

**ESI**THOUGHTLAB

# Driving ROI Through AI

*AI best practices, investment plans,  
and performance metrics of 1,200 firms*

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# Introduction

Artificial intelligence (AI) is spurring the next wave of the digital revolution. As we enter the cognitive age, forward-looking companies are using AI to transform every aspect of their business—from customer engagement and R&D to cybersecurity and back-office operations. For these firms, AI is more than a technology, it is a new way of doing business and galvanizing strategic, operational, and financial performance.

The COVID-19 pandemic illuminated the power of AI for many companies, as they used it to personalize digital experiences for customers and workers, predict market shifts in real time, and even explore coronavirus treatments and vaccines. But the crisis also exposed the limits of AI. Models needed to be retrained to continue working during a period of dramatic change.

As the pandemic propels businesses into a digital-first world, AI will become a key driver of corporate growth and competitiveness. But as digital leaders know firsthand, building proficiency in AI is not easy. AI is not a magic bullet or a one-size-fits-all solution. It can fail to deliver results if the wrong business case is selected, the data is prepared incorrectly, staff skills are not in place, or the model is not built for scale. That is why AI results are so mixed today, with 40% of AI projects garnering negative or no returns.

To help executives drive ROI from AI, ESI ThoughtLab, together with a group of AI leaders, including Appen, Cognizant, Cortex, Dataiku, DataRobot, Deloitte, and Publicis Sapient, conducted a benchmarking study of 1,200 organizations across a wide cross-section of industries and world markets. This ground-breaking research and report, *Driving ROI Through AI*, concluded in September 2020, is designed to provide executives with an evidence-based roadmap for supercharging their business performance through AI and winning in the Fourth Industrial Revolution.



**Lou Celi, Founder and  
Chief Executive Officer  
ESI ThoughtLab**



**Daniel Miles, COO  
and Chief Economist  
ESI ThoughtLab**

# Executive summary

Two-thirds of executives believe that AI will be critically important for their businesses. Yet firms are only seeing an average 1.3% return on AI investments. AI is a game-changer, but it will take time, scale, and expertise to realize its full potential.



## Driving ROI Through AI

## Executive summary

COVID-19 cast a spotlight on AI's ability to provide insights and direction in an era of unprecedented change.

The pandemic accelerated the adoption of emerging technologies—particularly AI, which proved vital during the crisis. By drawing on a range of AI technologies and solutions—from robotic process automation to natural language processing and machine and deep learning—companies were better prepared to cope with the rigors of remote work and social distancing. AI leaders were able to access time-critical data, predict market trends, protect against cyberattacks, and use automated processes to keep customers satisfied and employees productive. AI helped combat the coronavirus itself, as healthcare organizations used the latest analytical techniques to improve virus detection and advance vaccine research. Yet the pandemic also highlighted AI's downside, when predictive algorithms went astray because of fast-evolving customer behavior.

**AI is a management imperative for winning in a post-pandemic world. Companies are boosting their AI investments to prepare. They also need to up their AI game.**

ESI ThoughtLab's study of 1,200 organizations revealed that almost two-thirds of senior executives, across industries and world regions—and nearly nine out of ten executives from enterprises with revenue over \$20 billion—see AI as vital for the future of their businesses. Executives understand the benefits that AI will bring to a post-pandemic world of personalized digital experiences, flexible working, agile supply chains, and rapid decision-making—at a time when finding cost efficiencies will be paramount. Even before the pandemic, companies were upping their investments in AI—to the tune of 4.6% on average over the last year (to about \$38 million for each firm). Over the next three years, they plan to nearly double that increase to 8.3% per year. However, with 40% of AI projects showing no positive returns, executives will need to invest smartly.

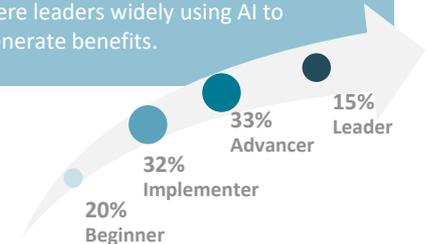


## Research background

ESI ThoughtLab conducted a benchmarking study of senior executives in **1,200 companies** in the spring of 2020, plus held in-depth interviews with over **20 AI leaders**.

The survey sample included firms across **12 industries** and **15 countries** with a combined revenue of **\$15.5 trillion**.

The firms represented a cross-section of AI maturity: **20%** were beginners in AI; **32%** were early implementers, starting to pilot AI; **33%** were advancers using AI in key parts of their business; and **15%** were leaders widely using AI to generate benefits.



## Driving ROI Through AI

# Executive summary

### AI is a slow-burning process that takes expertise, time, and scale to unlock its full potential and ROI.

Delivering ROI on AI can be elusive for the uninitiated and a slog even for experienced firms. Those in earlier stages of AI adoption tend to show flat results. It is not until they scale AI more widely across their enterprises that the ROI rises to 1.5% on average for firms that are advancing in AI to 4.3% for leaders. Generating returns requires that firms identify the appropriate business cases, acquire and prepare the right data, and then build, test, refine, and deploy working models. With frequently high upfront costs in data preparation, technology adoption, and people development, it takes time and scale to generate significant returns. Just to reach break-even takes 17 months on average for the typical firm. And most firms, even AI sophisticates, are still relatively early in their AI journey. Only about one-quarter of AI projects are now in widespread deployment among AI leaders; among companies in earlier stages of AI development, the number is less than two in ten.

### The real ROI of AI comes when companies deliver strategic change.

AI is a versatile tool that firms use to achieve a variety of business goals. When starting out, companies tend to use it to automate internal processes, boost productivity, and increase staff and customer engagement. As they progress and become leaders, they use AI to generate strategic gains. For example, 31% of AI leaders report increased revenue, 22% greater market share, 22% new products and services, 21% faster time-to-market, 21% global expansion, 19% creation of new business models, and 14% higher shareholder value. Most tellingly, the AI-enabled functions showing the highest returns for companies are all fundamental to rethinking business strategies for a digital-first world: strategic planning, supply chain management, product development, and distribution and logistics.

### The leader-follower divide

## 5x

The amount of ROI generated by AI leaders vs. followers, i.e. firms that are further behind in AI.

## 3x

The increase in revenue that AI leaders recognize compared with AI followers.

## 3x

The likelihood that AI leaders will gain efficiencies and lower costs vs. AI followers.

## 4x

The size of investment made by AI leaders vs. how much AI followers spend.

## Driving ROI Through AI

## Executive summary

Over the next three years, more than twice as many firms as today plan to harness AI across their businesses.

While just 29% of firms are maturing or advanced in adopting AI now, the percentage will leap to 63% by 2023. In industries that are earlier in their AI journey—such as insurance, wealth management, and media and entertainment—the increase will be fourfold. The number of firms proficient in using various AI technologies will also jump over the next three years: for RPA it will climb from 29% today to 68% by 2023; chatbots from 25% to 59%; computer vision from 13% to 22%; machine learning, from 19% to 45%; and deep learning, from 11% to 20%. With the success of AI being dependent on data, 73% of companies plan to be maturing or advanced in data management, up from about 37% today. Firms will also leverage more types of data by 2023, with use of psychographic data rising 109%, competitive 76%, geospatial 76%, real-time 75%, and social media 60%.

**Japanese and automotive companies are stealing a march on AI use.**

Japanese firms lead the pack in AI adoption, helped by government initiatives to support AI such as the Society 5.0 program. Faced with an aging population and stringent immigration laws, businesses and workers see machines as a convenient way to fill the employment gap. Similarly, automakers are at the forefront of AI excellence. With the biggest AI teams and budgets of all industries surveyed, automakers are rushing to use AI for every part of their business, from upgrading production processes and improving safety features to developing self-driving cars. Banks are a very close second, followed by healthcare, technology, and manufacturing.

**Executives should prepare for the challenges along the way.**

Companies face three sets of common AI challenges: (1) coping with regulatory, ethical, and data security risks; (2) project and talent management; and (3) data and technology limitations. These hurdles can be large or small, depending on where a company is on its AI journey. For example, limited AI skills, lack of an adequate IT infrastructure, and data access and quality issues are often major barriers for AI beginners, while preparing and integrating data, managing risks and ethics, and embedding AI into day-to-day business processes become more daunting as companies scale AI across their organizations. At 45%, project management is the top barrier cited by firms, followed by managing AI risks (44%) and regulatory constraints (42%).

### % of AI leaders by nation

<a href="#">Japan</a>	24%
<a href="#">US</a>	18%
<a href="#">UK</a>	18%
<a href="#">Singapore</a>	18%
<a href="#">Brazil</a>	16%
<a href="#">Germany</a>	16%
<a href="#">Canada</a>	15%
<a href="#">India</a>	15%
<a href="#">Mexico</a>	14%
<a href="#">Australia</a>	13%
<a href="#">China/HK</a>	12%
<a href="#">France</a>	12%
<a href="#">Netherlands</a>	10%
<a href="#">Nordics</a>	7%
<a href="#">Switzerland</a>	6%

## Driving ROI Through AI

# Executive summary

To be successful at AI and drive high performance, executives should consider five best practices uncovered by our research:

- 1 Begin with pilots, but then scale AI across the enterprise.** Companies starting out should work closely with business teams to identify use cases and demonstrate their value through pilots. Be sure to try different use cases, since some AI solutions will fail. Once pilots succeed, it is essential to follow through. The full value of AI can only materialize when firms offset their upfront costs with substantial business gains from widescale deployment. Indeed, three-quarters of organizations with large ROI have scaled AI across business units.
- 2 Lay a firm foundation.** According to beginners in our study, the most important lesson is having a proper IT and data management system in place (60%). That is followed by having a sufficient budget (49%); considering the data security, privacy, and ethical risks of AI (31%); developing a clear vision and plan (24%); obtaining the support of senior management (21%); and leveraging the ecosystem of AI partners and suppliers (14%). Defining the business case is vital for driving ROI: 77% of firms generating the highest returns from AI do this well.
- 3 Get your data right.** Nine out of ten AI leaders are advanced in data management. That is why 35% of beginners and 74% of implementers plan to have sophisticated data management systems in place by 2023. Ensuring your data is in good shape is not enough; to drive higher AI performance firms should bring in richer sets of data, such as psychographic, geospatial, and real-time data. At the same time, companies should integrate fast-growing data formats into their AI applications, such as high-dimensional, video, audio, and image.
- 4 Solve the human side of the equation.** AI is as much about people as it is about technology. AI leaders spend 27% of their AI budget on people, almost twice the amount that AI beginners and implementers spend. Of the firms in the study generating large returns, 83% have been successful at acquiring and developing the right people. AI leaders are also more apt to appoint specialists, such as Chief AI and Data Officers, to oversee AI initiatives. They outsource less, build internal teams more, and develop HR plans to address jobs that may be disrupted.
- 5 Adopt a culture of collaboration and learning.** About 85% of firms that generate large AI returns work to ensure close collaboration between AI experts and business teams. Nearly nine out of ten AI leaders excel at providing non-data scientists with the skills and tools to use AI on their own. They also decentralize AI authority to help ensure that AI expertise and responsibility are well distributed across their organizations.

# Research background

AI is more than a set of technologies. It is a new way of doing business. Yet many executives are still uncertain how to use AI to drive growth and performance. To answer that question, ESI ThoughtLab conducted a benchmarking study of 1,200 executives in the spring of 2020 and held more than 20 in-depth interviews with AI experts and business leaders.

# Our analytical approach

To conduct the analysis for *Driving ROI Through AI*, ESI ThoughtLab's team of economists and digital specialists used a rigorous, mixed-methods research approach that included the following elements:

- **A cross-industry survey of 1,200 companies worldwide** to collect detailed benchmarking data on their progress on AI development, along with their organizational approaches, use cases, performance results, and three-year plans.
- **Creation of a database of AI investment and returns.** This included current and future AI investments in people, process, and technology, the ROI from AI adoption across diverse business activities, and the length of payback periods.
- **A rigorous AI maturity framework** based on self-reported data that identifies the degree of progress that companies have made in key areas of AI and the effectiveness of their AI initiatives, including the ROI and range of benefits achieved.
- **Input from a high-level advisory board** of AI consultants, AI technology specialists, data scientists, industry executives, and academic experts to shape the research agenda, analyze the survey results, and validate the research findings.
- **In-depth interviews with more than 20 AI practice leaders and experts,** including C-level executives and their direct reports, data scientists, and AI specialists across industries and geographies.



# Survey profile: industries and executive functions

ESI ThoughtLab conducted a comprehensive benchmarking survey of executives at 1,200 companies across 12 industries and 15 countries. It was carried out over the phone in March and April 2020.

Respondents had superior or excellent knowledge of the use of AI within their organizations. A full 85% were C-level executives, and the rest reported directly into the C-suite.

The survey examined AI investments, plans, practices, and performance results at a wide array of firms. It included quantitative questions to allow ESI ThoughtLab economists to develop a robust AI maturity framework, analyze performance results, benchmark practices, and measure the ROI on AI investments.

## Companies in survey sample

**\$15.5tn**  
combined revenue

**\$7.3tn**  
contribution to global GDP

**7.9%**  
contribution as a share of global GDP

## Respondents by industry, approximately 8% for each sector



## Respondents by function \*



\* May not sum to 100% due to rounding.

# About the survey

## Countries surveyed

### Asia Pacific 31%

Australia  
 China/Hong Kong SAR  
 India  
 Japan  
 Singapore

### Europe 33%

France  
 Germany  
 Netherlands  
 Nordics\*  
 Switzerland  
 UK

### Latin America 8%

Brazil  
 Mexico

### North America 27%

Canada  
 US

\*Including Denmark, Finland, Norway, and Sweden

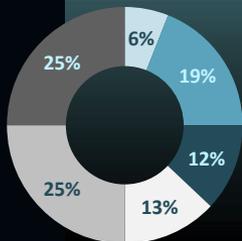
## Industry

Av # employees

Automotive	51,496
Banking	45,718
Consumer/retail	42,678
Energy/utilities	26,912
Healthcare	35,751
Insurance	23,973
Investment	24,404
Life sciences	25,754
Manufacturing	39,774
Media	15,420
Technology	26,779
Telecoms	42,886

## % of firms by revenue

- Over \$50 billion
- \$20-\$50 billion
- \$10-\$20 billion
- \$5-\$10 billion
- \$1-\$5 billion
- Less than \$1 billion



## Average company revenue by region



North America  
\$13.9 billion

Europe  
\$12.7 billion

Asia Pacific  
\$14.1 billion

Latin America  
\$6.4 billion

Total AI spending of all companies in sample in last year \$46 billion

# AI definitions

**Robotic process automation (RPA)**  
Software programs that do repetitive manual work tasks, such as processing transactions



**Machine learning (ML)**  
Computer systems that improve automatically through experience

**Deep learning (DL)**  
A machine learning method that teaches computers to learn by example



**Computer vision (CV)**  
Using computers to identify and classify objects, scenes, and activities in images

**Natural language processing (NLP)**  
The ability of computers to work with text and language the way that humans do



**Digital assistants (chatbots)**  
A software agent (such as Siri) that can perform tasks based on commands or questions

**Data management**  
Gathering, formatting, and processing data to ensure its accessibility and reliability



# AI comes of age

**“AI will be such an important part of life in the relatively near future that, like electricity, most of us will take it for granted.”**

Kurt Muehmel, Chief Customer Officer, Dataiku

# COVID-19 has accelerated the business use of AI

**The coronavirus pandemic has been this generation’s biggest health crisis, affecting millions of people around the world. It has also been a defining moment for business.**

COVID-19 inflicted unimaginable losses of life while wreaking social and economic havoc. As business offices, bank branches, and university campuses closed, and hospitals reached capacity, customers, employees, students, and patients turned to digital solutions to get things done. Online commerce and banking soared, remote working became the norm, and people moved to digital platforms to learn, socialize, and be entertained.

