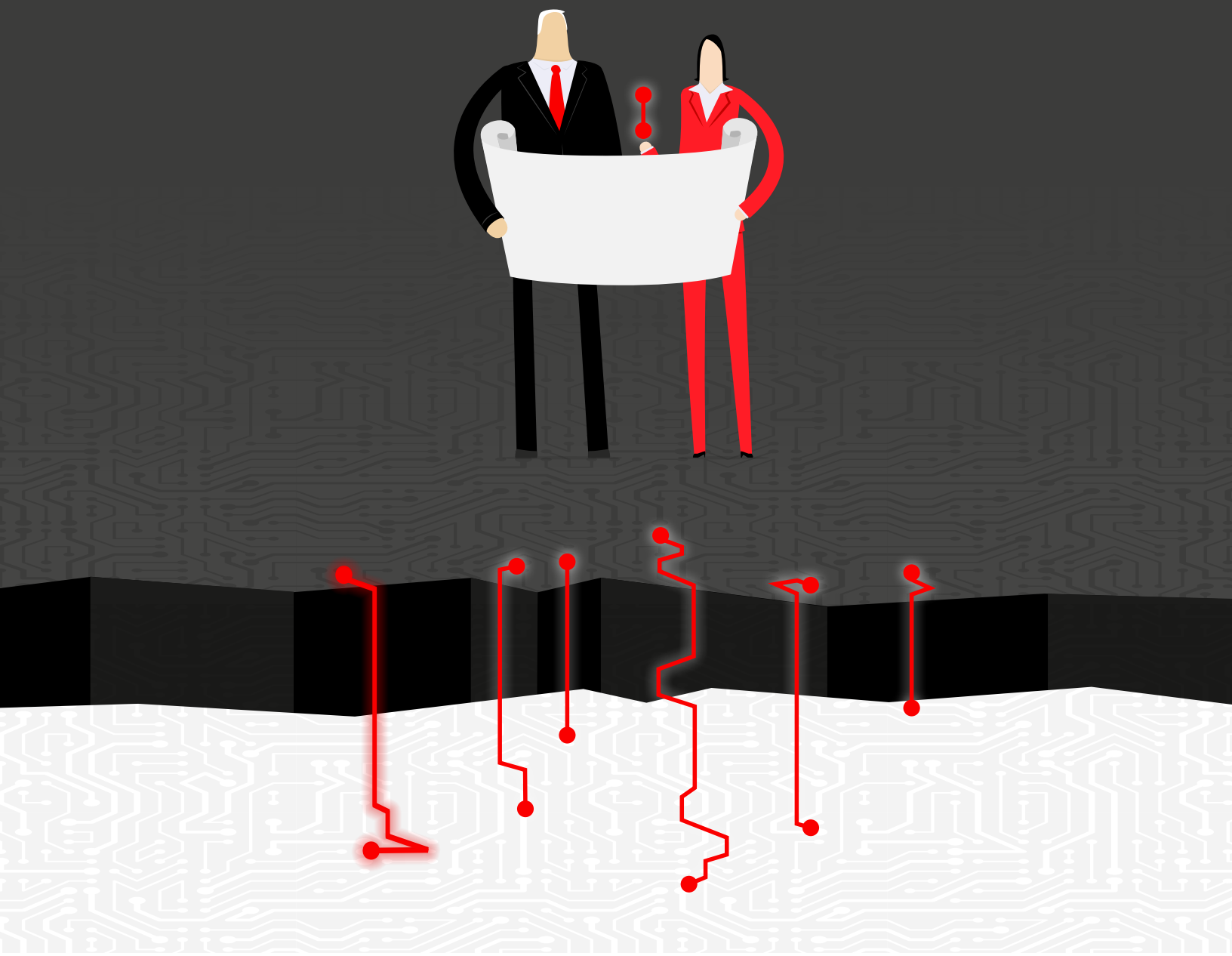
The Economist INTELLIGENCE UNIT

A report from The Economist Intelligence Unit

GREAT EXPECTATIONS:

Fulfilling the promise of emerging technologies



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Executive summary

An unprecedented wave of technological innovation is washing over the world, with profound implications for society, business and global economies. From corner offices to corner coffee shops, the transformative power of digital technologies such as artificial intelligence (AI), the Internet of Things (IoT), blockchain, cloud computing and robotics is changing how we live and work.

But even as consumers and businesses see the benefits, they are aware they must work to ensure that emerging technologies deliver fully on their promise of progress. A recent survey by The Economist Intelligence Unit, sponsored by IBM, asked 758 business professionals and 1,053 consumers around the world about their views on new technologies and the challenges involved in realizing their full potential. The survey gathered insights from several countries, with respondents from: Australia, Brazil, Canada, China, France, Germany, India, Italy, Japan, Mexico, the UK, the US and Sweden. Respondents also represented diverse industries, including: consumer packaged goods, retail, financial services, insurance, healthcare, industrial products, technology and IT, and telecommunications.

Survey responses suggest grounds for optimism that business and society will be able to fulfill the promise of emerging technologies. However, disparities in confidence and strategic priorities, across industries and geographic regions, also suggest that continued dialogue regarding how to most effectively harness their transformative power is still required. Indeed, businesses and technology companies in particular will have a significant role to play in these discussions.

