Cognitive China

Creating a blueprint for an AI-enabled China

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An AI future beckons

China is rapidly becoming a global leader in artificial intelligence (AI) and cognitive computing. In just a few years, China's AI investments have increased dramatically, with a goal to grow the industry to as much as CNY 1 trillion by 2030.[1] In 2016, the number of academic research papers published in China in the field of deep learning exceeded that of U.S. researchers.[2] And as of June 2017, China had applied for almost 16,000 AI patents, ranking second worldwide.[3] Chinese organizations are now able to deploy these substantial investments for optimal economic impact and growth. Employing the insights of 485 executives from China, this report provides a functional roadmap to help Chinese executives plan their AI-enabled cognitive future.

Introduction

Artificial intelligence is transforming economics and industries. As with many transformational technologies, while the net effect is expected to be positive, there likely will be winners and losers. To help ensure they come out on the positive side of the AI equation, Chinese businesses are making massive AI technology investments. According to a recent government plan, China aims to grow its core AI industries significantly to CNY 150 billion by 2020, CNY 400 billion by 2025 and CNY 1 trillion by 2030.[4]

Over the past six years, the IBM Institute for Business Value, in collaboration with the Economist Intelligence Unit, Oxford Economics and other organizations, has been studying the unique nature of AI and cognitive computing, as well as the economic and business impacts. This report draws specifically on insights from 485 Chinese C-suite executives and functional heads from 18 industries, as well as government and education leaders, surveyed across the major regions of China. Among these respondents, we identified a specific group of business leaders – the cognitive innovators – who feature highly on a number of AI-related metrics. We examined what these cognitive innovators are doing differently from others and then analyzed how cognitive computing is impacting enterprises at the function level. Using those insights, we developed a functional prioritization for AI investments based on the specific attitudes of Chinese business leaders and which investments they predict will have the biggest impact on both their businesses and the Chinese economy as a whole.

93% of China's cognitive innovators* said they realize value from both structured and unstructured data compared to 77% of other China respondents

87% of China's cognitive innovators* already cultivate the skills needed to adopt cognitive computing compared to 71% of other China respondents

97% of China's cognitive innovators* recognize the need to change employee roles as cognitive computing evolves compared to 77% of other China respondents

Applying a two-step approach, we first ranked a set of functional areas for AI investments in terms of likely return on investment or value created based on insights of the Chinese Chief Executive Officers (CEOs) we surveyed. Second, we ranked specific activities within each of those functional areas based on insights of the relevant area leaders (for example, Chief Financial Officers for the finance function, Chief Human Resource Officers for the HR function, etc.).

In another analysis across all countries, we similarly identified global trends and functional priorities among cognitive innovators globally. These insights are the focus of two additional 2017 IBV reports ("Fast start in cognitive innovation" and "Accelerating enterprise reinvention").[5] While we might make occasional comparisons to the global data, this report focuses specifically on trends and priorities in China.
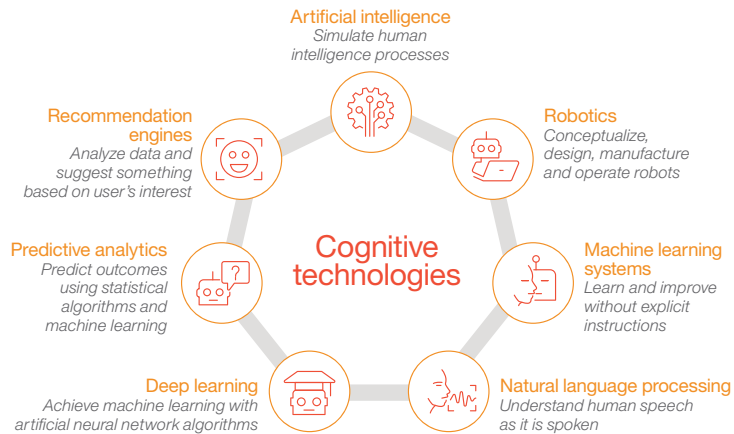
*Survey respondent group cognitive innovators represents approximately 10 percent of executives surveyed across the full global sample (n=6,050) and reflects an elite group defined by a strategic approach to adopting cognitive technologies. For more details, see the Research methodology section on page 20.

What is AI and why is it so important?

