

# The Rise of the Machines: How Chinese Executives Think about Developments in Artificial Intelligence

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# Introduction

Since the birth of the “thinking machine” in the 1950s, software developers have attempted to teach computers how to think like humans. But the path that artificial intelligence (AI) has followed in the decades since has been anything but linear. Advances in AI technologies have usually been followed by pauses and setbacks due to high development costs and a lack of sufficient pools of data needed to fuel AI algorithms.

Over the last decade, however, AI has entered a new phase of accelerated growth, driven by major advances in computing power, the development of powerful machine learning and deep learning algorithms, and an explosion in data that can be fed into these algorithms. After 60 years of development, AI is approaching a tipping point in its development, and is poised to make good on its promise of widespread commercial applications.

In China, AI is also set to take-off, driven by initiatives like Baidu Brain, which is developing a platform for third-party AI applications, investments in the development of autonomous vehicles, and the emergence of startups focused on developing machine learning applications and associated business models.

But as our recent research shows, the rapid development of AI is likely to favor the tech sector, which has the talent, technology, and funds to drive development and adoption. By contrast, firms in traditional industries in China are not prepared to leverage AI technologies, and most do not consider AI as a strategic priority.

## Key terms

**Artificial intelligence (AI)** is the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

**Machine learning (ML)** is a type of artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed. Machine learning focuses on the development of computer programs that can teach themselves to grow and change when exposed to new data.

**Deep learning** is an artificial intelligence function that imitates the workings of the human brain in processing data and creating patterns for use in decision making. Deep learning is a subset of machine learning in Artificial Intelligence (AI) that has networks which are capable of learning unsupervised from data that is unstructured or unlabeled.<sup>1</sup>

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<sup>1</sup> Source: <http://www.investopedia.com/terms/d/deep-learning.asp>

To better understand the potential impact that AI is likely to have on companies in traditional industries in China, we recently conducted a survey of 80 companies. Of the companies we surveyed, 60 are in traditional sectors such as retailing, heavy industry, and construction. We also surveyed 20 AI experts from some of China's leading Internet companies, including several startups. Survey respondents represented a mix of industries, including finance, healthcare, retailing, consumer goods, technology, media, and telecoms.

One thing most respondents did agree on was that AI will be a disruptive force in their industries. Although the pace of change will likely differ by industry, 90% of respondents agreed that AI would fundamentally change their industries. Respondents suggested over 100 ways that AI could impact their industries, from the development of applications that will make their operations more efficient, to the development of entirely new products and services.

Despite the promise that AI holds, our research shows that companies in traditional industries are struggling with how to invest in the technology. Over 40% of survey respondents do not see their CEO setting AI as a strategic priority, and over 60% do not think their companies have made satisfactory progress in their AI strategy in the last year (see Exhibit 1).

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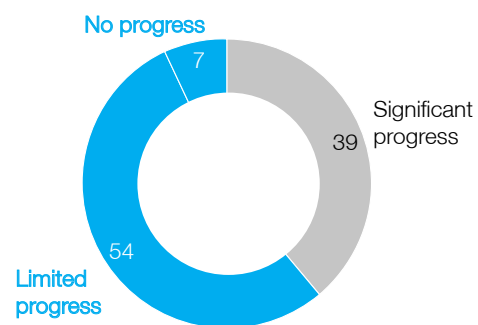
### Exhibit 1

**Only 40% experts surveyed do not see their CEO setting AI as a strategic priority, and over 60% do not think they have made satisfactory progress following their AI strategy over last year**

Is AI technology a strategic priority for the CEO or C-level executive team?  
% respondent



How much progress has your company made in the last year in implementing AI applications?  
% respondent



SOURCE: McKinsey China AI Survey 2016

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Most of the executives we surveyed point to the lack of talent as the primary obstacle to formulating a concrete AI strategy. In fact, less than 25% of AI practitioners in China have over 10 years of experience in the AI industry, compared with 50% in the US. As a Chief Technology Officer stated: “There are only a handful of Chinese universities with any machine learning programs. And most students there do not develop real-world applications.”