Key findings from the survey include:

- **Three-quarters of consumers worldwide predict that AI, cloud computing, IoT and robotics will improve quality of life and boost their economy over the next five years.** Their expectations are optimistic but also realistic. While only 32% expect their countries to be extremely or moderately successful in using technology to benefit society within a year, that figure grows to 71% over five years. However, expectations differ by country, with emerging markets, led by India, China and Brazil, more confident than developed economies, especially those in Europe.
- **Business professionals expect AI (47%) and cloud (43%) to provide the most value to their industry over the next five years, followed by IoT (36%), robotics (25%), blockchain (16%) and quantum computing (16%).** So far, many companies have used these technologies for specific projects (cloud 82%, IoT 67%, AI 64%, blockchain 57% and robotics 56%), suggesting businesses are experimenting to see where they can provide the most value. However, widespread adoption is more patchy; while 55% of businesses use cloud across their organization, just 36% use IoT, 26% AI, 23% blockchain and 20% robotics.
- **Both consumers and business professionals understand the challenges that come with technological transformation.** Consumers worry about cyber-security (43%), cost to consumers (43%) and ethical or privacy concerns (37%), while businesses similarly identify cyber-security (34%) and cost (30%), as well as lack of talent or skills (25%), as their top concerns. Fortunately, consumers and businesses overwhelmingly agree that businesses are obligated to maintain consumer privacy and confidentiality (87% for consumers and 90% for business) and to educate employees and consumers about new technologies (86% v 89%). They also agree that businesses must use technologies ethically (84% v 88%) and sustainably (83% v 89%), as well as ensuring that all members of society benefit from technological innovations (80% v 84%).

CHAPTER 1:

Great expectations

It is not hard to understand why both consumers and businesses expect new technologies to transform the world in fundamental ways, including how humans live and work.

Recent years have brought glimpses of the vast potential of digitization. IoT platforms that link sensors with predictive analytics software turn airplanes, irrigation systems and manufacturing equipment into prolific data fountains that enable companies to forecast demand more accurately, keep production lines humming, create new revenue streams and meet the ever-changing preferences of consumers.

In warehouses, robots lift productivity to new highs, while in financial services and insurance, AI-powered bots whip through loan applications and claims files at unprecedented speeds. Cloud computing gives even the smallest companies access to seemingly limitless processing power and storage at low cost, requiring them to pay only for what they use.

There will be no let-up in the pace of change and improvement that emerging technologies can deliver, if they are harnessed well.

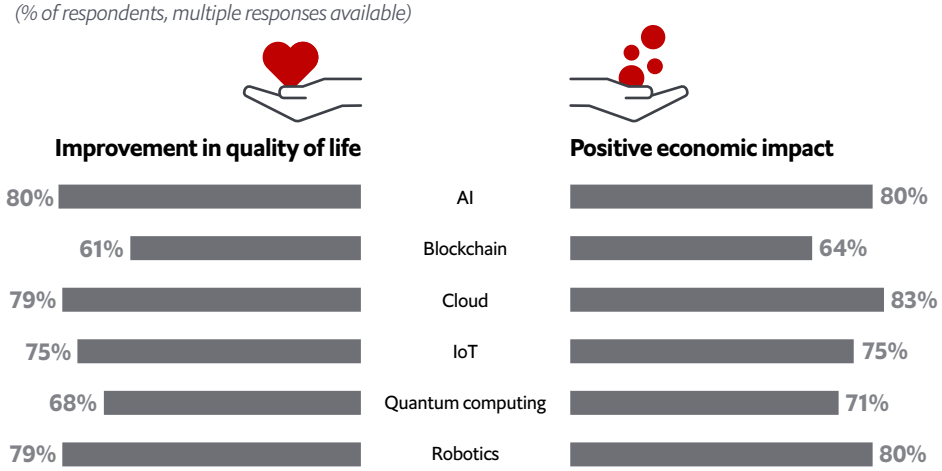
"Technology is going to come quicker than people expect," says Tim Harris, vice-president and chief technology officer at Marathon Petroleum, a US energy company with many refineries, pipelines and retail outlets across the country. "Everyone needs to think about what that means."

In light of these changes, consumers expect a digital boon. More than three-quarters of consumers globally predict that AI, robotics, cloud computing and IoT will improve quality of life and have a positive economic impact in their country. Nearly as many express similar hopes for quantum computing and blockchain (see Figure 1).

Figure 1

Consumers are optimistic about the potential of emerging technologies to improve the quality of life in their country and have a positive impact on their economies over the next five years

(% of respondents, multiple responses available)



Consumer expectations vary around the world, with people in emerging economies such as India, China and Brazil anticipating greater economic and social benefits than those in developed countries, particularly in Europe.

Emerging market optimism is perhaps not surprising given that India has historically had a robust IT services sector, and China has recently made significant investments in becoming an innovation hub to challenge Silicon Valley. However, consumer optimism may change as the challenges of technological progress become clearer.

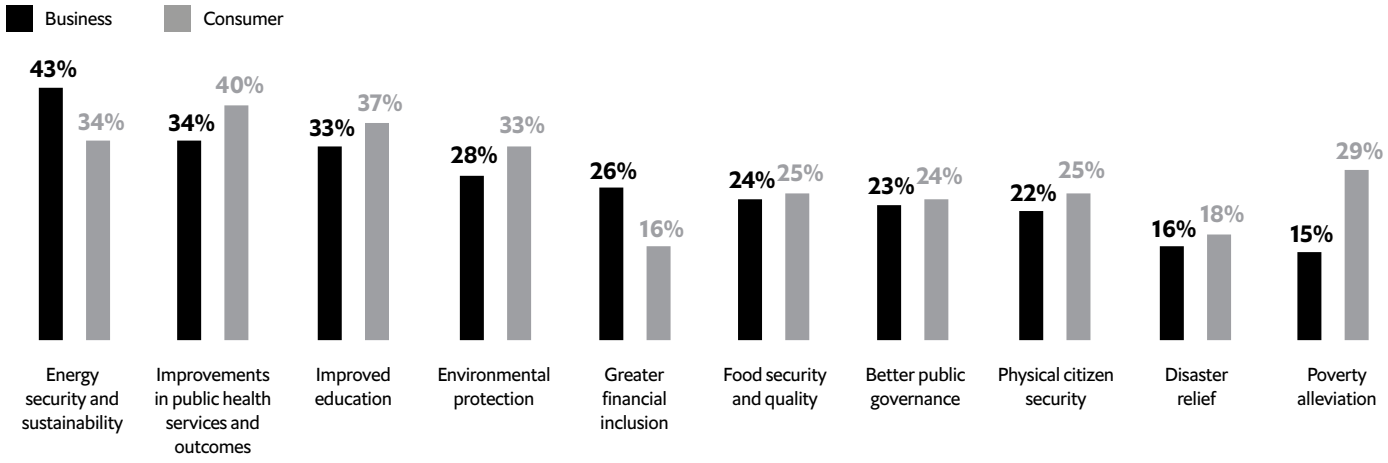
Still, for businesses and consumers alike, technological advances appear to hold answers to some of society's most vexing challenges. Business survey respondents most frequently cite energy security and sustainability as an expected societal benefit from emerging technologies, followed by improvements in public health, education and environmental protection.

