Accelerating enterprise reinvention

How to build a cognitive organization

How IBM can help

Clients can realize the full potential of big data and analytics with expertise, solutions and capabilities needed to infuse cognitive into virtually every business decision and process; empower more rapid and certain action by capitalizing on many forms of data and insights; and develop a culture of trust and confidence through a proactive approach to security, governance and compliance. For more information about IBM Cognitive and Analytics offerings from IBM, visit ibm.com/gbs/cognitive. For more information about cognitive solutions and cloud platforms that support cognitive workloads, visit **ibm.com/**cognitive.

Creating a functional cognitive roadmap

Executives worldwide have embraced the concepts of artificial intelligence (AI) and cognitive computing. Many are already applying these and other intelligent technologies to dramatically improve capability and productivity of their businesses while redefining the ways they engage with customers, partners and others. However, they need a way to prioritize their digital intelligence investments, as cognitive computing presents virtually endless possibilities across business processes and functions. Leveraging insights from more than 6,000 senior executives across industries and regions, this study provides a clear roadmap toward full adoption of cognitive computing – function by function, across the enterprise.

Reinventing business from the ground up with cognitive capabilities

Digital disruption and the cognitive era are driving organizations to reimagine the limits and boundaries delineating traditional industries and sectors. Cognitive computing and AI augment human capabilities and help generate insights for organizations to act and respond to changing market dynamics.

More than ever, organizations need to relentlessly reinvent themselves by assessing their competitive positions within evolving ecosystems, exploring new agile ways of working and addressing a basic question facing leaders: How can my organization shape the next wave of disruption rather than brace itself to be disrupted?

An emerging answer to this question is based on looking toward cognitive capabilities to redefine traditional business offerings, products, services and processes across the enterprise — from foundational back-office systems to critical middle-office capabilities to essential front-office functions. Cognitive computing not only can support radically simplified, improved and cost-effective modes of operation, but also can enable entirely new forms of innovation to dramatically expand revenue opportunities.

While traditional analytics can provide data-based insights, cognitive turns these insights into recommendations. Cognitive can understand unstructured information, such as the imagery, natural language and sounds found in books, emails, tweets, blogs, images, and audio and video files. What's more, cognitive systems can reason through data to unlock meaning, learn iteratively to empower more informed actions and interact to dissolve barriers between humans and machines. Ultimately, these capabilities can fuel unique, essential user experiences.

73%

of global CEOs say cognitive computing will play an important role in the future of their organizations

50%

of global CEOs surveyed said they plan to adopt cognitive computing by 2019

15%

Surveyed executives say they anticipate a **15% return on investment** from their cognitive initiatives

It is no surprise then that the concern just a few years ago about unproven business models, experiences and enablement of emerging technology has quickly developed into widespread recognition of cognitive computing's power. In fact, as many as seven out of ten global CEOs surveyed indicated it will play an important role in their organizations' futures. And 50 percent said they either have adopted or intend to adopt cognitive computing within their businesses by 2019.

To analyze the impact of cognitive computing on enterprises, the IBM Institute for Business Value, in cooperation with Oxford Economics, surveyed 6,050 executives globally across 18 industries (see "Study approach and methodology" at the end of this report). We examined CEOs' survey responses to determine their organizational priorities for applying cognitive computing across business functions. Then we analyzed responses from leaders of each function to determine their top three cognitive priorities.

From this foundation, we developed a three-phase approach that executives can adopt to explore different paths to scale new cognitive capabilities:
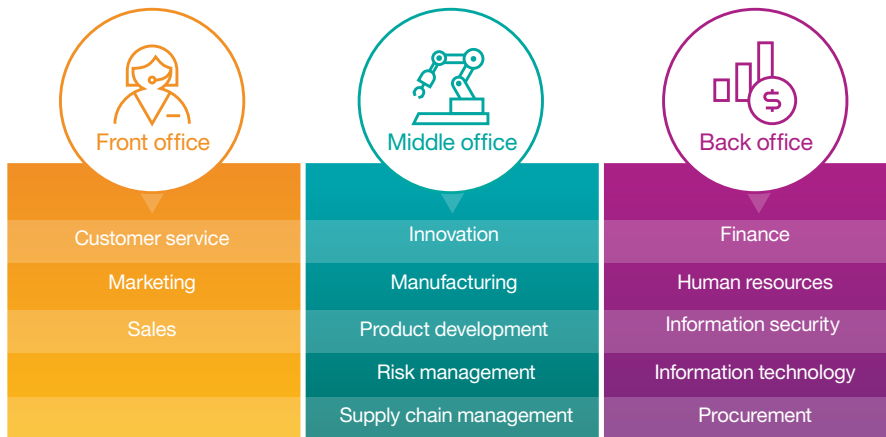
- Phase 1: Envision the future
- Phase 2: Ideate
- Phase 3: Incubate and scale