Given the challenges, respondents in traditional industries are not optimistic about their prospects for succeeding in this space: 84% of survey respondents indicated that the big winners in AI would likely be Internet players and startups rather than current industry leaders (see Exhibit 2).

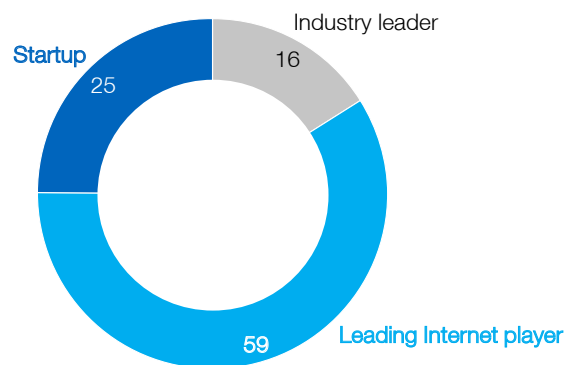
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## Exhibit 2

**Instead, about 60% of experts think that leading internet players are best positioned to become the AI leader in their own industry sectors**

Which potential players do you think would be the main driving force of the applications of Artificial Intelligence in your industry?

% respondent



SOURCE: McKinsey China AI Survey 2016

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# AI at a tipping point

Driven by technological breakthroughs and widening opportunities for application, AI is now at a tipping point for large-scale adoption. Four trends indicate that AI is on the verge of creating disruptive change across a variety of industries:

## Exhibit 3

The recent great progress in core computing technology, algorithm, dataset, and application drive AI towards its tipping point

	Growth Drivers	Take-away	Current Status	Future Outlook
Technology Drivers	1 Core computing technology	Major GPU producers and leading players heavily invest in AI-specific and ready-to-use computing devices and solutions	2014: Double precision ~1864 <sup>1</sup> GFLOP/s <sup>2</sup>	2017: Double precision ~7000 <sup>1</sup> GFLOP/s
	2 Programming platform & Algorithm	Mass collaborations on open source platforms largely propel deep learning and other techniques	2016: 96% <sup>3</sup> accuracy rate in voice recognition	2020: over 99%
	3 Dataset collection	An explosive amount of machine/human-generated, unstructured data is available for AI applications	2013: Over 4 ZB/year of digital data generated <sup>4</sup>	2020: 44 ZB/year of digital data generated <sup>4</sup>
+				
Adoption Drivers	4 Application and use cases	Tech giants and venture capitals are hyped up for startups of AI applications across functions and industries	2015: AI application market size of \$8B <sup>5</sup>	2020: AI application market size of \$20B <sup>5</sup>

1 <http://wccftech.com/nvidia-pascal-gp100-gpu-compute-performance/>

2 Floating-point Operations Per Second, a major indicator for computing power

3 Baidu's deep speech 2, <https://techcrunch.com/2016/06/11/google-baidu-and-the-race-for-an-edge-in-the-global-speech-recognition-market/>

4 <http://www.emc.com/infographics/digital-universe-2014.htm>

5 <http://www.iresearch.com.cn/report/2521.html>

SOURCE: Web search; McKinsey analysis

1. AI is a central target of the leading semiconductor vendors and all the top players in CPU and GPU are investing heavily in the high-capacity processing necessary for AI and machine learning.

2. The number and size of open-source AI platforms are growing dramatically, providing developers free access to programming interface and tools, algorithms, and training datasets for AI functions.

