Dialing in a new frequency

Your cognitive future in the communications industry

IBM Institute for Business Value

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More than ever, communications service providers need to rely on the latest solutions related to cognitive computing, analytics, cloud, mobility, network optimization, digital transformation and global integration. IBM has an extensive global network of telecom solution labs, research labs and innovation centers to support its industry offerings. With more than 22,000 subject matter experts working in the communications industry, we work with more than 200 major communications service providers across the globe. IBM continues to invest significantly in key acquisitions to add expertise and capabilities that enable clients in this industry. For more about IBM communications solutions, see ibm.com/communications.

IBM Watson

Watson is a cognitive system that enables a new partnership between people and computers that enhances and scales human expertise. For more information about IBM Watson, visit ibm.com/Watson.

A communications renaissance

For communications service providers (CSPs), cognitive computing has arrived, and its potential to revolutionize the industry is enormous. With the power to unleash a new era of innovation and growth, cognitive systems are already helping CSPs further enhance the customer experience and uncover new insights. Our research indicates that communications industry executives are poised to embrace this groundbreaking technology and invest in cognitive capabilities to spark a renaissance in communications.

Executive summary

Welcome to the age of cognitive computing, where intelligent machines simulate human brain capabilities to help solve vexing problems across multiple industries. For communications service providers (CSPs), the timing for an industry game changer couldn't be better.

Facing upheaval triggered by technological, societal and economic influences, the communications industry is primed for a landmark shift. As numerous CSPs experience slowed growth and pressure to reduce costs, they simultaneously must investigate ways to address the explosive growth in video.[1] In addition, the industry finds itself catering to increasingly demanding and empowered customers, while contending with continued security concerns and competition from over-the-top (OTT) players.

At the same time, CSPs have to manage increasing volumes of both structured and unstructured data – data brimming with latent insights that could potentially redress some of these issues. Unfortunately, most providers still struggle to unlock the full value of the data at their disposal. As the potential for insight increases with additional data, so, too, does the challenge in managing this data.

Advances in cognitive computing can help bridge the gap between data quantity and data insights. Cognitive-based systems can build knowledge, understand natural language and provide confidence-weighted responses. And these machine learning systems can quickly locate the proverbial needle in a haystack, identifying new patterns and insights.

89%

of CSP executives **familiar with cognitive computing** believe it will play a critical role in the **future of their business.**

85%

of CSP executives familiar with **cognitive computing** believe it will play a **disruptive role** in the industry.

94%

of CSP executives familiar with cognitive computing intend to **invest in cognitive** capabilities.

Our research reveals that cognitive solutions are already helping some CSPs blaze new territory. As a follow up to the "Your cognitive future" reports, we launched a new series of industry-specific studies based on research conducted in early 2015. (For more information on the research, which included a survey of 83 communications industry executives, see the "Study approach and methodology" section).

In this report, we examine current and future applications for the communications industry and provide recommendations for CSPs embarking on the cognitive journey. We also offer insights from CSP executives who recognize the potential to transform the communications arena – and plan to exploit cognitive capabilities to do so.

Conquering industry forces

The communications industry finds itself tackling multiple disruptive influences. From rising customer expectations and operational challenges to continued competition from OTT players, a number of powerful forces are shaping – and shifting – the communications landscape:

Evolving customer expectations: Seeking the same conveniences encountered in other industries, CSP customers have high expectations relating to access, service, quality and experience. However, CSPs struggle to meet these demands due to obstacles like siloed operations and lack of consistency across channels.[2] To better serve and delight subscribers, CSPs need to uncover deeper insights from a variety of structured and unstructured data.

Increasing OTT threat: According to our 2014 communications survey, almost a third of customers have reduced or plan to reduce their SMS usage by using alternative messaging channels.[3] According to another estimate, the communications industry will lose a combined USD 386 billion between 2012 and 2018 from customers using OTT voice applications.[4] To counter the OTT threat, CSPs should capitalize on their vast amount of customer data either to better compete or work with OTT players.

Rising use of data-intensive apps: The popularity of data-intensive applications has led to an explosive growth in mobile traffic, potentially exceeding available spectrum. Mobile video is of particular concern, with one report estimating it will generate almost 70 percent of mobile data traffic by 2019.[5] By gaining a clearer understanding of mobile traffic flows, CSPs can determine ways to better and more efficiently manage network capacity. In addition, increased insight regarding how people consume video can reveal opportunities to develop innovative video services and generate revenue from third parties (by creating the capability for video ad insertion, for example).

