Governance Insights Center
Technology series
Emerging technologies

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The Essential Eight technologies
Board byte: the internet of things

The internet of things (IoT) is transforming how some companies do business and is creating new business ecosystems. What should boards know?

The IoT is one of the biggest disruptors for companies across industries. As more devices connect to the internet and to one another, it's moving beyond consumer devices to businesses of all kinds. The IoT creates opportunities for new products, services and business models. Boards should understand how this technology will impact their company's strategy.

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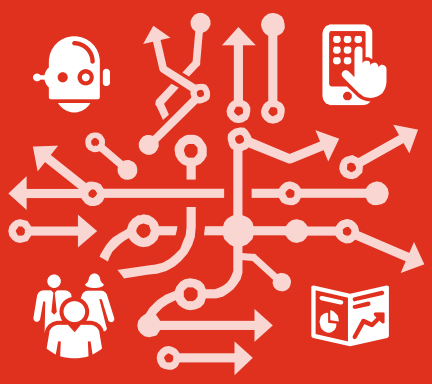
It sounds like a scene out of a futuristic movie. Your alarm clock talks to your coffee maker. Your medical device reports to your doctor. Your driverless car talks to your smartphone. And the engine of the aircraft you're flying in communicates with its maintenance department. Soon, everything will be connected, thanks to the internet of things (IoT).

The IoT refers to the connection of all kinds of devices to the internet and to each other. It's a network of digital connectivity that spans two overlapping areas. The first is smart, connected products and services, including consumer devices like smart watches. The second is the collection of data to improve business performance. This includes the industrial internet of things (IIoT), when manufacturers and other industrials collect and analyze data from equipment, machines and other sources. With this data, they can improve processes, predict and prevent problems, and ultimately create superior ecosystems for new products and services.

IoT disruption

The global IoT market is expected to reach $1.3 trillion by 2020.[i] Nearly three-quarters (73%) of executives responding to our *2017 Global Digital IQ Survey* say they're already investing in IoT, and 63% say they will be investing in three years. Among our *Essential Eight* technologies, respondents to the survey said the IoT was the one in which they most expect to invest. So it's little surprise that respondents rank IoT technology as the most disruptive technology to industry and business models.



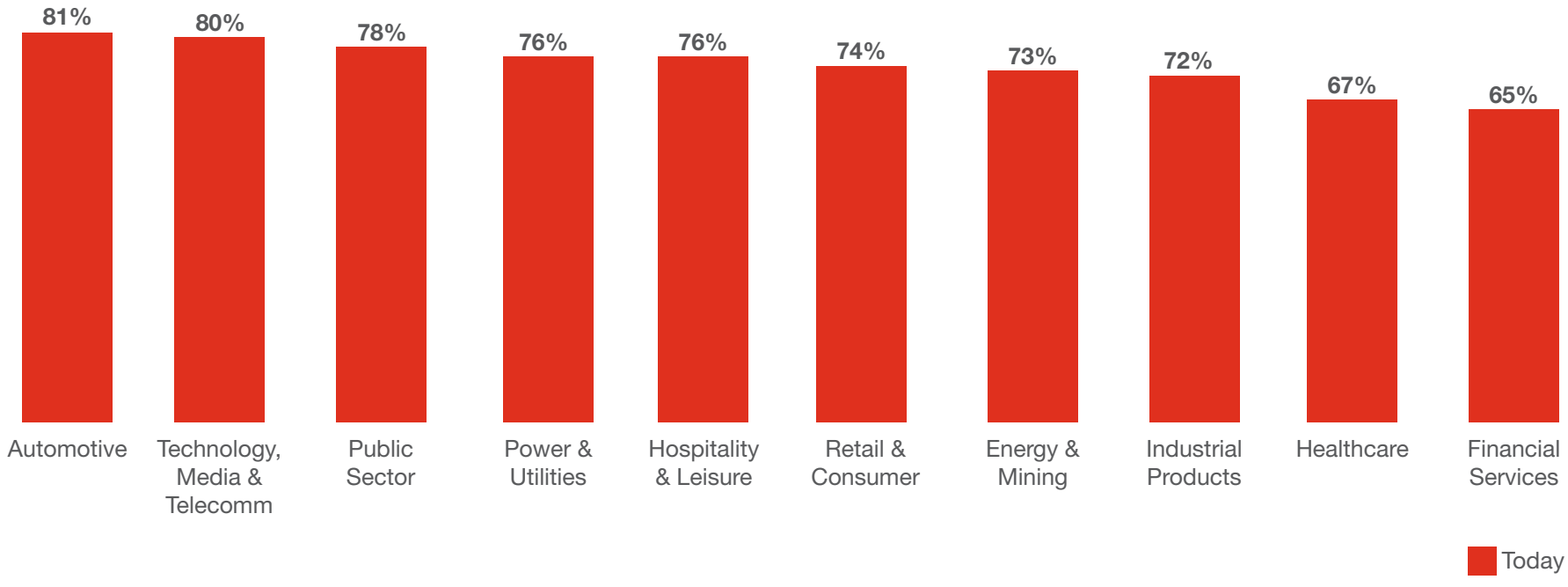
The IoT ecosystem

The IoT ecosystem is complex. It is made up of networks of sensors and smart objects designed to connect consumer and industrial things to make them more intelligent and better able to interact with humans and each other. It includes all of the components that enable businesses, governments and consumers to connect to their IoT devices – remotes, dashboards, networks, gateways, analytics, data storage and security.