AI and cognitive computing refer to next-generation information systems that understand, reason, learn and interact by continually building knowledge and learning, understanding natural language, and reasoning and interacting more naturally with human beings than traditional programmable systems. Specific AI technologies, such as machine learning, deep learning and natural language processing, can be combined with enriched predictive and descriptive analytics and complemented by robotics and other forms of automation. As a result, AI and cognitive computing technologies deliver entirely new types of customer engagement, strategic innovation and business transformation or – indeed – reinvention (see Figure 1).

Figure 1

Defining the spectrum of cognitive technologies

Artificial intelligence
Simulate human intelligence processes

Robotics
Conceptualize, design, manufacture and operate robots

Recommendation engines
Analyze data and suggest something based on user's interest

Predictive analytics
Predict outcomes using statistical algorithms and machine learning

Machine learning systems
Learn and improve without explicit instructions

Cognitive technologies

Deep learning
Achieve machine learning with artificial neural network algorithms

Natural language processing
Understand human speech as it is spoken

Source: IBM Institute for Business Value analysis.

Potential economic growth and business efficiency benefits from the application of AI are significant. AI capabilities can augment human expertise and put otherwise unattainable data and insights straight into an individual's hands. Consider the following scenario: While traveling to work, your car detects that you are about to suffer a major medical event based on in-vehicle sensors and instantly routes real-time data to nearby healthcare professionals. It evaluates treatment options based on the latest research, recommends the best option, and delivers you to the facility best equipped to provide immediate, world-class medical care. And it does this while arranging pre-approval with your insurer and notifying your closest family member, friend and/or employer of the incident.[6]

Or imagine you are preparing for a trip: Recognizing that an upcoming weather event will likely lead to major travel disruptions, your personal virtual concierge makes a suggestion to reconfigure your holiday plans based on its knowledge of your interests and preferences – taking into consideration other disruptive weather events halfway around the world and their likely impact on air, rail and road transportation options.[7]

China's cognitive innovators

As detailed previously, we defined a specific subset of survey respondents – the cognitive innovators – that lead the pack in adopting cognitive technologies. Specifically, cognitive innovators rank highest across five dimensions:
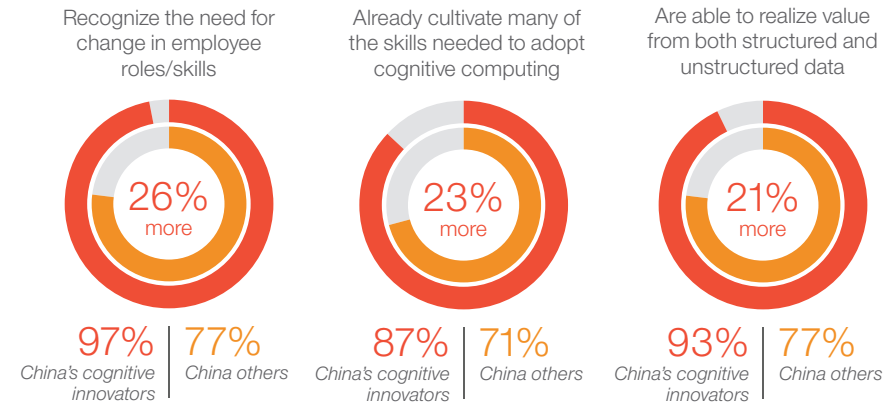
1. Familiarity with cognitive technologies and concepts

2. Leadership in innovation

3. Recognition of the importance of cognitive capabilities to their organizations

4. Willingness of their industry to embrace cognitive computing

5. Demonstration of a clear set of actions to indicate they have begun their cognitive journey.

This group of cognitive innovators is relatively small, representing approximately 10 percent of all executives surveyed globally and 14 percent of China respondents. And the cognitive innovators are disproportionately high performers compared to their competitive peers. For example, 33 percent of China's cognitive innovators are also outperformers, meaning they outperform their competition in terms of both revenue growth and operating efficiency, while only 10 percent of the remaining China respondents are outperformers.

China's cognitive innovators almost uniformly recognize the need for significant change in both the roles and the skills of their employees. Indeed, they told us that they have already cultivated many of the skills they need for the adoption of cognitive computing. As such, Chinese cognitive innovators are typically already able to realize value from both structured and unstructured data (see Figure 2).