What is cognitive computing?
Cognitive computing solutions offer various capabilities, including…

- Learning and building knowledge from various structured and unstructured sources of information

- Understanding natural language and interacting more naturally with humans

- Capturing the expertise of top performers and accelerating the development of expertise in others

- Enhancing the cognitive processes of professionals to help improve decision making

- Elevating the quality and consistency of decision making across an organization.

Accelerating cost pressures: Global mobile revenue growth is expected to slow, going from a compound annual growth rate of 4 percent for 2008-2014 to 3.1 percent for 2014-2020.[6] At the same time, the swell in mobile traffic forces CSPs to invest heavily in new generation networks. In this environment, providers are challenged to find ways to both dramatically reduce costs and increase operational efficiency.

Growing privacy and security concerns: CSPs are prime targets for cyber attacks in part because they provide an infrastructure used by the masses to communicate and store huge amounts of sensitive data. The impact of a security breach is high both in terms in cost and reputation. According to a 2015 global report, a quarter of CSPs surveyed had detected 50 or more security incidents in the 12 previous months.[7] As fraud and cyber attacks become more sophisticated and varied in nature, CSPs will require innovative solutions to better manage security, detect fraud and safeguard customer data.
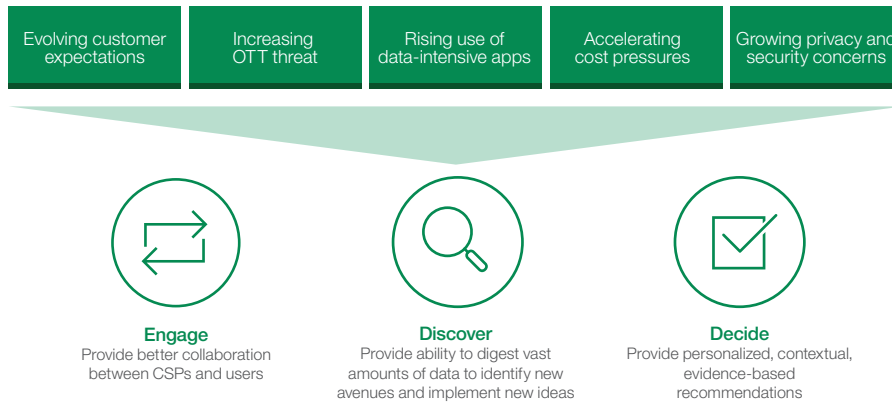
From disruption to focus
It is clear that CSPs are operating amid turmoil. Although forces challenging the industry appear varied in nature, we identified key themes among them relating to customer communication and engagement, insights and discovery, and recommendations and decision making.

To rise above the disruption, CSP leaders must be smarter in how they approach data. We suggest they start by improving their capabilities to *engage, discover* and *decide* (see Figure 1). Increased engagement between CSPs and customers can improve communication and collaboration, which in turn can aid development of more tailored and effective services and

better customer care. And new discovery capabilities that unearth insights buried in data can facilitate the creation of new products and services, as well as innovations in service delivery and operations management. Finally, more accurate and timely decision capabilities can lead to more personalized and contextual recommendations for customers, as well as better decisions.

Figure 1

To combat forces challenging the industry, CSPs need to improve their capabilities to engage, discover and decide

| Evolving customer expectations | Increasing OTT threat | Rising use of data-intensive apps | Accelerating cost pressures | Growing privacy and security concerns |

Engage
Provide better collaboration between CSPs and users

Discover
Provide ability to digest vast amounts of data to identify new avenues and implement new ideas

Decide
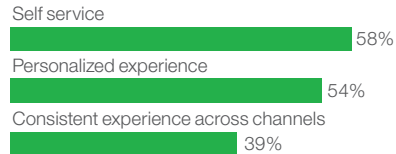Provide personalized, contextual, evidence-based recommendations
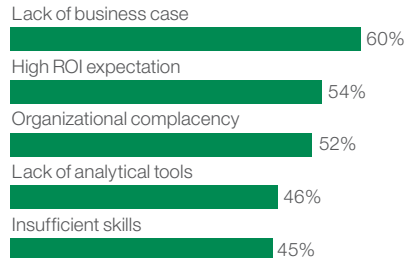
Source: IBM Institute for Business Value.