Taking a functional look at the enterprise

The full potential impact of cognitive technology is more than the sum of its parts. Cognitive can transform individual business functions, and the interactions behind those functional transformations are likely to create rapid evolution in organizations. To explore this effect, we applied findings from our study to divide the enterprise into 13 key functions, categorized them based on front-, middle- or back-office, and investigated the impact of cognitive on each area (see Figure 1).

Definition of cognitive

Cognitive computing refers to next generation information systems that understand, reason, learn and interact. These systems do this by continually building knowledge and learning, understanding natural language, and reasoning and interacting more naturally with human beings than traditional programmable systems.

Figure 1

The enterprise can be deconstructed into key business 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

Bringing the world's knowledge to every conversation[1]

Hilton Worldwide, a prominent hotel and resort chain in the United States, is the first chain in the world to use cognitive computing technology in a proof-of-concept project to receive, understand and answer guest questions — about everything from pool hours to nearby restaurants and attractions. As a result, the experience for guests when they make inquiries is more tailored and engaging. Front-desk employees' effectiveness is increased since they are able to focus on more complex queries. Customer insights generated by inquiries are routed back to the product development team in usable forms.

In the front office, self–learning cognitive systems enable deeper customer engagement, in which the technology recognizes, learns and improves with every interaction. In doing so, cognitive systems can increase customer satisfaction and retention by enhancing the intimacy of customers' relationships or through efficiency in solving customers' problems. In many cases, these systems are part of a broader workflow and data fabric in which marketers or sales staff can approach new or existing customer segments with a more granular and relevant understanding, leading to hyper-personalized experiences.

Business leaders can use this information to access a realm of new possibilities. They often can more effectively deploy augmented human resources alongside intelligent, assisted, cross-channel, self-service options, based on customer type, job or problem complexity, or transaction value (see sidebar, "Bringing the world's knowledge to every conversation").

In the middle office, cognitive computing is already empowering employees to handle, share and interpret large volumes of data. Cognitive is enabling faster decision making in response to customer and stakeholder requests. Leaders can now shift from depending on staff for data management and curation, to generating insights with cognitive, turning those insights into action and delivering meaningful impact to the bottom line.

This pushes aside the traditional dependency on institutional knowledge, the limited use of new sources of data and analytics to mesh old with new, and lengthy decision-making workflows resulting in lost revenue opportunity. Finally, this contextual understanding throughout the decision-making process increases the rate and certainty of key actions, especially pertaining to identifying and remediating questionable decisions, requests or conclusions (see sidebar, "Expanding human capability at scale").

In the back office, cognitive computing can empower employees and improve productivity by automating repetitive tasks. The back office is also where organizations need to invest time and effort to develop a smart data fabric that can leverage big-data investments to help business users better consume, understand and inform decision making in the middle office and front office.

Companies can use this cognitive opportunity to become truly data driven, democratize data and strive for real-time insights. More important, this is where new augmented workflows are designed to enable the rest of the business to experiment at speed, standardizing types of analyses and insights for reuse.

Cognitive computing in the back office enables management to establish and promote much greater transparency and control for data, processes, actions, true cost and business value across shared functions, and enhances quality by reducing or eliminating human error (see sidebar, "Combining efficiency with dramatically improved outcomes").

Combining efficiency with dramatically improved outcomes[3]

The Australian Taxation Office (ATO) is using cognitive computing to assist in accelerating complex tax cases. By contextualizing and finding insights within the constant flow of real-time and historical tax information, the ATO is saving tax auditors and case workers thousands of hours of time each week while achieving faster, more accurate data analysis. With a 360-degree view of taxpayer information across tens of millions of tax cases, the ATO is dramatically improving metric and outcome quality.

Expanding human capability at scale[2]

In financial services, compliance issues can make or break a firm. Verifying entities, assessing business risk of those entities and preparing documents about past decisions can be time-intensive for compliance analysts. In the meantime the company cannot do business with these entities. Worse, if an analyst misses crucial information, the company's reputation could be jeopardized. Cognitive can reduce the process time significantly — by augmenting the analyst's expertise — and can help enhance integration across functions.