Through it all, AI and data analytics provided innovative solutions to keep businesses running. AI turbocharged efforts to find new health treatments and analyze trends in real time amid the pandemic, with use cases in virus detection and containment, hospital and healthcare operations, and vaccine R&D.

AI also helped to personalize customer experiences, keep employees productive, protect firms from cyber risks, and predict market turns. Management teams learned that in today’s interdependent world—where market shocks can cascade quickly in unpredictable ways—access to real-time data and analysis is essential.

As businesses emerge from the crisis, they will accelerate digital transformation for a world forever changed. Across industries, AI will be front and center of those plans to ensure that organizations are not caught flat-footed again.



**After COVID-19, there’s no going back**  
Bret Greenstein, Sr. Vice President, Global  
Head of AI and Analytics, Cognizant

“COVID-19 caused everyone to realize they did not have the data they needed. They didn’t have it in real time, and it was hard to interpret. The forecast models that previously were good enough, were way off target. It’s like realizing you’re on auto pilot, driving down the highway. But when the road curves, will the car turn in time? Can it see far enough ahead? Everyone realized they couldn’t trust their old decision systems.

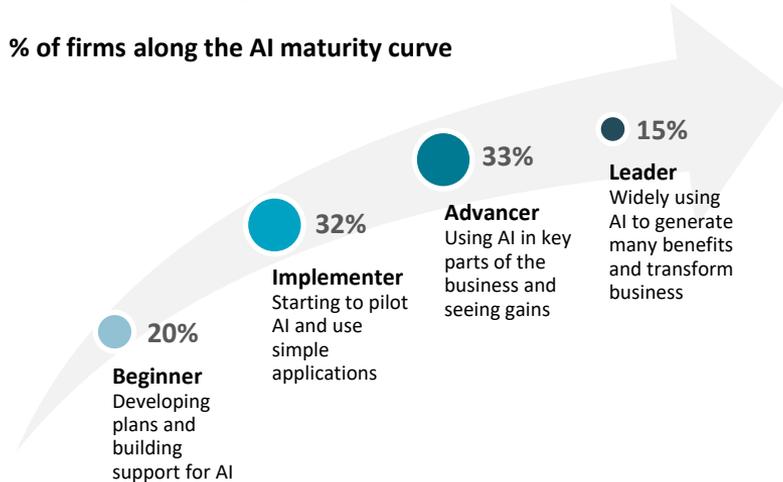
“After COVID, firms are not going back to the old, unproductive ways of working. Now that they are forecasting daily, they will not return to monthly. Executives realize that real-time access to data and the use of AI and ML for forecasting and planning makes you that much more efficient and resilient. Once the bar has been raised on efficiency, companies will keep going with fewer people to preserve margins and stay competitive.”

# Are you a leader or laggard in AI?

A prime objective of this research was to determine what constitutes an AI leader. To answer this question, ESI ThoughtLab assessed firms along two key dimensions: level of AI implementation and the benefits from AI investments. Here is what we found.

Slightly over half of the surveyed companies are in the early stages of AI development, either a beginner or implementer. Leaders account for 15%, while 33% of organizations (advancers) are right behind them, reflecting the rapid growth of AI.

## % of firms along the AI maturity curve



## Our maturity framework

We categorized each respondent into four distinct groups: beginners, implementers, advancers, and leaders. These categories were based on scores across the following criteria:

### AI implementation

- Stage of AI maturity across the enterprise
- Progress in specific areas of AI, such as creating business cases and developing talent
- Progress using AI for key functions, such as marketing or finance

### AI effectiveness

- Business, financial, and market benefits derived from AI
- Impact of AI on revenues and costs
- ROI from using AI in key functions, such as marketing or finance
- Performance improvements in industry specific processes

# How does your industry stack up?



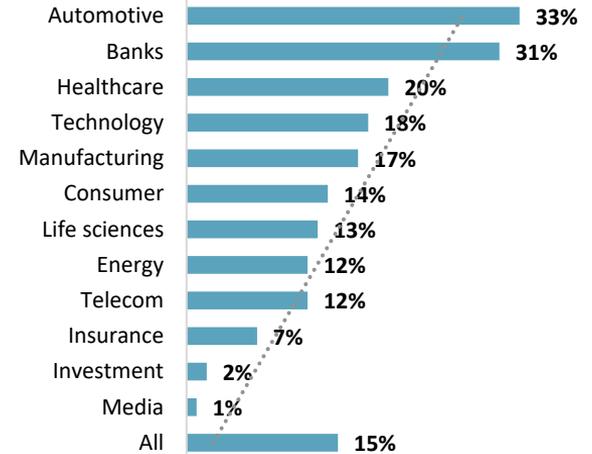
**Automotive firms and banks are ahead in AI, with healthcare not far behind. Wealth management and media firms are trailing.**

With huge revenue bases and exploding use of AI to enable driver-assistance, telematics, and voice recognition systems, automotive is among the most advanced sectors in AI. Cars are becoming “sophisticated computers on wheels,” according to Elon Musk, CEO of Tesla, which is planning to roll out a fully self-driving car at the end of 2020.

But the auto industry’s edge in AI goes beyond smart cars. Automakers invest a lot more than others in all aspects of their operations. They employ bigger AI teams, have more AI projects in place, and use a broader mix of AI technologies—ahead of others, for example, in RPA, machine and deep learning, and NLP. Reflecting their commitment, automakers’ AI budgets averaged about \$59.4 million last year, the largest of any industry. Automakers spent \$13.4 million more than banks and \$11.7 million more than technology companies. Automotive executives are more likely to see AI as critical for their industry’s future: 77% vs. 64% of others.

Banks are also well ahead in AI. With fintechs nipping at their heels and customers pushing for fuller digitized experiences, banks are scrambling to harness their rich data troves through AI. Yet investment management and insurance firms, which have as much to gain as banks, are still behind. They are held back by staid cultures, and in the case of wealth managers, an entrenched bias for personal contact.

## % leaders by industry



## Projects in place, average

		Automotive	All industries
Today	Piloting	5.5	4.9
	Partial deployment	4.5	3.9
	Widescale	3.0	2.2
In 3 years	Piloting	6.1	5.9
	Partial deployment	4.9	4.8
	Widescale	3.5	3.1

# Japan shows the way

Because of advances made by IBM, Microsoft, Google, and other Silicon Valley firms, the US is often seen as the leader in AI. But our study shows that when it comes to corporate adoption of AI, Japan takes the top spot.

There are several reasons why Japanese firms are further along in AI adoption:

- The government is partnering with the private sector and investing billions of dollars into AI as part of its Society 5.0 program to address social, economic, and environmental challenges.
- AI is viewed more favorably by business and workers in Japan, who see AI as augmenting jobs, not replacing them. Given an aging population and strict immigration laws, companies need to fill their ranks with machines.
- Firms in Japan are investing more in AI than their counterparts in other economies, and they have developed larger teams skilled in AI. That is partly because surveyed Japanese firms are bigger and have deeper pockets.

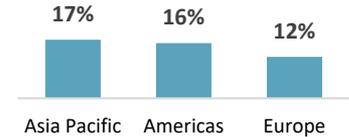
Firms in other countries are also racing to achieve AI supremacy. In June 2020, China revealed plans to invest more than \$1 trillion to become the world leader in AI by 2025. Brazil is ramping up investment to become an AI innovation hub: it is attracting top AI firms, such as IBM and Amazon. In 2018, Mexico became the first Latin American country to announce a national AI strategy.

On a regional basis, our analysis shows that firms in APAC are currently ahead in AI, with the Americas not far behind. Europe is moving more slowly, although some countries, such as the UK, are making impressive strides.

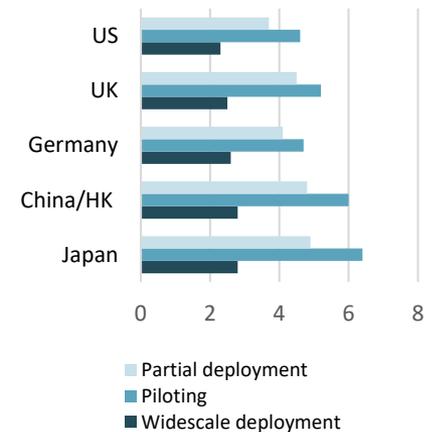
## % AI leaders by nation

Japan	24%
US	18%
UK	18%
Singapore	18%
Brazil	16%
Germany	16%
Canada	15%
India	15%
Mexico	14%
Australia	13%
China/HK	12%
France	12%
Netherlands	10%
Nordics	7%
Switzerland	6%

## % leaders by region



## Projects in place, average



# Company size influences AI maturity

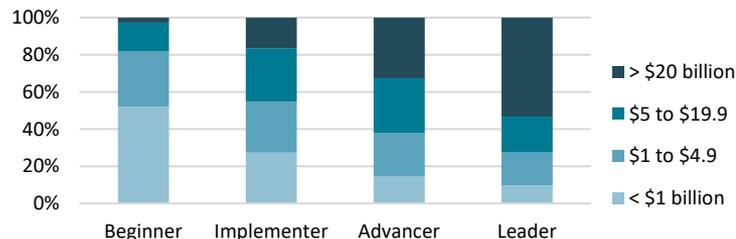
**AI maturity correlates partly with size. About half of AI beginners have revenue under \$1 billion, while about 50% of AI leaders have revenue over \$20 billion.**

When adopting AI, larger company size confers major advantages. These include bigger technology budgets, broader IT staffs, and better access to AI talent. With access to greater sets of data from their extensive operations, larger companies also have a data advantage.

Size also helps to explain why some industries are further ahead. Auto and healthcare firms are among the biggest in our sample and hence tend to be more advanced in AI. The investment sector, which includes private wealth officers, hedge funds, brokers, and other smaller businesses, has the fewest leaders. The same is true for the media and entertainment industry, which also includes smaller companies in the publishing, music, and movie sectors.

Yet size can also create some headaches. Larger firms sometimes struggle to orchestrate the organizational changes required to execute AI at scale. Furthermore, with the cost of AI technology dropping, revenue size is becoming less of a deciding factor in AI adoption. Some 40% of businesses with between \$1 billion and \$4.9 billion in revenue are advancers or leaders. That also helps explain why some industries in our sample, such as technology and banking, have a higher percentage of AI leaders despite having lower revenue bases.

AI maturity by revenue size



Industry	% AI leaders	Average revenue
Automotive	33%	\$18.93
Banking	31%	\$11.87
Healthcare	20%	\$16.81
Technology	18%	\$8.70
Manufacturing	17%	\$14.80
Consumer/retail	14%	\$14.06
Life sciences	13%	\$9.35
Energy	12%	\$14.12
Telecom	12%	\$12.07
Insurance	7%	\$19.23
Investment services	2%	\$8.74
Media & entertainment	1%	\$6.75

# The AI imperative

In today’s pandemic era, AI’s ability to drive huge cost efficiencies, supercharge business growth, and transform customer and worker experiences is elevating it on executive agendas.

A decisive majority—64%—of all executives surveyed believe that AI is considerably or very important for the future of their businesses. The figure is even greater among firms in our study that qualify as AI leaders (98%), and among firms with revenue over \$20 billion (85%).

The pandemic underscored the need for AI. As the world went online, many firms had difficulty processing and analyzing data quickly, as well as supporting the sudden spike in customer and employee online usage. Worse yet, predictive models failed to account for these abrupt market changes. As a result, executives shifted AI into high gear. In a 2020 study by Appen, nearly 40% of firms said they were accelerating AI work due to the pandemic.

Firms that see the importance of AI typically make the most progress, but that is not always the case. For example, 63% of insurance firms know the importance of AI for improving underwriting, claims administration, and other processes. But given the regulatory uncertainty, cybersecurity risks, and ethical concerns, the industry is progressing more cautiously on AI.

Companies under \$1 billion may be missing the boat entirely. Less than 50% believe in the critical importance of AI for their future. These entities may find themselves falling far behind their larger competitors and unable to catch up.

## % saying AI is considerably/very important

Industry	High importance	% leaders
Automotive	77%	33%
Banks	75%	31%
Technology	75%	18%
Healthcare	74%	20%
Life sciences	66%	13%
Telecom	66%	12%
All firms	64%	15%
Manufacturing	64%	17%
Insurance	63%	7%
Consumer/retail	60%	14%
Energy	59%	12%
Media	52%	1%
Investment	42%	2%

## % saying AI is considerably/very important, by size



“AI is a game-changer in certain settings. But you need to know which industries and conditions are ripe for AI, and which industries and conditions are right for AI and human collaboration. And which are not ripe for any of it.”

**Jon Nehlsen,**  
Associate Dean,  
Heinz School of  
Information  
Systems and  
Public Policy,  
Carnegie Mellon  
University

QB1: How important is AI to the future of your business?

# Gearing up for the age of algorithms

The number of companies that expect to be maturing or advanced in AI will more than double over the next three years. For some industries, the number will leap more than fourfold.

Firms in our sample say they invested a total of \$46 billion in AI last year, and they intend to increase spending by 8.3% per year on average over the next three years. While the economic fallout from COVID-19 may cause them to reduce this figure, companies across industries are still likely to meet their goals to become more sophisticated in AI usage by 2023.

The most spectacular progress is expected among industries still in early stages of AI maturity but where AI leaders, such as Netflix and Amazon, are showing the way. These include investment management, insurance, media, consumer/retail, and energy. Most will catch up in AI development, except for investment and media, which will stay considerably behind.

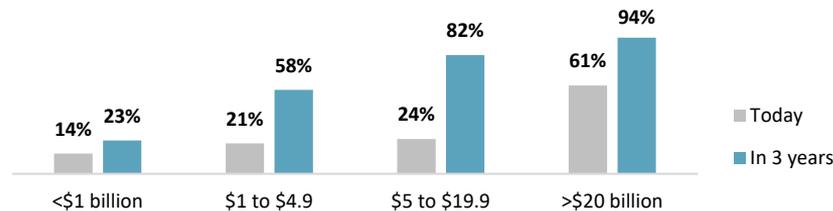
Company size will continue to drive maturity. Firms with revenue over \$20 billion have the greatest number of leaders at present and nearly all expect to be advancers and leaders in three years. Firms between \$1 billion and \$4.9 billion and those between \$5 billion and \$19.9 billion are now behind their larger peers but plan to make substantial progress.