Figure 2
China's cognitive innovators do things differently

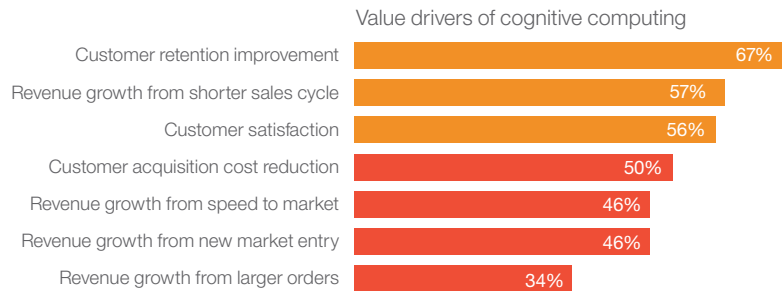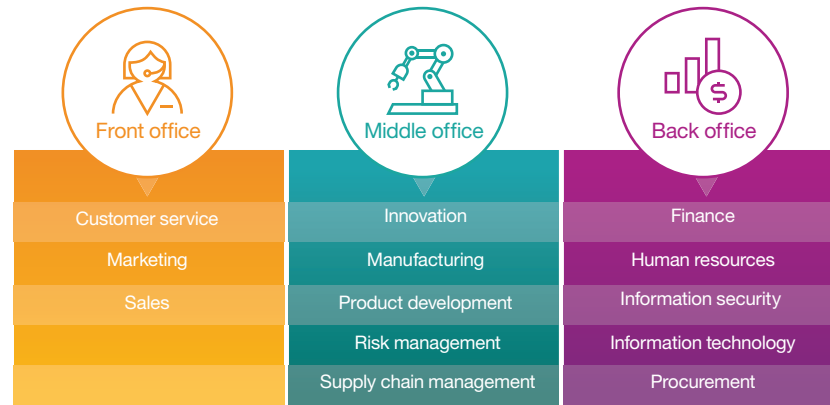| Recognize the need for change in employee roles/skills	Already cultivate many of the skills needed to adopt cognitive computing	Are able to realize value from both structured and unstructured data
26% more	23% more	21% more
97% China's cognitive innovators | 77% China others	87% China's cognitive innovators | 71% China others	93% China's cognitive innovators | 77% China others

Source: IBM Institute for Business Value survey on cognitive computing in collaboration with Oxford Economics, 2016. IBM Institute for Business Value analysis.

Cognitive innovators in China primarily view AI and cognitive as a growth play. They identify customer retention, revenue growth and customer satisfaction as the key rationale for embracing cognitive technologies and see cognitive capabilities as central to driving new revenue and dramatically improved customer experience (see Figure 3).

Figure 3

Key value drivers for China's cognitive innovators

Value drivers of cognitive computing

Driver	Percentage
Customer retention improvement	67%
Revenue growth from shorter sales cycle	57%
Customer satisfaction	56%
Customer acquisition cost reduction	50%
Revenue growth from speed to market	46%
Revenue growth from new market entry	46%
Revenue growth from larger orders	34%

Source: IBM Institute for Business Value survey on cognitive computing in collaboration with Oxford Economics, 2016. IBM Institute for Business Value analysis.

Creating a cognitive enterprise

The impact of AI and cognitive technologies is far more than the sum of their parts. AI and cognitive computing transform business functions, driving rapid evolution in organizations. To explore this effect, we applied findings from our study to divide the enterprise into 13 key functions and categorized them based on a front-, middle- or back-office organizational deconstruction (see Figure 4).

Figure 4
The enterprise's key functions

Front office	Middle office	Back office
Customer service	Innovation	Finance
Marketing	Manufacturing	Human resources
Sales	Product development	Information security
	Risk management	Information technology
	Supply chain management	Procurement

Source: IBM Institute for Business Value analysis.

In the front office, self-learning AI systems enable deep customer engagement, through which the technology underpinning engagement recognizes, learns and constantly improves. By doing this, cognitive systems can help increase customer satisfaction and retention by enhancing the intimacy of customers' relationships. Systems are typically part of a broader workflow environment in which marketers or sales staff can approach new or existing customer segments to create hyper-personalized experiences.