Engage
Percentage of CSP executives who believe their
organizations are not competitively delivering
customer service (by area of service)

Self service
58%

Personalized experience
54%

Consistent experience across channels
39%

Discover
Percentage of CSP executives citing key challenges
when pursuing disruptive innovation

Lack of business case
60%

High ROI expectation
54%

Organizational complacency
52%

Lack of analytical tools
46%

Insufficient skills
45%

Decide
Two thirds of CSP executives are not confident
about decisions relating to cost reductions

Two
thirds

Source: IBM Institute for Business Value.

Engage: Today's empowered customers seek personalized, convenient and consistent service across multiple channels. More than 71 percent of CSP executives surveyed understand that customers want personalized experiences. However, well over half of the executives surveyed do not believe their organizations are competently meeting this demand. In addition, 58 percent do not believe their organizations are providing successful self-service options.

Discover: Almost 70 percent of CSP executives surveyed are actively pursuing industry model innovation, while 46 percent are actively pursuing product and service innovation. CSP executives cite lack of business case, high return on investment expectations, organizational complacency, lack of analytical tools and insufficient skills among their greatest challenges in pursuing disruptive innovation. Discovery can also be limited by rigid analytics platforms (e.g., nonintegrated platforms across business units) and a dependency on specialized skills (e.g., advanced analytics professionals).

Decide: Effective decision making is important in any industry. For CSPs, prudent budget decisions are particularly significant in light of expense pressures. According to our survey, though, two-thirds of industry leaders are not confident in their organizations' cost reduction decisions. A potential reason could be that many organizations are forced to make decisions based on incomplete insights because they lack the tools necessary to optimize the data available to them.

Cognitive opportunity in communications

Big data has been called the new natural resource, and this resource continues to rapidly grow in volume, variety and complexity.[8] For example, annual global mobile data traffic is predicted to reach 292 exabytes per year by 2019, up from just 30 exabytes in 2014.[9] Despite explosive growth of information across industries, less than 1 percent of the world's data is currently analyzed.[10]

While effective for a number of applications, traditional analytics solutions cannot fully exploit the value of big data: They are unable to adapt to new problem domains or handle ambiguity and are only suitable for structured and unstructured data with known, defined semantics (the relation of words and phrases and what they mean). Without new capabilities, the data paradox of having too much data and too little insight will continue.

How can the communications industry bridge the gap between untapped opportunities and current capabilities? How can hidden insights that reside in data be fully harnessed for discovery, insight, decision support and dialogue? The answer is cognitive computing. Cognitive-based systems build knowledge and learn, understand natural language, and reason and interact more naturally with human beings than traditional programmable systems.

While CSPs can still derive value from analytics solutions, cognitive computing opens the door to new levels of value. Cognitive systems take analytics to the next level by applying machine learning algorithms and natural language processing to make sense of vast quantities of data, much of which is unstructured. Cognitive capabilities can help CSPs extract meaningful patterns from their wealth of data – and derive insights to help drive competitive advantage over OTT and other players.
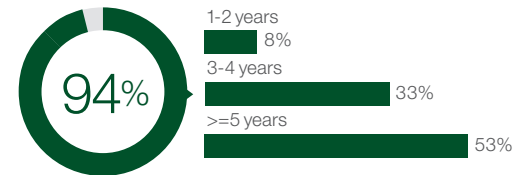
89%

89% of CSP executives familiar with cognitive computing believe it will have a critical impact on the future of their business
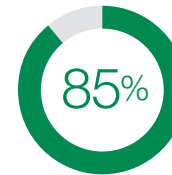
85%

85% of CSP executives familiar with cognitive computing believe it will play a disruptive role in the industry

94% of CSP executives familiar with cognitive computing are likely to invest in cognitive capabilities in the future

