

# The human-machine interchange

*How intelligent automation is reconstructing business operations*

IBM Institute for Business Value

## Executive Report

Digital Operations

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## High expectations for intelligent automation

*Machine learning is beginning to transform the way businesses organise their operations and benefit from technology investments. And intelligent automation – the use of machines that understand their environments, interact with humans and other machines, learn from these experiences and apply what they learn to future decisions – is accelerating due to this change. But realising the value of this transformation for digital operations requires more than technology investment. Companies must train employees to work with machines in new ways and redesign operations to optimise for automation. Some industries are highly advanced in their use of intelligent automation. In other industries, adoption is more tenuous.*

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## The intelligent automation outlook

Since the early 1960s, robots have helped organisations automate business operations. But these machines have become capable of much more than routine action and tasks. Today, robots are adaptive, able to alter their responses as the environment changes.

Intelligent automation is transforming the way humans interact with and benefit from technology, and the way businesses operate (see sidebar on p. 4, ‘What is intelligent automation?’). It is helping organisations create new personalised products and services, improve operations, reduce costs and elevate efficiency. Coupled with the greater IoT ecosystem, intelligent machines can even learn from other connected devices to cyclically improve their actions.

To learn more about how far along organisations are in deploying intelligent automation and in developing plans and strategies for its adoption, the IBM Institute for Business Value, in collaboration with Oxford Economics, surveyed and interviewed 550 technology and operations executives (for more information, see the Methodology section).

The results of our study show that intelligent automation is moving toward the mainstream and that executives are recognising its potential to provide ongoing value. Seventy-six percent of respondents agree that increasing automation will have a positive impact on operational efficiency (see Figure 1).



## 76%

of operations executives surveyed report that increasing automation will have a positive impact on operational efficiency



## 75%

of operations executives surveyed say intelligent machines will meaningfully impact their business performance in the next three years



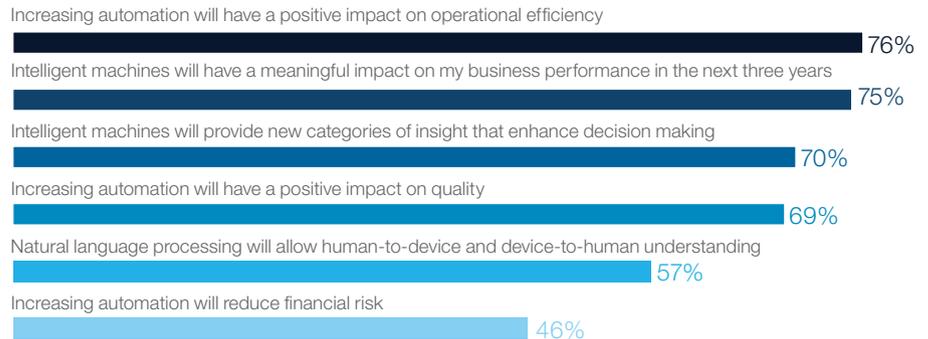
## 70%

of operations executives surveyed expect intelligent machines to lead to higher-value work for employees

Appreciation for intelligent automation includes its convenience: over half of operations executives anticipate that natural language processing will allow human-to-device and device-to-human understanding. What's more, many executives expect to rapidly improve their organisations' intelligent automation capabilities – and to realise substantial business value – in the near future. In fact, 75 percent indicate intelligent machines will have a meaningful impact on their business performance within the next three years.

**Figure 1**

*Executives are seeing the positive impact intelligent automation can have on their businesses*



*Question: To what extent do you agree with the following statements about human-machine interactions? 'Agree' and 'Strongly agree' responses.*

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## The rise of intelligent automation

Intelligent machines promise to change the way work is done and have the potential to vastly improve business performance for organisations across sectors. Consider healthcare, an industry in which advancing science and increasing complexity make it difficult for doctors to keep up with the deluge of information – generated by sources ranging from clinical trial research to patient cases.