In the middle office, AI is already empowering employees with large volumes of data. Faster, better decision making can occur, with leaders shifting from depending on staff for data management and curation to generating immediate and, at times, unexpected insights.

In the back office, AI can empower employees and improve productivity by automating repetitive tasks. Back-office AI technologies can enable organizations to establish and promote transparency and control of data, processes, actions, true cost and business value across shared functions. And they help reduce, or even eliminate, human error. This provides opportunities for improvement across compliance processes, among many others.

China bank improves customer experience with robot

A bank in China has introduced a robot that uses cognitive computing capabilities to better serve customers. Located in the bank's entrance hall, the robot can identify customers' needs and then direct them to the right places and people in the bank. Using interface capabilities that encapsulate context, the robot can also interact with customers about different financial products, helping them make purchase decisions.

Chinese executives' cognitive enterprise priorities

Executives surveyed globally anticipate a 15 percent return on investment from their cognitive initiatives. And at the same time, according to a new IDC spending guide, global spending on cognitive platforms will climb from around USD 12 billion in 2017 to more than USD 57 billion by 2021.[8]

But to decompose AI investments more specifically, we ranked functions across the enterprise based on CEO priorities in applying cognitive and AI technologies according to highest expected return on cognitive investment or other strategic but equally important rationale.

As part of a second-tier analysis to establish investment priorities within functions, functional activities were then ordered based on data from the executives responsible for each respective function. For example, Chief Risk Officers prioritized AI investment for risk and compliance function.

For cross-enterprise priorities, Chinese CEOs identified product development as the highest priority function. Interestingly, in the global equivalent of the China study, respondents rated product development last in terms of priority. The Chinese CEOs surveyed rated manufacturing second, risk third and finance function fourth (see Figure 5). Below are insights for each of the functional areas based on our research.

Figure 5

Chinese CEOs ranked functional priorities across the enterprise

- Front office
- Middle office
- Back office

Source: IBM Institute for Business Value analysis.

Cognitive startup brings world-class care to rural China

A healthcare information service provider is targeting its cloud-based service specifically at oncologists based in small rural hospitals and clinics to help provide more accurate and personalized cancer treatment. Using cognitive capabilities, the company provides access to a vast quantity of knowledge and experience on and around cancer care that would otherwise be inaccessible due to a dearth of highly experienced physicians. The cognitive-enabled environment is expected to vastly simplify, accelerate and improve diagnostic and treatment processes.

Product development leaders' cognitive priorities

- Innovation/idea generation
- Life cycle management
- Prototype development and testing

Manufacturing leaders' cognitive priorities

- Manufacturing/production
- Logistics and distribution
- Production planning and scheduling

Risk leaders' cognitive priorities

- Risk analysis
- Risk operations
- Risk compliance management

Finance leaders' cognitive priorities

- Procure-to-pay
- Organic growth strategies
- Order-to-cash

1. Product development

Chinese executives believe that a cognitive computing system can improve prototype development capabilities and testing at scale. It can help improve designs efficiently by dramatically compressing verification process times associated with design changes.

2. Manufacturing

In manufacturing, AI or cognitive computing capabilities can help unlock valuable insights from dark data – which is acquired through various computer network operations but not used in any manner to support decision making – in failure reports, as well as through intelligent automation. They can integrate new sources of Internet of Things (IoT)-based sensor data and help improve the productivity of field engineers through access to real-time, more granular analyses and insights. And they can help organizations dramatically reduce production outages through better, more insightful analysis of equipment data.

3. Risk

By ingesting massive amounts of relevant data, including regulation and company policy information, AI solutions can help risk managers better assess different types of risks. Cognitive computing also can help organizations anticipate compliance gaps by mining ambiguous data to identify indicators of unknown risks that humans may miss.

