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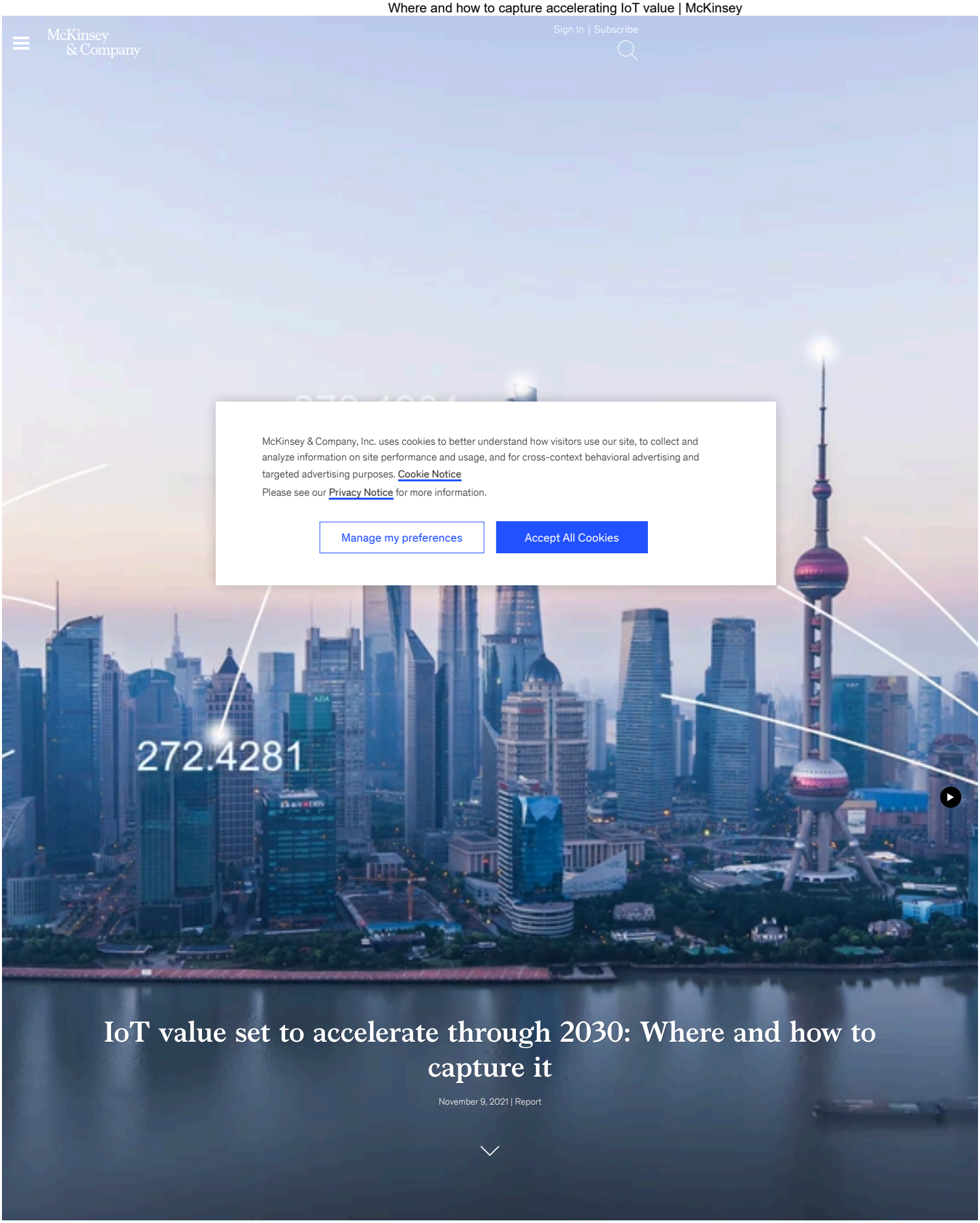

IoT value set to accelerate through 2030: Where and how to capture it

November 9, 2021 | Report

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By Michael Chui, Mark Collins, and Mark Patel

New research shows that the Internet of Things offers significant economic value potential, particularly in standardized production settings, but companies must achieve scale to capture it.

The Internet of Things (IoT), the convergence of the digital and physical worlds, has emerged as one of the fundamental trends underlying the digital transformation of business and the economy. From the fitness trackers we wear to the smart thermostats we use in our homes to the fleet-management solutions that tell us when our packages will arrive to the sensors that promote increased energy efficiency or monitor natural disasters resulting from climate change, the IoT is now embedded in the lives of consumers and the operations of enterprises and governments.