The smallest companies have much weaker ambitions, which could hurt their performance in a data-driven business world.

## Growth in AI adoption: % maturing/advanced by industry

Industry	Today	3 years	% Change
Investment management	11%	47%	327%
Insurance	16%	65%	306%
Media & entertainment	11%	41%	273%
Consumer/retail	17%	57%	235%
Energy & utilities	20%	62%	210%
Technology	28%	66%	136%
Life sciences	27%	59%	119%
All firms	29%	63%	117%
Manufacturing	30%	59%	97%
Telecom	37%	68%	84%
Banks	46%	72%	57%
Healthcare	48%	73%	52%
Automotive	56%	84%	50%

## Growth in AI adoption: % maturing/advanced by revenue



QB2: What stage of development is your firm at in adopting AI across your business? Where do you expect to be in three years? Maturing is defined as using AI in key parts of the business, and advanced as widely using AI across the organization.

# Leaders are well ahead in mastering most AI technologies

Leaders are out in front of other firms in using a variety of AI technologies. Nearly all are making extensive use of RPA and machine learning, the bedrock of AI. For most leaders, chatbots have gone mainstream because of their benefits for customer service. Most leaders are tapping specialized tools, such as computer vision, NLP, and deep learning.

In three years, earlier-stage firms expect to close the gap with leaders in the use of core AI technologies, such as RPA and machine learning. These firms will make less headway with next-gen tools, such as computer vision, NLP, and deep learning.

But as firms build out their tech-stacks, they should remember that applying the latest AI technology is not really the goal. AI leaders concentrate on the business problems they face, and then work back to the technology they will need to solve them. They also blend these technologies to deliver the best results.

## % of companies in maturing or advanced stages in use of AI technologies

AI technologies	Today			In three years			
	Leader	Non-leader	All firms	Leader	Non-leader	All firms	% change all firms
RPA	92%	18%	29%	97%	63%	68%	134%
Machine learning	80%	8%	19%	94%	37%	45%	137%
Chatbots	77%	15%	25%	87%	54%	59%	136%
Computer vision	64%	4%	13%	82%	11%	22%	69%
Natural language processing	59%	3%	12%	74%	8%	18%	50%
Deep learning	59%	3%	11%	85%	8%	20%	82%

### The rising importance of AI in the pandemic era

“Across the board, companies need to rapidly find signals in the unprecedented noise of the changing world. Models used for predictions and other business decisions are based on data that is limited or no longer applicable.

“Businesses are looking to AI to more rapidly gain insights based on the changing economy, shutdown of physical businesses, the move to online purchasing, and changing interactions with their clients and customers.”

**Ari Kaplan, Director, Industry Marketing, DataRobot**

QB4: What stage of development is your firm at now in adopting the following AI technologies? Where do you expect to be in three years? Maturing is defined as using AI in key parts of the business, and advanced as widely using AI across the organization.

# Leaders have adopted AI across large parts of their enterprises

**Finding the right use cases for your business is critical for success with AI. About nine out of ten leaders report having largely or fully implemented AI in the 19 areas covered in the study.**

Use cases vary by industry and are best selected in close conjunction with business teams. In general, companies have made the most progress in implementing AI for customer service and IoT, followed by IT operations, customer analysis, and data security. Firms overall have made the least progress on distribution and logistics, finance and auditing, supply chain, R&D and innovation, sales and business development, risk management, and fraud detection.

Curiously, those are the areas where leaders are most ahead, based on the ratio of progress by leaders compared with non-leader firms. Companies in their AI journey may want to follow the example of leaders and target these use cases.

“Every industry has its own unique use cases. We believe that applying machine learning in these use cases will become status quo in the very near future. But it’s the use cases that are very specific to the business’s operations that will become the most important and bring the most value.”

**Kurt Muehmel, Chief Customer Officer, Dataiku**

**% firms that have largely/fully implemented AI, by function**

	Non-leader	Leader	Leader ratio
Customer service and experience	34%	93%	2.74
Connected devices	34%	94%	2.76
IT operations	26%	91%	3.50
Market and customer analysis	24%	89%	3.71
Data security and privacy	23%	94%	4.09
E-commerce	19%	89%	4.68
Legal and compliance	20%	94%	4.70
Customer onboarding and admin	20%	94%	4.70
Marketing, channel management	20%	95%	4.75
Brand management	19%	94%	4.95
Strategic planning	19%	94%	4.95
Fraud detection	18%	93%	5.17
Pricing and business models	18%	93%	5.17
R&D and innovation	17%	92%	5.41
Finance and auditing	17%	94%	5.53
Sales and business development	17%	94%	5.53
Supply chain, procurement	17%	95%	5.59
Risk management	17%	96%	5.65
Distribution and logistics	14%	89%	6.36

QE8: Please tell us about the progress that your firm is making on implementing AI across key functions and the ROI that you are seeing.

# Driving value from data

**“Thanks to cost-effective solutions and computational horsepower, the ability to aggregate and manipulate data at scale has changed dramatically.”**

David Kuder, US Market Offering Lead for AI Insights & Engagement, Deloitte Consulting

# AI success is all about data

“In AI, one plus one can be greater than two. Information that is synergistically related can lead to actionable insights when properly combined. This is certainly an important frontier in AI.”

**Bulent Kiziltan, Chief Data & Analytics Officer, StealthX**

## View from the top

46% of CEOs and 53% of CIOs say making sure your data management system can support AI is a key lesson learned.

## Budgeting for data

Firms spend about 35% of their AI budgets on data management, or about \$13.3 million per company. Beginners spend even more, or 44%.

## Data as a competitive tool

The Americas are out front in the data race. 43% of firms there are ahead in managing data vs. 35% in APAC and 33% in Europe.



## Leaders show the way

91% of AI leaders have mature or advanced data management systems. By 2023, they expect that percentage to grow to 97%.

## Size advantage

Access to data provides the world’s largest firms with a huge competitive edge: 70% of firms with revenue over \$20 billion have advanced data management systems to harness the trove of data they hold.

“Adopting AI is a major transformation for companies. It’s asking corporations to make their data not only accessible but also findable and connected, perhaps for the first time.”

**Peter Henstock, Machine Learning & AI Technical Lead, Pfizer**

“Big data is essentially meaningless without AI and ML. It’s our only way to manage complexity, which is increasing at an exponential rate.“

**Gary Grossman, SVP, Global Lead, AI Center of Excellence, Edelman**

# AI leaders excel at data management

Leaders are out in front of other firms in their data management capabilities. Healthcare, banking, automotive, and technology firms plan to make the biggest leaps going forward.

Sophisticated data management is a hallmark of AI leaders: nine out of ten are in maturing or advanced stages in data management. Nearly all of them expect to reach that level in three years. More than half of healthcare firms, banks, and automakers have already made significant progress in data management, and an overwhelming majority expect to by 2023.

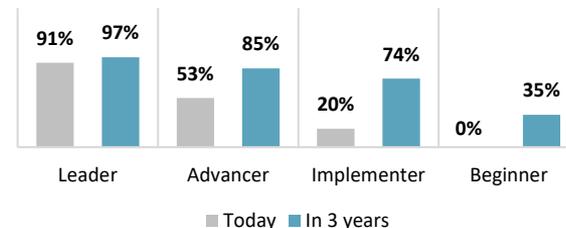
Companies in earlier stages of AI know that superior data management is a prerequisite for AI success. That is why 35% of beginners and 74% of implementers plan to have more sophisticated data management systems in place in three years' time.

Although only around a third of insurance and life science firms have made substantial progress in data management, most are expecting to be data virtuosos by 2023. And while less than 25% of investment and media firms have well-developed data management systems now, the number is expected to climb to over half by 2023.

“The success of AI is governed by three factors: the amount of clean data readily available, the skill in leveraging AI, and the maturity of the industry in its acceptance of data-driven analyses. Older companies can have a wealth of data but may have a disadvantage in organizing that data compared with younger firms, which, like Uber, have created their data platforms with analytics in mind.”

**Peter Henstock, Machine Learning & AI Lead, Pfizer**

% maturing/advanced in data management



	Today	In 3 years	% growth
Healthcare	57%	82%	44%
Banks	56%	87%	55%
Automotive	55%	85%	55%
Telecoms	50%	78%	56%
Technology	44%	90%	105%
Insurance	35%	74%	111%
Life sciences	31%	76%	145%
Manufacturing	29%	63%	117%
Consumer/retail	27%	61%	126%
Energy	25%	73%	192%
Investment	21%	56%	167%
Media	17%	53%	212%
<b>All industries</b>	<b>37%</b>	<b>73%</b>	<b>97%</b>

QB4: What stage of development is your firm at now in adopting the following AI technologies? Where do you expect to be in three years?

# Integrating data formats unlocks higher value

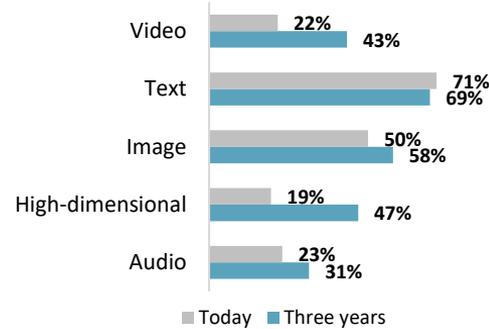
**Text and image are the most common data formats for AI today and will remain so over the next three years. But audio, video, and high-dimensional data will grow the fastest.**

AI can make sense of almost any data. It can create intricate, multi-dimensional models of risk scenarios, detect gene expressions, and predict customer trends. While 44% of data is still unstructured, firms across industries are striving to make sense of it. For example, many financial firms are untangling unstructured text found in documents from years of regulation, often using deep learning and ontology-based search, according to Mihir Sharma, Head of AI, Financial Services, North America for Publicis Sapient.

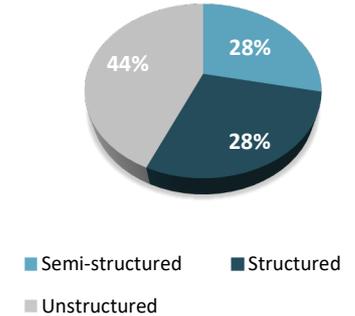
While text is the most common data source in AI applications, firms will integrate more formats in the future. Data from video will nearly double over the next three years. Use of high-dimensional data—from telematics to health status data—is expected to grow even faster, from 19% to 47%, a 250% increase. Use of image and audio data will also climb.

Automakers are ahead of others in integrating high-dimensional and audio data, particularly useful for self-driving functions and commands. Healthcare leads in video, a crucial format for medical instructions. Both manufacturing and media are ahead in integrating images, a format used extensively by both sectors.

**% firms integrating data formats into AI now and in the future**



**% data by structure**



**% of firms integrating data formats, by maturity and industry**

Data format	Leader	Non-leader	% gap
High-dimension	46%	15%	31%
Audio	41%	20%	21%
Video	36%	19%	17%
Image	52%	50%	2%
Text	51%	75%	-24%

Highest now	Highest 3 years
Automotive (36%)	Telecoms (55%)
Automotive (30%)	Technology (58%)
Healthcare (59%)	Consumer (71%)
Mfg., Media (59%)	Insurance (85%)
Automotive (35%)	Media (53%)

QC1: What is the structure of the data your company possesses? C2: Which of the following data sources are you integrating into AI applications now and planning to integrate in the next three years?

# Firms will use a wider array of data to gain greater insights

IoT, customer, and internal information are now the main types of data integrated into AI applications. But by 2023, companies will use AI to generate insights from wider and more diverse sets of data.

One of the reasons why companies focus on IoT, customer, and internal data for AI initiatives is the sheer volume of accessible data generated in these areas. Most other forms of data are used less. Yet that is where the greatest insights often lie, particularly when such data are combined.

Over the next three years, organizations will broaden their use of different types of data to take fuller advantage of what AI can do. Companies will double their use of psychographic data and ratchet up their reliance on competitive, geospatial, and real-time data by around 75%.

Data used for AI today	
IoT	52%
Customer	46%
Internal	43%
Social media	21%
Real-time	20%
Manufacturing	18%
Supply chain	18%
Competitive	17%
Macro	16%
Local	15%
Psychographic	8%
Geospatial	7%

Fastest growing over 3 years	
Psychographic	109%
Competitive	76%
Geospatial	76%
Real-time	75%
Social media	60%
Macro	41%
Supply chain	35%
Customer	31%
Manufacturing	24%
Local	15%
IoT	14%
Internal	13%

Data used for AI today	Beginner	Leader	% gap
Real-time	11%	32%	21%
Customer	30%	49%	19%
Competitive	9%	27%	18%
Geospatial	2%	19%	17%
Social media	13%	29%	16%
Psychographic	2%	17%	15%
Macro	10%	21%	11%

“In most analytics functions, teams are limited to using data that is curated only through internal resources. Without proper data augmentation, they are expected to provide valuable insights with black-box AI tools. This combination is destined to fail.

“Creatively combining data sources that are not in the standard data pipeline is a way companies can generate significant ROI. Data science teams have to go well beyond the limitations of standard practice and continually push the envelope to create significant value.”

**Bulent Kiziltan, Chief Data & Analytics Officer, StealthX**

QC3: Which types of data are you integrating into AI applications now and planning to integrate in three years?

# What kinds of data should not be overlooked?



## Don't leave customer data on the cutting room floor

Bret Greenstein, Sr. Vice President, Global Head of AI and Analytics, Cognizant

“When firms plan out their AI programs, they should not overlook the voice of the customer data. That includes information from social media, customer complaints, and call centers—everything.”

According to Greenstein, much of that data is generally lost or summarized to a point of being useless. “If people are calling all day long and talking about your products and services, then someone should extract that data and get it to the business team.”

Greenstein also believes that firms should consider real-time, hyper-local data. “For example, we worked with a home goods store that wanted to know where people went when they left the store. We combined geospatial data with other data and found out that 30% of people go to McDonald’s. That became very valuable for cross promotions.”



## Harnessing data in motion

David Kuder, US Market Offering Lead for AI Insights & Engagement, Deloitte Consulting

“Data in motion is the next generation of data that firms should focus on. The future is about data that is moving, not staying static. Data at the edge.

“Autonomous vehicles offer a good example. Data is processed remotely at the edge while algorithms are enhanced centrally for the benefit of the entire population of users.”



## Not all data is equal: the value of predictive data

Brennan White, CEO and Founder, Cortex

“Some data is much more valuable than others. The predictive insights are important to the customer. Each firm needs to give some thought to what data is most valuable and then double down from there.

White sees AI as an iterative process. “Once you have built predictive models, you can use the misses in the predictions to refine the data set and build more accurate models and data.”

# Each sector has its own AI data strategy

A company’s industry influences its use of data for AI. Technology companies are currently the largest users of IoT, followed by media, which employ it to monitor network and content usage, and insurance companies, which need to track documents and analyze risks. The automotive sector relies more heavily on real-time and geospatial data, which support driving activities, whereas supply chain data is most relevant for manufacturing and consumer and retail firms. Media and entertainment firms leverage social media more than other companies.