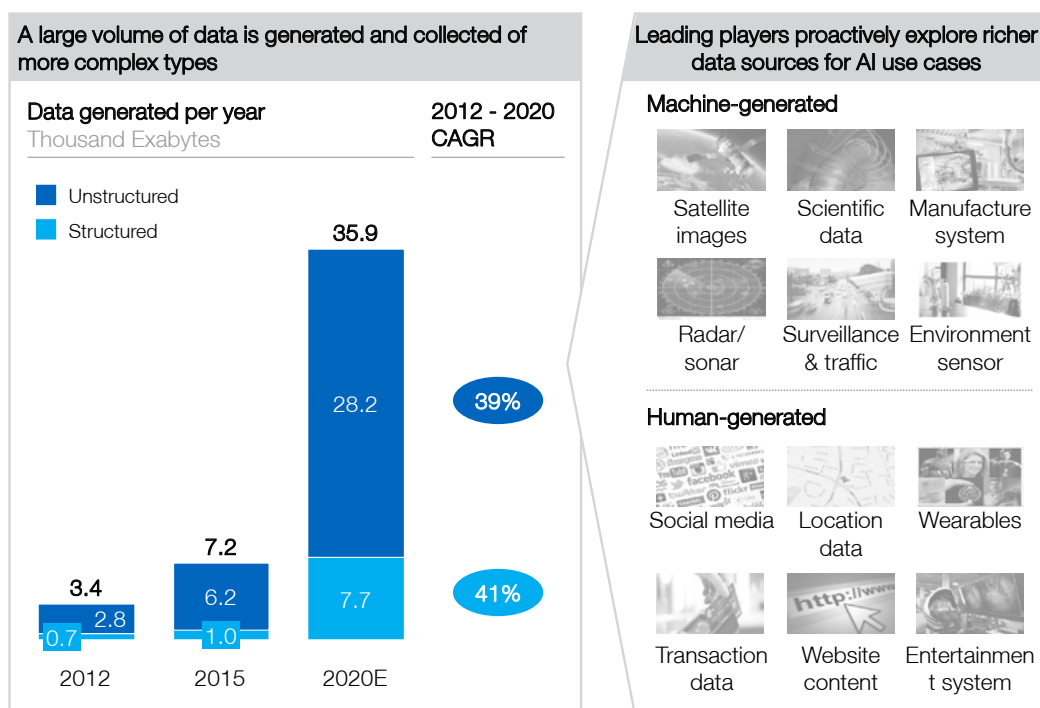


3. A massive increase in the amount and variety of data sources means that machines can be trained to make better decisions more quickly (See Exhibit 4).

4. Tech giants and venture capitalists are eagerly pursuing start-ups that innovate the uses of AI across industries. Venture investments in AI startups have grown more than 20-fold from 2010 to 2014.

#### Exhibit 4

### An explosive amount of more complex data is generated and collected from diverse sources



Source: IDC executive summary 2015 ([https://www.datanami.com/solution\\_content/hpe/media-entertainment/navigating-unstructured-retail-data-storm/](https://www.datanami.com/solution_content/hpe/media-entertainment/navigating-unstructured-retail-data-storm/))

We have seen such pivotal transitions before, when technological innovations have coincided with market forces to create products that transform entire industries. The introduction of the iPhone in 2007 was one such moment, when the maturation of the touchscreen intersected with the growing popularity of mobile phones, resulting in a category-changing product.