In 2015, the McKinsey Global Institute published a research report entitled *The Internet of Things: Mapping the value beyond the hype*. The report analyzed the economic potential that the IoT could unleash through consideration of hundreds of use cases in the physical settings in which they could be deployed.

DOWNLOADS

The Internet of Things: Catching up to an accelerating opportunity

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Six years later, in a new report, *The Internet of Things: Catching up to an accelerating opportunity*, we have updated the analysis to estimate how much of that value has been

Full Report (90 pages)

Sidebar

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Defining the Internet of Things

captured, how the potential value of the IoT could evolve in the coming decade, and the factors that explain both (see sidebar, "Defining the Internet of Things"). The market has grown considerably in the intervening years but not as fast as we expected in 2015. The IoT has faced headwinds related to change management, cost, talent, and cybersecurity, particularly in enterprises.

Here's what our latest research found:

Video

Research overview

- The potential economic value that the IoT could unlock is large and growing. By 2030, we estimate that it could enable $5.5 trillion to $12.6 trillion in value globally, including the value captured by consumers and customers of IoT products and services.
- The IoT's economic-value potential is concentrated in certain settings (types of physical environments where IoT is deployed). We found that the factory setting (which includes standardized production environments in manufacturing, hospitals, and other areas) will account for the largest amount of potential economic value from the IoT, around 26 percent, in 2030. The human-health setting is second, representing around 10 to 14 percent of estimated IoT economic value in 2030.
- B2B applications are where the majority of IoT value can be created, with around 65 percent of the estimated IoT value potential by 2030. But the value of B2C applications is growing quickly, spurred by faster-than-expected adoption of IoT solutions within the home.
- The 2030 IoT economic-value potential of the developed world will account for 55 percent of the global total, decreasing from 61 percent in 2020. China is becoming a global IoT force as not only a manufacturing hub and technology supplier but also an end market for value creation.

Video

How the COVID-19 pandemic has affected the IoT market

- While the potential economic value of IoT is considerable, capturing it has proved challenging, particularly in B2B settings. Many enterprises have struggled to transition from pilots to capture value at scale successfully. We estimate that the total value captured by 2020 ($1.6 trillion), while considerable, to be in the lower end of the range of the scenarios mapped out in 2015.

Our research began in 2020 before the spread of SARS-CoV-2 virus, which causes COVID-19, led to a global pandemic in the first quarter of that year. The COVID-19 crisis represents a threat to both lives and livelihoods, but it also serves as a market-shaping force. While the report on which this article is based does not focus solely on the impact of the pandemic, that impact has been acting as a catalyst for the deployment of IoT solutions in specific areas as the world grapples with managing the pandemic and enabling a faster and safer return.

Potential economic value of the IoT

The IoT stands at the forefront of our ability to bring together the digital and physical worlds in a manner that could have profound implications for both society and the economy. The benefits could be in the form of improving operations, the management of physical assets, and health and well-being, for example. Against that backdrop, the IoT can be the beating heart of digital transformations.

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Video

Outlook for IoT in the factory setting

Setting is the main way we disaggregated the potential economic value of the IoT (Exhibit 1). Factory, the setting with the largest potential economic value in 2030, could generate around $1.4 trillion to $3.3 trillion by 2030, or 26 percent of the total.

Exhibit 1

Based on our research, the greatest potential for value creation in the factory setting will be optimizing operations in manufacturing—making the various day-to-day management of assets and people more efficient. Overall, operation-management applications in manufacturing could account for around 32 to 39 percent of the total potential IoT economic value created in the factory setting, or around $0.5 trillion to $1.3 trillion, by 2030.

Video

Outlook for IoT in health and wellness

In the human-health setting, the second largest, IoT value involves applications that are deployed in and affect the human body. We estimate that IoT economic impact in the setting could reach around 14 percent of the total, or between $0.5 trillion and $1.8 trillion, by 2030.

Over the past five years, the perceived value of IoT solutions within healthcare has increased. From connected glucose and heart monitors for patients with chronic diseases to mass-market solutions that monitor physical activity, consumer awareness has grown significantly. IoT solutions are not only being used by individual customers but also being provided by some insurers and governments as a way to improve health and patient outcomes. The COVID-19 pandemic has potentially accelerated the use of IoT solutions in healthcare, as the world wrestles with both virus containment and a safe return to the workplace.

