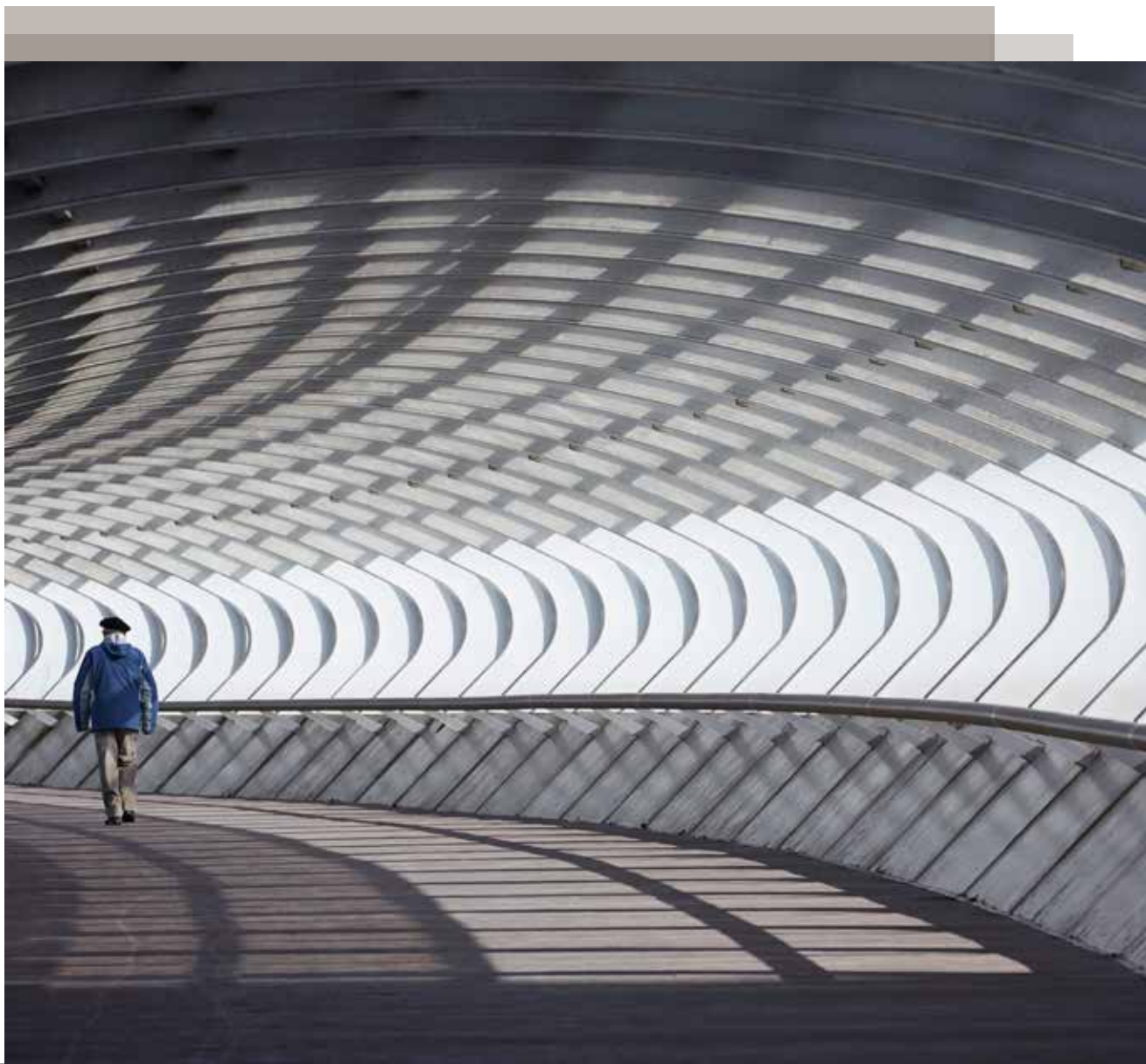


The Industrial Internet of Things

Why it demands not only new technology—but also a new operational blueprint for your business