Looking ahead, firms across industries plan to expand their use of different data. With market pressures building, consumer and retail firms will quintuple their use of competitive data. Financial services, telecom, and healthcare firms will more than double their use of psychographic data to stay on top of evolving customer needs and attitudes. Energy and utility companies will draw much more heavily on local data to monitor consumer trends and provide better information to users.

## % of firms integrating types of data into AI now

	Automotive	Bank/wealth	Consumer	Energy	Healthcare	Insurance	Life sciences	Manufacturing	Media	Technology	Telecoms
IoT	40%	53%	48%	58%	49%	55%	50%	42%	64%	66%	50%
Customer	42%	48%	50%	37%	66%	57%	25%	32%	54%	37%	51%
Internal	29%	59%	26%	36%	54%	67%	44%	30%	35%	38%	41%
Social media	20%	25%	17%	22%	26%	14%	17%	11%	33%	16%	29%
Real-time	33%	15%	20%	20%	21%	14%	24%	14%	17%	22%	24%
Manufacturing	33%	9%	16%	17%	13%	3%	28%	60%	8%	12%	11%
Supply chain	28%	7%	39%	25%	12%	5%	24%	34%	3%	22%	9%
Competitive	20%	20%	6%	15%	16%	19%	15%	16%	16%	22%	22%
Macro	22%	19%	16%	16%	15%	24%	14%	12%	11%	13%	15%
Local	15%	16%	15%	16%	12%	17%	19%	14%	10%	9%	22%
Psychographic	7%	7%	9%	5%	10%	8%	9%	4%	8%	11%	9%
Geospatial	13%	6%	3%	8%	6%	6%	5%	9%	1%	10%	10%

QC3: Which types of data are you integrating into AI applications now and planning to integrate in the next three years?

# AI maturity brings its own data challenges

**The thorniest data challenges involve quality, governance, security, integration, and trust. To move forward with AI, firms must vault over these hurdles.**

Some impediments, such as data integrity, security, and integration, become less onerous as firms move up the maturity curve. Others remain a hindrance or become more arduous. For instance, compliance becomes harder as firms scale AI solutions around the world, and cleaning and normalizing data becomes twice as difficult as companies become AI leaders leveraging richer data sets.

These challenges also vary by industry. Data governance and security can be more difficult for highly regulated industries such as banks, investment firms, and insurers. Data quality is top of mind for consumer firms, which rely on precise market and customer intelligence and strive to personalize customer experience, and for life science companies, which grapple with critical health issues. In fact, just finding the data can be a headache, according to Pfizer's Peter Henstock, who needed to comb through 5,000 databases when starting his AI efforts.

“Firms often start their AI efforts by hiring a few AI experts to deliver quick results. But the first thing the AI team does is look for the data. Sometimes it doesn't exist, or it is low quality and scattered everywhere. Getting that data is a huge effort, much harder than creating a few AI models. You have to get data management right before you can use AI on a large scale.”

**Wilson Pang, Chief Technology Officer, Appen**

Top 10 data challenges	Total	Non-leader	Leader	% gap
Data integrity/quality	38%	39%	35%	-5%
Governance/compliance	36%	36%	41%	5%
Data security	36%	37%	36%	-1%
Integrating data	36%	38%	28%	-10%
Identifying trusted data	35%	35%	33%	-2%
Identifying corrupt records	25%	25%	19%	-6%
Size/frequency of data	22%	22%	22%	0%
Availability of data	17%	19%	10%	-9%
Data silos in organization	16%	16%	13%	-3%
Cleaning and normalization	10%	9%	19%	10%

Top challenges by industry	
Data quality	Consumer*, life sciences, technology
Identifying trusted data	Manufacturing, telecoms
Integrating data	Energy, healthcare
Governance/compliance	Auto, investment, media, telecoms
Data security	Banks, insurance, consumer*, media

\*Data quality and data security tied as biggest challenge for consumer firms

QCB: What are the main challenges that you face when dealing with your data?

# Mastering data management



## Four steps that will help you get the most from your data

Wilson Pang, Chief Technology Officer, Appen

“There are four main principles to bear in mind. First, firms need a system to make data available for people who need it. It should clarify where the data comes from, how it got processed, and who the experts are in those domains. That way you liberate the power of data.

“Second, firms need to address integration. Data is more powerful if it is integrated. Think of an online travel company. It knows where people booked hotels, when they take flights, which tour they are going to take. You know everything about the customer if the data is integrated. You could also do this with weather data, data from ticket services, and other sources to gain a deep understanding.

“Third, organizations need a different approach for structured, semi-structured, and unstructured data. Companies should create a team to formalize the processes for using these different types of data.

“Finally, companies need the right mindset. People shouldn’t focus on what data they have, but on data they need to solve the problems they face. Executives should think of data as an asset.”



## Reimagining your data as a service

Claire Gubian, Global Head of Customer Value, Dataiku

“Data is the new name of the game. We have so many ways now to collect data. We measure everything. Data is everywhere.

“The data leaders don’t just use the data for themselves, they sell it to their customers or use it to enhance their products and services. It’s a completely different mindset.

“For example, savvy automotive executives are no longer just thinking about selling cars. With reams of customer data created from connected devices inside the car, why not sell it to people who will need it to create other great products and services? Or use it to support customer service and warranty programs?

“PayPal is also leveraging its huge data assets. The firm is using its data to provide risk-as-a-service and to provide customer insights to merchants. Amazon is doing the same.

“Companies are sitting on a goldmine of data. But they don’t know how to use it or extract additional value from it. That is where AI fits in.”

## Case study

# Building a business around data and AI



**Andrei Lopatenko,**  
Vice President,  
Engineering,  
Search &  
Conversational AI,  
Zillow Group

Since its founding in 2006, Zillow, the online real-estate marketplace, has amassed massive amounts of data on some 110 million US homes. One of the world's leading destinations for buying or renting property, the company starts with understanding the digital needs of real estate buyers, sellers, and agents, and then finds the data and technology solutions that will work best. In the process, Zillow has created more than two dozen apps, ranging from its hugely popular price estimator tool to apps for basics such as scheduling a showing. Zillow leverages virtually every data source and technology emerging in the cognitive age.

Machine learning is at the heart of the estimator tool's ability to assess a home's value and predict how much it will change. Using oceans of data from public sources and home-owners, Zillow currently runs millions of statistical models daily so users can find out the expected price of a house several months hence.

Users also want to see pictures of a house, and increasingly in these times of social distancing, they take a virtual tour. That led Zillow into computer vision and high-dimensional data. The company's software organization developed software that uses photographs of a home and creates 3D models using only the static pictures to create a virtual tour.

To keep a pulse on what realtors and consumers say about their experience on the site, Zillow has invested in speech recognition software and natural language processing. That allows the company to extract and classify speech data to assess what is working and is not working for users. Zillow also provides more basic functionality such as scheduling and planning tools using AI. Given the firm's scale, it has driven growth and reputation by understanding user needs and then leveraging AI tools and data types to meet them.

# Bringing people and machines together

**“We are at an inflection point with AI. Companies are trying to figure out how to empower people to do more with automation and how to navigate the current volatility in the most intelligent way possible, to make better decisions, and ultimately, drive more business value.”**

Dan Wright, President and Chief Operating Officer, DataRobot

# As firms mature in AI, they build a culture of learning

**When organizations start their AI journey they rely on consultants, outsourcing firms, and technology partners.** But as they mature, companies take talent development in-house and increase their purchases of products to support best practices. Use of outsourcing falls while academic partnerships rise.

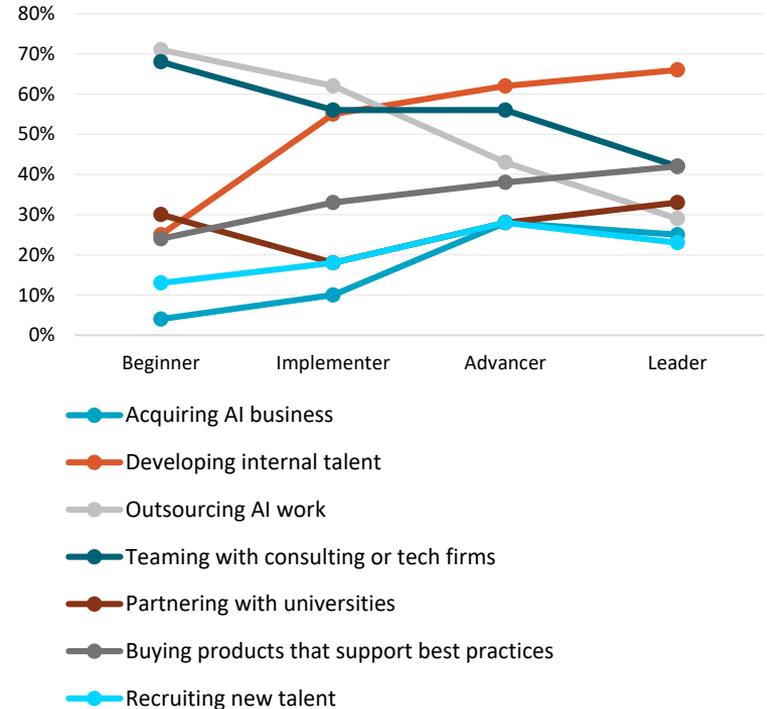
Internal development of AI talent among leaders goes beyond established methodologies such as seminars and tuition reimbursement. Leaders are far more likely than non-leaders to make data and AI applications broadly available throughout the organization via off-the-shelf, self-serve applications. Leaders also strengthen their internal AI talent pools by acquiring AI businesses.

Talent approaches also vary by industry. Banks and technology firms tend to partner more. Media and energy companies outsource more. Healthcare and automotive firms more frequently recruit talent from the outside.

“Data science can only deliver its full potential in a culture of learning. Companies need to continually invest in their teams. Data science is an emerging field that is continuously evolving. Unless companies promote learning, mentoring, training, and collaboration, they will become siloed. This will inevitably result in high turnover and add to the overhead cost of the analytics operation.”

**Bulent Kiziltan, Chief Data & Analytics Officer, StealthX**

The impact of AI maturity on talent development



QB11: How is your organization developing the talent, skills, and capabilities that it needs to implement AI initiatives?

# Leaders excel at recruiting and nurturing AI talent

Leaders staff their organizations with far more AI professionals than do beginners. In fact, one hallmark of a leader is the ability to attract, develop, and retain AI talent.

What separates AI leaders from followers is often not the strength of their technology and processes, but their people. AI leadership requires talent to implement the technologies and to manage organizational and other challenges that can arise.

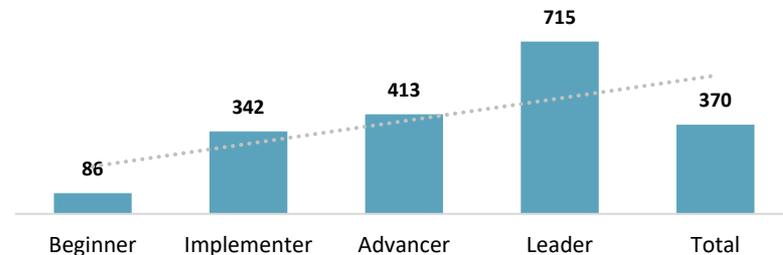
Part of it is a numbers game. Beginners have an average of 86 AI professionals (1.5% of total employees on average), while leaders have over eight times as many (715, or 1.8% of total employees). Leaders also devote a greater share of their AI budgets to people (vs. process and technology) than do beginners.

The pandemic underscored the importance of having the right in-house talent. When social behaviors changed dramatically during the crisis, AI models needed to be retrained to stay effective. Some firms found they didn't have the people required to adjust the models.

“Many people assume that tech spends will be high. But the technologies are commoditizing reasonably quickly. Firms that invest in the education of their own teams will go further.”

**Bret Greenstein, SVP, Global Head of AI & Analytics, Cognizant**

Average number of AI professionals globally



“There is a scarcity of data scientists in the market. Firms face a challenge in understanding how to restructure and transform their businesses to meet the needs of a digital world.

“The key to becoming a successful AI-enabled firm is to organically grow AI capability within each department and business domain, stay nimble, and deliver business value incrementally and consistently, thereby showcasing the overall capability and ROI.”

**Mihir Sharma, Head of AI & Cognitive Initiatives, Financial Services, North America, Publicis Sapient**

QB9: Please estimate the total number of personnel across the worldwide enterprise who are focused on AI.

## Case study

# Putting AI in the hands of thousands of employees



**Jonathan Tudor,**  
Director of Data  
and Analytics,  
GE Aviation

GE Aviation pioneered the idea of a jet engine as a service. The company analyzes sensor data from some 65,000 commercial and military aircraft in order to predict maintenance needs before they occur. Being proactive can slash a plane's down time and significantly reduce a customer's costs. But GE Aviation faced a challenge: as the sophistication of engines and services increased over time, it found itself with rapidly mounting amounts of critical data.

Every GE engine has 9,600 sensors providing a steady flow of data on 70% of the world's commercial and military jet aircraft. On top of that, the company is tracking additional data such as weather, flight patterns, and airline schedules to accurately predict what services it will have to provide, when, and where.

This impressive data set runs into the millions of columns and is the life blood of the company's operations and its engineering and product design. To keep pace with its growth, Jonathan Tudor, Director of Data and Analytics, turned to “no-code” (i.e. self-serve) AI tools. He often saw newly minted engineers create predictive models as good as—and sometimes better than—models that data scientists developed. Tudor realized that he could significantly advance AI capabilities by deploying “no-code” AI tools across the entire company.

His first step was to choose the tools. He stresses that AI professionals need to work closely with business and functional units when selecting applications. He picked five potential candidates from more than 60 he examined. To make the final decision, he invited about 40 employees from across the organization to spend a day learning and working with the tools and then to choose what they felt were the best. Bringing people into the decision-making process had a pleasant twist—the testers became ambassadors for the selected tools in their respective units.

To keep engineers and others up to date on how to use AI, Tudor established a training program in AI and advanced analytics. His first foray, two years ago, trained about 2,000 engineers and other professionals. Today, the program trains thousands more each year at GE Aviation locations across the globe.

# Outsourcing practices morph as firms mature in AI

With smaller AI teams, firms in earlier stages of AI maturity naturally depend more on outsourcing. Over four out of ten outsource the creation and retraining of models. Slightly fewer go outside to scope these models and monitor their health. But as organizations advance, they bring in their own talent and outsource less.