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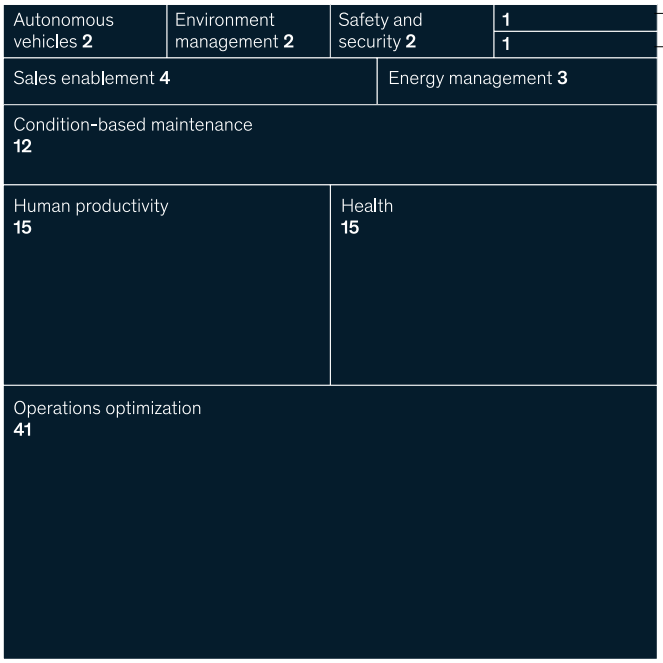
Another way to disaggregate potential economic value is by use-case cluster. This view allows us to observe the effects of use cases that are similar in nature but arise in different settings (Exhibit 2).

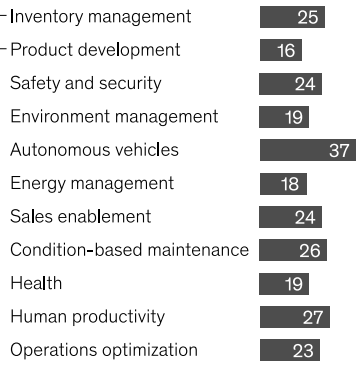
Exhibit 2

Among use-case clusters, operations optimization accounts for the largest proportion of the Internet of Things' projected economic value.

Disaggregation of Internet of Things' economic value in 2030 (maximum estimate), by use-case cluster, %



CAGR in 2020–30, %



Note: Figures may not sum to 100%, because of rounding.

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Using this approach, our research indicates that the operation-optimization and human-productivity clusters could comprise around 56 percent of IoT economic value in 2030; health and condition-based maintenance are estimated at around 15 and 12 percent, respectively.

In relative terms, autonomous vehicles (which include partial-driving automation, or level-two autonomy, and up) make up the fastest-growing IoT-value cluster. Its expected CAGR between 2020 and 2030 is 37 percent (to $0.3 trillion in 2030, from $0.01 trillion in 2020) in the high-end scenario. While autonomous-driving systems steal the headlines, the steady increase in the use of sensors throughout vehicles is set to continue as consumers demand greater safety and reliability. Indeed, during the first half of the next decade, increased safety features are expected to account for much of the IoT added value.

The safety and security use-case cluster in the vehicle setting is estimated to contribute around $130 billion to $140 billion to IoT potential value by 2030. By the end of 2020, 20 percent of vehicles globally were likely to have already been equipped with safety systems (for example, forward-collision avoidance, blind-spot assistance, and adaptive cruise control), potentially reducing the number of accidents and the value of personal auto-insurance policies.

B2B versus B2C

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Video

Outlook for the IoT in the home

Our 2015 research estimated that B2B solutions would represent around 70 percent of the total value creation potential of the IoT. Five years later, B2B solutions remained the majority of the economic value from IoT solutions. But the value of B2C applications has accelerated as a result of faster-than-expected adoption of IoT solutions within the home (for example, home automation).

As a result of these dynamics, B2B applications are expected to account for 62 to 65 percent of the total IoT value in 2030. In economic terms, this translates to around $3.4 trillion in the low-end scenario and around $8.1 trillion in the high-end scenario.

