Winning the innovation race: how to future-proof your business

Contents

Introduction

If you're a global organisation, you're always under pressure to keep up with the latest innovations to stay at the forefront of your market. But it's not easy when the goalposts keep moving.

External disruptors and start-ups are constantly shaking things up, pushing technological boundaries and reimagining the future. Connectivity is exploding, creating a world where smart objects talk to each other and it's perfectly normal for your phone to effortlessly outperform your laptop in processing power. Digitisation has transformed how, when and where we work — never more tested than by the coronavirus pandemic. And artificial intelligence has reached the point that it can hold a natural conversation over the phone and beat humans in games of skill.

The challenge is to take all this on board to pull out the trends that are going to redefine the world

and to harness their potential for your business. With so much going on, it can be easy to miss a crucial opportunity or to dismiss something that's relatively established as not for you. That's why we're always exploring and investing in technological innovation and watching trends over time to work out how we can use it to help our customers.
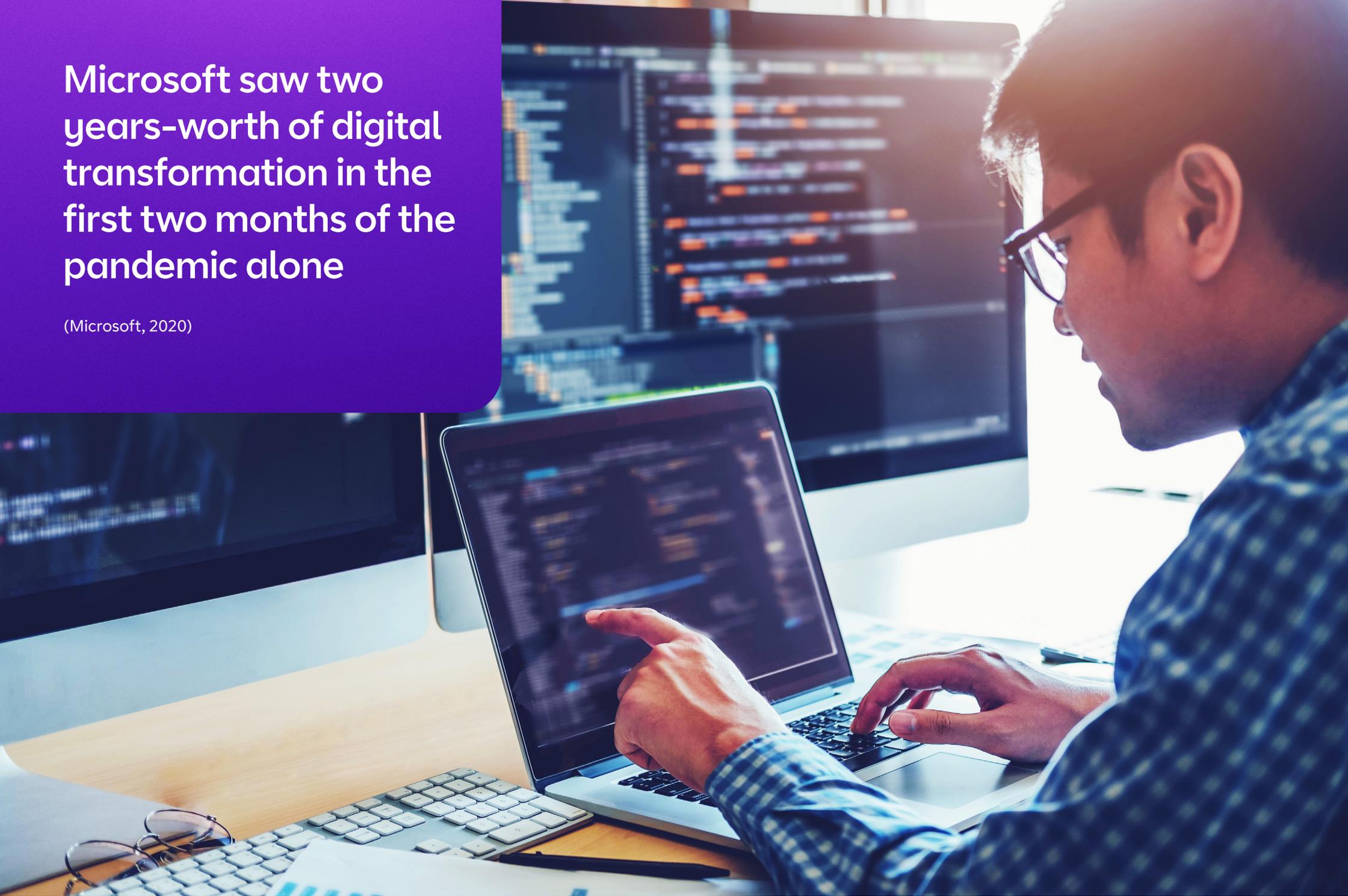
We're going to take you through four of our top innovation priorities:

- AI and machine learning
- big data and analytics
- 5G
- the Internet of Things.
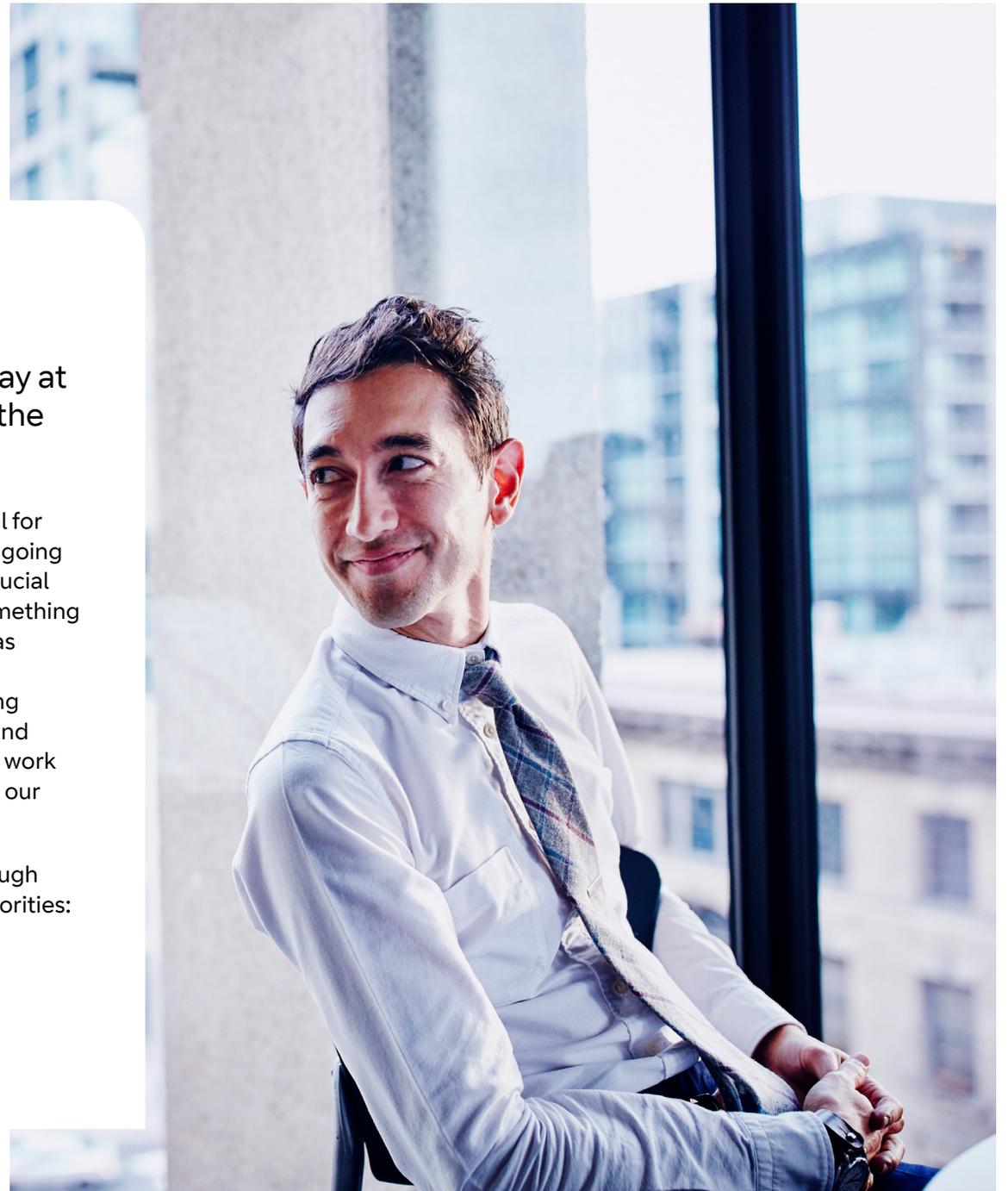
Microsoft saw two years-worth of digital transformation in the first two months of the pandemic alone