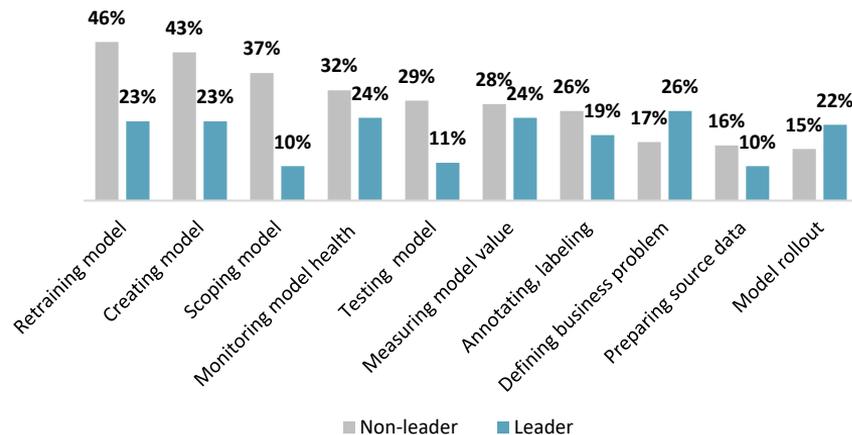
There are exceptions. Leaders are more likely to outsource business problem definition to get objective, outside-in assessments. Leaders also tend to outsource tasks that require less dependence on internal knowledge, such as model rollout.

In the future, non-leaders will seek additional help for annotation and labelling, data preparation, and model creation and rollout. To help them scale AI, leaders will up their use of external firms for model testing, rollout, and retraining. They will also use more outside help for measuring model value.

“The open-source ecosystem provides everything that you need. But it can be very hard to scale. It has a lot to do with the skill sets required for AI, which change as applications grow. AI can start with an individual, but it needs proper balance, support, and diverse skill sets to scale.”

**Francisco Garcia, Director, Enterprise AI/ML & Data Science Capabilities, Dell Technologies**

Outsourcing trends by maturity



Biggest changes in outsourcing over next 3 years

Non-leaders	Leaders
Annotation and labelling (+11%)	Testing model (+9%)
Preparing source data (+9%)	Model rollout (+9%)
Model retraining (-8%)	Model retraining (+6%)
Model creation/rollout (+8% each)	Measuring model value (+5%)

QB8: Which of the following functions do you outsource or plan to outsource (or continue to outsource) over the next three years?

# Collaborative AI management

**How do you organize responsibility for AI in a company, when the technology is becoming as commonplace as an Excel spreadsheet? That is the question most firms are still figuring out.**

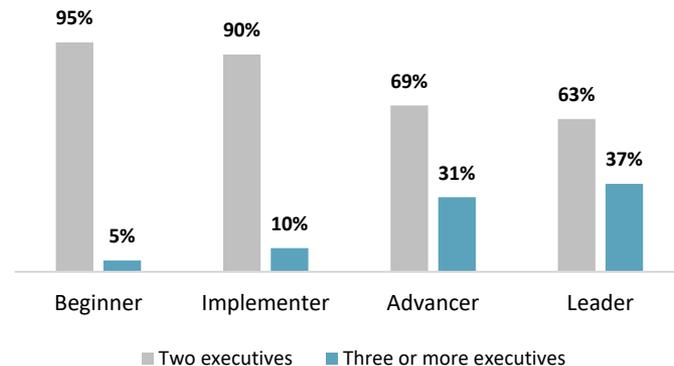
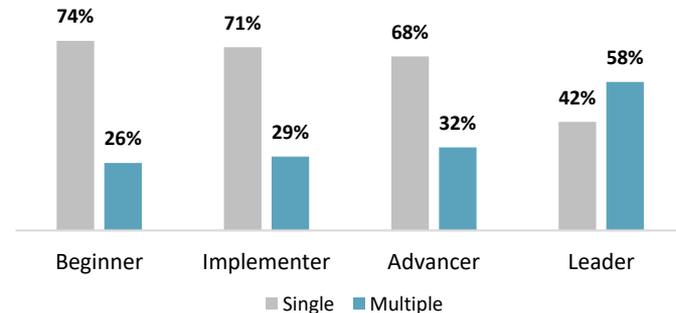
When companies start out in AI, they are likely to have a single executive in charge of AI. As they develop AI capabilities, additional executives also play a role and cross-functional teams become more common. Seventy-four percent of beginners have only one executive in charge, compared with 42% of leaders.

When beginners do involve multiple executives, in 95% of the cases there are two executives. For leaders, the figure is 63%; for the remaining 37%, three or more executives share responsibility. A similar pattern holds true for company size, with firms with revenue under \$1 billion having fewer executives in charge than those with revenue over \$20 billion.

“Here, no one is fully in charge of AI. We have a council that brings together all the distributed AI leads. These multiple AI leads are spread throughout the company. The council meets monthly to go over the challenges of commercializing AI and of deploying AI. The council pulls it all together.”

**Manuela Veloso, Managing Director, Head of AI Research, J.P. Morgan**

The number of executives in charge of AI



QB7: Which executive(s) has the main responsibility for AI in your organization?

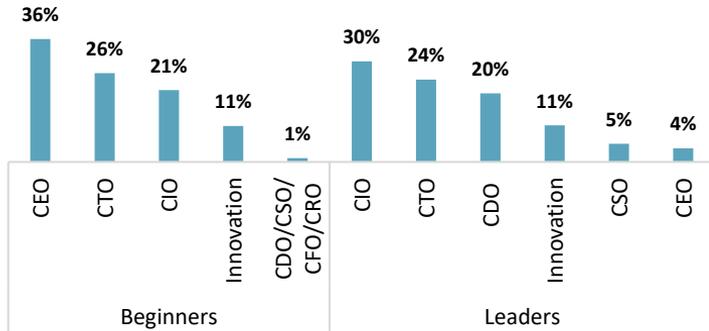
# Organization in flight

**In many firms, AI organization is still evolving. Each company has its own style: some have tightly knit groups, others let a thousand flowers bloom. Even the titles and number of executives in charge can vary.**

As companies start out in AI, the CEO is most often the one in charge of AI, since the push for strategic change works best from the top down. As they mature and operationalize AI, responsibility shifts from CEOs to technology teams. While Chief Information or Data Officers are rarely in charge among beginners, they become more prominent as firms advance in AI and move from outsourcing to cultivating in-house talent.

For companies that have multiple executives in charge of AI, the combination of executives is almost as varied as the companies themselves. Firms with two executives use one of 53 different combinations and companies with three executives use one of 57 different combinations. Sixty percent of the combinations include the CTO, 49% the CEO, 25% the CIO, 16% the CFO, and 14% the Chief Data Officer. When multiple executives are involved, the CFO, COO, CHRO, Chief Data Officer, and Chief Risk Officer are more likely to play a leadership role than in firms with only one executive in charge.

## AI responsibility when single executive in charge



## AI responsibility when multiple executives in charge



### Two executives

- CEO/CTO
- CEO/CIO
- CFO/CTO
- COO/CTO
- Chief Data Officer/CTO
- Chief Digital Officer/CIO



### Three executives

- CEO/CTO/Chief Analytics Officer
- Chief Analytics/Innovation/Technology Officer
- CEO/CTO/Chief Innovation Officer
- CFO/Chief Analytics Officer/CTO

QB7: Which executive(s) has the main responsibility for AI in your organization?

# Building a hybrid organizational structure to scale AI



## Balancing central control with local implementation

Bret Greenstein, Sr. Vice President and Global Head of AI & Analytics, Cognizant

“Beginners frequently start out centralized with a core of data scientists. But they struggle since they’re often not sponsored by the business lines, which are the ones with many of the ideas. These central service teams are slow. They crush under their own weight.

“The businesspeople tend to work in a decentralized way. You want to be close to them. You want to be near the HR leader, the marketing leader, the supply chain leader, the ops leaders. You want to provide data science and AI as a service to them, not something you centrally control. Firms should build a community of best practices, including standards, tools, libraries, and environments for sharing.

“When you grow enough, you need to start establishing standards. How do you know when you’re using AI responsibly? How do you eliminate bias? What tool chains are appropriate? How do integrate third-party data? Which partners do you need? Those decisions are better made centrally but executed locally as you scale.”



## Providing the tools for decentralization to work

Ryan Kolln, Vice President of Corporate Development, Appen

“Decentralized AI is optimal, but you will need to check if you have the right things in place to ensure its success. First, do you have a well-defined data set accessible across the organization?

“Second, are the tools to develop AI available throughout your firm and have you invested in building up the AI capabilities of your people? Then, decentralization will work, since you’ll be able to combine line expertise with the ability to create decision-support models.

“On the other hand, if your data is all over the place and there’s four people in the company that understand what each table means, then decentralized AI is going to fail. People will be using the data in the wrong way and making poor decisions.

“Many companies flip a switch and say that they want to be data-driven. So they hire a bunch of data scientists across business units. But the data isn’t available. So the business units are unsuccessful in harnessing AI and the business owner loses credibility.”

## Case study

# Aligning AI by leading from the middle



**Peter Henstock,**  
**Machine Learning and AI Technical Lead,**  
**Pfizer**

Large enterprises have distinct advantages when trying to advance the use of AI, including fatter budgets and a greater ability to attract talent. But size also confers daunting challenges. The rapid rise of AI, with its ability to affect almost any part of the organization, makes it very difficult to optimize its impact across many different groups. With more than \$50 billion in annual revenue and nearly 90,000 employees in 125 countries, biopharmaceutical company Pfizer is facing this exact dilemma.

Businesses often use a top-down/bottom-up approach when trying to launch and expand a new technological initiative such as AI. One of the biggest challenges is to drive the top-down strategy and simultaneously kick-start the effort and build bottom-up momentum. But what if the initiative catches fire and the bottom-up part of the equation begins to soar? This is a distinct possibility as enthusiasm for AI mounts.

Pfizer is in the throes of tackling this challenge. Peter Henstock, the firm's Machine Learning and AI Technical Lead, notes that Pfizer employs many scientists who are heavy users of data and technology. Moreover, since their work focuses on lives that may be hanging in the balance, AI's ability to dramatically accelerate new drug development is a potent lure.

AI has spread across Pfizer in everything from R&D to supply chain management. In the wake of this growth, the company has accumulated several different AI technologies housed everywhere from the cloud to individual desktops. Critical data is spread across more than 5,000 databases, adding to the complexity.

To harness AI for Pfizer and formulate a central strategy, Henstock is working to lead from the middle. He believes that successful implementation of AI requires a combination of top-down strategy to coordinate efforts and bottom-up technical skills in this area that meet in the middle. He has formed a network of AI practitioners from across the organization who meet regularly to share solutions and address issues such as leveraging compute power. The team is becoming the fulcrum of AI that helps fortify individual efforts, informs interested parties, and generates buy-in across the organization.

# Where firms are investing

**“AI is still not moving the needle. It doesn’t yet create the margins to really affect the P&L. But in five to seven years it will be a critical game-changer in how we compete and serve our customers. You have to invest in it until it reaches that pivotal point where it becomes strong enough to fuel growth on its own.”**

Abhinav Singhal, Chief Strategy Officer,  
Asia Pacific, thyssenkrupp



# AI leadership carries a higher price tag

On average, firms in our study invested more than \$38 million each in AI in the past year, about 0.75% of their revenue. One-third of firms invested more than \$50 million. In absolute terms, leaders invested 2.6 times the average—more than \$99 million.

As firms move up the AI maturity curve, they typically invest more. Last year, leaders spent about 18% more than beginners as a share of revenue, but due to their bigger size, that came to 7.6 times the dollar investment of beginners.

Firms with revenue over \$20 billion invested \$87.5 million on average over the last year, compared with \$7.1 million for those with less than \$1 billion. But due to economies of scale, the largest firms in our study invested just one-fifth of what the smallest spent as a share of revenue.

Automotive, healthcare, manufacturing, and technology firms invested the most on an absolute basis, and media, investment, and consumer, the least. As a share of revenue, tech firms led the way, followed by banks, life science firms, and automakers.

## Average budget for AI by industry

Industry	Total in \$ m	% of revenue	% investing > \$50m
Automotive	\$59.40	0.86%	49%
Healthcare	\$54.10	0.85%	46%
Manufacturing	\$48.50	0.50%	28%
Technology	\$47.70	1.21%	31%
Banks	\$46.00	0.96%	44%
Insurance	\$38.80	0.55%	34%
Telecoms	\$37.60	0.75%	38%
Life sciences	\$33.40	0.88%	33%
Energy	\$29.70	0.69%	31%
Media	\$24.70	0.57%	21%
Consumer	\$24.40	0.71%	24%
Investment	\$19.10	0.47%	18%
All firms	\$38.30	0.75%	33%

## Average budget for AI by size, maturity

	Up to \$1b	\$1b-\$4.9b	\$5b-\$19.9b	\$20b+
Total \$ m	\$7.1	\$28.6	\$34.1	\$87.5
% revenue	1.19%	1.18%	0.35%	0.24%
% investing > \$50 m	3%	28%	40%	63%
	Beginner	Implementer	Advancer	Leader
Total \$ m	\$13.0	\$27.1	\$39.4	\$99.2
% revenue	0.74%	0.70%	0.74%	0.92%
% investing > \$50 m	8%	32%	32%	75%

“Firms are doubling down on AI investments because of the promise of greater efficiencies and revenue. Because of COVID-19, firms want to be smarter with how they’re spending more limited dollars.”

**Alyssa Simpson, Former Vice President, AI and Data, Appen**

QE3: What was the total budget for AI across your enterprise (both held centrally at headquarters and distributed across business units) in the past financial year?

# Firms are spending more to narrow the gap with AI leaders

**Companies increased their investments by 4.6% on average over the last year. Over the next three years, they plan to up their investments by 8.3% per year.**

Firms in earlier stages of AI expect to double their AI investment—from 4.4% over the last year to an average of 9% annually over the next three years. Leaders expect to trim their growth in AI investments—from 6% over the last year to an average of 4.5% over the next three years. Yet since leaders are spending 2.6 times others in absolute dollars, non-leaders will fail to close the gap.

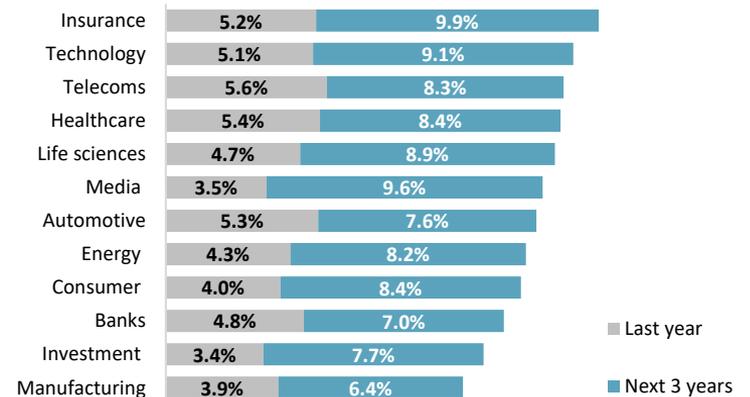
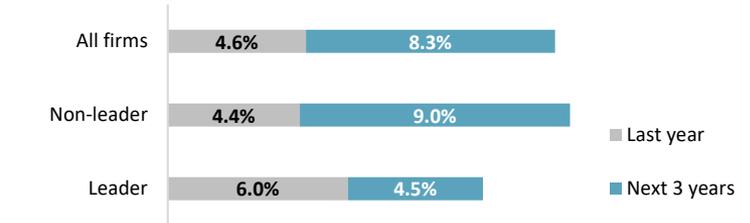
All industries in our survey plan to hike their AI spending over the next three years at a faster clip than last year. On average, they plan to raise spending by 1.8 times last year’s rate. Some sectors plan to ramp up spending at more than twice the rate of last year—media, investment management, and consumer and retail.