Consumers agree with business leaders that energy security and sustainability, education, and public health are the top three potential social benefits of technology. However, consumers have higher hopes when it comes to helping the poor. Some 29% of consumer respondents say they expect technology to help alleviate poverty, a benefit expected by only 15% of business respondents (see Figure 2).

Figure 2

Businesses and consumers expect new technologies to have myriad positive societal benefits, although expectations often differ by industry or country of origin

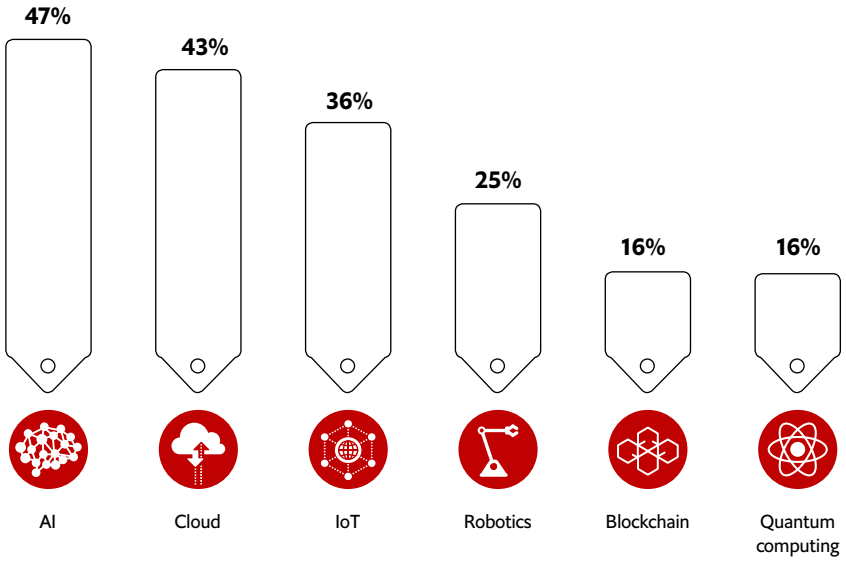
(% of respondents, multiple responses available)



Businesses have high hopes that these technologies will also have a transformative impact on their industries, with AI and cloud cited as those with the most promise (see Figure 3). However, blockchain and quantum computing—which may have the greatest long-term impact on business—were ranked last in value-creation potential. Quantum computing is still in its infancy and pre-commercialization, so it is understandable that businesses are unsure of its potential. Companies continue to explore the potential applications of blockchain, with early blockchain networks already showing promise as a way to improve data quality and sharing between business partners.

Figure 3

Innovations in the following technologies are expected by businesses to provide the most value to their industries:
(% of respondents, multiple responses available)



Anticipated benefits from various technologies differ across industries. Retailers see great promise in AI, which can help them to extract value from reams of customer data. AI technologies analyze individual shoppers' purchasing patterns to generate customized pricing and promotional offers, and power chatbots that create personalized shopping experiences. Fast-growing French beauty retailer Sephora, for example, has launched a chatbot that converses with shoppers and helps them choose make-up by displaying images of their faces with various products on mobile phone screens.

Manufacturers, not surprisingly, have the highest hopes for robotics, which can automate production processes, increase factory output, reduce costs and ease the pain of labor shortages. Since German industrial conglomerate Siemens automated production at an electronic component plant in Amberg, Germany, manufacturing defects have declined by 98% and output has increased by nearly ninefold without an increase in employment levels.

AI, however, which can leverage IoT-based data infrastructure and the scalable computing power of cloud, is the top priority for companies across sectors. "AI and machine learning are game-changers for our industry," says Mr Harris of Marathon Petroleum.

Marathon's IoT network gathers data from thousands of sensors at the company's refineries, and in turn uses AI-enabled modeling analysis to help predict and prevent energy outages, automate decision-making and improve productivity. "Applying this type of technology, techniques and tools along with new capabilities is providing significant insights and opportunities to change our business processes even before AI is fully mature," says Mr Harris.

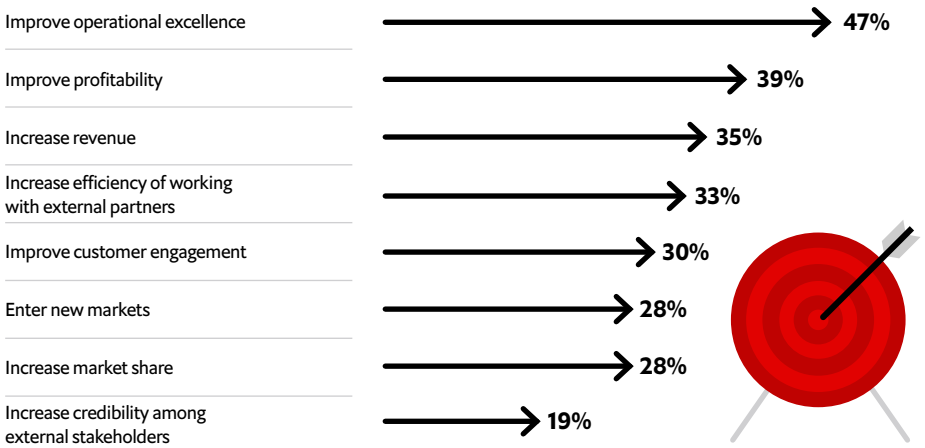
While these technologies have the potential to affect society and industries, they also are capable of addressing businesses' strategic objectives. The top three strategic objectives indicated by survey respondents were improving operational excellence, profitability and revenue growth (see Figure 4). Nearly half of business respondents say innovation from new technologies will improve operational excellence, and more than a third expect it to boost profitability and accelerate revenue growth.

