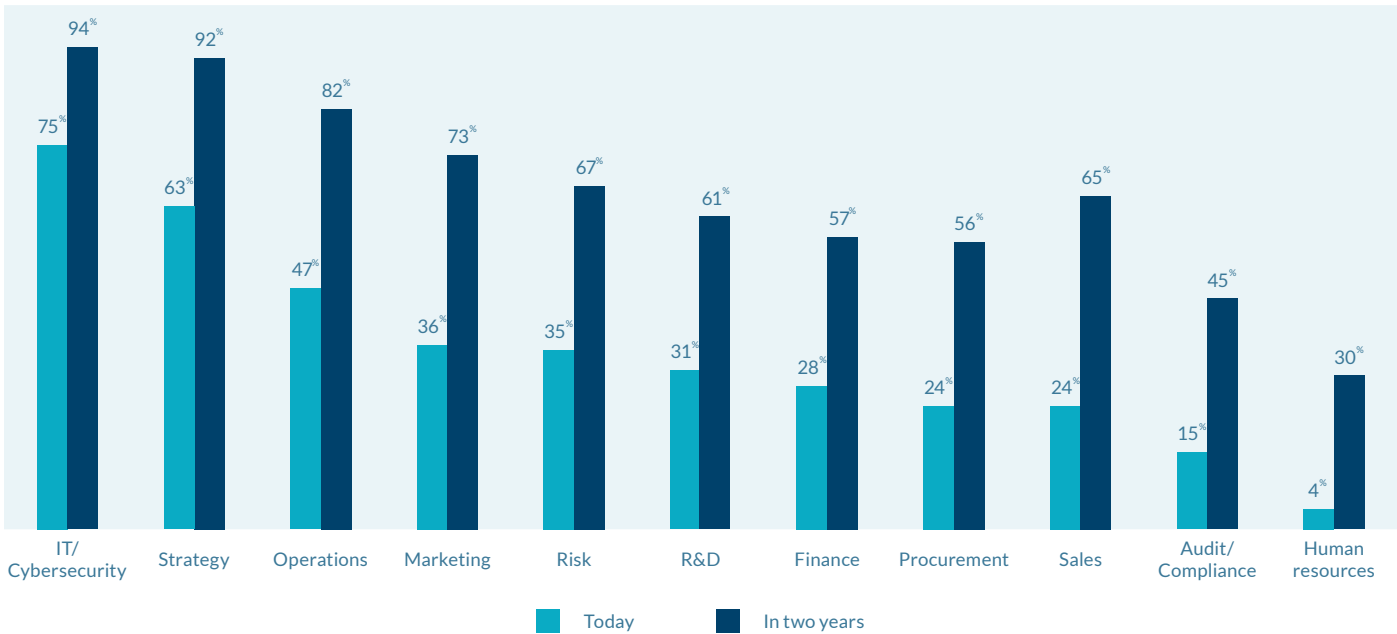
While to date the use of AI has been more limited in other business activities, companies across industries have ambitious plans to draw on advanced AI for practically every function, including marketing and customer experience (73 percent), risk management (67 percent), sales/business development (65 percent), and research and development (61 percent). Additionally, more than half of companies will turn to AI to boost performance in finance and accounting and procurement/supply chain.

Only a small minority of companies currently see advanced AI as having a notable positive impact on human resources and talent management, although that number is expected to reach 30 percent in two years time. Dil suggests that AI offers a significant opportunity to support talent management efforts. "The cost of recruiting and onboarding is significant for most firms," she says. "Companies can use AI to help find candidates that are likely to stay for a long time."

"The cost of recruiting and onboarding is significant for most firms. Companies can use AI to help find candidates that are likely to stay for a long time."

— Shaheen Dil, Senior Managing Director, Protiviti

· · · **Where advanced AI is having the greatest impact**
(percentage of organizations reporting moderate or significant positive impact)

Category	Today	In two years
IT/Cybersecurity	75%	94%
Strategy	63%	92%
Operations	47%	82%
Marketing	36%	73%
Risk	35%	67%
R&D	31%	61%
Finance	28%	57%
Procurement	24%	56%
Sales	24%	65%
Audit/Compliance	15%	45%
Human resources	4%	30%

Businesses Leapfrog to Deep Learning

01

Businesses are leapfrogging from more traditional machine learning (ML) applications to complex solutions using deep learning (DL).

- DL can be highly valuable for organizations with significant amounts of data in both structured and unstructured formats.
- Computer vision — the ability of machines to recognize an image such as a customer's picture — is also driving growth of DL applications.
- DL can be used with robotics when processes are complex and require a substantial amount of exceptions management.
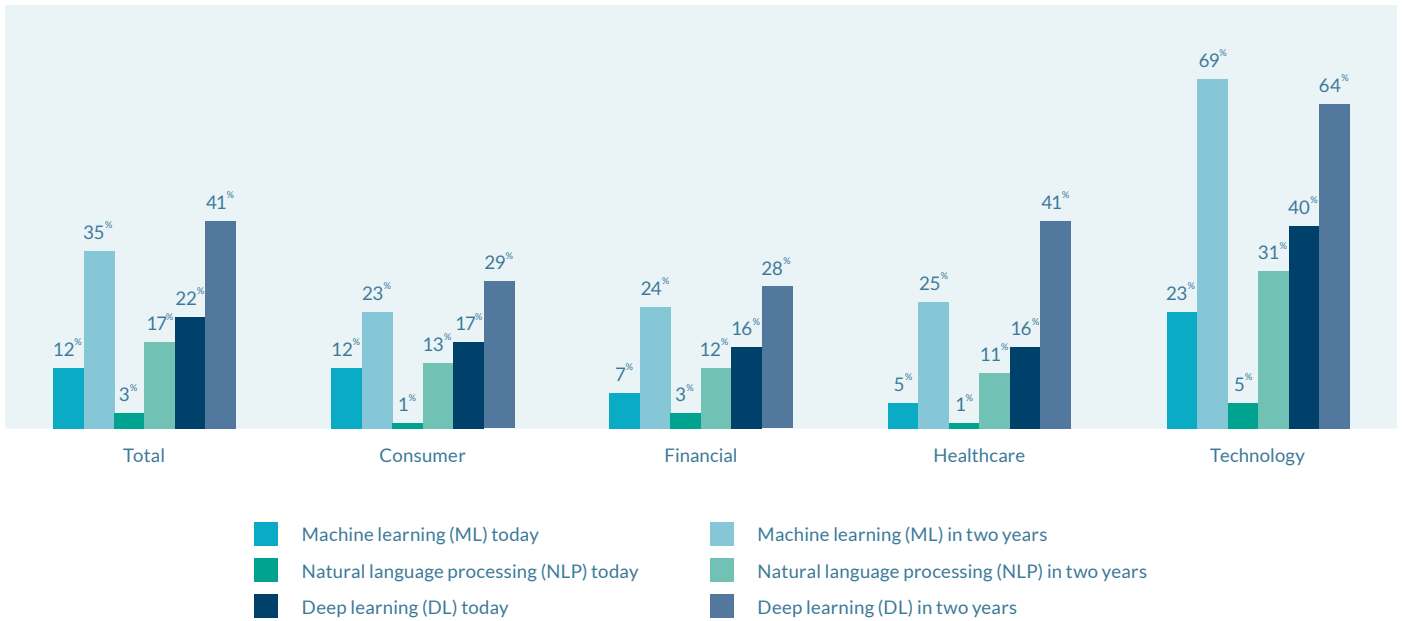
02

DL applications are highly complex, and many managers do not completely understand how they work. This can lead to error and bias. Regulators, especially in the financial services industry, are reluctant to approve any DL application if management cannot thoroughly explain how and why it reaches decisions.

Reflecting the growing corporate enthusiasm for advanced AI, our study found that businesses across sectors are leapfrogging more traditional machine learning (ML) applications to pursue more complex solutions using deep learning (DL).

Overall, 12 percent of businesses are at advanced stages of ML. However, 22 percent have already moved to advanced stages of DL sophistication. In two years, the numbers for both will be even bigger — 35 percent will have reached advanced stages of ML and 41 percent will be at advanced stages of DL.

• • • Stages of AI development today and in two years, by industry
(percentage of organizations reporting they are at a "maturing" or "advanced" stage of AI adoption)

Legend:
- Machine learning (ML) today
- Machine learning (ML) in two years
- Natural language processing (NLP) today
- Natural language processing (NLP) in two years
- Deep learning (DL) today
- Deep learning (DL) in two years

Chart values by industry:

	ML today	ML in two years	NLP today	NLP in two years	DL today	DL in two years
Total	12%	35%	3%	17%	22%	41%
Consumer	12%	23%	1%	13%	17%	29%
Financial	7%	24%	3%	12%	16%	28%
Healthcare	5%	25%	1%	11%	16%	41%
Technology	23%	69%	5%	31%	40%	64%

The trend toward DL cuts across all industries, with significant growth expected in both ML and DL in two years.