At a glance

Across the world, forward-thinking manufacturers and industrial product companies have made great strides in connecting their products and appliances to the Industrial Internet of Things (IIoT). But succeeding in the IIoT era demands much more than technology connectivity. In fact, the advent of the IIoT is a once-in-a-lifetime business disruption—one that requires new capabilities in managing direct relationships with customers,

supported by transformed operating and business models designed specifically for an IIoT-enabled world. And it's a disruption that's coming faster than most companies think. Those manufacturers that move to tackle the necessary transformation today will position themselves as future leaders in their markets. Those that fail to act now risk being left behind—and will face a real struggle to catch up.

\$6 trillion will be spent on IoT solutions between 2015 and 2020 (compounded).

Business investment will grow from **\$215 billion** to **\$832 billion** versus consumers at **\$72 billion** in 2015 to **\$236 billion** in 2020.

Combined, businesses, governments and consumers will invest nearly **\$1.6 trillion** to install IoT solutions in 2020.

Software and application development are predicted to make up the majority of the investment.

Source: BI Intelligence, *THE INTERNET OF THINGS 2015: Examining How The IoT Will Affect The World*, November 2015

Realising the opportunity of the IIoT...

Picture the scene: You're the CEO of a company that manufactures Heating, Ventilation and Air Conditioning (HVAC) units for consumers. You've seen and embraced the emergence of the IIoT, and have invested accordingly in establishing Internet connectivity for the HVAC systems you sell.

As a result, you can monitor and maintain your HVAC system's performance remotely in people's homes, detect imminent leaks or failures, and alert your customers to possible problems. But your customers' satisfaction with your offerings seems to be falling rather than rising. Why?

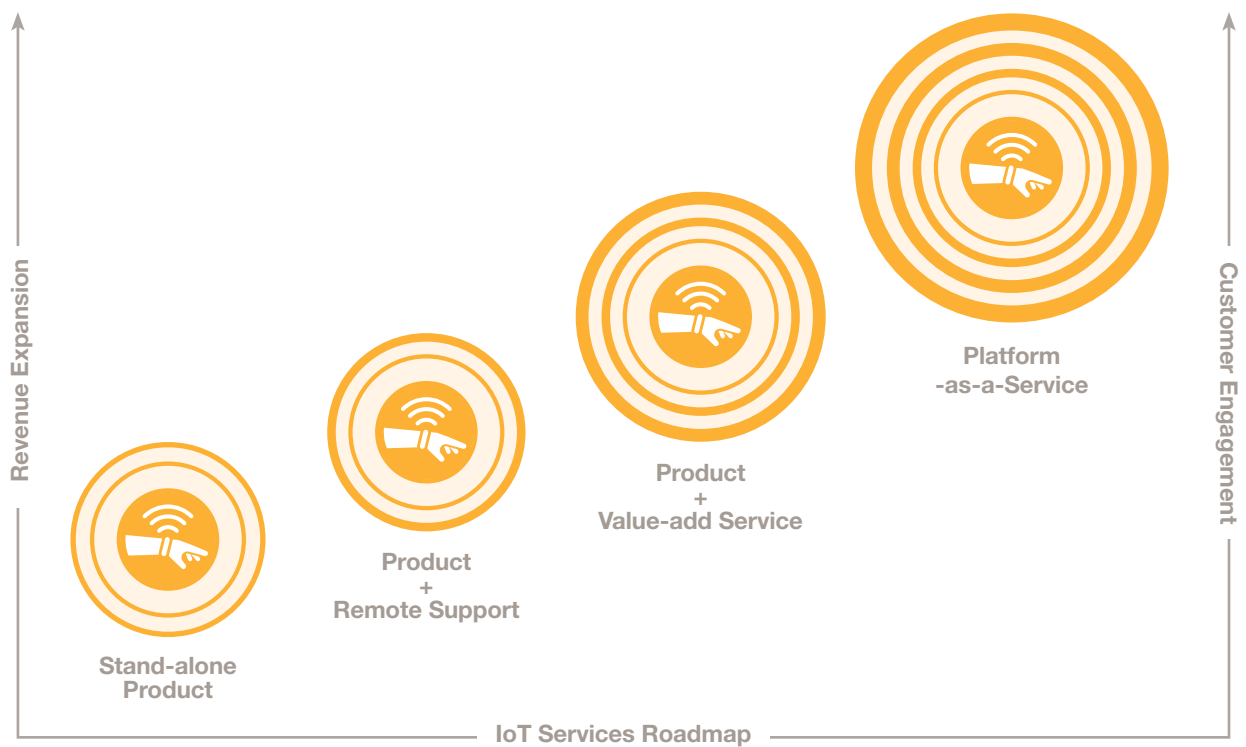
The answer lies in the changing expectations and demands of today's connected consumers—but also in the pervasive impacts of the IIoT on your operations and business model. Put simply, connecting appliances and devices to the Internet is perhaps the easiest part of the challenge of dealing with the IIoT disruption. Alongside the technology, it's every bit as important to address the behavioural, operational and business model impacts it brings with it.