At Danish shipping giant Maersk, technology investments support a broader corporate goal of enhancing efficiency. Svitzer, a subsidiary that operates tugboats in ports around the world, is testing a system that allows one captain to oversee two or three towing operations by remote control, says Matthijs Schot, chief financial officer of European operations for Svitzer.

"We see efficiency gains, and we make our personnel more productive," says Mr Schot, noting that crew labor represents 40% of the company's total costs.

Figure 4

Businesses expect new technologies to help them meet the following strategic objectives:
(% of respondents, multiple responses available)



And while this industrial transformation will undoubtedly change how many businesses operate and grow, companies are ultimately adopting emerging technologies to better address the demands of their customers, including the various societal and economic benefits they desire.

Dawn Foods, a US baking ingredients supplier that serves 40,000 bakeries in 100 countries around the world, hopes to forge deeper ties with customers by leading them into the digital age. CEO Serhat Unsal says Dawn aims to create a differentiated customer experience for bakeries by giving them tools to digitize their businesses. Many are small family operations without the resources or expertise to implement new technology on their own.

A digital sales and inventory management system currently in testing at a handful of bakeries would give Dawn a window on customers' product offerings, sales patterns, inventory levels, costs and pricing. Applying AI and data analytics to the customer data, Dawn could help bakeries refine sales forecasts, optimize inventories and spot opportunities to drive growth by adding new products and adjusting prices.

"It's about how we can help them sell more of their products," Mr Unsal says.

While survey respondents are optimistic about the potential of new technologies to reshape markets, respondents are also keenly aware that digitization raises practical concerns that must be addressed if society is to reap the benefits of innovation. We look at some of these matters in Chapter 2.

CHAPTER 2:

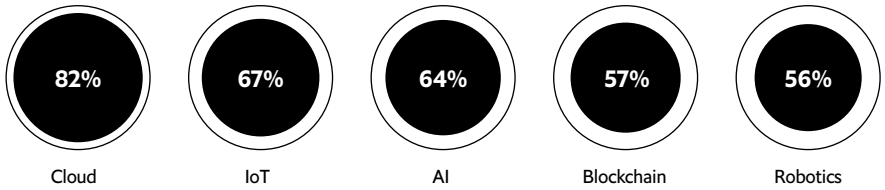
Getting real

New technologies may hold out great promise of transformation. However, businesses and consumers face many barriers when it comes to applying them, which affect the rate at which they can be adopted and the resulting benefits. Technologies can malfunction. Even when systems work as advertised, resistance by people or organizations unwilling to change their ways can derail implementation of new technologies. And even when employees are eager to take advantage of digital innovations in the workplace, they may not receive sufficient training to use the technology effectively. All these barriers must be overcome through careful planning and piloting, ahead of deployment.

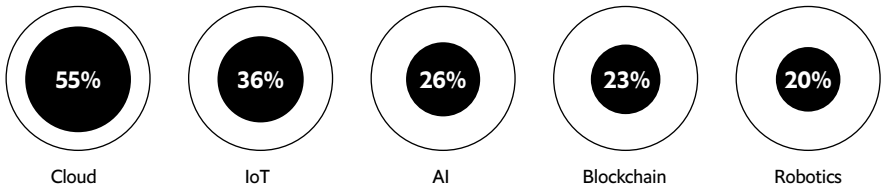
Such barriers typically result in an initially cautious, piecemeal approach to implementation, which makes more sense than an "all-or-nothing" approach when risks are involved. In line with this, the survey shows that while most companies are using emerging technologies on specific projects, fewer have figured out how to use digital innovations across their entire organizations (see Figure 5). Of course some technologies, particularly robotics and blockchain, may not be appropriate to use across the company. Cloud computing is the only technology to have been employed widely by over half of survey respondents.

Figure 5

Many companies are using these technologies in specific projects or across the business:
(% of respondents, have used)



Fewer companies have figured out how to use them widely across their organization
(% used widely)



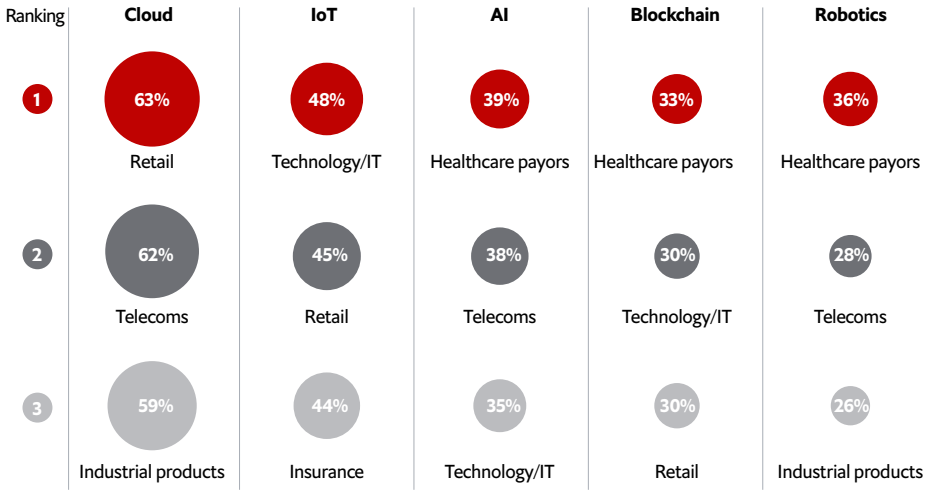
Across industries, adoption rates for different technologies vary (see Figure 6). Retailers, for example, have been among the most dedicated to implementing cloud computing. This technology provides economical access to the storage capacity, processing power and cutting-edge applications that retailers need to develop omni-channel capabilities while gathering, storing and analyzing data from millions of customer transactions.

Walmart has invested heavily in its own internal cloud infrastructure as it tries to cut into Amazon's e-commerce dominance. The big-box retailer's digital sales are rising, thanks in large part to acres of cloud servers continually capturing and analyzing torrents of customer information. Cloud data enable the company to craft customized offers, sharpen inventory assortments and improve service.