Burgeoning computer power, larger data sets and new techniques are fueling the rise of DL. According to Pfizer's Henstock, over the last two years DL has advanced rapidly due to faster hardware and new algorithms. "In the last couple of years, DL has been able to outperform not only many of the traditional ML techniques, but also human capability in recognizing objects and speech."

DL can be particularly valuable for organizations with outsized amounts of data in different structured and unstructured formats. As an example, Dr. Kiziltan cites healthcare organizations that combine structured data from organizations such as the Centers for Disease Control and Prevention with unstructured data from medical records and doctors' notes to predict patterns such as when and where a flu epidemic might hit and how severe it will be.

STAGES OF AI ADOPTION

Not considering or not applicable

Planning stage: Developing plans and still building internal support and a business case

Implementation stage: Starting to pilot and use a few simple applications

Maturing stage: Using in key parts of the business and seeing early performance gains

Advanced stage: Widely implementing across the organization and seeing ongoing performance gains

Bhattacharyya of Protiviti agrees. "The use of AI has significant promise in the healthcare industry, where, for example, AI can analyze patients' electronic health records or interpret diagnostic scans."

Lau at Protiviti sees computer vision — the ability of machines to recognize an image — as a major benefit of DL. For example, auto insurers use DL to identify a customer by their picture. They can also assess the damage to a car after an accident through photos. Even farmers are taking advantage of DL by using DL applications with cameras to assess crops and identify issues such as insect infestations.

"Businesses do not always realize how complex the processes are that they automate. Deep learning is a powerful tool to manage that complexity."

— Shaheen Dil, Senior Managing Director, Protiviti

DL can also play a major role in robotics, according to Dil. "Businesses do not always realize how complex the processes are that they automate," she says. "Deep learning is a powerful tool to manage that complexity."

Gunderson observes that many companies see the jump to DL as a means of getting ahead of the competition. However, he cautions businesses that DL applications use many layers of algorithms that can make them opaque, which can lead to poor decisions.

A well-known example, according to Henstock, is a case study about patients with pneumonia, performed by Rich Caruana at Microsoft and others. The goal was

"Regulators are not likely to approve an advanced AI application such as predicting credit risk if the institution's leaders don't understand how the algorithms work and can't explain them."

— Jonathan Wyatt, Managing Director, Protiviti

to determine whether these patients should be treated at home or admitted to the hospital. The most accurate predictive methods seemed to be counterintuitive — they recommended treating patients with prior lung disease or asthma at home. "What the application didn't know, however, is that these patients had physicians in the hospital who knew their history and would treat them aggressively, which was not captured in the data," says Henstock. "Because this data was not captured, the AI guidance could lead to poor decisions and less effective treatment."

When organizations start adopting AI, it is important that they are prepared to deal with questions from regulators, warns Jonathan Wyatt, managing director and global head of Protiviti Digital. To illustrate, he points to the financial services industry, where regulators are typically receptive to new technologies and understand their importance to the future of the industry. "However, if the management team that they engage with is not capable of explaining why they're confident that the algorithms they're implementing are working, then the regulator will say `no.' Regulators are not likely to approve an advanced AI application, such as predicting credit risk, if the institution's leaders don't understand how the algorithms work and can't explain them."
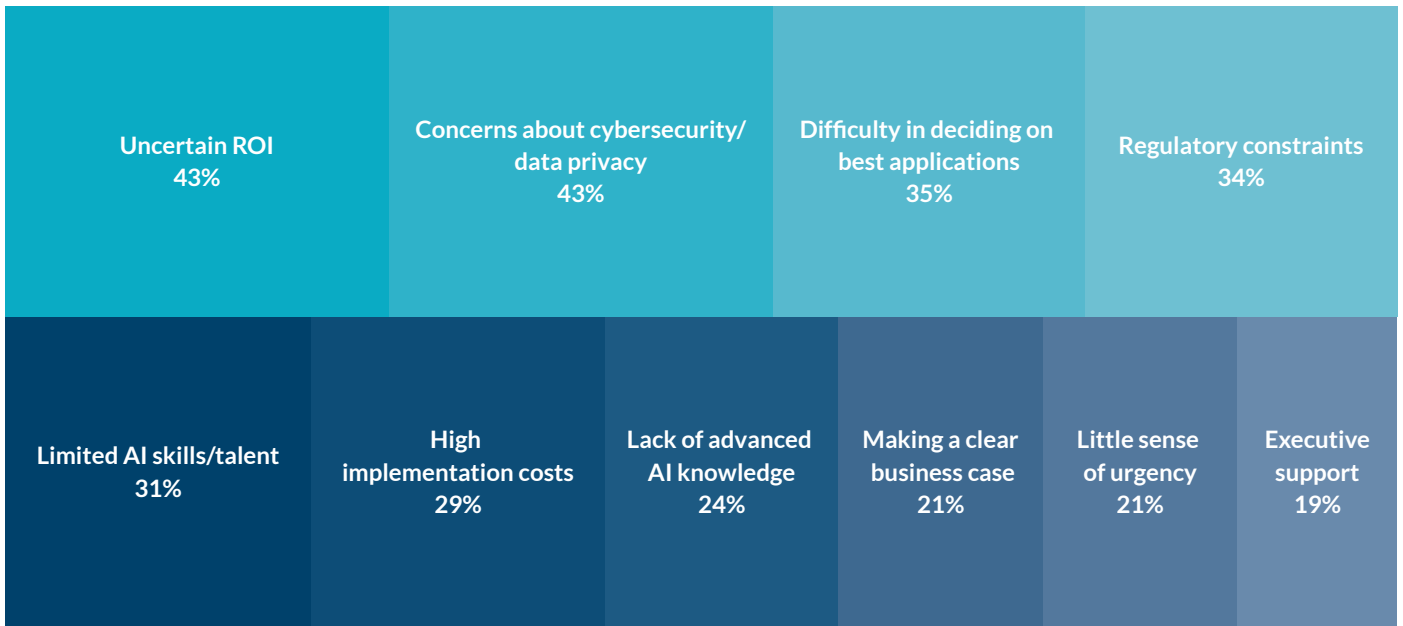
Overcoming the Barriers to AI Adoption

01 Although improved cybersecurity is a major advantage of AI, it also brings its own cybersecurity risks due to the greater access to sensitive and personal data.

02 Regulatory constraints are another major roadblock. Organizations must be able to audit their advanced AI applications to ensure that data is secure and company leaders understand how the application works.

03 Many organizations apply less rigorous standards to AI business cases than to other investments. This leads to concerns about the actual ROI of AI — one of the top barriers to moving more quickly with advanced AI.

04 Universities are not producing enough advanced AI specialists, which is spawning a talent war and pushing up salaries.

05 CEOs, COOs and non-technology senior executives remain skeptical about advanced AI. Compelling proofs of concept and pilots are essential to gaining their support. Pilots should address low-hanging fruit that is not easily solved by other analytics approaches.

There are a range of issues that can represent obstacles to AI adoption and which present challenges to advocates of the new technologies. However, Smythe at SomaLogic believes that barriers to moving forward with AI usually are not about technology, but rather are related to business performance and organization. Many of the respondents to our survey agreed. Uncertain ROI (43 percent), concerns about regulations (34 percent), and lack of AI talent and skills (31 percent) are among the top obstacles companies encounter.

• • • • **Biggest obstacles to AI**

Uncertain ROI 43%	Concerns about cybersecurity/ data privacy 43%	Difficulty in deciding on best applications 35%	Regulatory constraints 34%		
Limited AI skills/talent 31%	High implementation costs 29%	Lack of advanced AI knowledge 24%	Making a clear business case 21%	Little sense of urgency 21%	Executive support 19%

One reason for the **concerns about ROI**, which tops the list of obstacles, is lax standards in approving AI business cases. Only half of all companies apply the same standards to AI investments as they do to other initiatives. Approximately one in three makes AI investments based solely on proof of concept, while one in five requires neither ROI nor proof of concept.

As is often the case with new technologies, companies tend to focus on the technology instead of its business outcomes. According to Protiviti's Lau, "Organizations need to have a clear picture of the business problem they need AI to help solve. If a company has a very clear business goal in mind, it can figure out how to capitalize on its AI solution and see what the return will be."

"If a company has a very clear business goal in mind, it can figure out how to capitalize on its AI solution and see what the return will be."

— Lucas Lau, Director, Protiviti

As an example, Canaday of Protiviti describes a bank that wanted to shorten the approval time for a home mortgage from 50 days to seven. The approval process was mostly manual — everything from onboarding the customer to obtaining their credit scores. However, AI could do much of this work more efficiently: The ROI was calculated by comparing the investment costs against the savings in labor and the increased revenue from a more competitive customer experience.

Although AI can help protect against cyberattacks, it also carries its own **cybersecurity risks** due to the greater access to sensitive and personal data. "When you have regulations such as the recent General Data Protection Regulation (GDPR) in the European Union, the stakes get higher," says Canaday. "You need to know that these algorithms are using personal data in both a legal and ethical way, and that they are thoroughly protecting that data at the same time."