Cloud Therapy, a cognitive solutions company, recognised the potential applications of intelligent automation for healthcare. “We saw a huge opportunity: if we could help doctors sift through millions of pages of medical literature and find relevant case histories within minutes, they would potentially be able to diagnose conditions and deliver the appropriate treatment much sooner,” says Andre Sandoval, the company’s chief executive officer (CEO).<sup>1</sup>

The company is now applying the technology to enormous data sets in an effort to cut the diagnosis time for rare diseases in half, from six months to three, on average. “We’re combining big data analytics with artificial intelligence to process health data – years of R&D that pharmaceutical companies have accumulated,” says Mr. Sandoval. The potential impact on diagnosis and treatment is significant, for both doctors and patients.<sup>2</sup>

The application of intelligent automation to augment human intelligence is a highly promising use of the technology. Our study shows that operations executives are beginning to change their strategies for this new way of working.

**What is intelligent automation?**

Intelligent automation incorporates recent advances in technology to manage and improve business processes automatically and continuously. Constituent components of intelligent automation include:

- *AI/machine learning* – The application of systems equipped with software that simulates human intelligence processes, including learning without explicit instructions
- *Natural language processing* – The ability to understand human speech as it is spoken
- *Robotics* – The use of robots that can act on IoT and other data to learn and to make autonomous decisions
- *Predictive analytics* – The practice of predicting outcomes using statistical algorithms and machine learning.

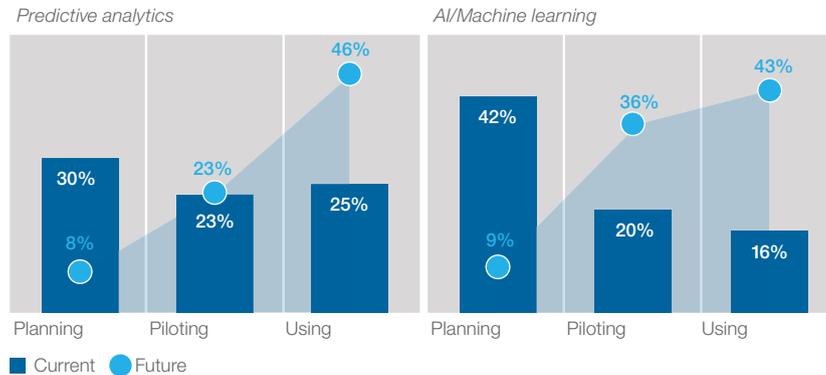
In this report, we interviewed executives directly involved with their organisations' operations functions to view intelligent automation through an operational lens, focusing on where organisations are in their intelligent automation adoption journey. Throughout, we use the terms 'intelligent automation' and 'intelligent machines' interchangeably. A data-oriented perspective on this topic based on interviews with C-suite executives, including their thoughts on which business processes are most 'automatable,' will be provided in our upcoming study, 'The evolution of process automation: Moving beyond basic robotics to intelligent interactions.'

What is the first sign of their enthusiasm? Increasing use and maturity over the next three years of two technologies critical to intelligent automation: predictive analytics and AI/machine learning (see Figure 2).

As with the adoption of any new technological capability, some sectors are further along in their implementation of intelligent automation-constituent technologies. Adoption rates and investment priorities tend to be tied to industry business models. For example, automotive companies – which are focused on building vehicles with connected systems,

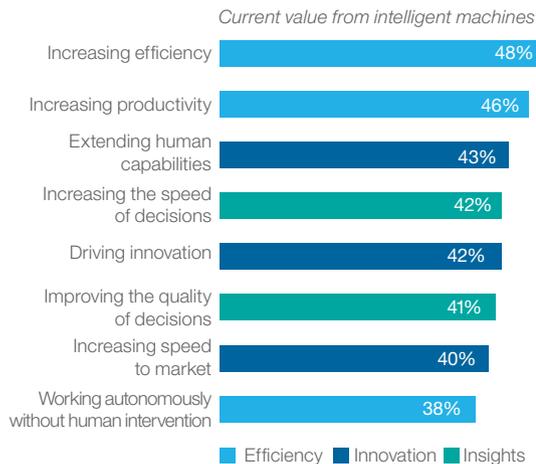
**Figure 2**

*The future of these emerging technologies is less about planning for them and more about using them*



*Question: Please rate your organisation's level of maturity in the adoption of the following technologies today and in three years.*

**Figure 3**  
*Early benefits of intelligent machines include efficiency, innovation and insights*



*Question: To what extent has your organisation realised value from robots and other intelligent machines? ‘Some positive impact’ and ‘substantial positive impact’ responses.*

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driver-assistive features and even full autonomy – are early leaders in the adoption of AI/ machine learning: 36 percent say the technology is already in use in some or all parts of the business. The banking and retail industries, which must sift through customer information to make better predictions and recommendations, are close behind at 32 percent.