Figure 6

Emerging technology adoption, by industry

(% used widely)



IoT technology is catching on fast with insurers looking for better risk management tools. Auto insurers from Allianz in Europe to Sompo Japan Nipponkoa in Asia and Allstate in the US provide customers with connected devices that monitor driving habits. The devices help insurers distinguish between reckless and careful drivers, and, based on individualized risk profiles, insurers can raise rates on hot-rodders—or cut them off altogether—and offer price breaks to safe drivers.

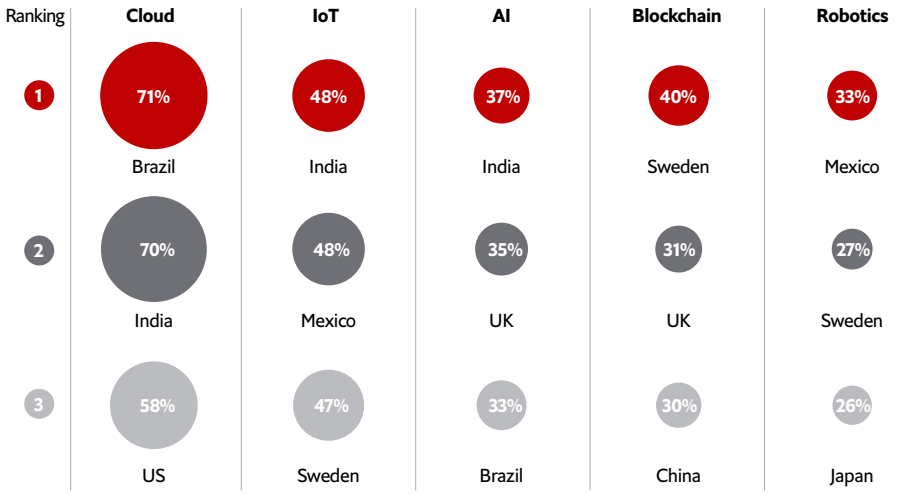
Telecommunications companies are deploying a range of AI applications to drive sales, improve customer experience and manage their networks more efficiently. AT&T uses AI to analyze signals from cell phone towers, detect signs of trouble and dispatch crews to prevent outages before they occur. AI is the technology behind voice-activated remote controls from Comcast and Dish Network, which enable customers to simply call up a program without having to scroll through channel guides. CenturyLink has developed an AI-based sales assistant that sends up to 30,000 marketing emails per month, analyzes responses for words and phrases that signal potential sales opportunities, and forwards those hot leads to company sales representatives.

Globally, developing countries show greater enthusiasm for innovation (see Figure 7). India, China and Brazil are rapidly deploying new technologies amid government-backed efforts to modernize their economies and overtake more advanced countries. India (along with Mexico) reports the highest adoption of IoT and AI as government leaders push country-wide digitization initiatives. And Mexico, an emerging manufacturing hub, leads in robotics implementation.

Figure 7

Emerging technology adoption, by country

(% used widely)



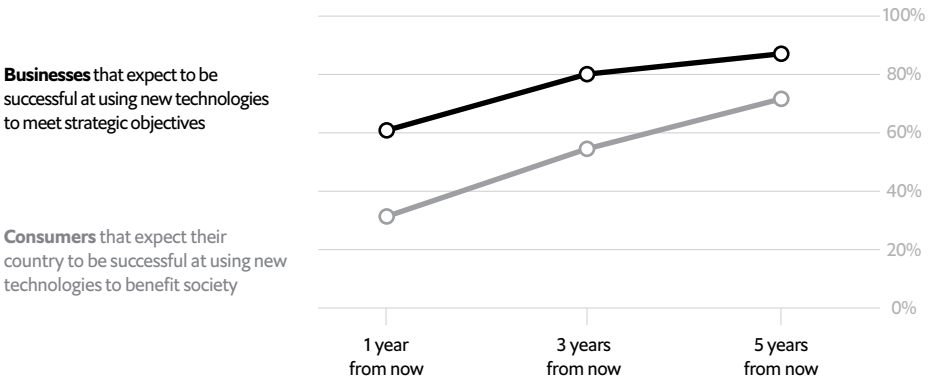
Among developed countries, Japan and the US, both of which have histories of embracing innovation, are the most aggressive when it comes to new technologies. Adoption is slower in some European countries—notably France and Italy.

Slow deployment may explain the middling marks companies give themselves for capitalizing on new technology. Although confidence improves over time for business respondents, consumers express less confidence in the success of technology adoption over the short term, though the confidence gap narrows over the long term (see Figure 8).

Figure 8

Consumer and business confidence in emerging technology adoption are set to improve over time, although consumers lag behind business in their positive expectations

(% of respondents, moderately successful and very successful)



Both groups list many barriers to successful technology adoption. The biggest of these, for both business leaders and consumers alike, is cyber-security. It is a top-of-mind concern for business leaders in particular, in the wake of massive data breaches at major companies from Target to Chase Bank and British Airways to T-Mobile. Across the survey, one in three (34%) business respondents cite cyber-security as a barrier to adopting emerging technologies, ahead of cost (cited by 30%), lack of talent or skills (25%), changing regulations and compliance (23%), and a lack of strategic alliance between IT and the wider business (19%).

By industry sector, concerns over data security run highest in telecommunications, healthcare providers (excluding healthcare payors), financial services and retail, all industries with vast troves of sensitive consumer information. By region, companies in North America, where some of the most newsworthy breaches occurred, showed relatively high security concerns. Worries about security were lower in Asia and, somewhat surprisingly, among European respondents, despite some high-profile breaches in the UK.

Other barriers have little to do with the technology itself. Indeed, human factors play a big role in the success, or otherwise, of technology implementation. "The challenge is more about organizational change and adoption. Awareness and alignment are key components for full adoption of the technology across our business," says Marathon's Mr Harris. "Honestly, it has so little to do with the technology and more about the enterprise's willingness to think differently." (See Figure 9.)