Canaday firmly believes **regulatory constraints** are going to be a major issue. "When you start to look at things like DL, where computers are essentially writing their own algorithms, how do you audit that?" he asks. "Can a regulator have confidence even when some people don't understand how AI is coming up with its answers?"

Lael Brainard, a member of the U.S. Federal Reserve Board of Governors, recently put an emphasis on the need for organizations to completely understand how their algorithms work and make decisions. "Perhaps one of the most important early lessons is that not all potential consequences are knowable now," she says. "Firms should not assume that AI approaches are less susceptible to problems because they are purported to be able to 'learn' or less prone to human error. There are plenty of examples of AI approaches not functioning as expected — a reminder that things can go wrong." To ensure that algorithms do not conceal issues that would run afoul of regulations, businesses need to validate their algorithms continually (see page 28).

"There's a war for talent for people with the skills to translate raw data into business outcomes. It's a little bit of an art and science."

— Tyrone Canaday, Managing Director, Protiviti

Choosing the right application can also be difficult as companies deal with legacy systems and other infrastructure issues. Suresh Baral, a managing director at Protiviti, urges executives not to "shoot for the moon" by making huge infrastructure investments from the start. Instead, businesses should focus on the business challenge at hand and carefully choose the application best suited to the problem.

Limited AI talent is a major hurdle for many companies. According to Canaday, "There's a war for talent for people with the skills to translate raw data into business outcomes. It's a little bit of an art and science." He believes the ultimate challenge is finding people that understand the business as well as the technology and data. "Sometimes you have people that understand the business, but don't understand technology and data. Other times you have people that understand just the technology and data and not the business. You need people that can connect all three of those circles."

VALIDATING ALGORITHMS

To ensure ML models provide accurate and understandable results, they must be validated from four perspectives: conceptual soundness, process verification, ongoing monitoring and outcome analysis.

Conceptual soundness. Validation from this perspective entails analyzing the model's design, reviewing its documentation, assessing empirical evidence and verifying that the variable selection process is sound, including being free from bias.

Process verification. Before a model is implemented, it needs to be subjected to the organization's model validation and approval process. For example, if a model dynamically redesigns its inner workings, the company should have the capability to save all versions of a model to test the validity of changes.

Ongoing monitoring. Model risks and limitations need to be monitored regularly. This is especially the case when systems use automated processes to redevelop the models on their own. Validation teams should have the capabilities needed to monitor these programs on an ongoing basis.

Outcome analysis. Model performance needs to be checked. For example, simpler models can lead to higher levels of bias. Conversely, more complex models can result in greater amounts of variance. Verification teams need to assess the trade-offs carefully between bias and variance.
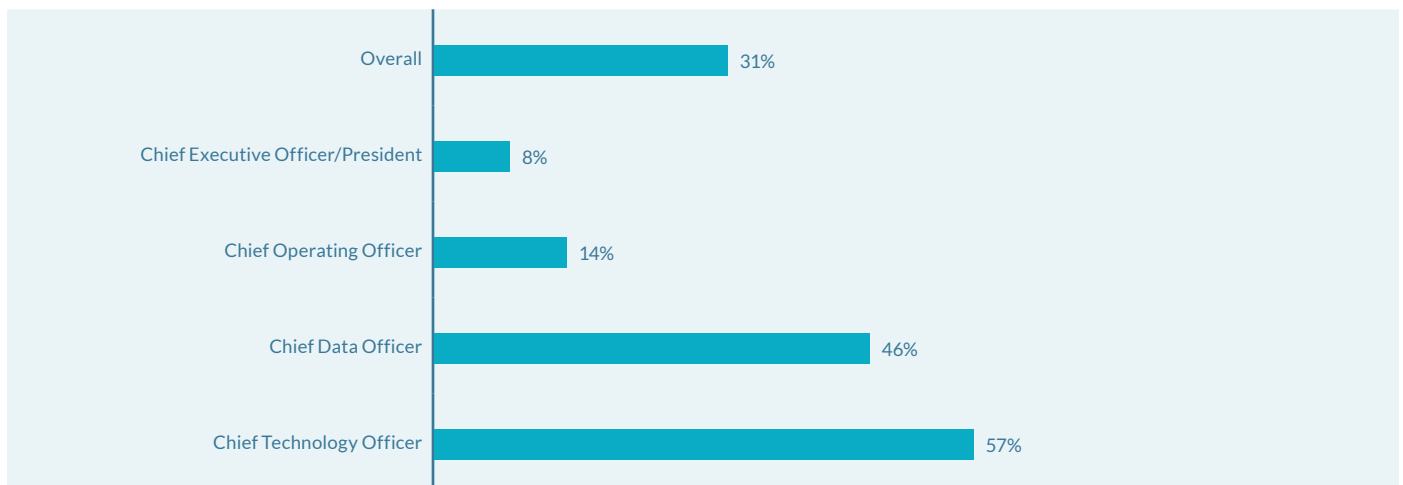
For more information, read Protiviti's white paper, *Validation of Machine Learning Models: Challenges and Alternatives*, available at www.protiviti.com.

Gaining senior management support

Our study found that general management teams remain skeptical about AI. Only 8 percent of CEOs and 14 percent of COOs see advanced AI as considerably or very important to the future of their businesses.

Technology executives feel the exact opposite: 57 percent of CTOs and 46 percent of chief data officers recognize the importance of advanced AI.

• • • **General managers are skeptical about AI — technology executives are not**
(percentage of organizations reporting advanced AI is considerably or very important to the future of their business)

Overall	31%
Chief Executive Officer/President	8%
Chief Operating Officer	14%
Chief Data Officer	46%
Chief Technology Officer	57%

Several factors underscore the doubt expressed by senior executives. The first is media coverage of AI, which often is negative. Stories and reports frequently focus on thorny issues such as the impact of AI on the global workforce. "Senior executives know they need to do something about AI, but the reports in the press and even in some analysts' work have made the issue sensitive," says David Judge, vice president of SAP Leonardo. "The conversation is built around, 'Are we going to have red-eyed killer robots?' This is not a useful business conversation. We should instead focus on pragmatic uses of AI that are already here and

ready." Respected voices have amplified these worries. For example, in 2016 Stephen Hawking famously said: "The rise of powerful AI will be either the best, or worst, thing ever to happen to humanity."[1]

Given the negative press, management should prepare for resistance to AI within their organizations. This resistance often comes from lack of knowledge. "People are naturally nervous about something they don't understand," says Protiviti's Dil. She suggests that one of the first things companies should do is plan an enterprisewide educational program to teach everyone about the basics of AI and its benefits for the workplace.

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[1] www.innovatorsmag.com/stephen-hawking-dies-aged-76/.

As part of that educational process, companies need to explain to their workforce that AI is not necessarily going to eliminate jobs. "Firms need to help their people understand that no matter how effective AI can be, it's never going to replace a human being," says Dil. "Every output of every ML or DL model must be reviewed by a human being. Rather than eliminating jobs, AI will transform them. It will remove repetitive and boring tasks, and instead make jobs more interesting and challenging. However, there is a short-term challenge of talent development and re-training that companies will need to undertake."

Proofs of concept are key

Another major roadblock to gaining executive support is proving ROI, as today most leaders are not convinced. Our survey shows that only 23 percent of CEOs and 21 percent of CFOs expect AI to drive significant value to their firms, compared with 69 percent of chief data and analytics officers and 64 percent of CTOs. Singh of Ayasdi points out that senior executive skepticism is not necessarily bad. He believes it is the CEO's job to make sure the organization is on the right track. Given the hype that often follows the rise of new technologies, it is incumbent on internal advocates to clearly demonstrate AI's value to the company and its senior leaders.

According to Protiviti's Baral, the best way to overcome executive doubt is through a proof of concept. "Rather than taking on a big project, you should start with something small that can be done in a reasonable amount of time. If you come up with a project and tell the CEO this is going to take two years, she or he is not going to invest the money."

"Firms need to help their people understand that no matter how effective AI can be, it's never going to replace a human being."

— Shaheen Dil, Senior Managing Director, Protiviti

Baral suggests selecting a project where you have the data, people and systems to show tangible results. "If you do such a proof of concept, any business person will get converted. Who is going to leave dollars on the table? If your ML algorithm comes up with something that's 10 percent better, people will be converted and want more."

Baral says that low-hanging fruit is optimal for pilots. In addition, pilots should address a challenge that cannot be addressed as effectively by other analytics applications. "This is where DL comes in," he says. "If you need to analyze structured and unstructured data, DL applications can make an excellent pilot."

Although internal advocates may be expecting exceptional results, pilots should not be oversold. Says Ayasdi's Singh: "I remember when we first started working with a banking client, they told us that if we could make a 3 percent difference they would be thrilled. We accepted the challenge and ended up making a 25 percent improvement. However, had we made such a claim at the beginning, they would have thrown us out of the room."