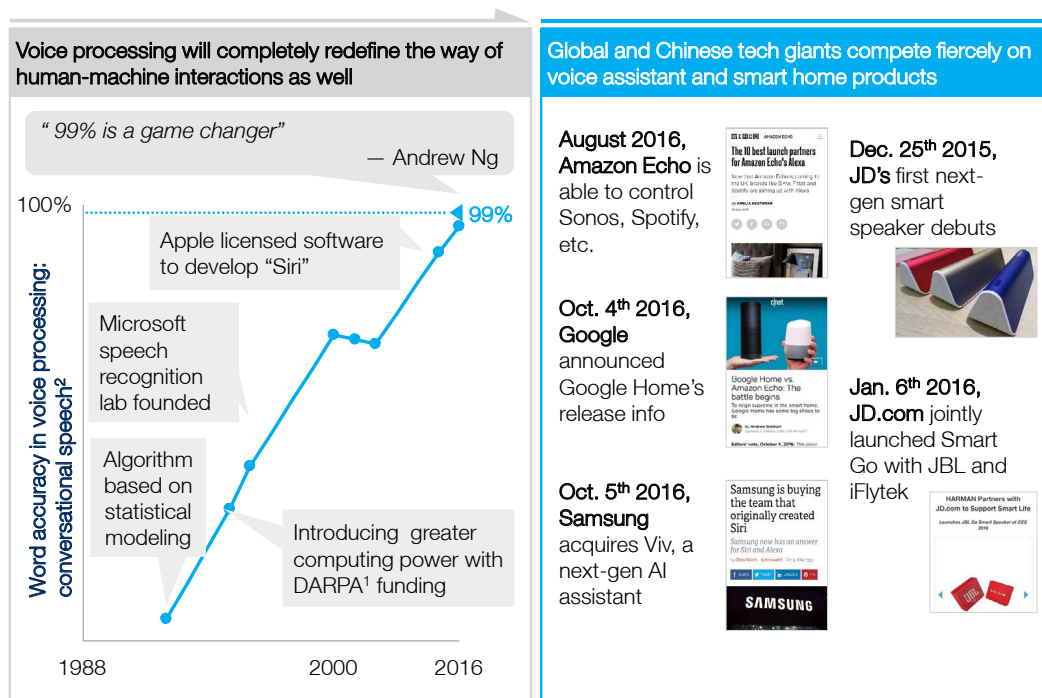
Though the exact timing is impossible to predict, AI appears to be on the brink of a similar breakthrough. Significant technological advances in AI are creating opportunities for game-changing products and services. One key application is voice recognition. Success rates for

natural language processing are approaching 99% (the technology tipping point) and major global and Chinese tech players are working hard to bring to market home network devices like routers that use voice input technologies (see Exhibit 3).

In autonomous driving, key technologies are also approaching the tipping point: the object-tracking algorithm, the algorithm used to identify objects near vehicles, has reached a 90% accuracy rate. Solid-state LiDAR (similar to radar but based on light from lasers) was introduced for high-frequency data collection of vehicle surroundings. Because these technologies have quickly become viable, major technology companies like Google, Nvidia, Intel, and BMW are accelerating efforts to develop self-driving vehicles.

## Exhibit 5

**Voice processing is also approaching its tipping point and will redefine human-machine interactions as voice assistant and smart home take off**



<sup>1</sup> The Defense Advanced Research Projects Agency of the United States Government

<sup>2</sup> <http://blogs.microsoft.com/next/2016/09/13/microsoft-researchers-achieve-speech-recognition-milestone/#sm.0000068z54nyc9fe1udmte9k6ls5h>

SOURCE: Literature search; McKinsey analysis

# China pushing to take the lead

While most advances in AI are currently being driven by global technology firms, Chinese companies aspire to become leaders in this emerging field.

For example, China's effort to build an indigenous semiconductor industry is heavily focused on developing the CPU and GPU technologies that underpin machine learning. With a 96% accuracy rate, Baidu is a leader in the voice recognition market, matching or surpassing rivals like Google, Microsoft, and Amazon. China's AI application market is projected to grow at 50% year over year, outstripping the 20% CAGR expected across the global market.

The Chinese government has identified AI as a new engine of economic growth, and is pouring investment into academic research and economic incentives for AI enterprises. For their part, China's Internet giants are making AI a focus, while startups are developing AI applications in everything from robotics to healthcare to drones. Some Chinese companies are even winning prestigious global competitions in AI technology, such as iFlytek at NIST and HIK Vision at ImageNet.

## The challenge for traditional companies: lead or be left behind

China's aggressive push to lead the AI revolution creates something of a conundrum for Chinese non-tech companies when it comes to adopting AI. To increase their own chances of success, many of these traditional companies are beginning to partner with Internet companies on AI applications. In doing so, however, they are providing valuable proprietary data and industry learning to companies that could someday disrupt them. Can traditional companies succeed by partnering with the very companies that may disrupt the industry in the same way they have disrupted banking, commerce, and other industries? Will tech companies be the only winners in China's AI boom?

For traditional companies, the alternative to forming partnerships could be to invest in a massive arms race in AI technology and capabilities. However, such a move would be difficult to justify on the basis of forecasts alone and given the uncertain time horizon for the expected AI boom. Is there a way traditional Chinese companies can take advantage of the country's leadership in the development of AI?