94%

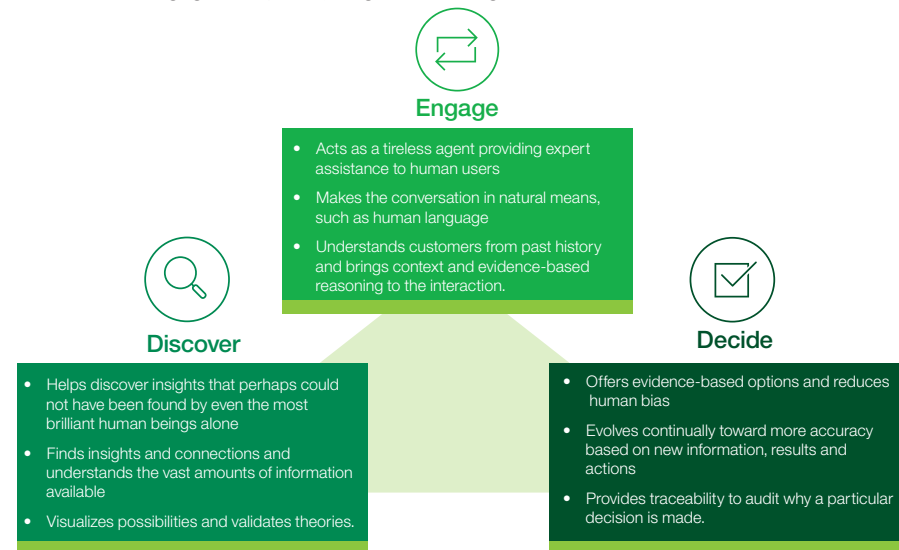1-2 years 8%
3-4 years 33%
>=5 years 53%

Source: IBM Institute for Business Value.

A vast majority of communications leaders we surveyed agree that cognitive computing has the potential to radically change the industry. Among industry executives familiar with the technology, 89 percent believe it will critically impact the future of their business, 85 percent believe it will play a disruptive role in the industry and 94 percent intend to invest in cognitive capabilities.

So, how specifically can CSPs leverage cognitive computing to address issues plaguing the industry? This new computing paradigm has three capability areas that specifically address the industry's need to improve engagement, discovery and decision making (see Figure 2).[11]

Figure 2

There are three emerging capability areas for cognitive computing

Engage

- Acts as a tireless agent providing expert assistance to human users
- Makes the conversation in natural means, such as human language
- Understands customers from past history and brings context and evidence-based reasoning to the interaction.

Discover

- Helps discover insights that perhaps could not have been found by even the most brilliant human beings alone
- Finds insights and connections and understands the vast amounts of information available
- Visualizes possibilities and validates theories.

Decide

- Offers evidence-based options and reduces human bias
- Evolves continually toward more accuracy based on new information, results and actions
- Provides traceability to audit why a particular decision is made.

Source: IBM Institute for Business Value.

Engagement capabilities

Cognitive systems can fundamentally change the way humans and systems interact and significantly extend the capabilities of humans by leveraging their ability to provide expert assistance. These systems provide advice by developing deep domain insights and bringing this information to people in a timely, natural and usable way. Here, cognitive systems play the role of an assistant – albeit one who does not require sleep, can consume vast amounts of structured and unstructured information, can reconcile ambiguous and even self-contradictory data, and can learn.

Because they are able to engage in dialogue with humans, these systems can help CSPs improve customer service by providing relevant and accurate automated responses to questions posed in natural language (see sidebar, *Cognitive capabilities help enhance call center interactions*). They also can understand customers based on their history and bring context- and evidence-based reasoning to the interaction, enabling more customized and self-service options.

Future cognitive systems likely will have free-form dialogue capabilities, which could power transformative service initiatives.[12] For example, customers could engage in dialogue with a virtual customer service representative that could answer questions in natural language. Similarly, cognitive systems could help future network analysts as they troubleshoot issues by answering questions.

Engage

Cognitive capabilities help enhance call center interactions

A Tokyo-based CSP wanted to help call center agents respond more rapidly and reliably to customer inquiries. The agents had to search a database of more than 5,000 responses to frequently asked questions and approximately 100 customer service cases, making it difficult to quickly provide accurate responses. In addition, the provider struggled to train and promote highly skilled operators due to high employee turnover rates.

The company implemented a cognitive solution that combines natural language processing capabilities with machine-learning technology to automatically provide suitable responses to questions posed in natural language. The solution offers relevant and accurate automated responses to unstructured user inquiries. Call center employees now can retrieve the right responses to customer inquiries quickly and easily, improving both call center productivity and customer satisfaction. In addition, the early employee turnover rate has gone down, resulting in cost savings.

Discover

CSP embraces cognitive computing to create consolidated product knowledge hub

Call center agents for a tier 1 CSP had to use multiple applications to find the right information to help customers, which often led to higher than necessary call times, increased costs and customer satisfaction issues. The provider turned to cognitive computing to create a consolidated product knowledge hub that would arm call center agents with relevant information regardless of the source.