AI advocates need to work carefully with executives to build their understanding as part of the pilot process. For example, they can query the CEO about what he or she feels are the company's top five challenges and develop a pilot around one of them. Development of a small training program for senior executives is one method that can help to gain acceptance.

People, Structure and Culture

WHAT YOU SHOULD KNOW:

01 AI efforts are led by senior technology executives in most companies. However, many experts believe it should be the domain of the CEO or line-of-business head to ensure AI applications are tied closely to specific business outcomes.

02 Advanced AI encompasses both technology adoption and business change. Thus, only a small percentage of organizations completely centralize AI professionals. Nearly all combine a center of excellence with additional AI staff housed within individual functions and business units.

03 To fill talent gaps, businesses are partnering with consulting firms, developing internal talent, outsourcing, recruiting new talent and partnering with universities. The most successful AI companies are much more likely to develop talent in-house.

04 The use of off-the-shelf or internally developed advanced AI tools with interfaces that most mathematically inclined managers can use simplifies the training challenge and lessens the need for advanced AI specialists.

According to Sumedh Mehta, CTO of Putnam Investments, to derive significant value from AI, two things must happen. First, internal technology departments must turn data into insights to capture business partners' curiosity about how AI can advance their business interests and decision-making. Second, the team must identify a highly relevant business challenge that can be addressed through AI. Business units must work closely with technology teams to identify one or two use cases where the impact of AI can meaningfully enable or augment important capabilities. A significant amount of the work will involve data collection and manipulation. AI teams need engineers and business partners, as well as experts in the field of machine learning, to make serious strides toward overall project objectives.

In most companies, technology executives are charged with overall advanced AI responsibility. More than 75 percent of organizations worldwide have put AI in the CTO, CIO or CDO portfolio. Only 15 percent of CEOs have AI in their ambit.

Because of AI's power to transform a company, experts such as Protiviti's Wyatt believe that an organization's AI strategy should be defined at the highest levels of the organization. The CEO and other board members should be engaged and should be able to articulate the organization's attitude and goals of AI. SAP's Judge echoes the sentiment, underscoring that AI needs C-suite strategic authority. Top-level business heads need to cascade new expectations about what AI can deliver through the entire organization — everything from greater profitability through automation to more competitive customer experiences.

Senior technology executives need to be in the leadership mix. "But they can't be responsible for carrying all the water," says Judge. "They have to be able to work with the business to help them understand the technology capabilities but then let the business be able to help use this new toolbox to do very interesting things for their customers."

Lau of Protiviti homes in on three skill sets critical to AI and that are rarely found in one person: business knowledge, data science and data engineering. "AI teams need these three skills and the leadership team should have them in their ranks also," he says.

Helping the culture embrace AI

Eliminating fear of AI is one of the critical mandates for senior leadership. In many organizations, people are afraid of AI because they believe it will be used to eliminate their jobs. But the opposite better reflects the potential of advanced AI to the organization and individual employees.

"My advice to CEOs is to make sure the message goes out from the very top of the house and is very clear," says Dil. "AI is a way to empower employees and make work more meaningful, efficient and fulfilling."

"AI will open the door for employees to learn and grow in ways they never imagined."

— Madhumita Bhattacharyya, Managing Director, Protiviti

Protiviti's Bhattacharyya notes that workers may be concerned that AI will eliminate jobs. "AI will, in fact, change or eliminate some positions, but it will create even more new, advanced opportunities with different or more exciting responsibilities. AI will open the door for employees to learn and grow in ways they never imagined."

Lefferts of Protiviti notes that while multiple studies indicate AI may eliminate several million jobs over the next decade, it will create far more jobs than are eventually lost. "Emerging technology is often met with some hesitation, but as acceptance grows and we ultimately adopt and learn how to use new tools, we see business and job creation advancing exponentially."

How to organize AI resources

As organizations accelerate their use of advanced AI, they must decide where they will house AI professionals. Because AI is about both technology adoption and business change, siloed approaches generally are not effective. What works best is an organizational structure that ensures AI specialists and business partners collaborate hand-in-hand on AI solutions.

If the scale tips too far toward the technology side, it can result in the development of applications that fail to deliver business benefits attuned to market needs. In addition, as Pfizer's Henstock has experienced in the healthcare field, data scientists tend to think more about long-term projects and may not provide a good balance between short- and long-term goals.

If the scale tips too much toward the business side, the approaches may not be as technically sound as they need to be. "There are huge numbers of organizations that don't have enough business people who understand advanced AI and how it can be used to transform operations," says Protiviti's Wyatt. "The revolution will only happen when business leaders and technical people are aligned and working together to shape the future."

Most companies understand the need to strike a balance. Only 7 percent of organizations take a fully centralized approach by housing AI staff in a single center of excellence. Even fewer, 4 percent, are fully decentralized. Nearly 90 percent use a hybrid model, with 56 percent placing most of AI professionals in business functions supported by a small central department of AI professionals and 33 percent relying on a central AI function, with some AI professionals residing in business units or divisions.

• • • **Where companies house their AI staff**

Most advanced AI personnel are housed in business units or divisions, with some central department AI professionals
56%

A central department with some professionals housed in business units or divisions
33%

Central department or center of excellence
7%

All advanced AI staff reside in business divisions
4%

Protiviti's Baral notes that companies often start with a center of excellence to build AI capability with some flexibility. As the center of excellence and the company's need for AI grows, its specialists can be moved into different business units. Regardless of the option a company chooses, it should be consistent with the business's overall structure. "If a company has an open and highly collaborative structure, it may want to decentralize AI efforts," he says. "But if it is led strongly from the center, it may want to reflect that in how it deploys AI professionals."

Closing the talent gap

A shortage of talent is one of the main obstacles to moving forward with advanced AI. As a result, the number of AI professionals in businesses is relatively small compared with the cadres of data and analytics specialists. The ratio of AI specialists to data and analytics professionals is 1:25, and it is even lower for healthcare companies (1:33) and firms in North America (1:33).

To fill the gaps, businesses are using a broad array of techniques, including partnering with consulting firms (55 percent), developing internal talent (54 percent), outsourcing (32 percent), recruiting new talent (31 percent) and partnering with universities (27 percent).

The ability to develop talent internally is a hallmark of AI success. Only 2 percent of organizations that are garnering the greatest value from AI report talent as a top barrier. Nearly 90 percent of these overperformers develop talent in-house.

Developing talent internally may be easier than many companies think. Dr. Kiziltan notes that businesses may not need armies of data scientists. In fact, off-the-shelf products that non-technical managers can use after a brief training are growing steadily.

Dil takes a similar view and observes that there are two types of AI experts. The first are managers with a mathematical bent that can be trained to use basic AI tools with a user-friendly interface. These can be either off-the-shelf products or applications developed in-house. These individuals may be called "citizen data scientists." Data scientists and engineers are the second type of experts. Organizations need these professionals to build the applications but should not rely on them to be the only ones who can use those applications because of their complex interfaces. As Dil puts it: "You don't have to know how to build a car in order to drive one."

Although internal talent development is important, companies should not shy away from using their ecosystems for skills and talents, especially if a specialty is needed. "You may want to use external talent that you may not need internally," says Pfizer's Henstock. "If your goal is to improve marketing, then that may be a very specific task that you need to outsource to a vendor or bring in by leveraging the ecosystem."

"There are huge numbers of organizations that don't have enough business people who understand advanced AI and can adopt it effectively. The revolution will happen when business and technical people come together with a common understanding of AI and the business it serves."

— Jonathan Wyatt, Managing Director, Protiviti

Data Dilemmas

01 Many companies are amassing multiple sources of data. However, only one in three are confident that their existing data support their advanced AI programs.