On the customer front, there's a growing trend for consumers—and also business customers—to want direct links to the companies that manufacture the products and services they use, cutting out the traditional 'middlemen'. This profound behavioural shift is evident across a host of industries, from energy to telecoms, and from mainstream media to technology. It's one of the key drivers of manufacturers' industry-wide move into services—a change that increasingly involves progressing from product-based to service-based offerings by building platforms, thus simultaneously expanding revenues and building 'stickiness' (see Figure 1).

Meanwhile, on the operational front, the fact is that Internet connectivity—for a HVAC system or any other piece of equipment, whether a brake pad or a turbine engine—means much more than just linking it digitally to your business' systems. It also represents a way of getting closer to end-users than ever before, creating a degree of direct customer engagement and interaction that most manufacturing companies have never experienced.

On the customer front, there's a growing trend for consumers—and also business customers—to want direct links to the companies that manufacture the products and services they use, cutting out the traditional 'middlemen'.

Figure 1: Companies moving from product-based offerings to service-based offerings by building platforms, expanding revenues and building stickiness



Source: PwC

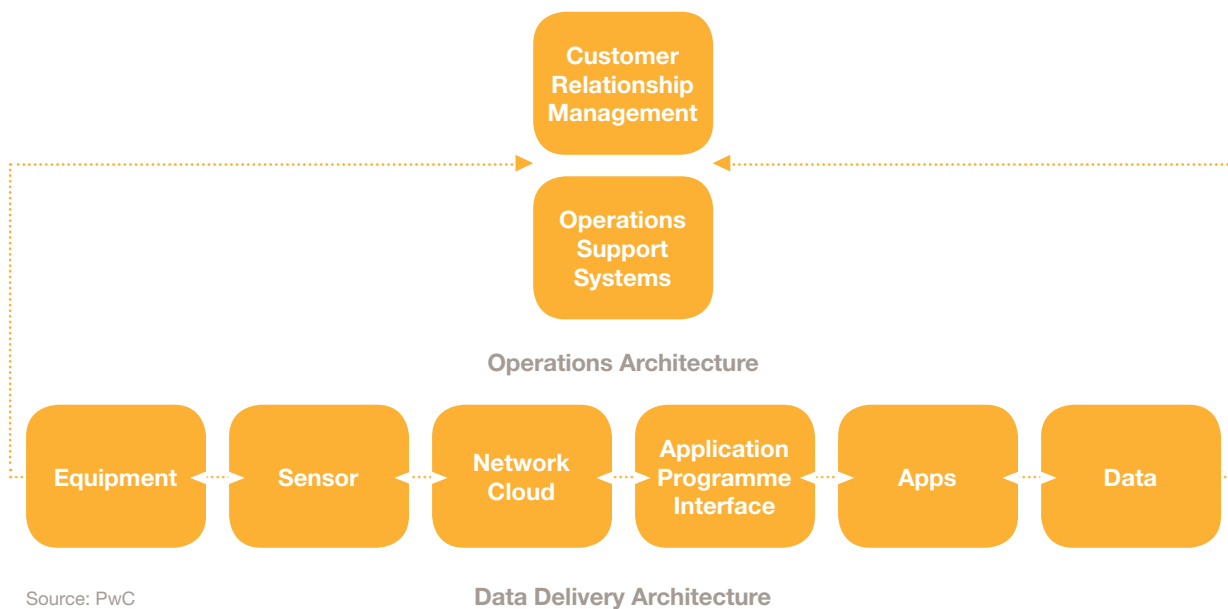
...demands capabilities that are new to manufacturing