Companies across industries are investing in the IoT. They're using the IoT to provide consumers with a better experience and to increase the effectiveness of their products and services. The goal? Overall, to make life easier and better by automating tasks, improving health, making homes and cars safer, and saving electricity and water, among other things.

Outside the consumer front, industries like industrial products manufacturing, automotive, utilities, and energy and mining are investing in IIoT. The IIoT links machines, sensors, computers and software to improve information data collection, processing and analysis. It also tracks business performance and allows for real-time monitoring of production lines. Through 2020, industrial companies are forecast to invest $907 billion each year to their IIoT initiatives. They expect these investments will lead to $493 billion in increased revenue and $421 billion in reduced costs over the next five years.[ii]

Internet of things investment by industry



Source: PwC, 2017 Global Digital IQ® Survey

Bases: Automotive: 72; Technology, Media & Telecommunications: 433; Public Sector: 156; Power & Utilities: 131; Hospitality & Leisure: 75; Retail & Consumer: 217; Energy & Mining: 1,235; Industrial Products: 375; Healthcare: 237; Financial Services: 332.

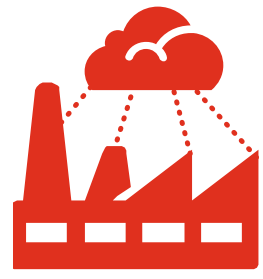
IoT in action today

Home sweet connected home: The IoT is changing the way many people live at home. People can use connected devices to monitor activity: adjust the lights, blinds and temperature, see who rings the doorbell while they are on vacation, and even signal the coffee maker to start brewing. More than one-quarter (26%) of US internet users currently own a smart home device.[iii]

Wearable devices are #trending: Wearable devices are the latest accessories gaining traction in the US market. Wearables incorporate sensors, software, and connectivity to track and share data. Nearly half (49%) of respondents to our wearable technology survey say they own at least one fitness band, smart watch or smart video/photo device, up from 21% in 2014.[iv] Clothing is also becoming connected: sneakers with sensors are on the market now.

Start your engines – the connected car takes off: Active window displays that show driving information on the windshield, brake and steering sensors, smart phone connectivity and comprehensive vehicle tracking are just some of the features of the connected car. They allow vehicles to send and receive signals, sense the physical environment and connect to other vehicles – to make driving safer, more enjoyable and more productive. The connected car market is expected to jump to $155.9 billion by 2022, from $52.5 billion in 2017.[v]

The new digital industrial: Several industrial giants are creating new company divisions dedicated to digital transformation and betting on factory automation and industrial IoT platforms as a means to change industry altogether. They have developed cloud-based IoT operating systems that connect machines, physical infrastructure and devices across companies. These platforms facilitate transactions, operations and logistics, and collect and analyze data. Once known solely as makers of machines and equipment, they are now rebranding themselves as “digital industrial” companies.



What's next for the IoT?

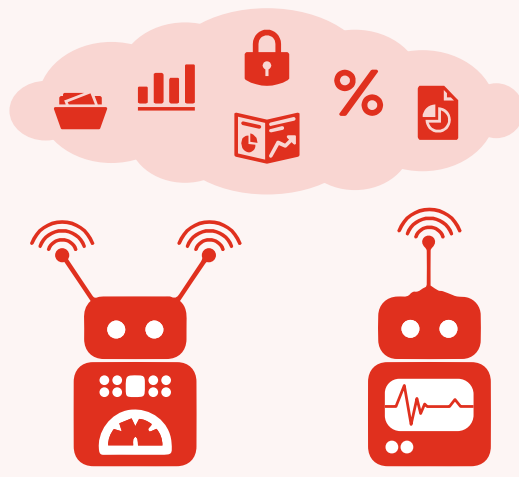
The IoT is changing the way companies operate and consumers behave. But this is just the beginning. As the IoT matures, we will see even greater developments in connected and smart solutions for companies and consumers alike – which could dramatically impact your business strategy.

The IoT is making cities smarter: As more people move to urban areas, cities such as Barcelona and Dubai are turning to the IoT to connect, automate and monitor public transit systems, parking, air pollution, traffic congestion, waste management and street lighting, among other things. These connected citywide systems aim to improve the quality of living for citizens and to provide investment opportunities for business. The smart-city market is expected to top $1.7 trillion in the next 20 years.[vi] But cybersecurity is an issue. As cities get smarter, they should be sure to have security protocols in place.