02 While businesses are trying to make fast progress with their AI platforms and data, they should start by focusing on data for pilots, which will provide insights into data and platform needs going forward.
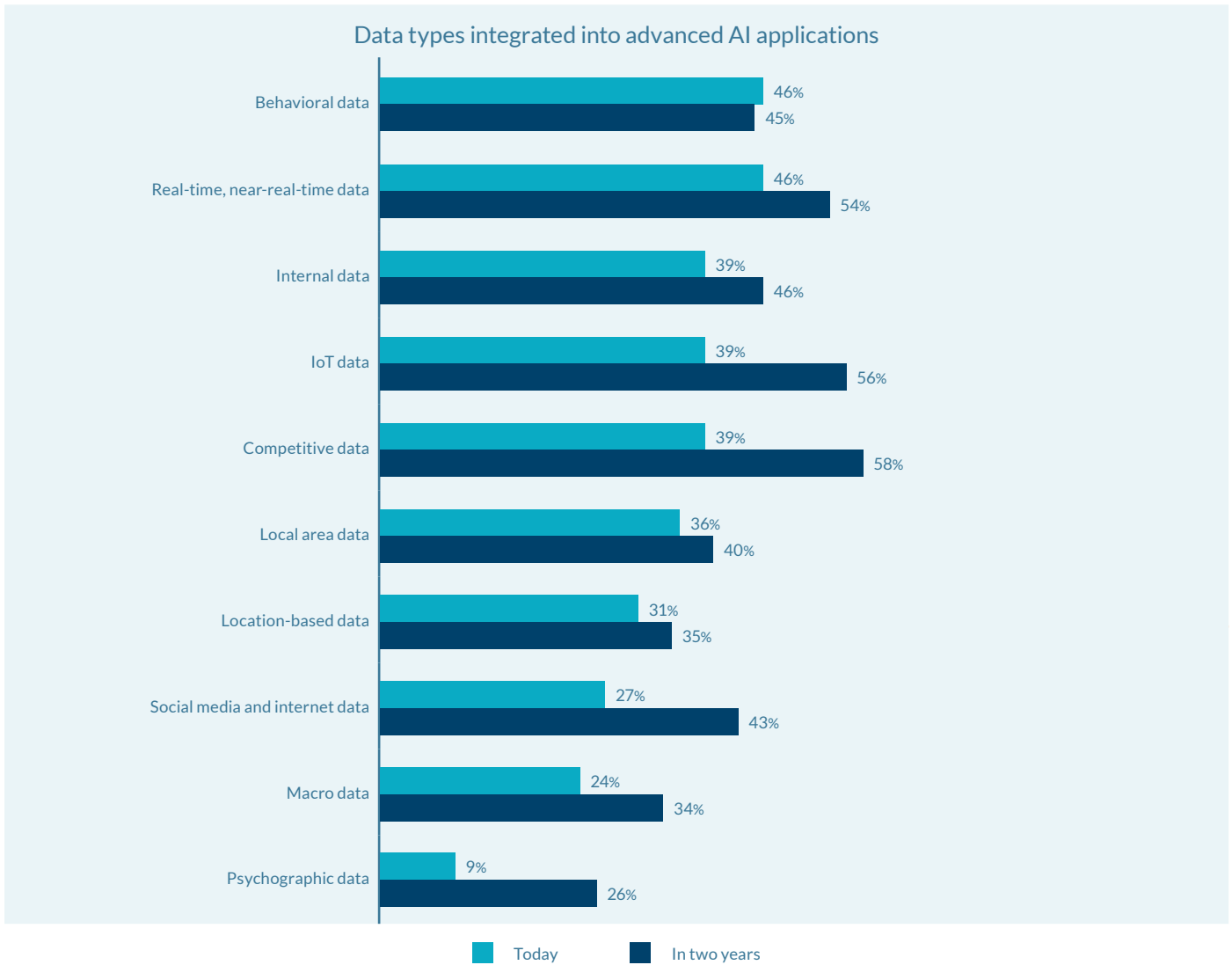
03 Few companies perceive data as a valuable asset, and thus they do not devote sufficient attention to how it is collected. Companies should begin by looking at the source of their data and make sure there are clear rules and policies in place that ensure it is clean and usable.

According to Bhattacharyya of Protiviti, "Data is the most important element in AI, but we have amassed more data than any human could analyze or interpret alone. Using AI, we can analyze large volumes of data to find patterns or solve problems, realizing new connections and yielding greater insights to help guide decision-making."

Companies are stockpiling hordes of data to drive their AI programs. Data is the rocket fuel for AI, according to Stanford's Ng. Our survey shows that companies are drawing on a rich blend of market and customer data to feed their AI algorithms. This includes real- or near real-time trend data (46 percent), behavioral data (46 percent), IoT data (39 percent), competitive data (39 percent) and social media data (27 percent).

Over the next two years, the priorities will change significantly. Competitive data will be the most used (58 percent), along with IoT data (56 percent), real-time or near real-time trend data (54 percent), customer channel data (49 percent), internal data (46 percent), behavioral data (45 percent) and social media data (43 percent). Technology companies are among the biggest users of IoT data — 44 percent currently and 72 percent in two years. Healthcare organizations will be the biggest users of internal data, given the information they have about patients, treatments and outcomes: 47 percent now and increasing to 55 percent in two years.

Data types integrated into advanced AI applications

Data type	Today	In two years
Behavioral data	46%	45%
Real-time, near-real-time data	46%	54%
Internal data	39%	46%
IoT data	39%	56%
Competitive data	39%	58%
Local area data	36%	40%
Location-based data	31%	35%
Social media and internet data	27%	43%
Macro data	24%	34%
Psychographic data	9%	26%

■ Today   ■ In two years

Although companies are accumulating multiple sources of data, they are having trouble integrating them and accessing the right data, which is critical to getting value from advanced AI. Just one-third of companies are confident that existing data sources can support their AI programs. Another one-third are moderately confident, while 32 percent have little or no confidence.

Due in great part to their legacy systems, businesses are struggling to become more agile with their data, according to Protiviti's Gunderson. "If you talk to most companies today, they would tell you they're not happy with the structure, quality or timeliness/accuracy of their data," he says. "Companies will have to decide if they want to create AI tools and techniques with imperfect data or wait until the data are fixed. One way or the other, it's a perpetual challenge."

Singh of Ayasdi believes the issue is more about corporate culture than technology. "Companies often treat data as a liability or expense," he says. "They need to treat data as an asset. Only then will the organization rally around the discipline and change needed to effectively manage data and its accuracy."

Nonetheless, companies are trying to move fast to prepare their AI platforms to handle data management, algorithm development and processing. Nearly 40 percent of companies have made considerable progress and the number will grow to 66 percent in two years.

However, companies do not have to fix all the data at once. They should start with the data they need for pilots and build systems from there as needs and applications become clearer.

Given the complexity of data management, Pfizer is experimenting with many techniques and technologies. "We have data lakes in some places and we have layers," says Henstock. "We're pushing things in the cloud, we're keeping other things out of the cloud. We are doing lots of different things. We'll see where it all lands."

"Using AI, we can analyze large volumes of data to find patterns or solve problems, realizing new connections and yielding greater insights to help guide decision-making."

— Madhumita Bhattacharyya, Managing Director, Protiviti

AI Leaders Point the Way

01	Sixteen percent of companies are already gaining significant value from AI. They are developing it differently and seeing a greater bottom-line impact than other companies.
02	AI leaders employ nearly three times as many AI professionals than do businesses overall.*
03	AI leaders are much more likely to make advanced AI part of their digital transformation and use technology to fundamentally change how they conduct business.
04	AI leaders stress that companies' IT infrastructure must support AI programs, and that business and functional units should work closely together to ensure there is a clear ROI.

*   We define "AI leaders" as those organizations reporting that they currently gain "high" or "very high" value from the use of advanced AI.

The 16 percent of companies that are gaining the greatest value from AI are in a different position altogether than are other businesses. They are developing their AI differently and deriving more bottom-line results than companies overall.
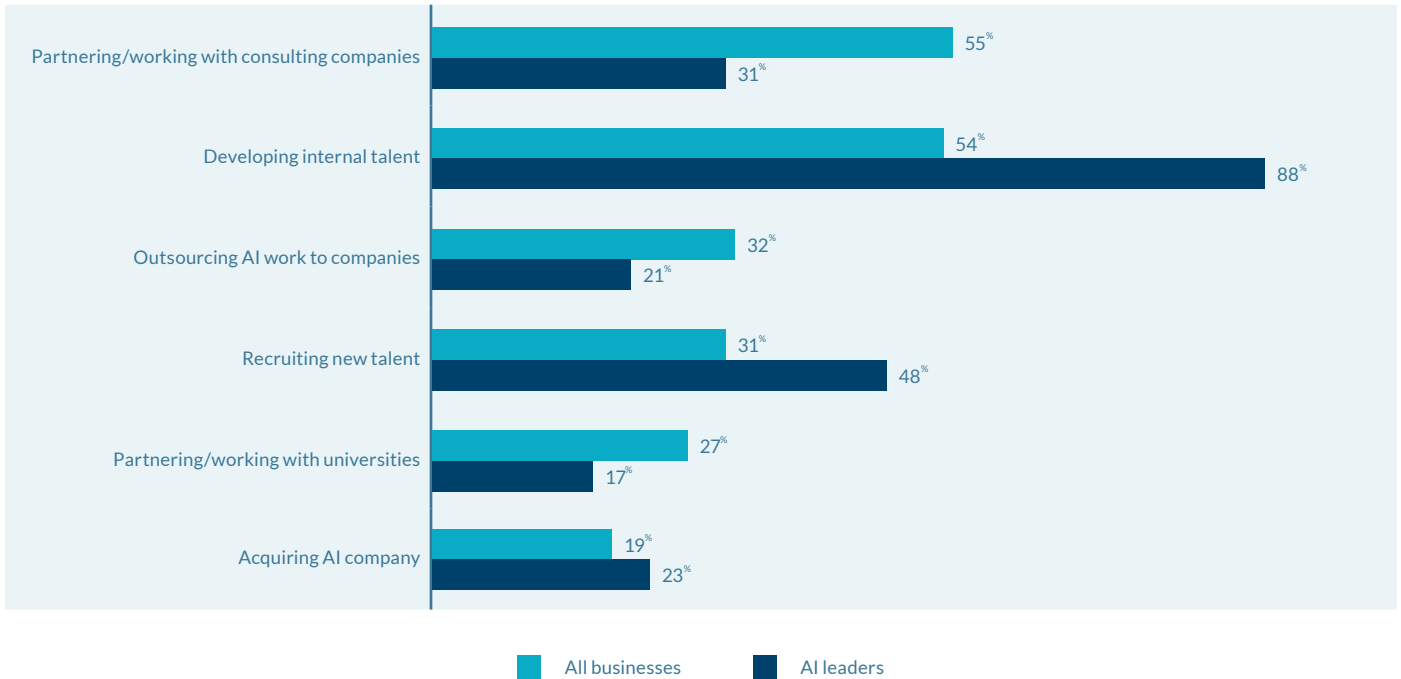
To determine which companies are AI leaders, we asked each respondent to rank their stage of AI development compared with that of their competitors. Based on these rankings, we categorized companies into three groups: leaders (32 percent), intermediates (35 percent) and laggards (33 percent).