4. Finance

In the finance function, AI or cognitive computing capabilities can help organizations mitigate risk, proactively prevent fraud, and accelerate and improve due-diligence processes for new suppliers. They can also help increase cash on hand by accelerating payment cycles and substantially improving decision making for regulatory compliance through natural language processing, machine learning and automated reporting.
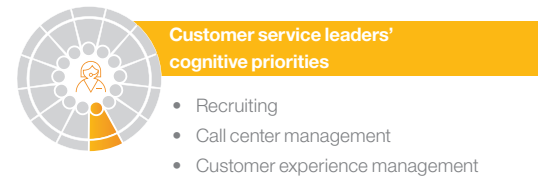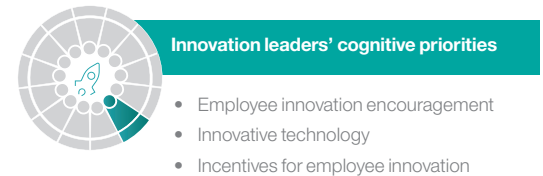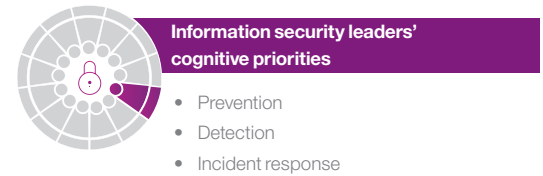
5. Information security

Cognitive computing can enable faster, more reliable detection of fraud or other activities within volumes of structured and unstructured data. It can potentially save thousands of staff-time hours, freeing personnel to focus on more business-critical initiatives by accelerating threat detection and reducing resolution time.

6. Innovation

AI solutions can help organizations formulate hypotheses, identify and validate new ideas, accelerate and deepen scenario envisioning throughout incubation, and make unexpected associations. Specific activities might include sourcing existing patents, engaging entrepreneurs to build new products and services that better monetize enterprise assets, or drawing upon new investments for other geographies or parts of an industry.

7. Customer service

AI or cognitive computing systems can help companies connect with customers more deeply by better understanding what customers want through automation of vast amounts of information. With more insights, not only are organizations better able to identify customer attitudes, needs and desires, they also can better anticipate and resolve issues to create even higher levels of customer satisfaction.

Information security leaders' cognitive priorities

- Prevention
- Detection
- Incident response

Innovation leaders' cognitive priorities

- Employee innovation encouragement
- Innovative technology
- Incentives for employee innovation

Customer service leaders' cognitive priorities

- Recruiting
- Call center management
- Customer experience management

Information technology leaders' cognitive priorities

- IT finance/procurement/vendor management
- Operations
- IT architecture and engineering

Supply chain leaders' cognitive priorities

- Demand planning and forecasting
- Risk and security management
- Asset management

Sales leaders' cognitive priorities

- Supply chain operations
- Front-of-house/Customer-facing services
- Sales management

8. Information technology

IT ranked as the highest priority among executives surveyed in the global sample. However, it rated eighth among Chinese executives. Application of cognitive computing and AI can help promote accelerated solution design and improved amplification of employee expertise in IT. And it can support faster, more efficient planning, development and testing of enterprise software, as well as enable greater agility.

9. Supply chain

AI or cognitive computing capabilities can help companies dramatically improve insights for decision making; enhance trust in the type, quantity and quality of goods purchased, delivered, received and invoiced; and reduce working capital needs to support commerce. They can also help logistics professionals better predict the likelihood of impacts on the supply chain, anticipate actions needed and more accurately predict potential issues.

10. Sales

Sales rated second in importance in the global sample, while rating tenth among Chinese executives. Applied to sales, AI can help organizations improve the efficiency of customer-facing services, expand customer account management capabilities, increase cross-sell and up-sell opportunities and — through richer contextual understanding — improve efficiency of lead management.
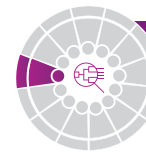
11. Procurement

AI or cognitive computing capabilities can help organizations improve global sourcing and integration with suppliers, accelerate and enhance analysis, enable more effective automation of repetitive procurement tasks, and support more efficient returns and replacements activities.

12. Human resources

Cognitive computing systems can help companies significantly improve payroll and benefits administration efficiency, as well as workforce planning. Through advanced linguistics and machine learning capabilities, cognitive computing solutions also can help dramatically increase recruiting speed and accuracy by instantaneously providing a 360-degree view of a potential candidate via social media and other channels.

13. Marketing

AI or cognitive computing systems can process vast quantities of data, helping organizations more accurately identify target audiences and leverage a variety of channels for campaigns. Better, faster, richer automation of research across multiple channels, including those channels with unstructured data, enables market researchers to spend more time on strategy and execution, as opposed to mechanical tasks and basic analysis.