Insurance companies are among the leaders in their use of predictive analytics at 47 percent, followed by telecommunications at 43 percent and automotive at 42 percent. Automotive companies also lead all other industries in their use of robotics at 56 percent.

Investment in intelligent automation is expected to pay off substantially over the coming years, delivering business value in functions ranging from customer service to product and service optimisation and quality control. Early goals centre on extending human capabilities and productivity: 65 percent of survey respondents cite increasing operational efficiency as a top-three objective for their use of these technologies.

Some organisations are already realising value in their adoption of intelligent automation, with increased efficiency and productivity as the top-cited benefits (see Figure 3). “We can provide higher customer service levels and net promoter success while reducing operating costs,” says Josh Ziegler, CEO of ZUMATA, a Singapore-based company that provides computer services to the travel and transportation industry. ZUMATA’s bot allows organisations to automate incoming calls, using natural language processing to ask users clarifying questions and to generate appropriate responses.<sup>3</sup>

Similarly, Autodesk Inc., a US-based software company, is using cognitive-based tools to improve customer relationships. “If nothing else – if we can just understand what customers want – we can route more appropriately, collect more information and create a case so that when it gets to a human agent they’re not having to do all that work,” says Gregg Spratto, vice president of operations. “This ultimately leads to quicker resolution and a better customer experience.”<sup>4</sup>

## Putting smart machines to work

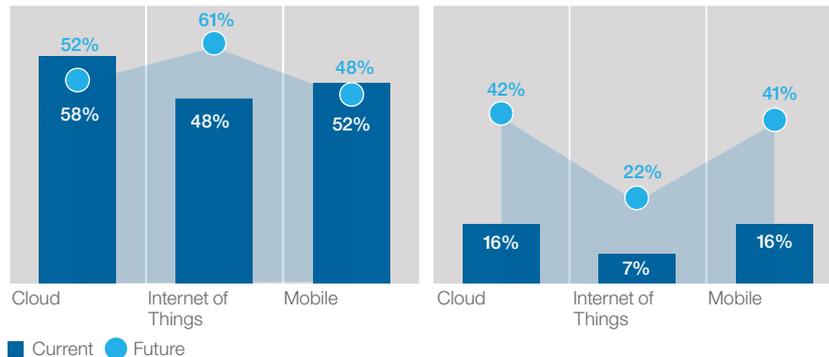
Automation is not a plug-and-play solution: organisations cannot just buy the technology, flip the switch and watch robots run the business without any human intervention. In reality, work with intelligent machines is much more complex – and is not something that happens all at once.

Businesses that successfully use intelligent automation can benefit from strong foundations in technology investment and implementation. Building blocks such as cloud, mobile and IoT technologies are important precursors to machine learning and about half of organisations are laying the groundwork now (see Figure 4).

**Figure 4**

*The basic building blocks for intelligent automation are being implemented across the business*

*Using this technology in **some** parts of our business    Using this technology in **all** parts of our business*



*Question: Please rate your organisation's level of maturity in the adoption of the following technologies today and in three years.*

While 74 percent of operations executives say their organisations are using cloud in some or all parts of the business today, momentum continues to build: 42 percent plan to implement cloud applications across their businesses in the next three years. The same is true for mobile, which more than half of operations executives say is in use in some parts of the business, with 41 percent planning enterprise-wide use in the next three years.

IoT, while increasingly pervasive, is still in a relatively early stage, with over half of operations executives using it in some capacity. Operations executives across industries expect rapid adoption of IoT over the next three years, including 98 percent of respondents in both telecommunications and banking and 96 percent in automotive.