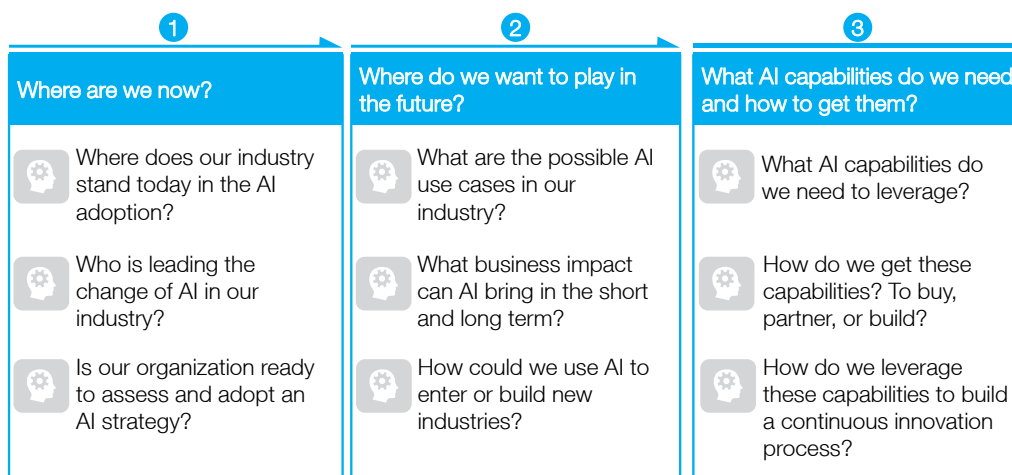
# Nine questions CEOs should answer about their AI strategy

When it comes to decision making about AI, “strategic neglect” is not among the options for traditional Chinese businesses. Chinese CEOs must proactively engage this question and make a conscious strategic decision: “Go big,” “Partner,” or just “Wait and see.”

Here are nine questions that business leaders need to address when formulating an AI strategy (see Exhibit 6).

## Exhibit 6

**Faced with the fast moving trends and fierce competition, CEOs of traditional players need to answer 9 questions to build their leading position with AI**



SOURCE: McKinsey analysis

### *Where are we now?*

- 1) Where does our industry stand in the adoption of AI? Are we currently using AI-enabled applications, or are we starting at the very beginning in introducing AI in our business?
- 2) Who is leading the adoption of AI in our industry? Is our company a leader or a follower? Are there best practices that our company can learn from?
- 3) Is our organization ready to assess and adopt an AI strategy? What elements need to be in place in order to develop a comprehensive approach to using AI in the company?

*Where do we want to play in the future?*

- 4) What are the possible AI use cases in our industry? What technologies are relevant? What players could enter our industry?
- 5) What business impact can AI bring in the short and long term? How soon can an investment in AI be expected to pay off? What are the expected tradeoffs in deciding when to invest?
- 6) How could we use AI to enter or build new industries? AI applications offer capabilities that go far beyond the current norm and may enable organizations to expand beyond their current focus. How might AI change the rules of the game or competitive landscape for our organization?

*What AI capabilities do we need, and how to get them?*

- 7) What AI capabilities do we need to leverage? Based on our analysis of potential use cases and competitive implications of AI, what specific technical and business talent would we need to implement our ideas?
- 8) How do we get these capabilities? To buy, partner, or build? Each choice has potential advantages and disadvantages.
- 9) How do we leverage these capabilities to build a continuous innovation process? To make the most of any investment in AI, organizations must be able to forecast how these capabilities will enable them to continue to grow in the future.

For organizations in traditional industries, the question is no longer whether they should consider adopting AI in its business and strategy processes—the question is what their AI strategy should be and how to implement that strategy. Chinese non-tech companies can either gain from or suffer through the leadership of their compatriots in the technology industry. To avoid being left behind or worse, rendered irrelevant, CEOs must actively consider the current and potential future state of AI in their industry, develop a clear focus on future goals, and build an engine to identify and capture benefits from AI as it rolls out in their industry.

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