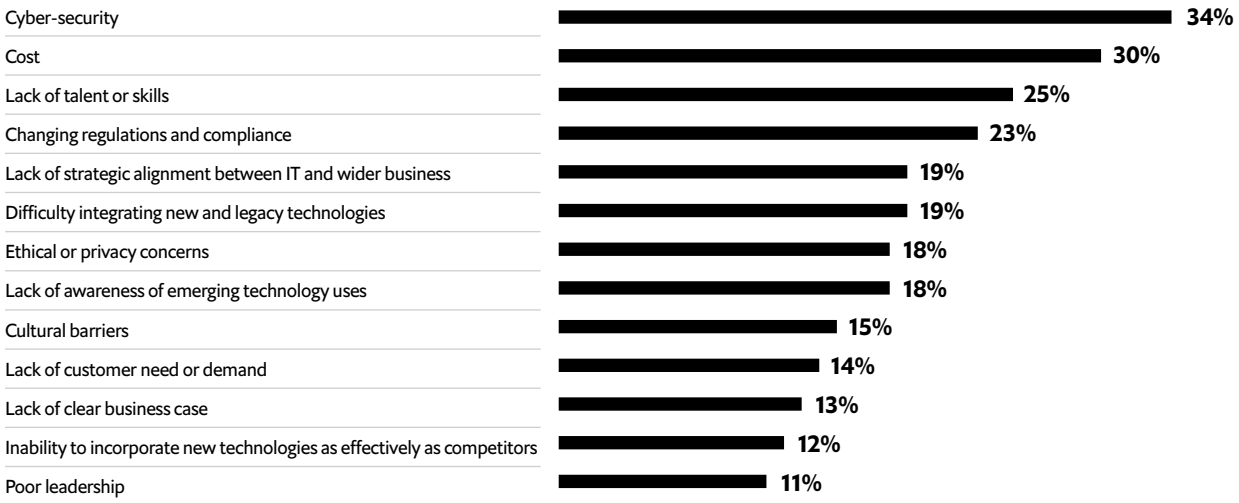
Often, proving the technology works is the easy part. At Svitzer, for example, Mr Schot says early testing already confirms the remote-control system for tug boats performs as expected. But obstacles to widespread adoption remain. New regulations are needed to authorize remote-controlled towing, establish staffing requirements and set safety standards for tugboats using the technology. Liability and insurance issues also must be resolved, and the shipping industry's tendency to delay big technology investments overcome.

"The industry as a whole has to want these things to come about," Mr Schot says, pointing out that, when it comes to operations being automated, "most people in this industry know it's unavoidable."

Figure 9

Businesses face the following barriers when adopting and using new technologies:

(% of respondents, multiple responses available)



Consumers are similarly concerned by the many barriers to society's successful adoption and use of new technologies:

(% of respondents, multiple responses available)

At Dawn Foods, Mr Unsal highlights the importance and potential difficulty of integrating new technology into existing operations. He says the company gets better results from technologies that are easy to use and compatible with legacy systems such as enterprise software.

"It's not just about the technology, but also how well we adapt the technology on a daily basis," he says. "Getting into that daily rhythm is the biggest challenge."

Looming over all these barriers are both the natural human aversion to change and corporate cultures rooted in longstanding practices threatened by innovation. Some industries are historically reluctant to embrace new technologies, and many workers question the need for new technology that they fear will eliminate their jobs.

"Culture is at the heart of everything," says Mr Unsal. "At the end of the day, if the culture is open to change, it is much easier."

Pioneering leadership pays off

Business survey respondents who describe their companies as aggressively pursuing opportunities to use new technologies, as well as those who say their companies' leaders actively encourage technology adoption, more frequently identify their efforts to leverage new technologies as "extremely successful" relative to peers. These "pioneers" also more commonly predict rapid success in reaping the benefits of innovation.

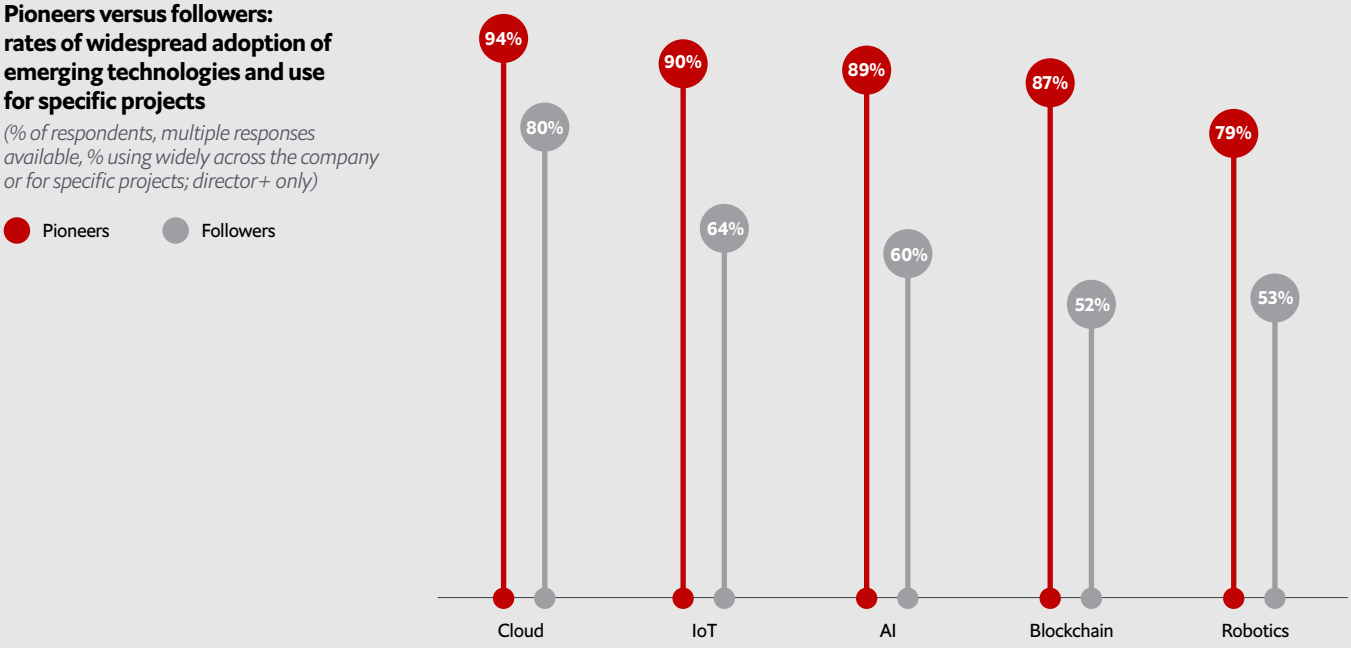
Pioneers are most numerous among healthcare payors. Healthcare payors make up 20% of the pioneer group. Close behind are industrial manufacturers, telecom providers and non-health insurers. There are fewer pioneers in financial services, consumer goods and healthcare providers, accounting for less than 10% of respondents in each of those industries. Geographically, pioneers cluster in emerging markets like Brazil, China and India, along with the US and Japan. More than half the respondents in the Asia-Pacific region say their companies are pushing technological boundaries, well ahead of second-place Latin America (18%) and North America (17%). Europe came in last, with only 12% of respondents qualifying as pioneers.