One surprising finding is that the ranks of AI leaders include more than digitally born entities. Although AI leaders tend be more concentrated in technology, they are found in multiple sectors, including healthcare, consumer products and financial services. They are particularly strong in the insurance industry.

What do they do differently? One standout area is the amount of AI talent they have and how they develop it. AI leaders devote a higher percentage of analytics specialists to AI. Among all organizations, 7 percent of analytics staffs are focused on AI. Within AI leaders, it is 11 percent. AI leaders are not letting talent scarcity get in their way. They are significantly more likely to develop talent in-house than are other organizations.

Partnering/working with consulting companies
All businesses: 55%
AI leaders: 31%

Developing internal talent
All businesses: 54%
AI leaders: 88%

Outsourcing AI work to companies
All businesses: 32%
AI leaders: 21%

Recruiting new talent
All businesses: 31%
AI leaders: 48%

Partnering/working with universities
All businesses: 27%
AI leaders: 17%

Acquiring AI company
All businesses: 19%
AI leaders: 23%

■ All businesses   ■ AI leaders

AI leaders are far more likely to see these technologies as integral to their digital transformation, defined as using technology to fundamentally change how the business works — 70 percent of AI leaders say they are ahead of their competitors in their digital transformation, compared with just 25 percent of companies overall. "These companies know too well that their competitors are going to be using analytic techniques of AI, ML, DL and robotics," says Dil. "The race is on to perform the same tasks faster and more efficiently than companies that aren't as digitally mature."

It is not surprising that AI leaders are ahead of other companies in using advanced AI technologies and are likely to remain in the lead over the next two years: 34 percent of AI leaders are at advanced stages of ML currently, against 12 percent of companies overall.

In two years, the number will balloon to 81 percent for leaders, compared with 35 percent of organizations overall.
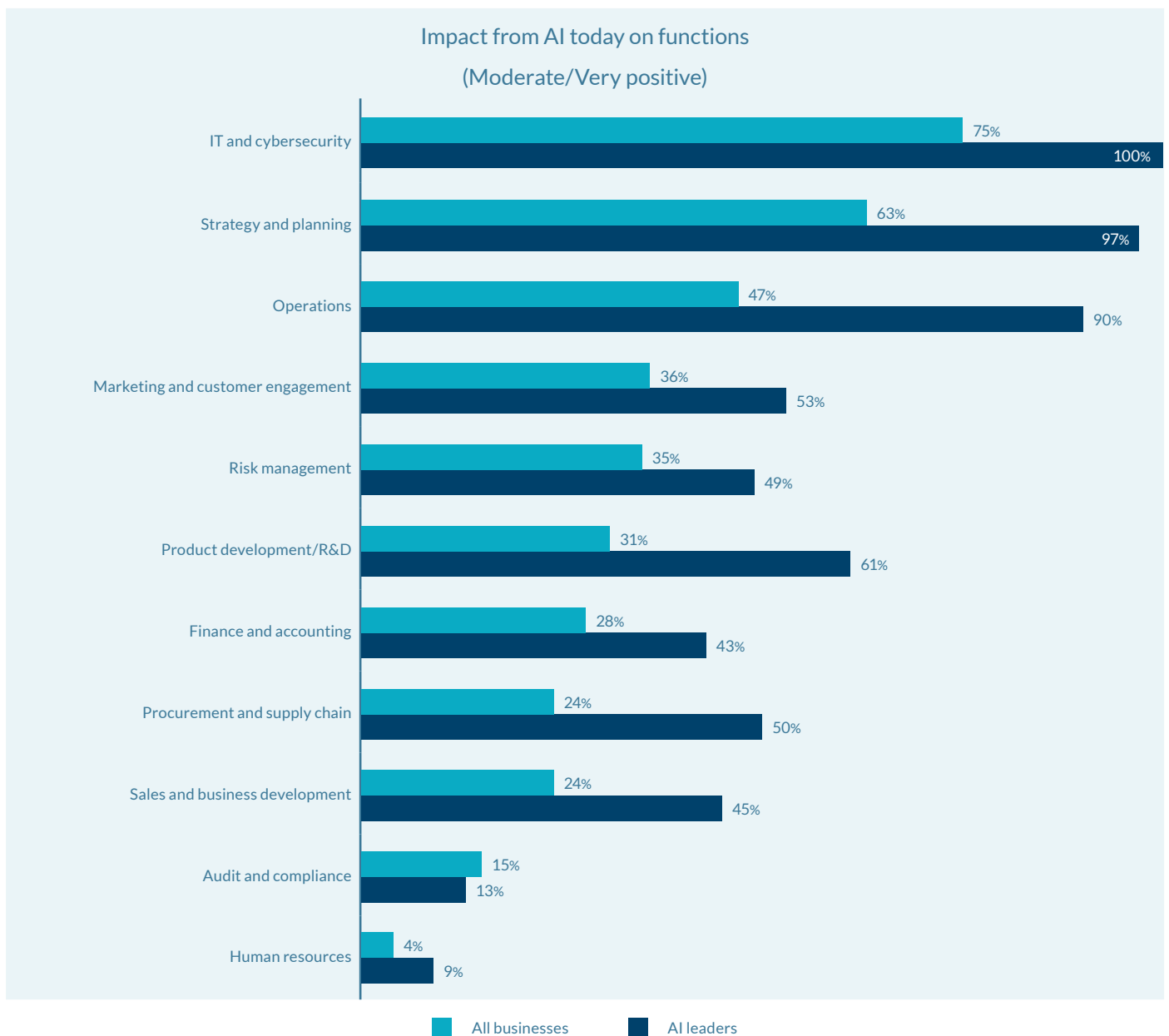
Natural language processing is at an advanced stage among 8 percent of AI leaders, compared with 3 percent of companies overall. In two years, it will mount to 44 percent compared with a scant 17 percent among businesses overall. Moreover, an eye-opening 58 percent of AI leaders are at advanced stages of DL, and 79 percent will have mastered it in two years. Among the rest of companies surveyed, the percentages are 22 percent today and 41 percent within two years.