Budgetary pressures from the pandemic may moderate these expectations. Nonetheless, firms remain likely to boost their AI spending to find new efficiencies and to stay agile and resilient—which will be crucial if the health crisis persists and the economic fallout continues.

“There’s a lot of focus now on using AI for demand and inventory forecasting, price optimization, and decision-making. Some companies that invested early in RPA are looking at intelligent process automation—a combination of RPA with cutting-edge machine learning.”

**Dan Wright, President and Chief Operating Officer, DataRobot**

**Average annual rise in AI budgets last year and next 3 years**



QE4: How has your firm’s AI budget changed over the last year, and how do you estimate it will change over next three years?

# Balancing investments in people, process, and technology

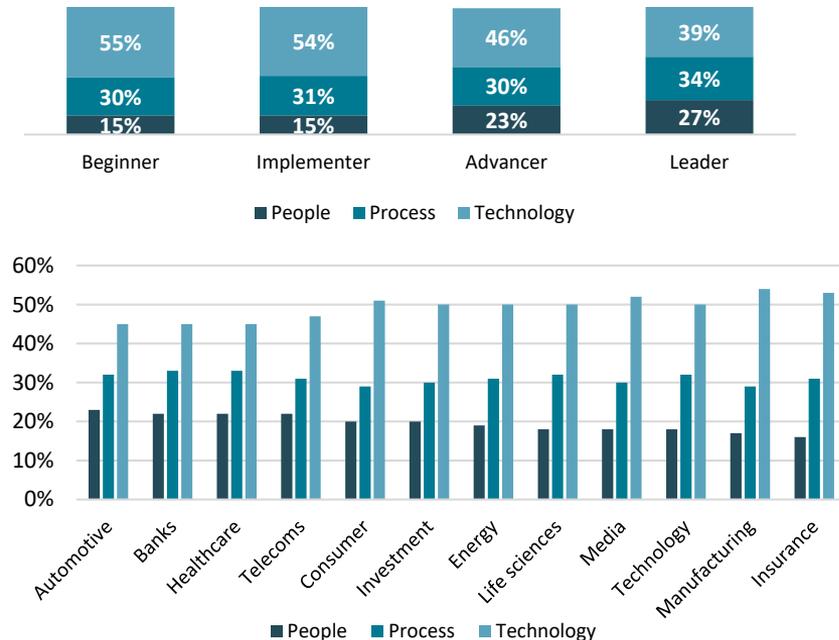
**When companies start out, they spend over half of their AI budgets on technology and only 15% on people. As they mature in the use of AI, the share of spending on technology falls while the share allocated to training and hiring people to achieve their AI plans rises.**

AI leaders are investing almost twice as much in people as AI beginners. They know that AI excellence goes beyond using the latest AI technology. It requires hiring the best talent, training staff on AI, investing in external partnerships, and building a culture of collaboration between analytics teams and business units.

Still, across all sectors, firms continue to invest the most in technology, followed by process and people. Automotive, banks, and healthcare lead in investments in both people and process, while manufacturing, insurance, and media spend a larger share of their budgets than others on technology. This supports the notion that companies that are further ahead in AI tend to allocate a relatively larger share of funds to hiring and developing talent.

Over the next three years, leaders expect to maintain their allocations, while non-leaders plan to shift a greater share of spending towards process and people as they scale AI across their firms.

% of AI budget spent on people, process, and technology



QE5: What percentage of your AI budget is devoted to people, process, and technology? What will it be in three years?

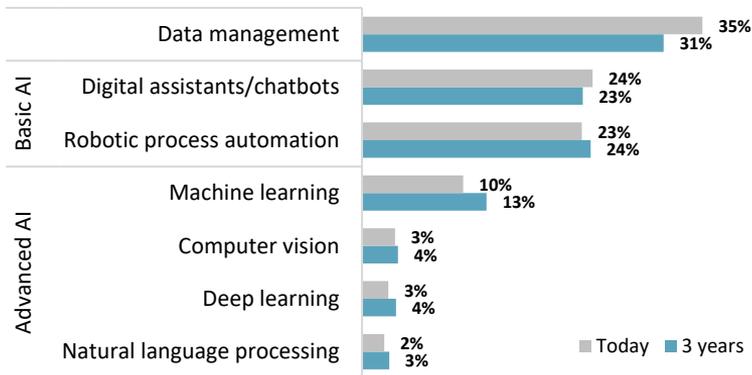
# Firms still focus on core AI, but leaders look ahead

Most investment today is flowing to data management, RPA, and digital assistants. Much less is going to more advanced AI solutions, such as machine learning, computer vision, and deep learning. AI leaders, however, are spending more than non-leaders on these technologies, and both groups will beef up outlays over the next three years.

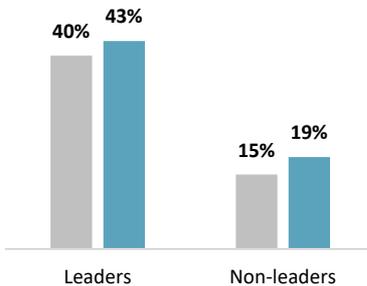
Through 2023, as firms become more experienced in AI, they will invest more of their AI budgets in machine learning, computer vision, deep learning, and natural language processing. At the same time, they will allocate slightly less to data management and digital assistants.

AI leaders show the path ahead: they already allocate 40% to advanced AI, while other firms spend just 15%. And leaders plan to pick up investment in most of these transformative technologies, particularly machine learning and deep learning. Deep learning will be particularly valuable in the next phase of the AI revolution, since it will provide firms with the ability to find meaning in diverse sets of unstructured data.

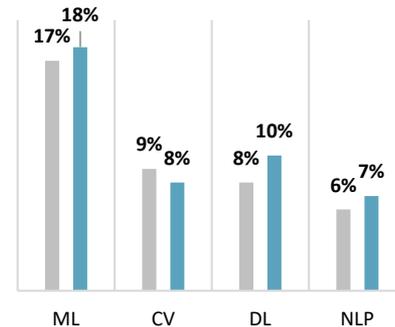
% of AI spending by type



% of AI spending on advanced AI



% of AI spending by leaders



QE6: What percentage of your AI budget is devoted to each of the following areas? What will it be in three years?

# Investment in advanced AI varies by industry

**Automakers currently spend the most on advanced AI, followed by technology firms, manufacturers, and banks.** The media, investment, insurance, and consumer/retail industries spend the least. In three years, automotive, technology, and manufacturing firms will still invest more than others in advanced AI.

Each industry has its own play on advanced AI. Automakers are investing heavily in self-driving vehicles, banks in AI-enabled cybersecurity detection and protection, and manufacturers in real-time supply chain management. Over the next three years, media, investment, and insurance firms will post the largest increases in spending on advanced AI, as they embrace these applications for their businesses.

## % of AI spending on advanced AI

	Today	Three Years	Increase	
Automotive	31%	34%		10%
Technology	25%	31%		26%
Manufacturing	22%	26%		17%
Banks	21%	24%		15%
Telecoms	21%	24%		15%
Healthcare	20%	25%		25%
Life sciences	19%	23%		21%
Consumer	15%	19%		24%
Energy	14%	17%		24%
Insurance	13%	18%		35%
Investment	12%	17%		38%
Media	12%	17%		42%
All firms	19%	23%		22%

## Top 3 industries that spend the most as % of budget on advanced AI

Machine learning	Computer vision	Deep learning	Natural language processing
Automotive	Manufacturing	Automotive	Automotive
Technology	Automotive	Technology	Technology
Telecoms	Life sciences	Banks	Banks

## Top 3 industries planning largest investment increases in advanced AI in 3 years

Machine learning	Computer vision	Deep learning	Natural language processing
Media	Energy	Media	Investment
Healthcare	Technology	Investment	Insurance
Insurance	Media	Consumer	Consumer

QE6: What percentage of your AI budget is devoted to each of the following areas? What will it be in three years?

# Which AI technologies will generate the greatest value?



## The case for computer vision

Brennan White, CEO and Founder, Cortex

“Humans and most animals are vision first. We make our decisions about whether we like something, whether something looks safe, whether something’s attractive, primarily with our eyes.

“That is why computer vision is so important. When the internet first started, it took forever to load a photo or video. As technology caught up, communication channels become much richer and more visual. With the tools now in place, computer vision will be hugely critical.”



## NLP with DL deliver greater R&D results

Peter Henstock, Machine Learning and AI Technical Lead, Pfizer

“We use ML, DL, NLP, and computer vision daily for our R&D activities. NLP is probably going to drive the most value for us, and DL is starting to take over. The combination of the two will allow us to more easily mine research, perform medical searches, track competitive trends, figure out which drugs to go after, and more.”



## Voice is the future

Mihir Sharma, Head of AI & Cognitive Initiatives, Financial Services, North America, Publicis Sapient

“Voice is going to be a game-changer. In the last few years, there have been huge advances in voice recognition, whether to capture different accents or build capabilities into more smart devices. If you think about using Siri or Google Assistant on your phone, it wasn’t predominant two years ago. Voice recognition wasn’t good enough, and the usage was quite low.

“Alexa has become the new norm. Now if you want to change the music you are listening to or dim the lights in your room, you don’t need to get up. You just say, Alexa, play this song or dim the lights. Voice, along with the digitization of phones and devices, and even most of the AI-enabled home appliances these days, can take a voice command and do what someone would otherwise have to do by getting up and performing a physical action.

“The sky’s the limit when it comes to AI applications. It will change our day-to-day lives in the forthcoming years.”

# The ROI of AI

**“Companies can create ROI once they meticulously align AI strategies across multiple verticals. Data science does not exist in a vacuum. Company-wide strategic growth and operational efficiency will drive sustainable returns.”**

Bulent Kiziltan, Chief Data & Analytics Officer, StealthX

# ROI increases with AI maturity

**AI will revolutionize business. But it will take expertise, scale, and time to reach its full potential. Firms should be planting the seeds now, including building systems for measuring and tracking results.**

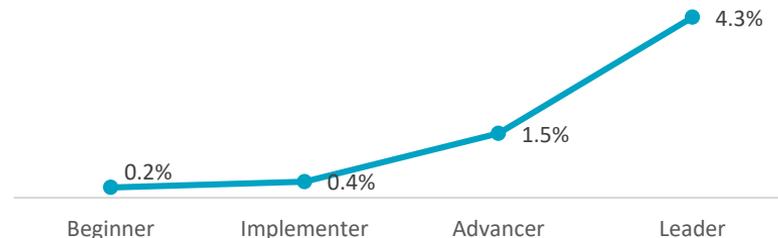
While about two-thirds of senior executives believe that AI is important for the future of their business, the average return on all AI investments by company\* is only 1.3%. Leaders do better, with an average return of 4.3%, but that still pales against returns on other corporate investments. That begs the question: Is the buzz around AI justified?

The answer is yes, but only if you have patience. Our research shows that corporate returns on AI bloom as companies become more advanced in AI. AI beginners and early implementers essentially show flat results. It is not until firms start to use AI more widely across their enterprises that the ROI starts to grow. With high upfront costs in data preparation, technology adoption, and people development, it takes scale to reach break-even and then eventually earn significant returns.

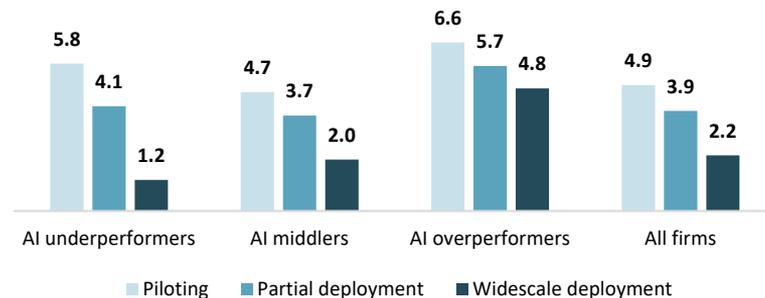
It is still early days for most companies: only 20% of AI projects are in widespread deployment, and among AI underperformers (those showing negative or no returns), the number of projects in widespread deployment is half that. Even among AI overperformers (firms with over 5% ROI on AI), only 28% of AI initiatives are in widescale deployment. The rest are still in pilots or partial deployment stages.

\*The average ROI by company was calculated by taking the average of the ROI for each AI-enabled function for each respondent.

Average ROI by maturity level



Average number of AI projects by stage



QE8: Tell us about the progress that your firm is making on implementing AI across key functions and the ROI that you are seeing. QB3: How many AI projects are you piloting, have in partial deployment, and have in widescale deployment today? How many do you expect to have in three years?

# The art of measuring ROI

**One reason that ROI on AI appears low is the lack of corporate progress on measuring AI results. For many firms, calculating the ROI on AI is still an art, not a science.**

It is revealing that 79% of companies that report negative or no ROI, and 56% of those showing ROI of just above 0% to 5%, do not have systems in place to measure returns. Gauging the ROI on AI is more complicated than for traditional technology investments, where the costs and impacts are more easily defined and predictable. AI does not offer a one-size-fits-all solution. It is a versatile tool that can generate a rich set of benefits geared to the financial, strategic, and operational outcomes that a company seeks to achieve. For that reason, the ROI metrics in this report should be viewed as directional, not definitive.

## Best practices to consider

To measure ROI effectively, firms should start by fully accounting for their costs, not just for technology, but also for hiring and training AI staff, together with putting the proper processes in place. Since AI is not a “one-and-done” solution, executives should consider the cost of maintaining and finetuning the AI application. For example, companies using AI during the pandemic were hit with the unexpected cost of retraining their models to respond to changing market behaviors.

Quantifying AI benefits can be even more vexing. Many of AI’s benefits are qualitative: How can firms put a price tag on better decision-making, faster time-to-market, and improved reputation? And, like data, AI can underpin a broader business initiative or series of projects, making it tough to identify the full value it brings. Finally, AI projects have an element of R&D. So the payback from efforts can be uneven, and some of the most profitable outcomes may be unexpected or only come with scale.

“Companies are becoming more astute about the marginal or incremental benefit of a particular AI solution. There’s some areas where AI can absolutely show a dramatic impact. But while it may be material, does it pay for itself if the cost of implementing a solution is \$500,000 or \$1 million? Is the scale of your operation large enough to warrant that type of investment?”

**David Kuder, US Market Offering Lead for AI Insights & Engagement, Deloitte Consulting**

“Besides ROI, AI-enabled innovation has a great potential for social impact—in all areas but specifically education, health, information, and social justice. Many organizations and companies are building meaningful technology innovations around ML and AI. They are also interested in the social-good aspect of AI’s implementation and dissemination.”