Both pioneers and technology "followers" expect society to benefit from innovation over the next five years, but the tech trailblazers are much more likely to anticipate game-changing social effects. Large majorities of pioneers expect artificial intelligence, cloud and the Internet of Things to have a "significant positive impact", a view shared by less than half the followers. Both groups do not fear the social impact of technological progress. Less than 10% of followers expect technologies to have negative effects on society, and virtually all pioneers foresee no social downside.

Figure 10

Pioneers versus followers: rates of widespread adoption of emerging technologies and use for specific projects

(% of respondents, multiple responses available, % using widely across the company or for specific projects; director+ only)



Having the right people is obviously vital to creating that culture of innovation, and a quarter of survey respondents cite talent as a top concern. The skills gap appears most troubling to financial services providers, 36% of whom ranked it among their top three barriers to technology adoption. Demand for tech talent is surging at banks and other finance companies, which face multiple challenges ranging from the need to overhaul legacy systems and comply with new regulatory mandates, to rising customer expectations for fully automated services accessible night and day from mobile devices.

Mr Unsal points out that the specific requirements of individual companies and industries complicate an already challenging search for talent.

"It's hard to find people who understand technology, understand business and, by the way, know how to bake a cake," he says.

Geographically, companies in Asia-Pacific are most likely to rank talent shortages as a significant obstacle. In some Asian countries, professions like law and medicine carry greater prestige, reducing the appeal of technology as a career for ambitious young people. And the tech graduates Asia does produce often leave for Western markets where their skills are highly remunerated.

Fortunately, consumers and businesses are broadly in agreement that the onus lies with businesses when it comes to maintaining consumer privacy and confidentiality (87% for consumers and 90% for business) and educating employees and consumers about new technologies (86% v 89%). They also agree that businesses must use technologies ethically (84% v 88%) and sustainably (83% v 89%), as well as ensuring that all members of society benefit from technological innovations (80% v 84%). This consensus strongly suggests that consumers and businesses will be able to move forward with a clear set of expectations in place.

In Chapter 3, we will explore in greater depth the social and ethical obligations of companies as they deploy new technologies.

CHAPTER 3:

Charting a path to progress

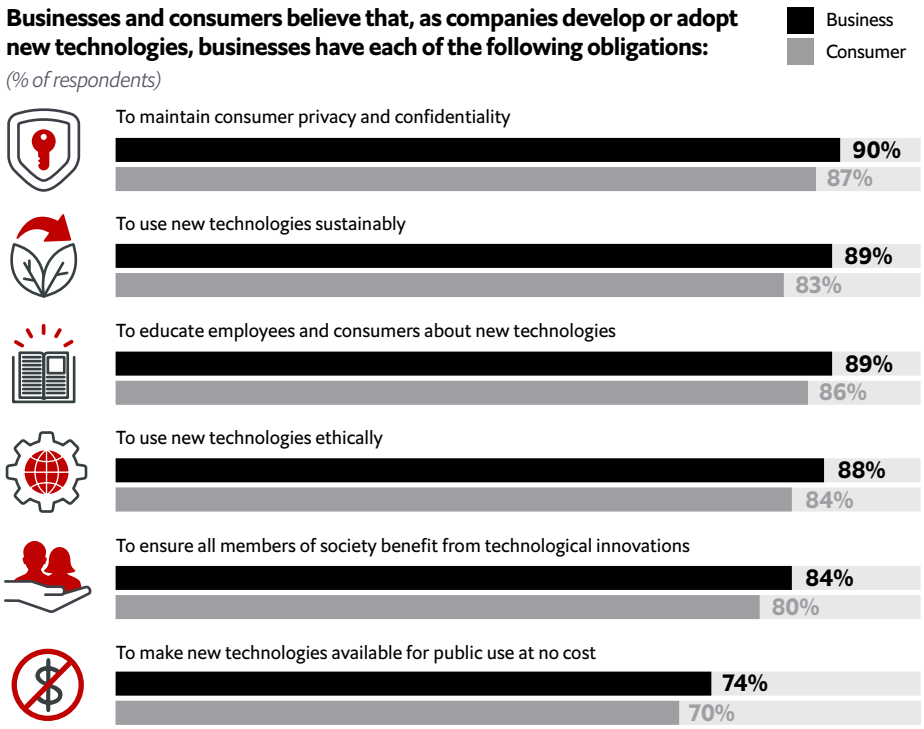
New technologies may have the potential to transform business and society, but those changes won't happen overnight. Nor can technology alone solve the world's problems. The attitudes of business and consumers about the practical utility of new innovations reflect a healthy awareness that deployment is only part of the picture. Indeed, a vital prerequisite is a deeper understanding of why challenges exist in the first place, gained through ongoing dialogue among all stakeholders and open discussion about the best way to make technology work for everybody's benefit.