This is a profound step-change with implications companies underestimate at their peril. Historically, a traditional manufacturing business selling through distributors and/or retailers would probably not even have run an end-customer helpline. But to keep its customers happy and loyal in the IIoT world, it needs to build a sophisticated and responsive customer management and service acumen capability.

To see why, imagine a situation in which the manufacturer's predictive analytic systems trigger a warning-light on a household's IIoT-connected HVAC system, signalling that

it's about to break down. Inevitably, the customer's response will be: "Fine, you've warned me proactively. But what do I need to do now?" If the problem can be fixed remotely, the answer may be "nothing at all". But unless the manufacturer can manage, engage and reassure the customer, the effect of IIoT connectivity may well be to damage the relationship rather than strengthen it. Perhaps the service manager places a call to the customer scheduling a preventative maintenance visit. Moreover, when the field technician does show up to the site, he has the right parts to replace and is also armed with what may go wrong in the near future.

Figure 2: The need for a robust 'operations' architecture alongside the 'data delivery' architecture



Source: PwC

So, while all current IoT implementations focus on the ‘data delivery’ architecture, a robust ‘operations’ architecture is also needed in order to maximise customer engagement (see Figure 2). Our experience suggests that many companies have yet to think these implications through. Commendably, they’ve responded to the rise of the IIoT by getting their appliances online and connecting them to their central manufacturing database and core systems. But in focusing on the shiny new IT aspects, they’ve often overlooked the need for new operational capabilities demanded by the new communication return path from the customer.

This challenge underlines the double-edged nature of IIoT connectivity. True, it opens up opportunities to expand customer revenues by selling value-added services like remote monitoring, maintenance, and other value-add services such as insurance. All of these offerings are made more viable—and potentially more profitable—by the granular, real-time device data made available thanks to IIoT sensors and connectivity. But failing to invest simultaneously in operational and customer care capabilities will drastically undermine these benefits.

Industrial IoT versus consumer IoT: Several magnitudes of difference

In the mainstream media, the explosive growth of the IoT is most often discussed mainly in terms of consumer devices and products. But if you consider the scale of the industrial products sector and its potential for device connectivity throughout the supply chain and with customers, then it’s set to dwarf the size of the consumer IoT by several magnitudes. While a few billion consumer devices—wearables, home automation devices, cars—will become IoT-connected during the next five years, the equivalent global growth curve for the industrial IoT is set to rocket towards 100 billion devices as the technology becomes pervasive in industrial sectors worldwide.



Manufacturing and industrial companies must re-engineer their strategy and culture...

However, to realise the full opportunities presented by the IIoT, more is required than just hiring a roomful of service reps. To truly leverage its new direct customer relationship and make the full transition to an IIoT-enabled, customer-centric and service-orientated organisation, a manufacturing business must fundamentally transform its strategy and organisational culture.

So while the operational challenges are significant, it's important for companies to grasp the fact that those challenges can only be discussed and understood in the context of a holistic and strategic review of the company's business models, new forms of customer engagement, and other related issues. In other words, the operational challenges result from the transformation that will become evident once a holistic and strategic review is done.

Furthermore, to achieve the required degree of customer centricity, the organisation will need to move away from a historical focus on engineering and products, and towards a mindset that puts customers front and centre. A culture change as profound as this is a major undertaking for any business. It's especially challenging for a manufacturing company with a deeply-embedded engineering culture. However, it's a transformation that's becoming increasingly imperative, for several reasons.