**Amir Banifatemi, General Manager, Innovation & Growth, Xprize**

# The biggest returns from AI come from strategic change

The ROI of AI does not stem from cost savings alone. It comes from strategic transformation.

When starting out, companies tend to use AI to automate internal processes, boost productivity, and improve staff and customer engagement. But the performance goals shift from efficiencies to strategic gains as businesses mature into AI leaders. These more advanced firms report greater benefits from faster revenue growth, greater market share, new business models, accelerated time to market, and higher shareholder value.

In fact, of the top ten functional use cases driving value for companies, many are fundamental to corporate business strategy, such as strategic planning, supply chain management, product development, and distribution and logistics.

“The power of AI compared with traditional analytics is that it can solve for predictive and prescriptive use cases. And where traditional analytics can optimize a system by 10%, AI can take that to 20%, 30%. AI pushes the limit since you have many more variables you can take in and can apply more sophisticated techniques like neural networks for optimization.”

**Abhinav Singhal, Chief Strategy Officer, Asia Pacific, thyssenkrupp**

% seeing value created by AI now



QE1. How is AI creating value for your company now, and how do you expect AI to create value over the next three years?

# But it takes time to generate meaningful ROI

**Don't let the AI hype curve mislead you—firms need to be wary of promises of quick paybacks. The average payback on AI investments is around 17 months. For beginners, it's even longer.**

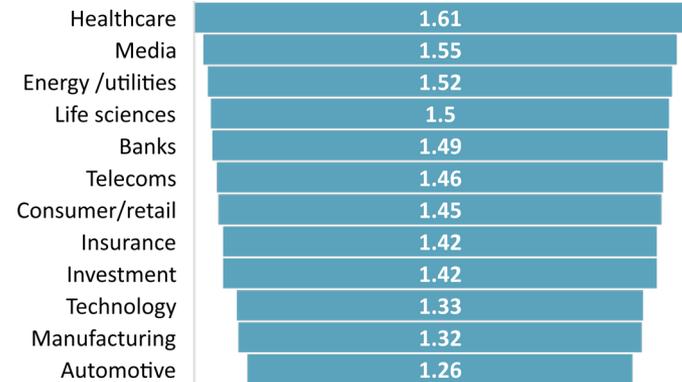
Executives should go into AI with their eyes open. Projects can take longer than expected to implement due to unanticipated hurdles—such as not having access to the right data or difficulties in training and testing the model. Sometimes the models fail altogether, requiring that AI teams start all over.

Payback periods vary widely, with 43% of AI projects hitting break-even in under a year, 37% between one and two years, and 20% between two and over three years. With their lack of experience, beginners bear the longest payback periods, of about 20 months, while leaders reach break-even in 14 months. Automakers report the fastest payback (roughly 15 months), and healthcare, the slowest (over 19 months).

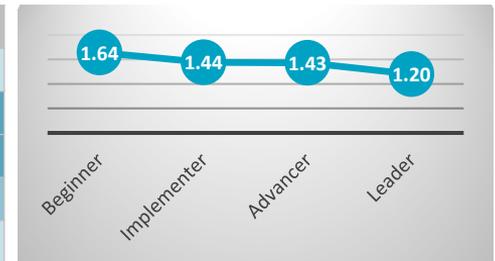
Executives report that COVID-19 has led to a shift in expectations. Hit by the economic downturn, firms are striving to shorten payback periods by breaking projects into smaller, bite-size chunks and taking other steps to deliver quick wins. By leveraging cloud platforms and related technologies, AI teams may be able to move faster and reduce costs.

QE7: What is the typical payback period on AI projects within your organization?

Average payback period in years for AI projects



Typical payback period	% of firms
Less than 6 months	5%
6 months to less than 1 year	38%
1 year to less than 2 years	37%
2 years to less than 3 years	17%
3 years or more	3%



# ROI requires a solid foundation and sufficient investment

To generate strong ROI from AI, firms need to first lay the groundwork and put the right processes in place. Like any strategic initiative, it requires adequate investment.

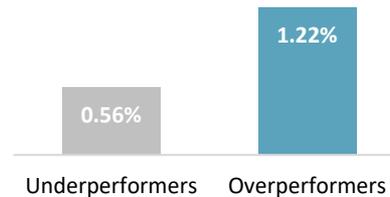
AI overperformers (with ROI over 5%) excel at building a solid foundation for AI. Most overperformers have made significant headway in setting up business cases, implementation plans, and systems for measuring and monitoring AI performance. They are also far along in implementing AI platforms to gather, integrate, format, and manage data. They are particularly more advanced than underperformers (those with no or negative ROI) in addressing privacy, security, and regulatory concerns, as well as creating standards and training on AI ethics.

Just as importantly, overperformers know that it takes money to make money. That is why they spend about twice as much as underperformers on AI. Moreover, having already made major progress on developing basic AI capabilities around data management and RPA, they are free to invest bigger portions of their budgets on next-gen tools, such as machine learning, deep learning, computer vision, and natural language processing.

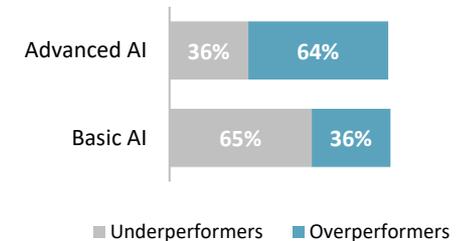
## % that have largely or fully implemented

	Underperformers	Overperformers
Addressing privacy, security, regulatory concerns	7%	90%
Creating standards and training on AI ethics	9%	89%
Gathering, integrating, formatting data for AI use	11%	87%
Measuring and tracking AI performance results	4%	87%
Preparing AI platform to manage data	11%	84%
Defining business cases, models, and plans	12%	77%

## AI investment as % of revenue



## Investment by type of AI



QB5: How much progress has your company made in implementing the following areas of AI? QE3: What was the total budget for AI across your enterprise (both held centrally at headquarters and distributed across business units) in the past financial year? QE6: What percentage of your AI budget is devoted to the following areas?

# People and collaboration are key drivers of ROI

**AI is as much about people as technology. ROI overperformers understand the importance of employing the right talent, developing in-house AI skills, and fostering collaboration across the enterprise.**

Eighty-three percent of overperformers are successful at developing and acquiring the right people vs. 9% of underperformers. In addition, overperformers are better at training and enabling non-data-scientists to deploy AI (88% vs. 2% of underachievers). They also devote more staff to AI (on average 894 per firm vs. 193 for underperformers). And they are more likely to appoint Chief AI/Analytics Officers to lead their AI initiatives (37% vs. 1% for underperformers).

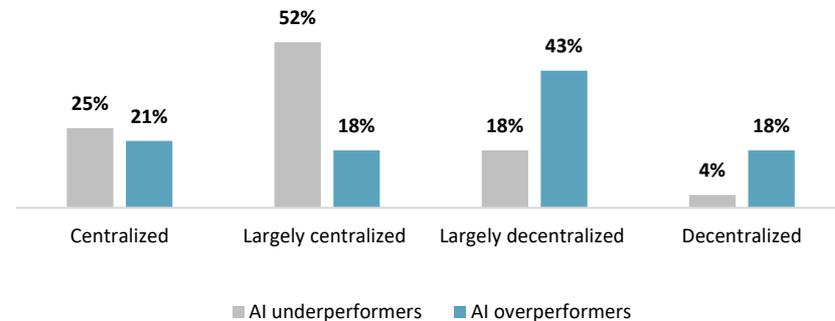
Without teamwork, AI projects often fall flat. Firms seeing high ROI are far more apt to foster a culture of learning and collaboration. Eighty-five percent facilitate coordination between AI experts and business teams (vs. 9% of underperformers). They also work closely with those teams to identify use cases and demonstrate AI's worth through pilots.

ROI overperformers outsource less and 75% have scaled AI across businesses units. Hence, they also decentralize AI authority to ensure that AI responsibility and expertise is distributed widely across the enterprise. Tellingly, 61% of overperformers are decentralized for AI, while 77% of underperformers are centralized.

## % that have largely or fully implemented

	Underperformers	Overperformers
Enabling non-data scientists with AI skills	2%	88%
Coordinating AI experts and business teams	9%	85%
Developing and acquiring AI talent	9%	83%

## Organizing internal AI staff



QB5: How much progress has your company made in implementing the following areas of AI? QB6: How does your company organize internal staff who are focused on developing and managing AI activities?

# Which use cases drive the highest ROI?

AI is an adaptable set of technologies that can drive value across nearly any business area. With the need to show results, executives should focus on the areas that will yield the greatest dividends.

Most firms surveyed are posting positive returns on all AI areas studied. The area generating positive ROI for the largest percentage of companies is customer service, followed by IT operations, strategic planning, risk management, innovation, and supply chain.

Connected devices, pricing and business models, brand management, and distribution and logistics also deliver positive returns to many companies. These returns are particularly impressive given that firms have made less progress in implementing AI in these areas.

**Still, investing in AI is not a silver bullet: 40% of projects are not yet showing positive ROI, based on an average across all 19 areas.** In fact, many firms advanced in implementing AI have yet to see positive gains. Underperforming areas include sales and business development, finance and auditing, fraud detection, and marketing and promotion.

“There is a buzz and excitement about using AI. It offers an opportunity to leverage data more fully and in new ways. It offers opportunities to do better science and better analysis and achieve better results.”

**Peter Henstock, Machine Learning & AI Lead, Pfizer**

**% of firms generating positive or no/negative returns by function**

	% seeing positive ROI	% seeing no or negative ROI
Customer service and experience	74%	26%
IT operations and IT infrastructure	69%	31%
Planning and decision making	66%	34%
Risk management	62%	38%
R&D and innovation	62%	38%
Supply chain, procurement	62%	38%
Connected devices and products	61%	39%
Pricing and business models	61%	39%
Data security and privacy	60%	40%
Brand management and reputation	60%	40%
Customer onboarding/admin	59%	41%
Distribution and logistics	59%	41%
Legal and compliance	58%	42%
E-commerce/customer platforms	58%	42%
Market and customer analysis	57%	43%
Marketing, promotion, channels	57%	43%
Fraud detection and mitigation	57%	43%
Finance and auditing	53%	47%
Sales and business development	51%	49%
<b>Average positive or negative return</b>	<b>60%</b>	<b>40%</b>

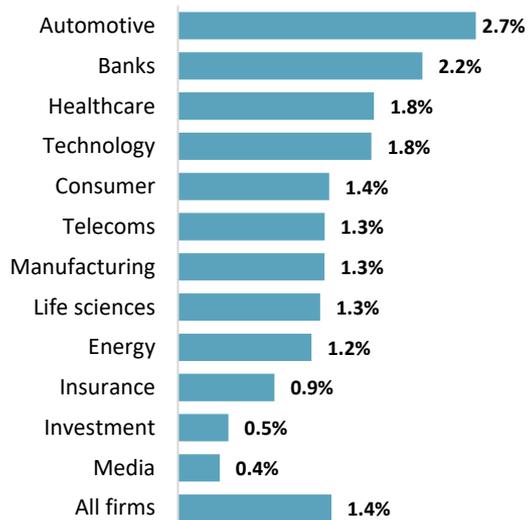
QE8: Please tell us about the progress that your firm is making on implementing AI across key functions and the ROI that you are seeing.

# Top AI use cases by industry

**Automotive, banking, healthcare, and technology firms are doing the best job in generating ROI from their AI investments. For most insurance, investment, and media firms, achieving a positive ROI is still elusive.**

The areas generating the highest ROI also vary by industry. Media, insurance and investment firms see the biggest returns from AI-enabled customer service and experience, while for automotive and life sciences, the largest dividends come from R&D and innovation. In most cases, adoption is lagging in the areas driving the largest returns. This suggests that there is significant value that can be unlocked.

## Average ROI across industries



## Functions where firms have seen the largest ROI

Automotive	Banks	Consumer and retail	Energy and utilities	Healthcare payers	Insurance
Connected devices	Supply chain, procurement	Strategic planning	Distribution and logistics	Supply chain, procurement	Customer service
Product development, R&D	Distribution and logistics	Customer service	Product development, R&D	Legal and compliance	Brand management
Strategic planning	Strategic planning	Pricing and business models	Brand management and reputation	E-commerce	Strategic planning
Investment services	Life sciences	Manufacturing	Media and entertainment	Technology	Telecoms
Customer service	Product development, R&D	IT operations and IT infrastructure	Customer service	Strategic planning	Supply chain, procurement
E-commerce	Legal and compliance	Brand management	Brand management	Market analysis	Strategic planning
Strategic planning	Strategic planning	Connected devices	E-commerce	Brand management	IT operations and IT infrastructure

■ <25% of firms have largely or fully implemented
 ■ 25% to 50% of firms have largely or fully implemented
 ■ >50% of firms have largely or fully implemented

QE8: Please tell us about the progress that your firm is making on implementing AI across key functions and the ROI that you are seeing.

## Case study

# To drive AI ROI never start with AI



**Abhinav Singhal,**  
Chief Strategy  
Officer, Asia  
Pacific,  
thyssenkrupp

A two-hundred-year-old industrial conglomerate, thyssenkrupp is taking major steps to harness AI to compete and serve customers in the manufacturing and metals sector. Abhinav Singhal, Chief Strategy Officer for Asia Pacific, believes that AI use is still in its early stages in the manufacturing sector and the emergence of fully automated factories is 5-7 years away. But given the “supercritical importance” of AI to the future of the industry, thyssenkrupp is actively investing in AI, with over 40 pilots now underway, about ten in scale-up mode.

According to Singhal, AI will be a game-changer for the industrial sector for three reasons: (1) the huge amount of data generated by manufacturing plants; (2) the sizable benefits from cost efficiencies, productivity, product quality, and new service models; and (3) the need to prop up eroding margins due to higher competition and economic uncertainty. To achieve these benefits, thyssenkrupp never starts with AI technology. Instead, the firm first identifies the business problem and investigates whether AI can provide a potential solution through a pilot. Before the company moves to enterprise-wide adoption, it identifies at least five or six customers across the globe with similar needs and that can adopt the solution. That way, the offering has enough momentum to scale profitably.

Singhal believes that AI has multiple applications for manufacturing across several broad areas: supply chain and operations, sales and marketing, and support functions, such as HR and finance. The firm focuses on three sources of value. The first is enriching machines and components using a combination of AI and IoT. The second is maximizing service revenue through techniques like remote monitoring and autonomous equipment. The third is developing new business models, such as Digital Advisory, where the firm works as a trusted advisor to help customers digitalize plants and use AI tools to increase productivity and performance.

So far, the highest ROI is coming from unlocking supply chain savings by reducing inefficiencies around logistics, warehousing, and inventory management. Such projects can yield positive ROI within about two years. However, not everything is measurable yet. Some cases are still evolving. For example, thyssenkrupp is experimenting with advanced sensors and deep image recognition tools to improve data capture for predictive maintenance. Training is another example. The firm provides employees with augmented reality glasses for training purposes even though there are less expensive options. Ultimately, AI will never replace humans, but humans who can work with AI will replace humans who cannot, says Singhal. Hence, good training and re-skilling are pivotal to successful AI implementation and help pave the way for generating ROI in the future.