(Microsoft, 2020)

The art of AI and machine learning

Where we are now

Artificial Intelligence (AI) is already here, an everyday part of our lives.

It's in the chatbots that answer our online queries and the recommendation systems used by online retailers. It's part of the medical scanning processes that identify disease and it's in the electronic trading systems that respond to market changes at beyond-human speed. And that's only the beginning.

True AI is the simulation of human intelligence by machines, creating models that learn from experiences, apply reasoning and self-correct. The goal is to move beyond the limits of human intelligence to a point where technology supports and enhances human understanding. AI has already been transformative and has the potential to make human jobs more meaningful, customer experiences better and businesses more effective.

AI technology doesn't stand still and, right now, experts will be adapting it in response to the effects of the pandemic. Human behaviour has changed, so the data that AI models are trained on must be updated and the models retrained. The latest challenge for AI is to model a pandemic scenario that there's no historical data for, so experts are shifting to techniques that use available data. And work is starting on developing AI that draws on the large, open and free data repositories data giants, such as Google, Facebook and Apple are creating. It's hoped that these pools of data can be used for new types of modelling to help communities plan and manage resources better.
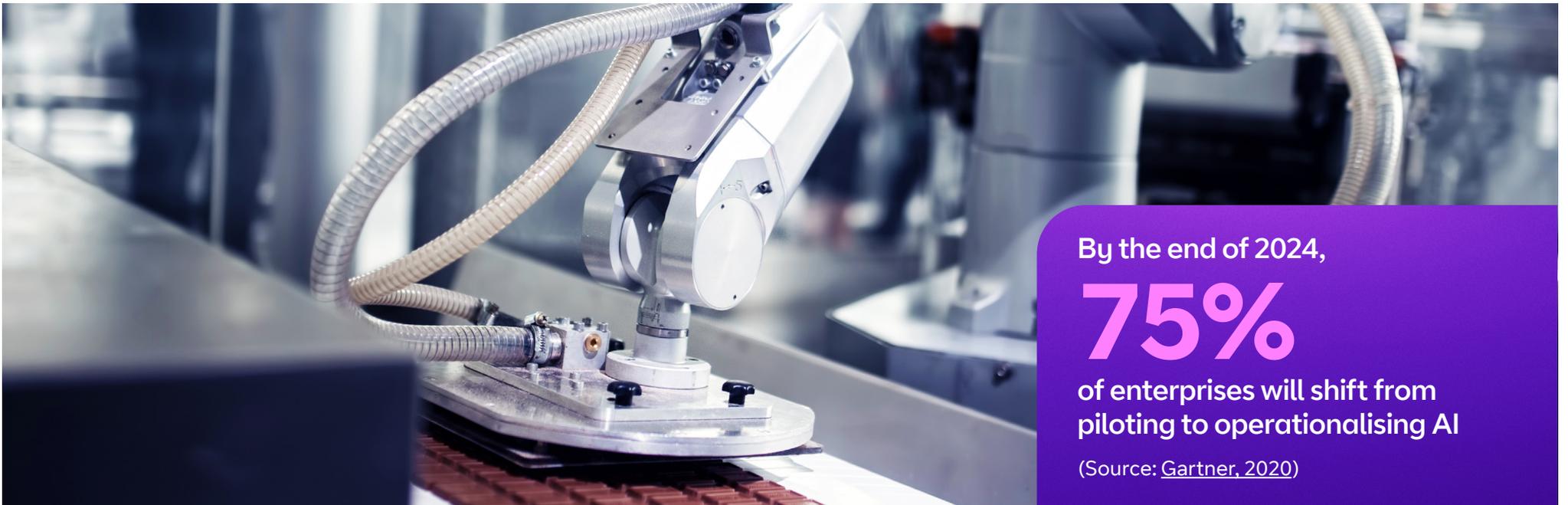
By the end of 2024,