One is that manufacturing and industrial products businesses are among the organisations that will be impacted most directly and deeply by the widespread disruption springing from IIoT. Not only do their products, markets and processes have a high propensity for IIoT-driven change, but also these companies have among the largest numbers of devices and appliances that will need to be adapted for IIoT connectivity. In this context, it's interesting to compare the projected size of the Industrial IoT with that of the Consumer IoT—a point examined in the accompanying information panel on the previous page.

A second reason for the scope of change required by the IIoT lies in manufacturing and industrial companies' legacy plants and processes. In many cases these have remained little altered for decades. But they're now set to change dramatically, as IIoT connectivity drives rapid convergence between operational technology (OT)—robots, conveyor belts, smart metres, generators, substation equipment, transformers and the like—and information technology (IT) such as back-office systems and software.

...and adopt a radically different product design philosophy

As well as requiring complex systems integration, this convergence will compel companies to think very differently about their supply chains and manufacturing methods—and to revisit their entire approach to product design and development. To return to the example of the consumer HVAC system, designing and building an HVAC system or other appliance from ground-up to be connected to the IIoT is very different from taking a legacy design and ‘bolting on’ an Internet connection.

This new design philosophy raises further complexities. An appliance designed to make the most of the IIoT will require different components and therefore a new supply chain. What’s more, it’ll need to have robust cyber security built in—an imperative that has been underlined in recent years by the high-profile instances of criminals gaining access to the core IT systems of major corporations by hacking in via their commercial heating and cooling systems. A few years ago, these appliances didn’t even need to have physical locks; now they represent a potential Achilles’ heel that can expose a business to a major breach.

This new design philosophy raises further complexities. An appliance designed to make the most of the IIoT will require different components and therefore a new supply chain.

An ‘Operations Checklist’ for seizing the IIoT opportunity

- ✓ *Conduct a holistic and strategic review of business models, new forms of customer engagement, and so on.*
- ✓ *Maintain the momentum of implementing IIoT connectivity for devices, sensors and networks.*
- ✓ *Discuss and understand the degree of operational change required, and the challenges it involves.*
- ✓ *Combine technology and operational change to transform the organisation’s customer centricity and put the customer front and centre.*
- ✓ *Lock the increased customer centricity in place by embedding culture change at all levels across the business.*
- ✓ *Continue to review and innovate around operations and technology on an ongoing basis, to keep driving further business benefit from IIoT.*

IIoT-driven transformation is not just imperative—but urgent...

As industrial companies take these implications on board and develop their IIoT strategies and approaches, a question that commonly arises is how fast they need to move. How long is their window of opportunity? Do they have five years to transform to a new technology and operating blueprint for the IIoT world? Two years? Just six months? The answer may vary by industry. But in virtually every case, we think the available timeframe for IIoT transformation is shorter than companies currently believe. Similar to other industries, the Internet will accelerate disruption.

Why? Because the stars are now aligned in a way that will see the IIoT advance and expand far more quickly than many businesses expect. The pace of growth is underlined by research from Gartner, who predicts that spending on new IoT hardware will exceed \$2.5 billion a minute in 2016—and that, by 2021, one million IoT devices will be purchased and installed every single hour.¹ Gartner also forecasts that the number of things connected to the Internet will grow to 35 billion by 2020, and that 47% of these devices will have the necessary intelligence to request support.² This opportunity could usher in new players and threaten the status quo.

The headlong growth in the IIoT reflects several drivers. First, the costs of IT are plummeting across the three key domains of storage, compute power and network capacity, even as the number of devices that can potentially be connected continues to proliferate. Second, the continuing flood of start-ups and venture capital investment in the IoT/IIoT space is showing no sign of slowing down from its current breakneck speed—in turn contributing to rapid advances in capabilities and benefits.

Third, the wave of technology disruption from the IIoT is affecting a wide array of industries, boosting its momentum still further. What most industrial companies do not fully realise and appreciate is that adopting the IIoT will cause them to think and plan like a technology company. This underlines the extent to which the IIoT is breaking down industry barriers. As a result, some industrial CEOs are having sleepless nights wondering whether a technology company might come in and disrupt their industry and business in a manner many of them cannot even fully envision, let alone plan for and react to.