As the driving force behind innovation, business carries a special responsibility for technology's impact on the economy and society. Technology companies, in particular, have an obligation to do more than just invent and market cool gadgets. They should help businesses use technology to not only achieve strategic objectives but also offer training and other services to close the talent gaps that often undermine successful implementation. More broadly, technology providers need to make intelligent policy choices about how technology is used, to prevent unintended social consequences and keep their customers out of regulatory crosshairs.

Survey results highlight broad agreement among businesses and consumers on the social and ethical obligations of companies as they implement new technologies (see Figure 11). At least eight out of ten respondents from each group say companies should protect consumer privacy, educate workers and consumers about new technologies, and use new technologies ethically and sustainably.

Figure 11

Businesses and consumers believe that, as companies develop or adopt new technologies, businesses have each of the following obligations:
(% of respondents)



Another encouraging sign is that business respondents were more likely than consumers to agree that business should spread the benefits of innovation broadly across society and provide free public access to new technologies. This may indicate that business leaders worry that widely publicized misuse of customer data and privacy intrusions by some large technology providers threaten public trust in technology as a force for good. Positioning technology firmly at the heart of corporate social responsibility efforts may be seen as an effective way to highlight the benefits of technology, thereby bolstering the public's trust.

Companies also recognize the role of workers in turning technological expectations into reality. Technology implementations rarely succeed without broad support from a company's workforce. To win that support, companies must address workers' legitimate concerns about how new technologies advance organizational goals and affect their own futures.

Mr Unsal says resistance can be strongest among "the best people, who you need to keep because the technology can't do everything." Calming their fears is essential to retaining indispensable human skills and experience that may never be digitally replicated.

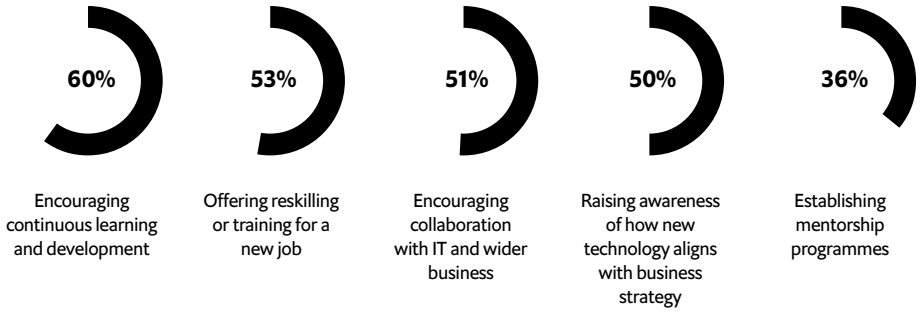
Businesses are pursuing a range of strategies to assure employees that breakthroughs such as AI and robotics create new opportunities for them and the company. More than half say companies can most effectively help employees adapt to new technologies by encouraging continuous development and retraining, explaining how technology advances business strategy and encouraging IT workers to collaborate with other company functions. British retailer Marks & Spencer is rolling out a company-wide effort to upgrade the technology skills of its current workforce. The company aims to enroll 1,000 employees in an 18-month training program focused on coding, data analytics, machine learning and other technologies.

Mr Schot recommends introducing technology gradually at first, enlisting a small group of employees interested in innovation to conduct a pilot project like Svitzer's remote control towing test. As the pilot demonstrates the value of technology, start rolling it out across the organization. Mr Schot says Svitzer also spells out the ongoing roles of workers in a digitized operation, telling them "it's not that we want to get rid of our crews. We just want to direct your time and attention to the most valuable decision points."

Collaboration on technology extends beyond organizational boundaries. Many businesses are forming partnerships to get the resources and capabilities to capture the full potential of new technologies. A majority of business survey respondents say they are working with industry peers on innovation, and linking up with academic institutions on research projects, such as Uber, which partnered with Carnegie Mellon University to produce breakthroughs in autonomous vehicle technology (see Figure 12).

Figure 12

Businesses can help employees adapt to the use of new technologies with various strategies:
(% of respondents)



In another sign that business understands the need to demonstrate the social benefits of technology, some respondents are investing alongside non-profits in public causes, contributing technology to those causes, and working with government leaders on policy issues. Among the more compelling examples is a partnership between a data analytics company, Palantir, and Polaris, a non-profit that fights human trafficking. Polaris uses Palantir technology to make sense of information pouring in from tip lines, public records, social media and other sources. Data analysis reveals patterns in trafficking networks, helping Polaris prevent kidnapping and modern-day slavery. While Palantir has attracted some criticism as a provider of technology used in government surveillance programs, the company's work with Polaris demonstrates powerfully how technology can help tackle a global scourge.

CONCLUSION:

The way forward

As business engages more closely with other stakeholders affected by new technologies, a path forward begins to take shape. To deliver on the promise of technology to transform the global economy and society at large, all businesses, and especially technology companies, should move forward in each of the following key areas:

- **Address concerns such as cyber-security and privacy:** if new technologies are to significantly change the way humans live and work, citizen and end-user trust will be essential to their success.
- **Recognize the importance of people:** emerging technology adoption requires the buy-in of all stakeholders, from employees to partners, customers and ultimately end-users. Without their support and proper understanding of how new tools work, real-world transformation of markets and society will only go so far.
- **Train employees to use new technologies ethically:** an increasingly digital world is not free of risk and such hyper-connectedness will only expand the opportunities for new technologies to be used inappropriately—sometimes through malice, but more often through carelessness. Staff will not only need training to apply these technologies effectively, but they will also need guidance on how to use them ethically, appropriately and securely.
- **Support an organizational culture of continuous learning and improvement:** innovations in business strategy do not stem merely from the use of new tools but rather from experimentation with different business processes and a culture of enterprise-wide, cross-functional collaboration.

These recommendations offer businesses opportunities to maximize the utility of emerging technologies. And they also create the conditions in which industrial transformation and progress on the path to a safer, healthier and more secure world are possible.

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