Using cognitive capabilities, the CSP is able to index multiple information sources, including large device manuals from multiple vendors, and create digestible chunks of information (sub-documents) for agents to use in solving customer issues. Greater access to relevant, real-time information helps agents provide more efficient and timely customer service.

Discovery capabilities

Cognitive systems can help users discover insights that might otherwise not be found by even the most brilliant human beings. Discovery involves finding insights, patterns and connections and understanding the vast amounts of information available around the world.

Some discovery capabilities have already emerged. For example, a tier 1 CSP is using cognitive capabilities to index large device manuals from multiple vendors, creating digestible chunks of information call center agents can use to solve customer issues (see sidebar, *CSP embraces cognitive computing to create consolidated product knowledge hub*). In addition, cognitive systems can reveal detailed information relating to customer preferences that can help improve products, services and business models.

In the future, cognitive solutions could help CSP marketing organizations better target campaigns by identifying new micro-segmented customer profiles based on attitudinal and behavioral insights derived from unstructured customer data. Future cognitive solutions could also enable more effective and timely matching of customers to offerings by rapidly analyzing historical customer data across all relevant areas.

Decision capabilities

Cognitive systems aid in decision making and reduce human bias by offering evidence-based options. They continually evolve based on new information, results and actions. Current cognitive systems perform more as advisors by suggesting a set of options to human users, who ultimately make the final decisions.

For a number of industries, these systems are already enabling more informed and timely decisions. In healthcare, for example, IBM Watson for Oncology can quickly analyze patient data, fast-growing medical literature, guidelines from world-class experts and the experience of specialists – and then identify personalized treatment options for a clinician to consider.[13] For the communications industry, future cognitive solutions that offer timely, customized recommendations could help providers optimize call center operations and troubleshoot networks (see sidebar, *Cognitive capabilities could support improved call center, network operations decisions*).

Decide

Cognitive capabilities could support improved call center, network operations decisions

Cognitive solutions that can quickly process data – relating to customers, product and service offerings, network conditions, devices, industry expertise and more – and then provide evidence-based recommendations could help CSPs improve decisions relating to call center operations, as well as network maintenance and repair and other areas.

For example, cognitive capabilities could automatically analyze call center performance data (such as average handling time, first-call resolution rate, etc.), incorporate data from other sources and inputs, and make recommendations on how to improve performance in specific areas. Cognitive decision capabilities could also assist call center agents by prioritizing call center issues, flagging issues that require immediate attention, offering automated resolutions and providing next-best-action recommendations. In terms of network maintenance, a cognitive solution could analyze past network issues, solutions and other relevant information and then proactively perform maintenance or repair. A network manager would then be required only to validate results.

The way forward

Despite the enthusiasm for cognitive, organizations should realize there is often a steep learning curve. In terms of system implementation and user interaction, cognitive systems are fundamentally different than traditional programmatic systems.[14] CSPs can learn from other pioneering organizations that have already implemented cognitive by following three key sets of recommendations (see Figure 3).

Figure 3

Organizations with cognitive computing experience have identified three critical action areas for success

1 Define the value	**2 Prepare the foundation**	**3 Manage the change**
• Find the right opportunity.	• Invest in human talent.	• Ensure executive involvement in the cognitive journey.
• Define the value proposition and chart a course for cognitive.	• Build and help ensure a quality corpus.	• Communicate the cognitive vision at all levels.
• Be realistic about value realization.	• Consider policy, process requirements and impacts.	• Continue to raise the cognitive IQ of the organization.

Source: IBM Institute for Business Value.

1. Define the value

Early planning helps ensure the greatest return on investment of resources. Defining the value of cognitive to your organization is critical and includes several steps:

Find the right opportunity – Cognitive solutions are well suited to a defined set of challenges. CSPs need to analyze the specific problem to determine if cognitive capabilities are appropriate:

- Does the challenge involve a process or function that today takes humans, such as call center agents, an inordinate amount of time to seek timely answers and insights from various information sources (e.g., customer databases, device manuals, etc.) using potentially various techniques in making a decision or thinking through a problem?

- Is there a need for users to interact with the system in natural language (such as customer inquiries relating to product or service issues)?

- Does it involve a process or function that requires providing transparency and supporting evidence for ranked responses to questions and queries (such as data plans)?