The IoT is transforming manufacturing: Manufacturers and industrial products companies are looking to the industrial IoT to reinvent manufacturing. They're increasing digital investments in their operations and across their value and supply chains, connecting their factories so they become the "factories of the future" – creating new industrial IoT ecosystems. Sensors can inform factory floor personnel of issues in the system, resulting in fewer equipment failures that slow production. Connected wearable devices can help workers with remote site management, tracking inventory and product line interruptions.

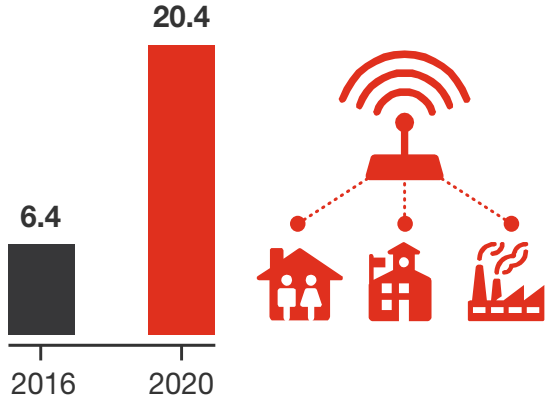
The IoT is helping healthcare: Connected devices are making their way into healthcare. People are starting to use wearable connected devices to help control their blood pressure, stress levels, weight and even sleep. The data from these devices allows doctors to provide more personalized care. Hospitals are implementing smart beds to monitor patient stays. PwC estimates the market for connected healthcare to grow to $61 billion by 2020. But the growing web of connections among consumer and medical devices, clinical equipment and hospital rooms means more opportunities for hackers – so security is a big concern.

The IoT is starting to work together with other technologies. Artificial intelligence (AI) is key to enabling the full promise of the IoT. AI simulates intelligent behavior in all kinds of machines, while the IoT connects devices and machines. By combining the two, smart and connected machines can interact and share data with one another and make well-informed decisions – with little or no human intervention. The cloud is another technology that works with the IoT. It's where much of the data collected from the IoT is processed, stored and shared.



Adoption benefits and barriers

Making billions of connections



20.4 billion connected things will be in use by 2020, **up 223%** from the 6.4 billion in use in 2016.

Source: Gartner, "Gartner Says 8.4 Billion Connected 'Things' Will Be In Use In 2017; Up 31 Percent From 2016," Press Release, February 7, 2017.

Like any new technology, companies and boards need to understand the pros and cons of adoption. Some benefits of the IoT and IIoT for companies include the ability to innovate and develop new products and services, increased productivity with higher levels of performance and better inventory management. Others include greater access to consumer data to observe patterns and behaviors for continued product and service enhancements.

But there are also challenges related to IoT adoption. One of the biggest is security. As more and more devices connect to an IoT ecosystem, that means more opportunities for a cyber incident. There are also concerns about data privacy and what happens to all of the data that is collected. Another challenge is getting all devices and platforms to connect so companies can overlay data from all of them. This can mean integrating with legacy systems and platforms, which can be costly.

IoT security is a big concern: In October 2016, a massive cyberattack took down half of the US internet for hours – and malware that infected IoT devices was noted as the source responsible for a majority of the attack.

Questions boards can ask management about the IoT

Boards will also want to keep abreast of the opportunities and risks that come with the consumer and industrial IoT. Here's what boards can ask management about how the IoT might fit into the company's strategy:

- Are there ways we could effectively leverage the consumer or industrial IoT? How might IoT impact our company and industry?
- Are we thinking about how other new technologies, such as AI and virtual reality, could also be integrated with the IoT? What is the potential impact on our business?
- Should we invest in the consumer or industrial IoT, and, if so, how they might change our business model and strategy? What are our competitors doing in this area?
- What are the risks associated with becoming connected, including the potential cyber and data privacy risks? Do we have a risk strategy for consumer and industrial IoT in place?
- Is there a business opportunity to use the data collected from sensors and connected devices in a consumer and industrial IoT ecosystem?
- What role might our company play in a new industrial IoT ecosystem?

Boards that develop a basic understanding of the consumer and industrial IoT and the other Essential Eight technologies can better oversee management's decisions on those most relevant to the company's business and most likely to create strategic opportunities.

For more resources on what boards should know about the Essential Eight and digital transformation, go to our website, ***Technology hub: insights for board members***.
And find additional ***resources on IoT*** and emerging technologies on PwC's ***Next in Tech*** hub.

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[i.] IDC, “Internet of Things Spending Forecast to Grow 17.9% in 2016 Led by Manufacturing, Transportation, and Utilities Investments, According to New IDC Spending Guide” Press Release, January 4, 2017; http://www.idc.com/getdoc.jsp?containerId=prUS42209117.
[ii.] PwC, 2016 Global Industry 4.0 Survey, 2016.
[iii.] PwC, Smart home, seamless life - Unlocking a culture of convenience, January 2017.
[iv.] PwC, The Wearable Life 2.0 - Connected Living in a wearable world, May 2016.
[v.] Strategy&, Connected car report 2016: Opportunities, risk, and turmoil on the road to autonomous vehicles, September 28, 2016.
[vi.] PwC, Smart cities: five smart steps to cybersecurity, March 2017.

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