Although AI leaders are seeing significant impact on key functions such as cybersecurity and strategic planning, they are also seeing impact on functions
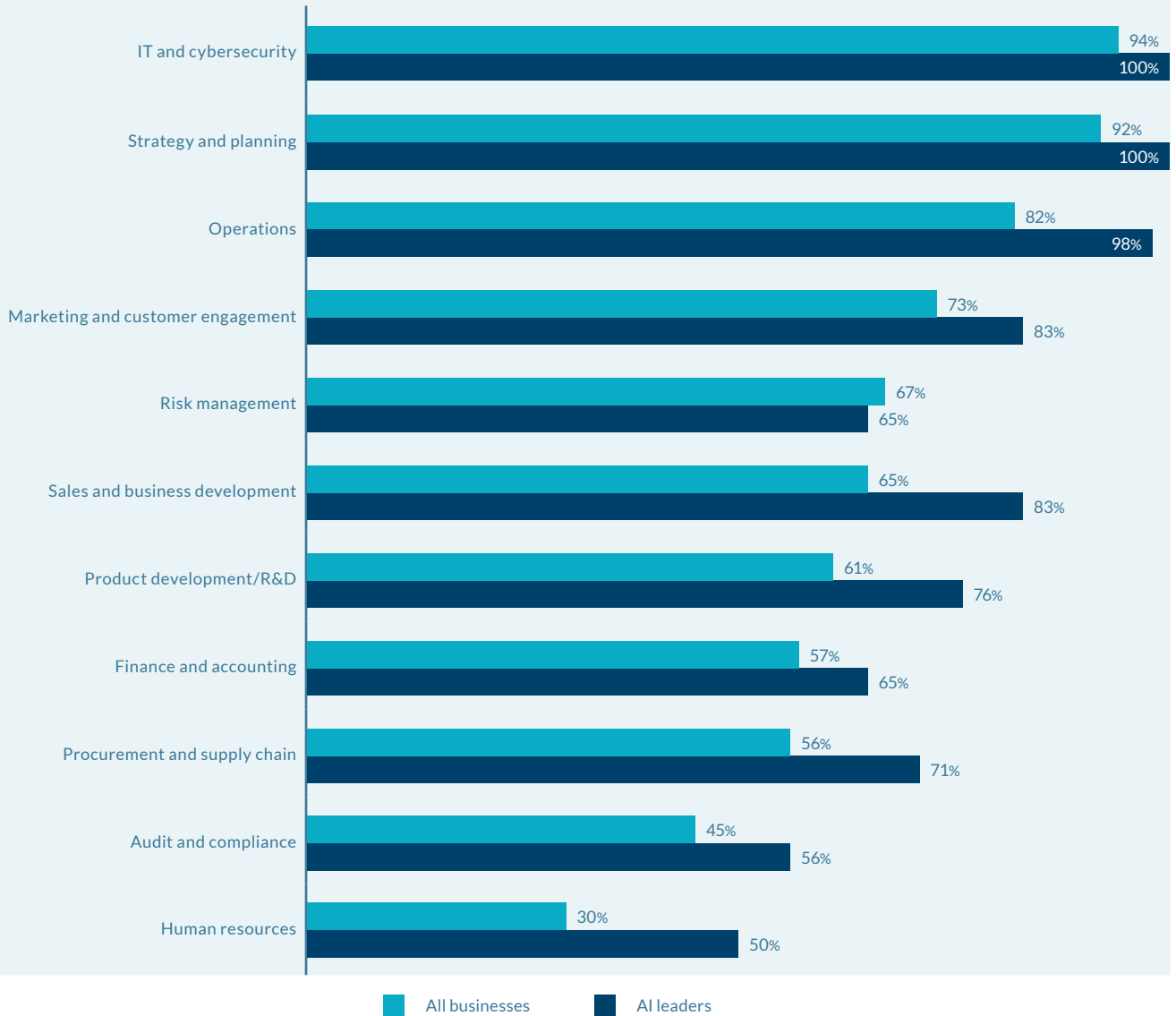
directly related to growth. For example, 22 percent are gaining significant benefits from AI applied to sales and business development, versus 11 percent of businesses overall. In two years, 46 percent of AI leaders will see benefits in sales, versus 32 percent of the rest of the market. These companies are following a similar path with marketing and customer experience — 34 percent are seeing benefits from AI today and 52 percent plan to do so in two years. That compares with 19 percent and 39 percent respectively for companies overall.

• • • AI leaders see huge benefits on the horizon
(percentage of organizations reporting moderate/very positive impact)

Impact from AI today on functions

(Moderate/Very positive)

Function	All businesses	AI leaders
IT and cybersecurity	75%	100%
Strategy and planning	63%	97%
Operations	47%	90%
Marketing and customer engagement	36%	53%
Risk management	35%	49%
Product development/R&D	31%	61%
Finance and accounting	28%	43%
Procurement and supply chain	24%	50%
Sales and business development	24%	45%
Audit and compliance	15%	13%
Human resources	4%	9%

■ All businesses   ■ AI leaders

Impact from AI over the next two years on functions
(Moderate/Very positive)

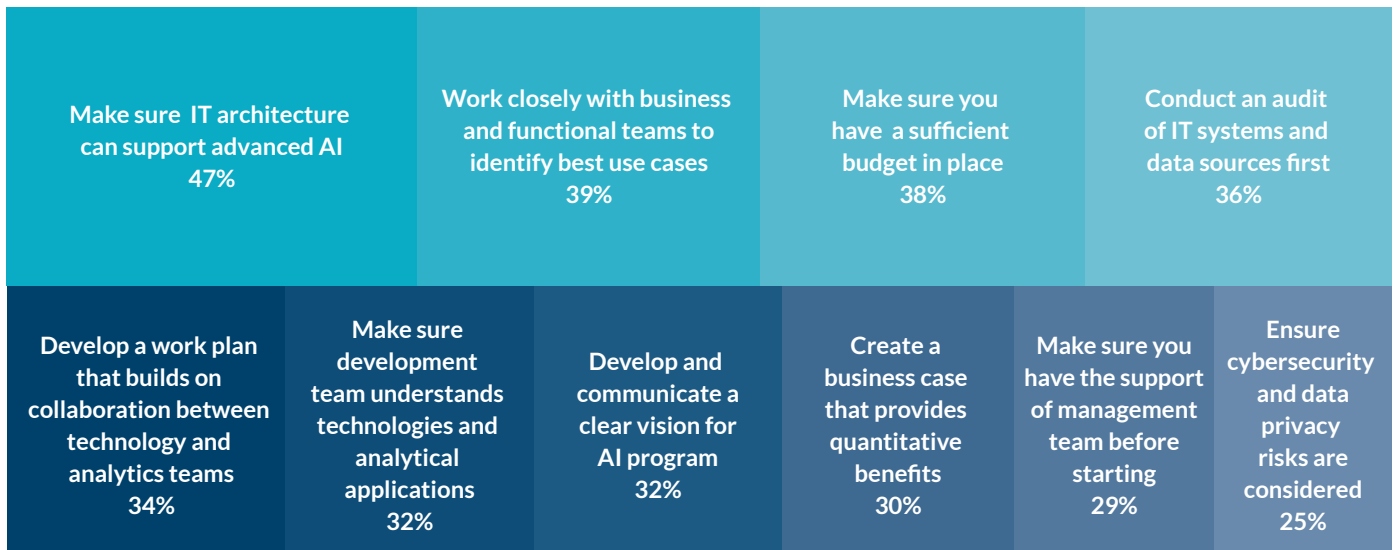| Function	All businesses	AI leaders
IT and cybersecurity	94%	100%
Strategy and planning	92%	100%
Operations	82%	98%
Marketing and customer engagement	73%	83%
Risk management	67%	65%
Sales and business development	65%	83%
Product development/R&D	61%	76%
Finance and accounting	57%	65%
Procurement and supply chain	56%	71%
Audit and compliance	45%	56%
Human resources	30%	50%

■ All businesses　■ AI leaders

In the next two years, AI leaders will move far ahead of the pack in applying AI to business processes specific to competitive advantage in their industries. For example, half of AI leaders in the financial advisory sector expect to see significant impact on portfolio management, versus only 12 percent of the total universe of financial advisory entities. Nearly 80 percent of AI leaders that are healthcare providers expect a sizable impact on regulatory compliance within two years, versus 16 percent of total healthcare providers. AI leaders in consumer products will outpace their industry average in customer segmentation (71 percent versus 22 percent) and in IoT/Interconnectivity (83 percent versus 28 percent).

Unlike AI leaders, most companies are just starting to chart their path to using AI. One-third of companies do not even employ AI staff. To help companies move out of the gate effectively and chart a smooth course, we asked executives at AI leader companies to tell us the top lessons that they have learned so far.

• • • Most important lessons learned by AI leaders
(percentage of AI leaders selecting each of the following)

Make sure IT architecture can support advanced AI **47%**	Work closely with business and functional teams to identify best use cases **39%**	Make sure you have a sufficient budget in place **38%**	Conduct an audit of IT systems and data sources first **36%**

Develop a work plan that builds on collaboration between technology and analytics teams **34%**	Make sure development team understands technologies and analytical applications **32%**	Develop and communicate a clear vision for AI program **32%**	Create a business case that provides quantitative benefits **30%**	Make sure you have the support of management team before starting **29%**	Ensure cybersecurity and data privacy risks are considered **25%**

The top lesson learned is to ensure the IT infrastructure supports AI. As Protiviti's Baral points out, companies need to carefully map out what their AI platform needs to do and how it will link to other systems. Conducting an audit of IT systems and data sources to ferret out infrastructure challenges is a closely related lesson learned.

Another important lesson is working collaboratively with business units and functional units, along with having development teams that are familiar with both technologies and analytical applications. The importance of tying these elements together cannot be overstated. When the right skills are in place and AI professionals are working with business heads, the ROI becomes clearer and companies can avoid under-budgeting advanced AI initiatives — another painful lesson learned.

A Call to Action: Advice on Becoming a Cognitive Leader

Although some companies have yet to embark on a path toward advanced AI, many of their leaders understand the pressing mandate. These organizations are planning to move quickly and expect to see gains in productivity, profitability, revenue and shareholder value — in just two years. Realizing these achievements is no small order, however. Organizations need to heed the experience of others in order to avoid the pitfalls along the way.

The following calls to action represent advice from advanced AI adopters.

Don't wait until the dust settles.