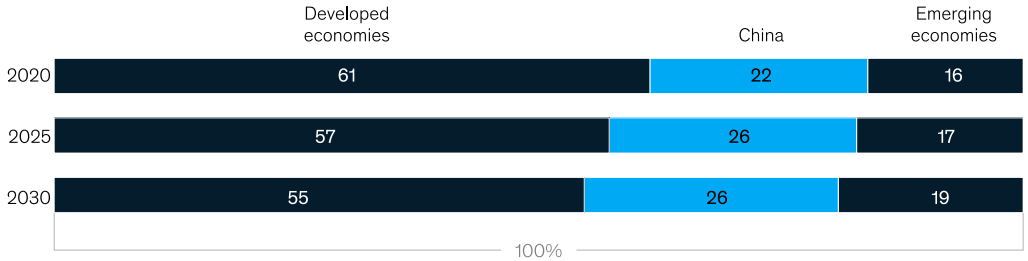
Geographic breakdown

While the developed world is expected to account for around 55 percent of estimated IoT economic value in 2030, the real growth story, from a geographic perspective, is China. It has become a global force in the IoT. China could be responsible for around 26 percent of the estimated economic value of IoT globally by 2030, slightly above its forecasted 20 percent share of the global economy and greater than the estimated IoT economic value from all emerging markets—19 percent of the total (Exhibit 3).

Exhibit 3

By 2025, China could account for 26 percent of the estimated global economic value enabled by the Internet of Things.

Share of estimated global economic value enabled by Internet of Things, by region, %



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We estimate that China's share of IoT economic value from factories could be higher than either developed or emerging markets by 2030. Today, China is estimated to have a significant share of the IoT-device installed base at around 32 percent, triple the estimated share of the emerging markets.[1]

IoT tailwinds and headwinds

While the potential economic value from the IoT is large and growing, capturing this value has proved challenging. Our latest research shows that the total value captured in 2020 ($1.6 trillion) is at the lower end of the range of the scenarios we mapped out in 2015. We have updated our estimates for 2025 and beyond by adjusting for current conditions, and we have developed scenarios that account for the range of various uncertainties. In aggregate, both the low- and high-end scenarios are lower than the original 2015 estimates: around $2.8 trillion to $6.3 trillion in potential IoT economic value in 2025, compared with around $3.9 trillion to $11.1 trillion from the 2015 work.

The revisions reflect a world that has changed significantly since 2015. There have been material changes in both the trajectory of IoT adoption and realized IoT impact. In addition, scale factors, such as GDP growth and oil prices (which are

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exogenous to the IoT), have also shifted. In this section, we discuss the main factors influencing the future growth of the IoT market overall, though there are some variations in each setting that are detailed in the full report.

A manufacturer's guide to scaling Industrial IoT

Read the report →

Tailwinds

Three main factors are spurring a material acceleration in the adoption of and impact from IoT solutions today:

- *Perceived value proposition.* Customers see real value in deploying the IoT, a significant step forward compared with our findings in 2015. The IoT is a core enabler of the digital transformations and sustainability drives under way in companies and public institutions around the world. The $1.6 trillion in economic value generated from IoT solutions in 2020 exemplifies the technology's ability to deliver value at scale.
- *Technology.* The past five years have seen remarkable advances in technology. For the vast majority of IoT use cases, affordable technology exists that enables deployment at scale. Sensors now cover the entire spectrum, from visual to acoustic and everything in between; computing is more than fast enough; storage is ubiquitous; battery power has improved. Progress in hardware has been matched by significant developments in advanced analytics, AI, and machine learning that enable faster, more granular insights and automated decision making from data provided by sensors.
- *Networks.* Networks act as the backbone that bring the IoT to life and make it all possible. Telecom companies' fourth-generation (4G) networks have spread to cover more people at higher performance, and 5G networks are rapidly being deployed. Matched with improvements in other network protocols, customers have a wide range of connectivity options that can meet their requirements, be they associated with capacity, speed, latency, or reliability.

Headwinds

The news is not all favorable for the at-scale adoption and impact of IoT solutions. Five factors are acting to dampen both areas overall (again, with some variations across specific settings):