As with more advanced technologies, certain industries are more mature in their use of these foundational tools. Eighty-eight percent in both healthcare and banking, while 86 percent in telecommunications are using cloud in some or all parts of their businesses. Three years from now, operations executives from these industries say they expect to be using it widely and industrial, automotive and insurance companies will join the leaders. Meanwhile, banking, retail and telecommunications are early leaders in the use of mobile in some or all parts of their businesses today. By 2020, 95 percent say mobile will be in wide use and healthcare organisations expect to join this leading group.

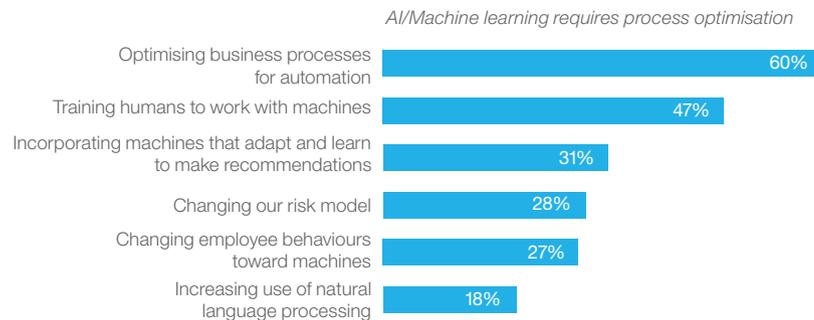
Progress and attention to implementation of the building blocks or foundational technologies may help explain why some industries are at the early stages of AI/machine learning automation and most are not yet prepared to automate complex decisions at scale.

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However, a solid IT foundation is just the starting point for intelligent automation. Organisations also must rethink the skills they need from employees and optimise their business processes for automation. For example, automating the enormous volume of security alerts that most companies receive every day demands reconceiving the processes to be automated, retooling human skillsets and then prototyping the technology before scaling it – also known as Digital Reinvention.

Many respondents are ill-equipped for these broader organisational changes and the more advanced use of technology that flows from them. While 60 percent have redesigned their processes for automation, just 47 percent have trained humans to work with machines and less than one-quarter are increasing their use of natural language processing (see Figure 5).

**Figure 5**  
*Process change precedes cutting-edge implementation*



*Question: How has your organisation changed processes and workflows, if at all, to reflect the involvement of AI/machine learning/adaptive robotics? Select all that apply.*

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The primary purpose of intelligent automation is to augment employees' skills, experience and expertise, extending the human mind in ways that allow for higher productivity, creative problem-solving and more engaging jobs for employees. At the Institute of Cognitive Science at Osnabruck University, researchers were conducting a project to predict and manage flu outbreaks. They saw that social media discussions held many potential clues and needed a way to effectively analyse the content to form predictions.<sup>5</sup>

Researchers were able to develop a natural language processing system that analyses Twitter feeds against a central body of knowledge. Now, the institute can generate predictions, analyse causes and suggest preventive actions for flu outbreaks based on instant analysis of social media combined with the latest research.<sup>6</sup>

Similarly, India-based start-up Signzy Technologies offers a cognitive system that can read, classify and understand unstructured text and images from government documents, court cases and financial records. The technology spots patterns of fraud and other illicit activity and helps financial institutions mitigate risk more effectively. Its machine-made decisions can potentially cut verification time for banks by 80 percent, shortening the process for approving loans and opening accounts from two weeks to two days.<sup>7</sup>

This kind of advanced decision making is a critical goal for intelligent machines. Improved quality and increased speed of decisions are seen as top benefits of machine learning. But relatively few organisations are using machine learning for decision making at this time: 59 percent say they allow no machine-made decisions and most of those that are automating decisions are still doing so for routine or simple tasks. Big gains are anticipated over the next three years, with the number of organisations using machine learning in some decision making capacity set to increase dramatically: seven in ten executives expect intelligent machines will provide new categories of insight to enhance decision making.