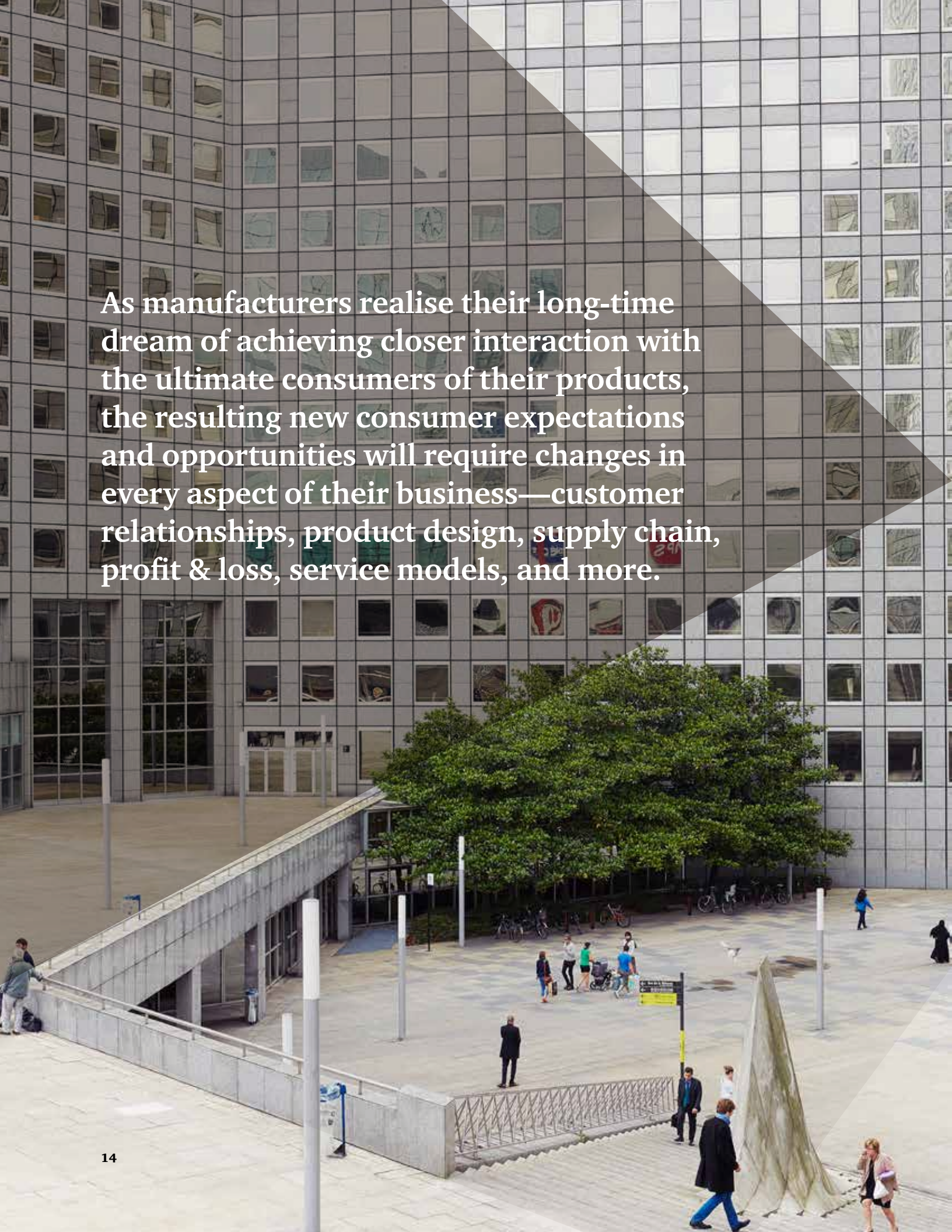
¹ Gartner, "Top Strategic Predictions for 2016 and Beyond: The Future Is a Digital Thing", 2 October 2015.