A financial services institution in the United States has piloted cognitive computing to assess regulatory documents with speed and scale, expanding the capabilities of its risk and compliance officers. Already achieving high levels of accuracy in its conclusions, the cognitive capabilities have demonstrated the ability to save the institution hundreds — soon to be thousands — of hours in manual activity. In addition to obvious efficiency benefits, the cognitive solution is resulting in significantly lower turnover among risk and compliance personnel, as well as vastly improved retention of institutional knowledge.

Starting points for reinvention

Based on our study, executives identify significant net benefits in adopting cognitive capabilities. Surveyed executives say they anticipate a 15 percent return on investment from their cognitive initiatives. According to a new IDC spending guide, global spending on cognitive platforms will climb from around USD 3 billion in 2016 to more than USD 31 billion by 2019.[4]

Clearly investment in cognitive is expected to yield significant competitive advantage and financial returns. But understanding the specific priorities for applying cognitive computing across and within business functions requires deeper analyses.

To examine investment priorities *across* business functions, we used survey data to identify and rank functions based on CEO respondents' priorities in applying cognitive technology to their organizations – either due to highest anticipated return on investment, or some other strategic rationale. CEO respondents ranked each function based on its ability to drive cognitive adoption, identifying as top-driver functions those that could be starting points for realizing value from cognitive.

To establish investment priorities *within* functions, we rated functional activities based on data from the executives responsible for each respective function (see Figure 2). For example, we used aggregated data from chief risk officers to prioritize cognitive investment for activities within the risk and compliance function. Similarly, we used aggregated data from heads of research and development (R&D) to prioritize cognitive investment for activities within the R&D function.

Figure 2

CEOs ranked functional priorities in applying cognitive capabilities to their organization
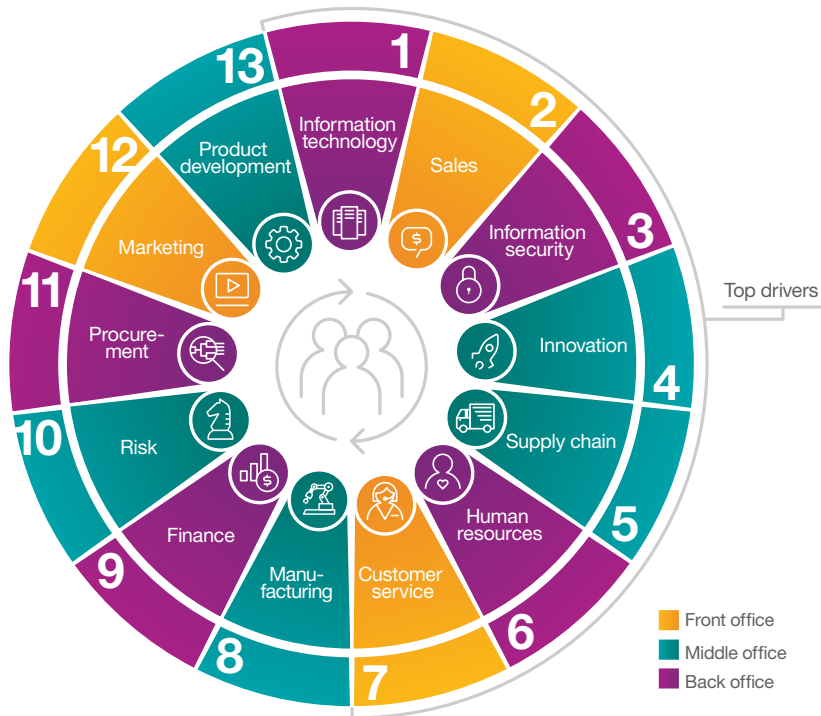
Source: IBM Institute for Business Value analysis

Information technology leaders' cognitive priorities

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

Sales leaders' cognitive priorities

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

1. Information technology

When applied to information technology, cognitive computing can promote accelerated solution design and improved amplification of employee expertise. It also can support faster, more efficient planning, development and testing of enterprise software, and can enable greater agility.

For example, a Korean technology company is using Korean natural language processing on application programming interfaces (APIs) to drive application development and expand innovation and business opportunities. The company can offer developers localized versions of several language-processing APIs, putting it at the center of a new business ecosystem and providing major strategic advantage.[5]

2. Sales

Cognitive computing applied to sales functions can 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.