Larger organisations – those in our study with more than USD 10 billion in revenue – are leading the way on this front. Compared to smaller organisations – those with USD 1 to 5 billion in revenue – they more frequently have: increased their use of natural language processing (32 percent versus 15 percent), changed employee behaviours toward machines (42 percent versus 22 percent) and optimised business processes for automation (78 percent versus 58 percent).

Operations executives indicate they are confident that automation will fulfill its promise of expanding human horizons. Seventy percent say intelligent machines will lead to higher-value work for their employees (see Figure 6).

**Figure 6**

*Teaching humans to work with machines begins with 'feeling' comfortable*



*Question: To what extent do you agree with the following statements about human-machine interactions? 'Agree' and 'Strongly agree' responses.*

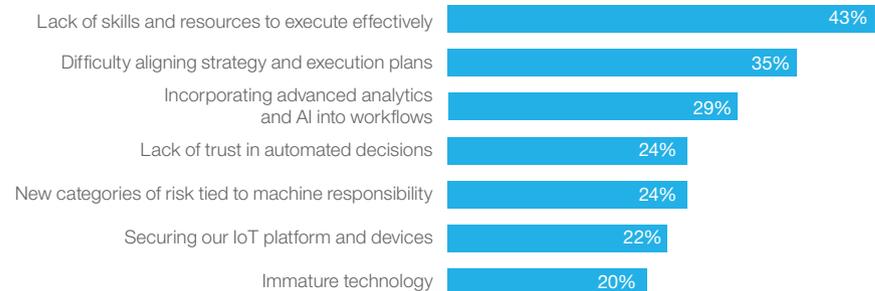
Reaching this goal will take some effort. More than 80 percent of operations executives say employees need training and encouragement to feel comfortable working with intelligent machines, but most have not taken steps to make this happen. What's more, 43 percent of executives cite a lack of skills and resources to execute effectively as the number-one challenge to their organisation's use of adaptive robotics (see Figure 7).

So there is work to be done. Companies need to embrace intelligent automation as a part of the business strategy and operating plans. Many are working on execution and communication plans to convey the scope and impact of these new technological implementations to their employees and their business partners.

**Figure 7**

*People skills and resources are the biggest hurdles to cognitive adoption*

*Greatest challenge to your organisation's use of AI*



*Question: Which of the following present the greatest challenges to your organisation's use of AI/machine learning/adaptive robotics and automation? Select up to three.*

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## Stocking the cognitive toolbox

The next wave of emerging technologies will add to the list of powerful tools that will be incorporated into intelligent automation. These technologies can change the way we perceive our environments through augmented reality (AR) and create new environments in which we can immerse ourselves in virtual reality (VR). Additionally, they can allow us to navigate and manipulate hard-to-reach parts of the physical world with drones and enable more secure transactions and information-sharing on a global scale with blockchain.

Adoption of these technologies remains limited and it may take years for some of them to see widespread business uptake. But as organisations complete their move to the cloud and adapt to the current wave of AI-based tools, these new entrants are gaining mindshare. Over one-quarter of operations executives plan to at least have pilot programs for AR and/or VR in three years and they anticipate their use of blockchain will grow quickly to 20 percent piloting or deploying it by 2020.

It is possible that the pace of adoption will increase as use cases become more widely understood. Blockchain, originally seen as a tool for alternative financial transactions, is now being used to share health records and manage energy purchases by homeowners. Drones could be useful to many businesses that manage inventory or property.

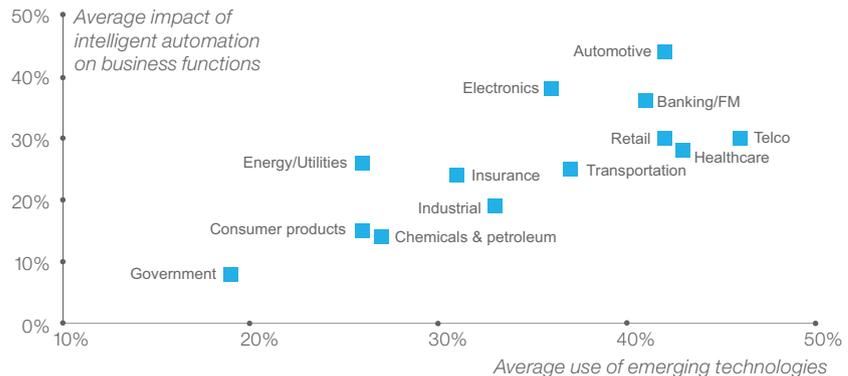
And AR, once mainly perceived as a training tool, now has enormous potential on the factory floor in distribution and in field-service processes. Employees can receive real-time 'advice' as they 'see' diagrams of machine or maintenance configurations and receive repair instructions.