AI is essentially the next wave of the digital revolution and most businesses want to move fast. Although companies have been able to play wait and see in the use of some technologies, AI cannot be one of them. Businesses fall behind at their own peril. "The most damaging approach, still extremely common, is simply doing nothing," says SAP Leonardo's Judge. "We see a lot of companies waiting for the benefits to become crystal clear. But by then it might be too late to play catch-up."

Develop an AI roadmap.

Companies need to have a plan to maximize the use of AI. It should start with an assessment that delineates where the company stands and what gaps need to be closed. The roadmap should identify the proofs of concept needed as well as all the functions, processes and businesses where advanced AI can make a significant difference. The plan should also include selection of leaders and project managers for each initiative, along with a budget.

Don't shoot for the moon.

Companies often make significant investments in platforms and infrastructure before they truly

"The most damaging approach, still extremely common, is simply doing nothing."

— David Judge, Vice President, SAP Leonardo

understand how their organization will use AI and the value it will bring. Instead, organizations should develop prototypes and proofs of concept that tackle low-hanging fruit that other analytics approaches cannot address as effectively. This may be an opportunity to use DL applications, given that they handle complexity well along with multiple types of data. But be sure to understand how the application's algorithms work and do not settle for a black box. In addition, with prototypes, businesses only have to work with the data needed for the proof of concept. As more pilots are developed, an organization's data needs will become clearer, which will bring greater clarity to infrastructure requirements and related investments.

View the business through an AI lens.

AI is more than a technology. It can have a significant impact on costs and productivity. But AI can also play a major role in revenue-generating activities. AI leaders, for example, are already focusing their AI efforts on sales and business development as well as marketing and customer experience to a much greater degree than the overall market.

An AI lens will reveal different opportunities in various industries. Consumer products companies, for example, may focus on identifying market changes. Pharmaceutical companies may emphasize R&D to accelerate the time-to-market for new treatments. Any HR function can use these technologies to identify potential candidates who are likely to stay in the organization for several years, thus reducing recruiting and onboarding costs.

Secure funding.

One of the main lessons learned by AI leaders is that companies need to budget enough resources for their AI initiatives. Gunderson says that businesses put resources into three major buckets: things that must be done (e.g., problems that must be fixed), things that would be good to do (which are often customer facing) and initiatives that make the organization more competitive. Advanced AI currently falls mostly in the third bucket.

Calculate ROI by experimenting.

Half of all companies are uncertain about the ROI of AI. A similar number have lax standards for AI business cases. To understand the ROI, company leaders should apply AI to specific business outcomes that need to be addressed. These outcomes can be measured, which will clarify the value that AI brings to the table.

To bolster certainty, companies should conduct A/B tests — where the results of a process without the advanced AI application are measured concurrently with the use of AI — as they are developing the application. Each idea can be tested as an agile sprint to lead to the most powerful outcomes. The result is that companies do not have to make huge investments up front and can see and learn the value of AI to the enterprise on an ongoing basis.

Validate AI programs.

AI algorithms should be validated to ensure they are accurate, free from bias, conceptually sound, and meet the organization's model validation criteria and standards. Models should also be tested against the manual processes they are replacing or augmenting.

Deepen understanding across the enterprise and root out fear.

Leaders, managers and employees need to understand what AI can do for their businesses, functions and jobs. Employees often fear that AI is simply a means to reduce headcount. To confront that issue from the start, organizations should conduct enterprise-wide training programs that demonstrate clearly how advanced AI can make jobs more engaging and employees more productive.

Build a structure that brings IT and business together.

To be successful with AI, companies need multiple skill sets that often are not found in a single individual. For example, AI and IT professionals do not often understand the business outcomes enough to create powerful applications. Conversely, line-of-business managers do not have enough AI knowledge to know what it can do. To bring these individuals closer together, companies tend to house AI professionals in business units, sometimes supported by a corporate AI center of excellence. Whatever the structure, Putnam's Mehta believes organizations need to have three elements in place for their business units to embrace AI:

- A culture that values change and allows for experimentation;

- Skilled AI professionals who can operate in a business context and understand the key drivers of results from the models; and

- Identification of the right problems to tackle — those that can have a meaningful impact on the business when solved.

Develop talent in-house.

Universities are not delivering enough AI talent to meet demand, and that is not likely to change in the near future. AI leaders recognize this — more than 90 percent have their own in-house AI development programs. Equally important, off-the-shelf tools designed for non-IT managers or data scientists are increasingly available, and such managers can be trained to use them. Moreover, when companies develop AI tools, they should create user interfaces that are relatively easy to use by any manager with a mathematical bent. They should not be just for data scientists.

Follow the leaders.

Nearly 20 percent of companies are already on the fast track. They are developing their own talent, focusing on revenue-generating processes such as business development and fortifying industry-specific processes far more than their competitors. These leading adopters will be good models for companies that are lower on the learning curve. Also, be mindful of the fact that an AI leader can emerge from any part of the world, especially China and the Asia-Pacific region.

Ensure that senior executives understand how AI works and what it can do.

"We're at this point right now where companies hire really smart, brilliant people to help develop AI capabilities," says Gunderson. "But the number of people who can credibly push back, challenge or just govern those individuals is very limited in most organizations. The referees know less about the game than the players on the field." Lack of senior management knowledge can slow progress and end up greenlighting projects that miss the mark.

In Closing

The digital transformation of business and society has been underway for some time, and advanced AI is entering the mix. Despite fear of its capabilities, advanced AI is poised to fundamentally change how businesses work — and to a far greater degree than virtually any other new technology since the advent of electricity.

Many companies are still at the starting gate or at early stages of AI development. Moreover, many senior executives worry about the payoffs of AI investments. But they see what is coming. In just two years, more than half of companies around the world expect to be garnering significant value from advanced AI.

As our study found, however, a great deal of work must be done in those two years and multiple obstacles stand in the way, including but not limited to lack of talent and challenging decisions about where to invest. However, AI leaders have figured out how to surmount these obstacles. They are already benefiting and are leading the way in everything from using AI to bolster employee engagement to boosting productivity and business performance. As Lefferts of Protiviti observes, "The reality is that AI can and will be deployed almost anywhere."

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Protiviti is a global consulting firm that delivers deep expertise, objective insights, a tailored approach and unparalleled collaboration to help leaders confidently face the future. Protiviti and our independently owned Member Firms provide consulting solutions in finance, technology, operations, data, analytics, governance, risk and internal audit to our clients through our network of more than 75 offices in over 20 countries.

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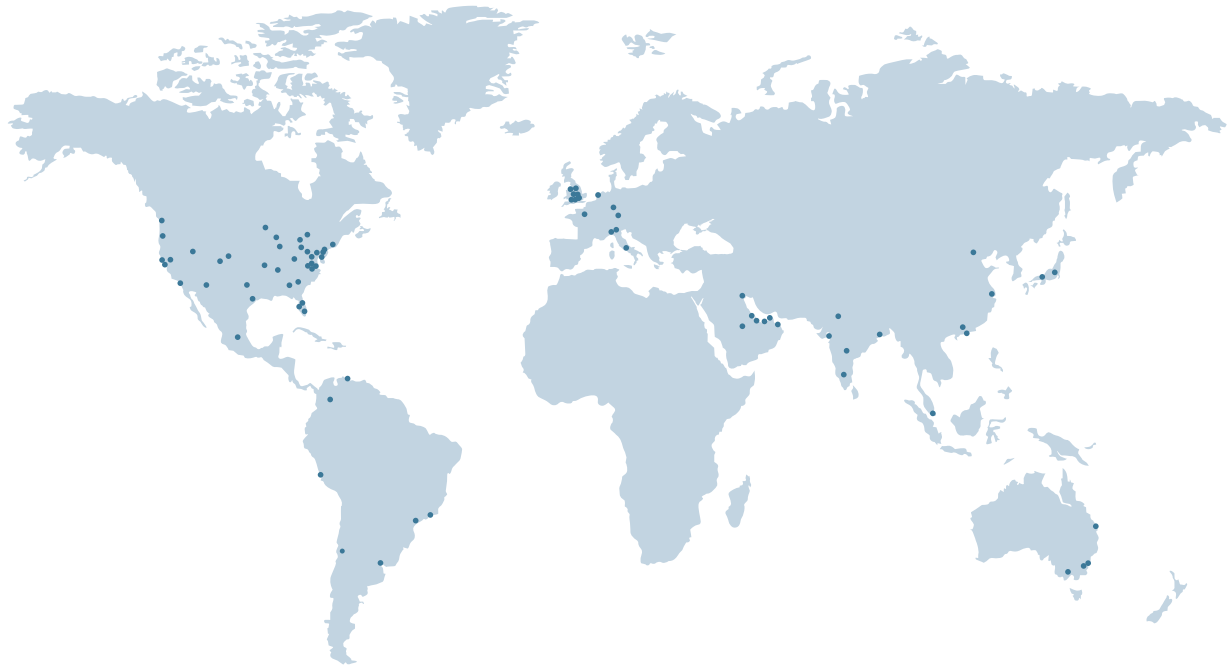
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