As a case in point, Opentopic Inc. is using a powerful cognitive engine that leverages AI to enable digital agencies and their clients, collaboration professionals, and banks and insurers to personalize at a human and behavioral level on a large scale. This helps unlock real-time insights that lead to a better understanding of the customer and the buyer journey.[6]

3. Information security

In information security, cognitive can enable faster, more reliable detection of fraud or other activities within volumes of structured and unstructured data. In doing so, it can save up to thousands of staff-time hours, freeing personnel to focus on more business-critical initiatives by accelerating threat detection and reducing resolution time.

A university medical center is using cognitive security to facilitate its growth and transformation. The center is using cognitive to manage the behavior of medical devices, reduce false-positive results and find anomalies in behavior. The cognitive system's ability to work around the clock is helping the center overcome the challenges of handling the 24/7 nature of security operations.[7]

4. Innovation

Applied to innovation activities, cognitive computing helps organizations better formulate hypotheses, identify and validate new ideas, accelerate and deepen scenario envisioning throughout incubation, and make unexpected associations. Associations can 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.

For example, the U.S.-based Mayo Clinic uses cognitive to match eligible cancer patients with clinical trials by combing through patients' medical records. As a result, the time to screen a patient for clinical trial has decreased from 30 to 8 minutes.[8]
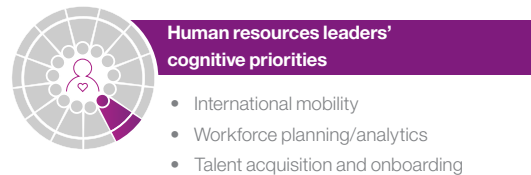
Information security leaders' cognitive priorities

- Prevention
- Detection
- Incident response

Innovation leaders' cognitive priorities

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

**Supply chain leaders'
cognitive priorities**

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

**Human resources leaders'
cognitive priorities**

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

5. Supply chain

When applied to supply chains, cognitive can dramatically improve insights for decision making; trust in the type, quantity and quality of goods purchased, delivered, received and invoiced; and working capital needs to support commerce. Cognitive helps logistics professionals better predict the likelihood of impacts on the supply chain, anticipate actions needed and more accurately predict potential problems.

Such is the case with an office-supplies retailer in the United States. The company uses cognitive APIs to provide a friction-free, personalized supply-reordering process for customers.[9]

6. Human resources

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

Forum Engineering Inc., an engineer staffing company based in Tokyo, Japan, is leveraging cognitive to help with its recruiting efforts. The company has adopted cognitive computing to recommend candidates, demonstrating explicitly how proposed engineers line up with job requirements.[10]

7. Customer service

Applied to customer service, cognitive computing can help companies connect with customers in context. It does this by better understanding what customers want through automation of vast amounts of information. Not only are organizations able to identify customer attitudes, needs and desires, they also can better anticipate and resolve issues to create even higher levels of customer satisfaction.

For instance, a communications provider in North America uses natural language processing and machine learning to better understand customer queries and infer personal context by analyzing data. The business has achieved a success rate of 90 percent in customer self-service without having to escalate to other customer care channels.[11]

8. Manufacturing

Application of cognitive computing in manufacturing is broad and significant. Cognitive can unlock valuable insights from dark data in failure reports. Additionally, it can integrate new sources of Internet-of-Things-based sensor data and improve the productivity of field engineers through access to real-time, more granular analysis and insights. Also, it can dramatically reduce production outages through better, more insightful analysis of equipment data.

A steel producer, for instance, is using cognitive computing to enable safer, more efficient plants by helping technicians transcend their own understanding of complex systems to anticipate, diagnose, fix and prevent failures.[12]

Customer service leaders' cognitive priorities

- Recruiting
- Call center management
- Customer experience management

Manufacturing leaders' cognitive priorities

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

Finance leaders' cognitive priorities

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

Risk leaders' cognitive priorities

- Risk analysis
- Risk operations
- Risk compliance management

9. Finance

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

For example, a bank is taking the first steps in a cognitive journey with an expense verification solution that clears a path for faster growth of its trust-fund business. Using machine learning, the solution has been taught to recognize the difference between qualified and nonqualified expenses by analyzing structured and unstructured data, including receipt details, claim forms, transactional records and frequently asked questions, increasing in accuracy as the corpus of knowledge grows. This cuts evaluation time by 60 percent by reducing errors and revisions, and the company estimates savings of hundreds of millions of U.S. dollars over a period of five years due to increased efficiency.[13]

10. Risk

By ingesting massive amounts of relevant data, including regulation and company policy information, cognitive computing can help risk managers more accurately assess different types of risks. Cognitive can anticipate compliance gaps by mining ambiguous data to identify indicators of unknown risks that humans may miss. Relieved of mechanical tasks, risk managers can focus on more strategic issues.