## Intelligent automation adoption across industries

Not all industries are implementing intelligent automation – and the technologies that support it – at the same rate. For the most part, investment priorities are tied to business models for various sectors. Taking these differences into account, some industries emerge as early leaders: automotive, financial services and electronics companies are further ahead on investment in a range of intelligent automation-constituent technologies – and are already seeing value across business functions. To understand the cross-industry spectrum of intelligent automation adoption, we considered the maturity level and the value expectations on performance impact (see Figure 8).

**Figure 8**

*Some industries are at a more mature stage of intelligent automation*



**Question 1:** Please rate your organisation's level of maturity in the adoption of the following technologies. **Question 2:** To what extent has intelligent automation affected your organisation's performance in the following areas?

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## **Challenges**

A lack of skills and resources is the biggest challenge for operations executives in adopting intelligent automation across sectors, but less so for automotive and telecommunications companies (33 percent for both). Meanwhile, government (63 percent) and industrial (53 percent) organisations cite it as a top barrier.

Companies across sectors need to adapt their processes for intelligent automation. Even the automotive industry, a leader in many areas, struggles: it has the fewest respondents of any industry reporting that their organisations have changed processes or workflows in order to train humans to work with machines.

## **Value realised**

Government, banking, healthcare and insurance organisations are most likely to report that intelligent automation provides value in terms of improving the speed of decisions. Chemicals and petroleum, government and insurance executives report that robots or intelligent machines will extend human capabilities.

Automotive companies have experienced a positive impact from implementing intelligent automation in manufacturing, quality control, product optimisation and supply chain management. Likewise, electronics companies are realising value in manufacturing, quality control and supply chain management.

## Recommendations

Staying competitive in the cognitive era demands an effective use of intelligent automation. Where should organisations start? Adopting this set of technologies requires a forward-looking approach to investment and implementation, careful organisational planning and a commitment to training and development.

### **Invest with intention**

Leadership must continually evaluate the landscape of emerging technologies to determine which should be prioritised in terms of spending and implementation. Investing intentionally requires more than monetary sources. Executives must build detailed execution plans, including approaches to communication and change management within the company, to get full value from the money and time dedicated to these new technologies.

The greatest discoveries often come from those dedicated to embracing digital innovation and operations-management disciplines simultaneously. An example is a real estate conglomerate that brought cognitive analytics to disparate environments to create a 'single version of the truth, in real time,' while optimising operational processes and organisational skillsets.

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### **Rebuild the business for automation**

Layering new technologies on top of old business processes is apt to be less productive – and less cost-effective – than rethinking processes to make the most of intelligent automation. Executives must optimise workflows for automation; this means envisioning the end result, enabling it through logical steps and prototyping the process – then repairing as necessary before scaling.

Leaders should take the same approach to business models, as changes in execution may uncover new capabilities that can be systematised and optimised. In supply chain operations, it is important to use simulation, modelling and predictive analysis to evaluate inventories, networks and of course, the associated constraints, such as demand volatility and supply availability.

### **Educate to automate**

Human employees will remain critical in the age of intelligent automation. Leadership must build agile, innovative workforces, which means hiring employees who fit the organisation's culture. They must also participate in broader ecosystems that can expand ways of thinking and working.

**Related IBV publications**

Butner, Karen and Dave Lubowe. "Welcome to the cognitive supply chain. Digital operations – reimaged." IBM Institute for Business Value. June, 2017.