Define the value proposition and chart a course for cognitive – Identify both the differentiated value provided by cognitive computing and the business value up front, from potential customer service improvements to cost savings. In addition, establish a cognitive computing vision and roadmap with executive-level support. Continuously communicate roadmap progress with appropriate executives and stakeholders, such as COOs, CTOs and call center directors.

Be realistic about value realization – Proven cognitive applications can many times lead to prompt value realization; however, an evolutionary approach should be taken when applying cognitive computing in innovative areas. The reality that these systems improve and can lead to increasing value over time must be understood, communicated to key stakeholders and accounted for in benefits realization plans, where applicable. In addition, specify benefits for both the CSP and its customers. Also, consider using a phased rollout or deploying the solution to a subset of trusted users who understand the technology's evolutionary nature.

2. Prepare the foundation

Prepare the foundation for a successful cognitive computing solution implementation by focusing on the following:

Invest in human talent – Cognitive solutions are "trained," not programmed, as they "learn" with interactions, results and new pieces of information and help organizations scale expertise. Often referred to as supervised learning, this labor-intensive training process requires the commitment of human subject matter experts.

In addition to domain expertise, a cognitive implementation also requires expertise in natural language processing, machine learning, database administration, systems implementation and integration, interface design and change management. CSP executives in our survey identified "lack of skilled resources and technical expertise" as the number one barrier to implementing a cognitive solution, so acquiring technical talent will be crucial. Finally there is an additional intangible "skill" required for team members: intellectual curiosity. The learning process never ends – for the system, the users and the organization.

Build and help ensure a quality corpus – Cognitive systems are only as good as their data. Invest adequate time in selecting data to be included in the corpus, which might include structured (e.g., customer account information) and unstructured data (e.g., call center transcripts) from multiple databases and other data sources and even real-time data feeds and social media. Data will likely emanate from new and untapped sources as well, such as blogs and devices in machine-to-machine platforms. In addition, invest in records digitization to secure the future of your organization's corpus, focusing on both historical and new documentation.

Consider policy, process requirements and impacts – Assess any potential impact on processes and how people work. Because users interact with cognitive systems in entirely different ways than traditional input/output systems, processes and job roles could be impacted. In addition, consider if any data policy changes are necessary. Obtaining necessary data could test the boundaries of existing data-sharing policies and might require new or modifications to existing policies, regulations and agreements.

3. Manage the change
Compared to traditional programmable systems, cognitive systems are a whole new ball game. As such, change management is more critical than ever.

Ensure executive involvement in the cognitive journey – Executive involvement should begin with active participation in defining the cognitive vision and roadmap and continue throughout the journey. This includes executive participation in regular reviews of incremental progress and value realization.

Communicate the cognitive vision at all levels – Because cognitive computing is new and not completely understood by most, regular communication at all levels (including business managers, IT staff and call center agents) is critical. Address any fears, uncertainties and doubts head on, and leverage executive sponsors to reinforce the value of cognitive to your organization's mission.

Continue to raise the cognitive IQ of the organization – Education is critical in assuring cognitive is understood and adopted. Of particular importance is managing expectations related to system-generated recommendations. Cognitive systems are probabilistic and not deterministic. While accuracy rates will improve as a system learns over time, the rate will never reach 100 percent. Educate stakeholders about accuracy rates, and conduct regular reviews on incremental improvements.

Ready or not? Ask yourself these questions

- What opportunities exist to create more engaging and personalized experiences for your customer and the wider communications ecosystem?

- What communications data aren't you leveraging that if converted to knowledge would allow you to meet key objectives and business requirements?

- What is the cost to your organization and the wider communications ecosystem associated with making nonevidence-based decisions or not having the full array of possible options to consider when actions are being taken?

- What benefit would you gain in being able to detect hidden patterns locked away in your data? How would this accelerate business model innovation, product development, customer services and the like?

- What is your organizational expertise skill gap in cognitive computing? What would change if you could equip every employee to be as effective as the leading expert in that position or field?

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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Study approach and methodology
As a follow up to the initial IBM *Your cognitive future* research study, we conducted additional research in early 2015 to dive deeper into select industries and explore opportunities for cognitive computing. Through a survey conducted by the Economist Intelligence Unit, IBM gained insights from more than 800 executives from around the world representing a variety of industries, including healthcare, banking, insurance, retail, government, communications, life sciences, consumer products, and oil and gas. The study also included interviews with subject matter experts across IBM divisions, as well as supplemental desk research.

Related publications

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