A cognitive initiative of a European life insurer, for example, is designed to provide underwriters with a dashboard that aggregates key patterns and findings from pertinent documentation. The whole synopsis is readily available so underwriters can quickly see what is important, identify any concerns and determine how much risk the institution might be prepared to incur.[14]

11. Procurement

In procurement, cognitive computing can 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.

A Sweden-based procurement solution provider has adopted cognitive capabilities to cut down costs and make its procurement activities more efficient. The cognitive procurement process uses pattern recognition and natural language processing to mimic human activities.[15]

Procurement leaders' cognitive priorities

- Risk management
- Logistics
- Spend analysis

12. Marketing

Within the marketing function, cognitive computing can process vast quantities of data to better 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.

An airline in Europe, for instance, is conducting a cognitive computing trial to find patterns or indicators of high-conversion propensities. Combining structured with unstructured data from social media activities, the cognitive platform self-learns to improve accuracy with every conclusion.[16]

Marketing leaders' cognitive priorities

- Advertising
- Marketing campaigns and promotions
- Business decision making

13. Product development

Cognitive computing 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.

A fashion designer in Australia and Asia is using cognitive this way. The designer is applying cognitive technologies to unstructured images and comments on social media to better understand audiences and predict fashion trends to guide creative decisions.[17]

Product development leaders' cognitive priorities

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

More than the sum of its parts

To determine whether cognitive investments might be beneficial to your organization, ask the following questions: Does your organization have highly repetitive processes? Are your business processes reliant on employees reading and comparing data sets from both structured and unstructured sources? Do your operations require high-demand skills that you could teach to a cognitive system? If you answered yes to any of these questions, cognitive capabilities are likely to be helpful to your organization.

While cognitive can significantly improve speed, accuracy, efficiency and effectiveness of functions and processes across the enterprise, its potential benefits exceed these advantages. As organizations mature in both digital intelligence and Digital Reinvention™, the dynamic interplay between functions is likely to evolve.

Cognitive risk, for example, can intersect with cognitive sales to give deep, almost profound insight into individual customers. New, unexpected forms of innovation can emerge. And the enterprise can realign in response to new opportunities, calibrating systems and personnel in real time.

The traditional front-, middle- and back-office functions alone already face massive change. New sources of data, analytics and insights, and their application in customer experience, business decision making and workflow enablement require more integrated value chains and blur traditional boundaries across silos.

More important, cognitive provides business leaders the opportunity to partner and jointly reinvent industries, connecting today's fragmented physical, digital and financial supply chains. This, in turn, creates the data fabric necessary to increase transparency and inform decision making across buyers and suppliers in business-to-consumer and business-to-business commerce.

Recommendations: Building a cognitive-enabled digital strategy

Organizations can embrace a three-phase approach to envision, ideate and incubate a comprehensive digital strategy that accelerates exploration of new cognitive capabilities.

Phase 1: Envision the future

As a leader of your organization, you can leverage cognitive capabilities and apply a cohesive and thoughtful business-led and technology-enabled strategy for the enterprise. Work with your organization to articulate an 18-to-24-month digital strategy with a limited set of initiatives that paves the way for smaller, more exploratory investments with finite objectives and time frames. These initiatives may draw from cross-functional resources, skill sets and complementary partner ecosystems.

In developing your strategy, define your enterprise or business unit reinvention case, KPIs and targets. Apply a targeted operating model and governance that support this strategy. Incorporate new ways of working based on cross-functional teaming. And to facilitate implementation, prepare your organizational culture to adapt to a "fail fast" mentality.

Phase 2: Ideate

With your cognitive strategy, initiatives and investment profile defined, focus on thorough and periodic assessments of the market and target users. Apply this user-centric approach in tandem with the use of Centers of Excellence (CoE).

Charge the CoEs with experimenting and educating the rest of the enterprise on new cognitive capabilities in the market — such as the use of natural language processing or machine learning for large data consumption and analysis — creating common use cases and applications, and designing the basic standards and architectural considerations tailored to the organization.