# Creating a roadmap to AI excellence

**“This world is seeing a massive disruption, with those companies not adopting digital business transformation either already extinct or running the risk of being irrelevant in five to ten years. To win in Industry 4.0, companies need a well-thought-out AI strategy.**

David Donovan, Executive Vice President, Financial Services Lead, North America, Publicis Sapient

# Start with the right business case

**Beginners start their journey by defining business cases and plans for AI. As they move into the implementation phase, they ensure their data is ready to be managed through AI platforms. They also create capabilities to scale AI across business units and functional groups.**

As companies advance further, they build on those capabilities and add new ones. These include addressing privacy, security, regulatory, and ethical issues; developing internal AI talent; and building better systems to track and measure performance.

By the time these firms become leaders, they are in peak form. They excel in the more sophisticated capabilities for managing and developing AI, such as leveraging an ecosystem of AI partners and suppliers, fostering close coordination between AI experts and business teams, and measuring ROI to guide plans. Perhaps most importantly, AI leaders create effective programs to ensure the ethical use of AI. According to Beena Ammanath, Executive Director, Deloitte AI Institute, AI leaders operationalize these AI programs by creating regulatory scanning mechanisms, conducting AI audits and landscape assessments, and developing strong standards and controls.

## The AI roadmap by maturity stage

	All	Beginner	Implementer	Advancer	Leader
Providing staff with skills to deploy AI	34%	1%	33%	33%	84%
Ensuring data is gathered and integrated for AI use	31%	1%	13%	45%	81%
Preparing AI platform to manage data and algorithms	29%	0%	8%	45%	79%
Scaling AI across functions and business unit	28%	3%	25%	31%	62%
Defining business cases, implementation plans	27%	11%	11%	32%	73%
Addressing privacy, security, and regulatory concerns	26%	0%	3%	39%	82%
Developing and acquiring AI talent	26%	0%	2%	41%	83%
Leveraging an ecosystem of AI partners and suppliers	26%	0%	1%	39%	87%
Creating standards and programs on AI ethics	25%	0%	0%	36%	89%
Building coordination between AI and business teams	25%	0%	1%	37%	84%
Measuring and tracking AI performance results	25%	0%	1%	38%	83%

“AI opportunities exist across the entire customer life cycle and across enterprise functions. As these technologies become as ubiquitous as an Excel spreadsheet is today, firms need to place focus on organization and governance.”

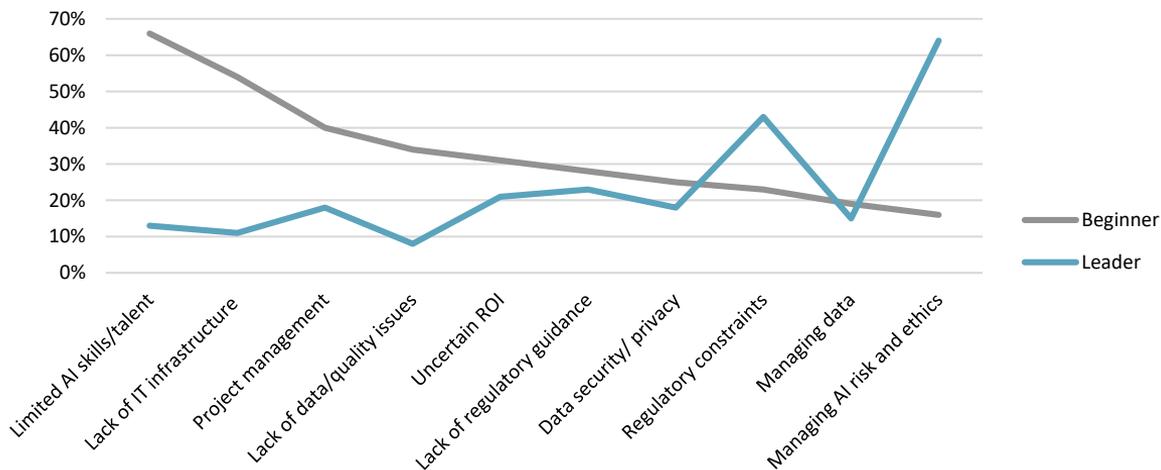
**Francisco Garcia, Director, Enterprise AI/ML & Data Science Capabilities, Dell Technologies**

QB5: How much progress has your company made in implementing the following areas of AI?

# Sidestepping the hurdles along the way

Companies face a set of common challenges when implementing AI programs. These fall into three categories: (1) coping with regulatory, ethical, and data security risks; (2) project and talent management; and (3) data and technology limitations. These hurdles can be large or small, depending on where a company is on its AI journey. For example, limited AI skills, lack of an IT infrastructure, and data access and quality issues are often major barriers to AI beginners, while preparing and integrating data, managing risks and ethics, and embedding AI into day-to-day business processes become more daunting as companies scale AI across their organizations.

## Challenges shift as firms mature in AI



QD2: What are the biggest challenges in adopting AI in your company?

## Top 10 AI challenges cited by all firms

- 1 Project management 45%
- 2 Managing AI risks and ethics 44%
- 3 Regulatory constraints 42%
- 4 Lack of regulatory guidance 33%
- 5 Limited AI skills/talent 28%
- 6 Lack of IT infrastructure 28%
- 7 Managing data 28%
- 8 Lack of data/quality issues 26%
- 9 Uncertain ROI 26%
- 10 Data security and privacy 25%

# Lessons learned on the path to AI leadership

**Where you are in AI maturity determines your next move. The lessons learned from those that went before you can help you map a successful path.**

For beginners, laying the right foundation is key. Firms starting out should ensure they have management support, along with an IT platform, data management system, and budget to drive their plans. They should articulate a clear vision and build on collaboration between the IT and analytics teams.

When implementing their plans, AI specialists should work closely with business teams to identify use cases and demonstrate their value through pilots. They should make sure they have an effective governance framework in place to mitigate data security, privacy, and ethical risks.

Organizations that are advanced in AI know the merit of collaboration, both inside and outside their organization. That is why they take proactive steps to expand their ecosystem of AI partners, suppliers, and consultants. Before scaling AI, firms should put an HR plan in place to address jobs that may be disrupted. As firms become leaders, they will want to adopt a start-up mentality, exploring ways to use AI to build new revenue streams, business models, and products and services.

Lessons learned in implementing advanced AI	Beginner	Implementer	Advancer	Leader
Develop collaboration between the technology and analytics teams	24%	26%	31%	28%
Develop and communicate a clear vision and implementation plan	24%	24%	28%	26%
Have an HR plan in place addressing jobs that may be disrupted	5%	6%	13%	18%
Leverage the ecosystem of AI partners, suppliers, and consultants	14%	12%	22%	27%
Make sure you consider the cybersecurity, data privacy, and ethical risks	31%	48%	34%	30%
Make sure you have sufficient budget in place for AI initiatives	49%	18%	14%	17%
Make sure you have the support of the management team	21%	25%	29%	23%
Make sure your IT architecture and data management system can support AI	60%	42%	32%	17%
Put a dedicated AI team in place to drive development	12%	23%	20%	16%
Start with simple pilots that can demonstrate value	17%	30%	15%	12%
Think like a startup: Take an entrepreneurial approach to AI development	7%	7%	13%	16%
Work closely with business and functional teams to identify best use cases	13%	23%	32%	28%

QD1: Which of the following have been the most important lessons learned in implementing advanced AI within your organization?

# Calls to action



**Remember AI is about business challenges—not technology.** “AI should not be the starting point for a company. Start with a business problem you are trying to solve. Focus on the value you want to create. Then assess, after traditional analytics, whether AI can help. I’ve seen firms adopt AI because it’s fun, it’s fancy. They end up with technologies they don’t know how to use, or the wrong use cases. Then you don’t see the ROI.”

**Abhinav Singhal, Chief Strategy Officer, Asia Pacific, thyssenkrupp**



**Don’t use AI as an “easy” button to reduce costs.** “AI doesn’t just magically automate what hundreds of people are doing. When thinking about applying AI to different individuals’ jobs, executives need to address the process complexity they are likely to find and be willing to reorganize to achieve the desired cost reductions. Many jobs may have to be redesigned and many employees will need to be retrained as the scope of their work changes.”

**David Kuder, US Market Offering Lead for AI Insights & Engagement, Deloitte Consulting**



**Jump in with both feet.** “You can do it on a local computer and try it. You can do it with people who aren’t trained data scientists or PhDs. Don’t be afraid to take a risk. Find the biggest problems that if solved would change your organization. Ferret out what makes everybody unhappy or drives down your revenue. Put some really bright people on it who care. Tell them to go at it. The results will surprise you.”

**Jonathan Tudor, Director, Data and Analytics, GE Aviation**



**Make AI a team sport and track the value that you are unlocking.** “Put together a multi-person team of analysts, business makers, IT, maybe general officers—people who have a different perspective on the business that you can use as a starting point. What business problem are you trying to solve? That’s number one. Second, make sure that you track the value that you generate.”

**Claire Gubian, Global Head of Customer Value, Dataiku**

# Calls to action



**Start by carefully choosing not one but several use cases.** “With dozens of potential use cases but limited resources, prioritize projects that have both substantial business value and a high likelihood of success. Why several use cases? The reality is that AI *isn’t* always the answer. But one failure doesn’t mean that the organization should abandon AI efforts entirely; it just means it hasn’t found the right use case.”

**Kurt Muehmel, Chief Customer Officer, Dataiku**



**Don’t roll out AI initiatives without an overall strategy.** “With the excitement about AI, there is a tendency to propose new AI initiatives to tackle problems. Without understanding the underlying technology, it is easy to waste money solving the same problem repeatedly. As AI begins to cascade through the organization, there needs to be a strategy guided by deep knowledge of the problem domain and machine learning field.”

**Peter Henstock, Machine Learning and AI Lead, Pfizer**



**Don’t leave governance as an afterthought.** “Governance needs to be involved in the entire journey of AI, before, during, and after modeling. Augmentation of AI should not ignore the regulatory concerns of bias detection and testing. Firms, whether advanced or just beginning, must give utmost importance to ensuring quality of the data and the models, to be able to provide ethical, responsible, and explainable decision-making support and capability in all matters.”

**Mihir Sharma, Head of AI and Cognitive Initiatives, Financial Services, North America, Publicis Sapient**



**Be ready to tackle complexity beyond the models and systems.** “The reality is that AI can be difficult to implement at scale. There are many prerequisites. You can start with design approaches that meet ethical and privacy standards, assure continuous availability of good data, and then make sure you have oversight over AI’s safe usage.”

**Amir Banifatemi, General Manager, Innovation and Growth, Xprize**

# Calls to action



**Create a data-driven culture to ensure success.** “Data-driven decisions can be something as simple as consistently acting on the results of A/B testing or leveraging an outside vendor to source data from machine learning models. Companies without the background and culture have trouble taking a leap of faith and use models whose results are difficult to explain or are counter-intuitive.”

**Ryan Kolln, Vice President, Corporate Development, Appen**



**Design metrics early on.** “Companies need to assess the value of their AI investments as they build their capabilities. Make sure that you define metrics up front so you can measure the value AI is adding as you expand its use across your organization.”

**Beena Ammanath, Executive Director, Deloitte AI Institute, Deloitte Consulting**



**Dig deep and then deeper.** “A product under development may have several hundred features to test with customers. If any of your predictions are off by too wide a margin, then you should do a deep dive into the data. This analysis will yield ideas for new features that you can test. As your predictions become more accurate, you’ll know that you are making good use of AI.”

**Brennan White, CEO and Founder, Cortex**



**Speed results by working directly with business units.** “In a recent project, a company realized that their supply chain predictive models didn’t work anymore due to COVID-19. They immediately put data scientists in with the supply chain team and deployed new models in just two weeks. The models went into production quickly because they were tied to a business outcome and the people on the hook for those outcomes.”

**Bret Greenstein, Sr. Vice President and Global Head of AI and Analytics, Cognizant**

# Calls to action



**Monitor your models over time, as data changes.** “Make sure the models are constantly updated and tuned to avoid data drift or decay. This has been a big wake-up call for people: the need to look at their architecture and figure out how to keep up with the rapid rate of change that we’re seeing now.”

**Dan Wright, President and Chief Operating Officer, DataRobot**



**Hire AI talent that can understand business needs.** “It is really important to bring in talent that has solid experience building AI solutions. There are a lot of people who can build models. But the real skill is creating business solutions supported by AI.”

**Andrei Lopatenko, VP Engineering, Head of Search and Conversational AI, Zillow Group**



**Don’t think you can do it all with a couple of data scientists.** “Hiring AI experts is important. But it takes a team to really make AI successful in an organization. First you should assemble a group of data scientists, engineers, and professionals with deep understanding of business problems. Then add people with analytical mindsets to help.”

**Wilson Pang, Chief Technology Officer, Appen**



**Go beyond standard practice when recruiting data scientists.** “Partner closely with your recruiters and HR. Job descriptions have to be specific and realistic. Recruiters rely heavily on key word searches which unfortunately will miss most of the game-changing data science talent. Effective leaders go above and beyond by proactively going after that top talent.”

**Bulent Kiziltan, Chief Data and Analytics Officer, StealthX**

## Calls to action



**Don't ignore the people side of the AI equation.** “Factor in how the technology will fit within the organization. Make sure you bring people along for the journey and show them how it could be a win-win for all. Company culture is a big piece of the success equation.”

**Gary Grossman, Sr. Vice President and Global Lead, AI Center of Excellence, Edelman**



**Collaborate but also empower.** “There isn't a single person at Dell Technologies who runs AI. It is incorporated across our organization to make our tools, systems, and processes smarter and more efficient. We empower everyone to leverage AI to improve their work.”

**Francisco Garcia, Director, Enterprise AI/ML & Data Science Capabilities, Dell Technologies**



**Use AI to service all your stakeholders.** “We identified three stakeholders: clients, employees, and regulators. We use AI to perfect client experience. We use AI to empower our own employees. We aim to use AI to support our regulators and automate policy compliance.”

**Manuela Veloso, Managing Director, Head of AI Research, J.P. Morgan**



**Understand AI's limitations—it is only one part of a bigger tool kit.** “ML, NLP, and computer vision are pioneering methods that are very good at solving certain types of problems, but not all. Other longstanding tools, such as operations research and traditional statistics, might be more appropriate. Think of these all as components of one continuous stack of technologies or methods.”

**Jon Nehlsen, Associate Dean, Heinz School of Information Systems and Public Policy, Carnegie Mellon University**



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<b>Ryan Kolln</b>	Vice President, Corporate Development	Appen
<b>Wilson Pang</b>	Chief Technology Officer	Appen
<b>Alyssa Simpson Rochwerger</b>	Vice President, AI and Data	Appen
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