- *Change management.* Companies and governments often treat the IoT as a technology project rather than an operating-model transformation. As such, they may be led by IT without regard to required changes in governance processes, talent, and performance management. Capturing value at scale from the IoT requires the collaboration of cross-functional actors to change people's behavior, systems, and processes, as well as introduce vigorous performance management.
- *Interoperability.* Ubiquitous operating systems for the IoT are still far off. Rather, the IoT landscape contains numerous proprietary, "walled garden" ecosystems. Many companies and public-sector bodies are struggling to get to scale without significant IT work to overcome the numerous system barriers.
- *Installation.* Ask consumers, enterprise customers, or governments, and many will cite installation as one of the biggest cost issues in the deployment of IoT solutions at scale. Interoperability challenges mean that almost every at-scale deployment requires customization, if not an entirely bespoke solution. The complexity of seemingly straightforward tasks, such as obtaining secure connectivity, retrofitting old devices, and linking into existing systems, adds difficulty, time, and cost, which discourages at-scale deployment.
- *Cybersecurity.* Consumers, enterprise customers, and governments are increasingly concerned with IoT cybersecurity, as the rising number of connected end points offer vulnerable points for hackers to exploit. Addressing this challenge requires security to be built in from the ground up, through every layer of the stack.

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- *Privacy.* With the adoption of the California Consumer Privacy Act and the European Union's General Data Protection Regulation, privacy is now front and center for many consumers. Companies are grappling with what customers are willing to give up in return for lower prices or special offers in a retail setting.

What it takes to scale the IoT

Video

Research implications for businesses and IoT players

How can the IoT market fulfill its promise? Let's look at what it will take to succeed from the point of view of IoT enterprise customers (implications for suppliers, consumers, investors, and policy makers can be found in the full report, *The Internet of Things: Catching up to an accelerating opportunity*).

Companies that have succeeded in deploying IoT at scale take seven main steps:

- *Decide who owns the IoT in the organization.* At present, many organizations have no clear owner for the IoT, with decision making dispersed across functions, business units, and levels. Companies that have succeeded in deploying the IoT at scale address this situation by assigning a clear owner (who could come from a variety of functions and roles).
- *Design for scale from the start.* The IoT must be grounded in business outcomes. Too often, corporate customers get caught up in the technology and focus only on pilots. The impact can be seen in the "pilot purgatory" that afflicts many corporate customers.
- *Don't dip your toe in the water.* Despite the concentration of economic value in specific IoT setting and use-case-cluster combinations, there is no silver-bullet use case. Deploying multiple use cases at the same time forces organizations to transform operating models, workflows, and processes to ensure value capture.
- *Invest in technical talent.* IoT technical talent is in short supply. A first critical step to filling the gap is hiring recruiters who speak the technical language and can navigate the landscape. Recruiting data engineers and scientists is essential, but for organizations to be at the cutting edge, they must also upskill their current workforces in data science.
- *Change the entire organization, not just the IT function.* Too often, IoT deployments are regarded as technology projects run by the IT department rather than business transformations. Technology alone will never be enough to unlock the potential of the IoT and enable maximum value capture. Instead, the core operating model and workflow of the business must be redesigned.
- *Push for interoperability.* The IoT landscape is dominated by fragmented, proprietary, supplier-specific ecosystems. While effective within the ecosystem, such an approach limits the ability to scale and integrate, constraining the impact of IoT deployments and driving up costs. Corporate customers can specify interoperability as a buying criterion and push vendors for interoperability that enables seamless integration of different use cases, solutions, and providers.
- *Proactively shape your environment.* Companies should diligently build and control their IoT ecosystems. For example, prioritizing cybersecurity from the beginning and starting with the hardware layer is critical to developing end-to-end security. Working with trustworthy suppliers can reduce the likelihood of a breach, but adopting a cybersecurity risk-management framework that incorporates not only technical solutions but also business processes and procedures that fit a company's environment and requirements can be much more effective.

The IoT market is growing fast. The growth may be slower than expected, but it's not for lack of confidence or belief in the impact that the technology can have. Rather, we find that operational factors are holding back the market. As we have seen, there are nuances at a setting and use-case-cluster level. This is true in not just growth but also the tailwinds and headwinds. If the IoT is to fulfill its potential, companies and their customers must address these headwinds.

How relevant and useful is this article for you?

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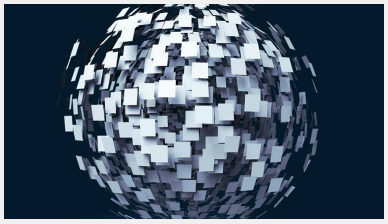

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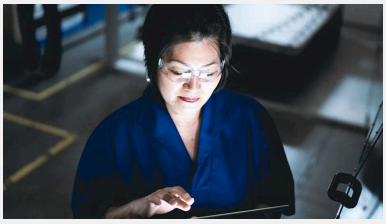

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