As you progress through the ideation process, assess market and user needs for pains to be addressed. Define future experiences, end-to-end processes and enabling capabilities that cognitive can facilitate. Design your future business and technical architecture based on the impact of cognitive capabilities. And refine individual initiative business cases and the broader reinvention case.

Phase 3: Incubate and scale
During your organization's shift from planning and design to execution, apply a use-case-centric approach founded on rapid exploration and prototyping to your initiatives. Doing so will help you demonstrate the alignment and value of new capabilities as they are piloted in the market to solve specific and measurable business challenges. Design and execute these pilots with a bias toward agility and limited risk to existing customers and operations. At the same time, be sure to clearly demonstrate potential value by measuring performance indicators of the pilots.

As capabilities mature, seek to promote reuse and extension across the enterprise. Finally, as your organization incubates, commercializes and scales these concepts, use a lean governance model to periodically review progress and value.

During this phase, develop new cognitive organizations, resources and skills. Use an iterative approach to developing a body of cognitive knowledge and to prototyping, building, testing and launching new capabilities. Provide ongoing feedback on market receptivity, and use that input to make decisions on either ending or scaling cognitive initiatives. And finally, monitor your business case value realization and make adjustments as necessary.

Key Questions

- Are your primary strategic imperatives centered on cost-reduction efforts, new revenue generation or a combination of the two across different parts of the business and operations? How can you use cognitive to address these imperatives?
- What are the critical potential or existing customer segments your organization is aiming to engage, attract or retain in new and differentiated ways?
- In your organization's future customer journey, what kind of cognitive capabilities can best enable front-, middle- and back-office experiences and operations?
- What new operating models, approaches to governance, resources and skills will be required within your organization to execute initiatives and deliver new cognitive capabilities?
- How will your organization explore, understand and educate functions with regard to emerging and future cognitive capabilities?

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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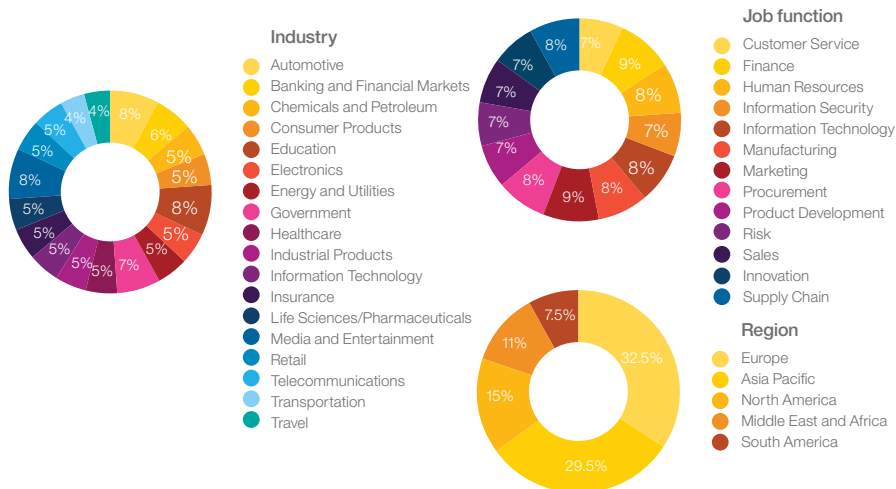
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Study approach and methodology

The IBM Institute for Business Value, in cooperation with Oxford Economics, surveyed 6,050 executives globally across 18 industries, including leaders of government departments and educational institutions. Roles of responding executives included C-suite members — CEOs, CMOs, CFOs, COOs, CIOs and CHROs — as well as heads of customer service, information security, procurement, product development and sales functions, among others.

IBM Institute for Business Value Global Cognitive Survey respondents

Industry
- Automotive
- Banking and Financial Markets
- Chemicals and Petroleum
- Consumer Products
- Education
- Electronics
- Energy and Utilities
- Government
- Healthcare
- Industrial Products
- Information Technology
- Insurance
- Life Sciences/Pharmaceuticals
- Media and Entertainment
- Retail
- Telecommunications
- Transportation
- Travel

Job function
- Customer Service
- Finance
- Human Resources
- Information Security
- Information Technology
- Manufacturing
- Marketing
- Procurement
- Product Development
- Risk
- Sales
- Innovation
- Supply Chain

Region
- Europe
- Asia Pacific
- North America
- Middle East and Africa
- South America

Source: IBM Institute for Business Value analysis

Related reports

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