<https://www-935.ibm.com/services/us/gbs/thoughtleadership/cognitivesupplychain/>

Berman, Saul J., Peter J. Korsten and Anthony Marshall. "Digital Reinvention in action: What to do and how to make it happen." IBM Institute for Business Value. May 2016. <https://www.ibm.com/services/us/gbs/thoughtleadership/draction/>

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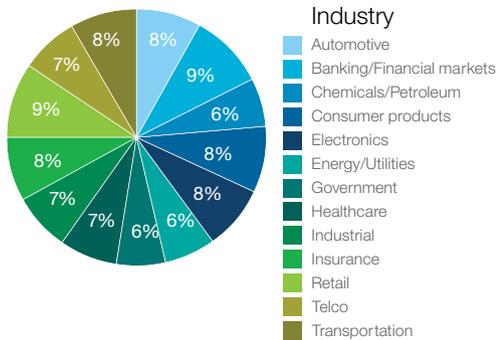
## Are you ready to intelligently automate your operations?

- How will you integrate data and cognitive IoT to deliver differentiated services and new revenue streams in response to evolving market conditions?
- To what extent will you automate production and optimise assets with IoT sensor/ actuator controls and adaptive robotics, enabling them to control their own environments?
- In which areas of your operations will you optimise processes and workflows to reflect the involvement of adaptive robotics and intelligent machines?
- How will decisions be influenced by machines that can adapt and learn to improve the quality and speed of operational decision making?
- What steps is your organisation taking to train employees to work with machines while optimising processes for automation?

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### Methodology: How we conducted our research

The IBM Institute for Business Value, in collaboration with Oxford Economics, surveyed 550 executives, most of them from the operations function and all with direct knowledge of it, about the ways their organisations are retooling to improve digital operations, particularly in the areas of AI/machine learning or intelligent automation. This research included respondents from organisations with at least USD 500 million in revenue in a dozen countries around the world and across a variety of industries.



**For more information**

To learn more about this IBM Institute for Business Value study, please contact us at [iibv@us.ibm.com](mailto: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](http://ibm.com/iibv).

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**About the authors**

Karen Butner is the Business Strategy and Analytics Cognitive IoT and Supply Chain Management Leader for the IBM Institute for Business Value (IBV). Karen is frequently invited to speak at international conferences and is widely quoted in leading business and industry publications. With over 30 years of experience in strategy development and transformation, her passion is to assist clients in developing improvement agendas to bring significant value to their global performance. Karen can be reached at [kbutner@us.ibm.com](mailto:kbutner@us.ibm.com), on LinkedIn at [www.linkedin.com/in/karen-butner-a114b31](http://www.linkedin.com/in/karen-butner-a114b31) and on Twitter at [@kbutner578](https://twitter.com/kbutner578).

Dave Lubowe is a Vice President and Partner in IBM Global Business Services and is the North America Leader for IoT and Supply Chain Management. Dave has over 30 years of industry and consulting experience in electronics and consumer products. His consulting work has focused on large-scale transformation and continuous improvement of operational performance. He can be reached at [dave.lubowe@us.ibm.com](mailto:dave.lubowe@us.ibm.com), on LinkedIn at [www.linkedin.com/in/dhlubowe](http://www.linkedin.com/in/dhlubowe) and on Twitter at [@DaveLubowe](https://twitter.com/DaveLubowe).

Grace Ho is a Partner in IBM Global Business Services and is the China/Hong Kong Leader for Cognitive & Analytics, Blockchain and Internet of Things. She can be reached at [hogsm@hk1.ibm.com](mailto:hogsm@hk1.ibm.com) or on LinkedIn at [www.linkedin.com/in/grace-ho-63823a47](http://www.linkedin.com/in/grace-ho-63823a47).

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- 2 'Cloud Therapy: Using cognitive computing to achieve big outcomes in the diagnosis of rare diseases.' IBM case study. October 31, 2016. <https://www-03.ibm.com/software/businesscasestudies?synkey=B255816W59748A12>
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IBM United Kingdom Limited  
PO Box 41, North Harbour  
Portsmouth, Hampshire PO6 3AU  
United Kingdom

IBM Ireland Limited  
Oldbrook House  
24-32 Pembroke Road  
Dublin 4

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