² Gartner, "Forecast: Internet of Things, Endpoints and Associated Services, Worldwide, 2014".

The pace of growth is underlined by research from Gartner, who predicts that spending on new IoT hardware will exceed \$2.5 million a minute in 2016—and that, by 2021, one million IoT devices will be purchased and installed every single hour.¹

Finally, ongoing advances around big data are also helping to drive progress in IIoT deployments and opening up opportunities for disruptive new business models. The result can be to reverse the polarities of whole industries, creating entirely new ways of procuring, provisioning and consuming goods and services of all types. For example, an aircraft engine manufacturer can now embed intelligent IIoT-connected sensors into its turbines, thus generating data that enables airlines to lease the engines by the minute or hour rather than buying them outright—effectively meaning they're paying for propulsion-as-a-service on a per usage basis.

Together, the pace of growth in the IIoT and the radical nature of the disruption it triggers mean manufacturing businesses must come to grips quickly with its implications—or face being on the wrong end of shifts that could put their future at risk. In recent decades, technology-enabled disruptions have turned sectors ranging from media to transport to accommodation upside down. The software sector is a good example: in the past fifteen years or so it's moved from an industry based mainly on selling licensed packages via resellers, to one that sells its offerings direct to users on an OPEX-based, software-as-a-service (SaaS) model.

A photograph of a modern building with a grid of windows. The building is the background, and a large, dark, triangular graphic is overlaid on the right side. In the foreground, there is a courtyard with a paved area, a large green tree, and several people walking. A ramp or staircase structure is visible on the left side of the courtyard.

As manufacturers realise their long-time dream of achieving closer interaction with the ultimate consumers of their products, the resulting new consumer expectations and opportunities will require changes in every aspect of their business—customer relationships, product design, supply chain, profit & loss, service models, and more.

...demanding a new operational blueprint

As IIoT connectivity and virtuality become pervasive, manufacturing and industrial products companies will face a similarly deep and broad transformation of their operating and business models. While many companies have gained some understanding of this transformation, what most do not yet realise is the high speed at which they will need to navigate through the resulting disruption. The timeframe available to industrial and manufacturing companies is far more accelerated than that already faced by software vendors in previous years.

With the advent of the IIoT, what's clear is that the days of stamping out widgets, shipping them out the door and forgetting about them are gone forever. As manufacturers realise their long-time dream of achieving closer interaction with the ultimate

consumers of their products, the resulting new consumer expectations and opportunities will require changes in every aspect of their business—customer relationships, product design, supply chain, profit & loss, service models, and more.

As a result, steering the right course to IIoT enablement will demand a new operational blueprint: one that not only establishes and maintains a real-time two-way connection to customer devices, but also effectively manages and leverages the opportunities resulting from the increased customer engagement that this connection entails.

Conclusion: Time to act— and turn disruption into opportunity

To date, manufacturing and industrial products companies have been doing a great job of connecting their devices to the IIoT. This is a vital step—but actually represents the beginning of the transformation journey not the end of it.

To complete the IIoT transformation journey, it is important to conduct a holistic and strategic review that enables the organisation to tackle the operational and customer engagement aspects, while also preparing the business for disruptive industry change that will go beyond anything we've seen in our lifetimes, and will demand a deep and broad transformation of the enterprise.

The message for your organisation is clear. You need to be holistic and strategic when it comes to fully leveraging the opportunities offered by the IIoT. And that means you need to take steps to focus on the operational impacts of IIoT connectivity to turn the resulting disruption into huge opportunities to build value and competitive advantage. Conversely, if you hold back from taking action, the IIoT opportunity has the potential to become a major disruption of your business bringing major threats—possibly putting its continued existence in doubt. Fortunately, the choice is not a difficult one to make.

Contacts

Shahid Ahmed

IoT and Emerging Technology Leader

+1 (312) 208-9562

shahid.ahmed@us.pwc.com

Raman Chitkara

Global Technology Industry Leader

+1 (408) 817-3726

raman.chitkara@us.pwc.com