Procurement leaders' cognitive priorities

- Risk management
- Logistics
- Spend analysis

Human resources leaders' cognitive priorities

- International mobility
- Workforce planning/analytics
- Talent acquisition and onboarding

Marketing leaders' cognitive priorities

- Advertising
- Marketing campaigns and promotions
- Business decision making

China manufacturer embraces AI to create an integrated experience

A leading white goods manufacturer in China is integrating its entertainment experience using artificial intelligence. With natural language processing capabilities, the company's televisions can understand and interact with users, providing personalized content and experiences. With features like smart interactions using voice, image and movement recognition; aggregated smart content for movie watching; customized information like user preference, user tag and dedicated content; and in-depth connectivity with other devices, the televisions can deliver new, superior entertainment experiences.

A cognitive China

Organizations can embrace a three-phase approach to pursuing AI or cognitive computing: Envision, ideate and incubate a comprehensive digital strategy.

Phase 1: Envision the future
- Build an 18- to 24-month digital strategy with a clear set of initiatives that pave the way for smaller, more exploratory investments.
- Establish finite objectives and time frames.
- Draw from cross-functional resources, skill sets and complementary partner ecosystems.
- Define your enterprise or business unit reinvention case, KPIs and targets.
- Apply a targeted operating model and governance that support the strategy.
- Incorporate new ways of working based on cross-functional teaming.
- Prepare your organizational culture to adapt to a "fail fast" mentality.

Phase 2: Ideate
- Conduct thorough, periodic assessments of the market and target users.
- Apply this user-centric approach to educate the rest of the enterprise on new cognitive capabilities.
- Create common use cases and applications, and design basic standards and architectural considerations tailored to your organization.
- Assess market and user needs.
- Define future experiences, end-to-end processes and enabling capabilities that AI and cognitive computing can facilitate.

- Design your future business and technical architecture based on the impact of cognitive capabilities.
- Align individual initiative business cases with the broader reinvention case.

Phase 3: Incubate and scale

- Apply a use-case-centric approach founded on rapid exploration and prototyping.
- Pilot new capabilities in the market to address specific business challenges.
- Design and execute pilots with agility and with limited risk to existing customers and operations.
- Demonstrate value by measuring performance indicators of the pilots.
- Seek to promote reuse and extend across the enterprise.
- Use a lean governance model to periodically review progress and value.
- Build new skills.
- Use an iterative approach to prototyping, building, testing and launching new capabilities.
- Provide ongoing feedback on market receptivity, and use that input to make decisions to either terminate or scale cognitive initiatives.
- Monitor business case value realization and make adjustments.

China bank pilots chatbot powered by cognitive

A leading bank in greater China relied on cognitive technologies to develop a chatbot solution prototype for its travel insurance and credit card divisions. The bank deployed the prototype on its website so the chatbot would be the first point of contact for customers, reducing the burden on call center agents. With the chatbot, the bank aims to improve customer service by offering a text-based conversational interface designed to help users more quickly find information. After experiencing great success with the prototype, the bank now plans to roll out the chatbot across services through both its website and a mobile app.

Key questions

For more information

To learn more about this IBM Institute for Business Value study, please contact us at iibv@us.ibm.com. Follow @IBMIBV on Twitter, and for a full catalog of our research or to subscribe to our monthly newsletter, visit: **ibm.com**/iibv.

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IBM Institute for Business Value

The IBM Institute for Business Value (IBV), part of IBM Global Business Services, develops fact-based, strategic insights for senior business executives on critical public and private sector issues.

- What are your primary strategic imperatives for AI or cognitive computing?
- How will you use AI to transform your customers' experiences and which segments will you target?
- What cognitive capabilities can best enable front-, middle- and back-office experiences and operations?
- What new business and operating models can AI enable?
- What governance will be necessary to build customer and employee trust in AI?
- What new skills, capabilities and resources will be needed?

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Related reports

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Research methodology

In cooperation with Oxford Economics, the IBM Institute for Business Value surveyed 6,050 global executives representing 18 industries, including leaders of government departments and educational institutions. Included in this global group of respondents were 485 Chinese C-suite executives and functional heads. Roles of responding executives globally included major C-suite members – CEOs, CMOs, CFOs, CIOs, COOs and CHROs – as well as heads of customer service, information security, innovation, manufacturing, risk, procurement, product development and sales.

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