75%

of enterprises will shift from piloting to operationalising AI

(Source: Gartner, 2020)

The AI roadblocks

Incorporating AI and machine learning into your business isn't a question of simply flipping a switch and powering ahead. Getting it right takes a radical rethink of how you handle data throughout your business to make sure it's accurate. Flawed data will lead to AI you can't rely on.

For many organisations, this will be the first time they've really questioned the quality of their data — unless it's governed by regulation or supports processes like billing, where accuracy is essential. They're looking at a complete culture shift to a system where the quality and availability of data is policed from the moment it enters the business.

This change in culture needs to extend ethical and regulatory structure for everyone to operate in. After all, AI isn't infallible and, when it gets things wrong, we'll need the protection of regulations to ensure things are put right. And from both an ethical and a legal point of view, we'll need checks and balances on the decisions AI makes — plus safeguards against liabilities stemming from future regulatory changes.

Running and regulating this new AI-powered world needs a whole new set of human skills that are in short supply right now, and growing this skills base is going to take time. Industry is particularly short

of data scientists and engineers who understand the AI field and technologies and can prepare data for AI models to use. Without this expertise, how do you progress your AI plans? How do you avoid being left behind by the competition?

What if you could...

Have confidence in the quality of your data?

Focus on the quality of your data from the moment it enters your business, so you're confident it's ready to support AI accurately. Test, and keep testing throughout its lifecycle. And make sure you test your AI models with data that you haven't used to build them — then test the models again, once they're operational. If you're buying in AI or data analysis services and can't do this testing yourself, make sure your vendor's testing protocols match your standards.

Use AI securely, within an ethical and regulatory framework that protects you from whatever's around the corner?

Start by creating a culture that's ready for any regulation and audits by knowing exactly where you're using AI in your business. Record every use you make of data, every time you change it and every decision you make based on it. Plan for the fact that AI will make mistakes and put systems in place that can explain what

happened if anything went wrong and adapt your risk management and governance frameworks to include your use of AI.

Get hold of the skills you need to unlock the full potential of AI and machine learning?

At this point in AI development, partnering with a specialist vendor is a straightforward way to tap into the necessary expertise. At BT, helping to expand the skills pool is business as usual. As well as our own research, development and training programmes we support

the AI ecosystem on a national level. We draw extensively on our long-standing research partnerships with global universities, such as MIT's Computer Science and AI Lab and Centre for Information Systems Research to explore the possibilities, the applications and the implications of AI technologies, and to grow the experts of tomorrow. And we're taking part in industry groups to define new Masters-level apprenticeships in AI, data science and operational research — all while spotting talented individuals and recruiting them into our organisation.

# Beating today's big data analytics challenge

Where we are now

Big data has been around for a while, so why have so many companies not realised its full potential?

In the early days, big data was all about collection. But now, it's all about making the most of data throughout your organisation. Today, big data means you can make better decisions, faster and more cost-effectively. From matching resources to where they're needed, to preventing events rather than just predicting them, big data, together with AI and machine learning, are automating complex processes that would otherwise be too expensive to contemplate. This frees people from tedious and time-consuming tasks to do something more productive.

Big data is transforming the customer experience, too, in ways that have direct value. It can build detailed pictures of your customers, helping you tailor products and services to meet their needs. And it generates usage insights that let you build a relationship with your customer, helping you grow loyalty by pre-empting problems and suggesting alternatives or extras.

However, there's a big gap between companies that were born digital and are native exploiters of big data, and those that need to go through a digital transformation to be able to get the most from data. Many of these organisations may already have invested in big data projects but feel they haven't got the value they'd expected from them or have had some success and are looking for ways to build on it. Wherever you are on this journey, it's time to reassess what big data can bring to your business, particularly in the light of the impact of coronavirus.
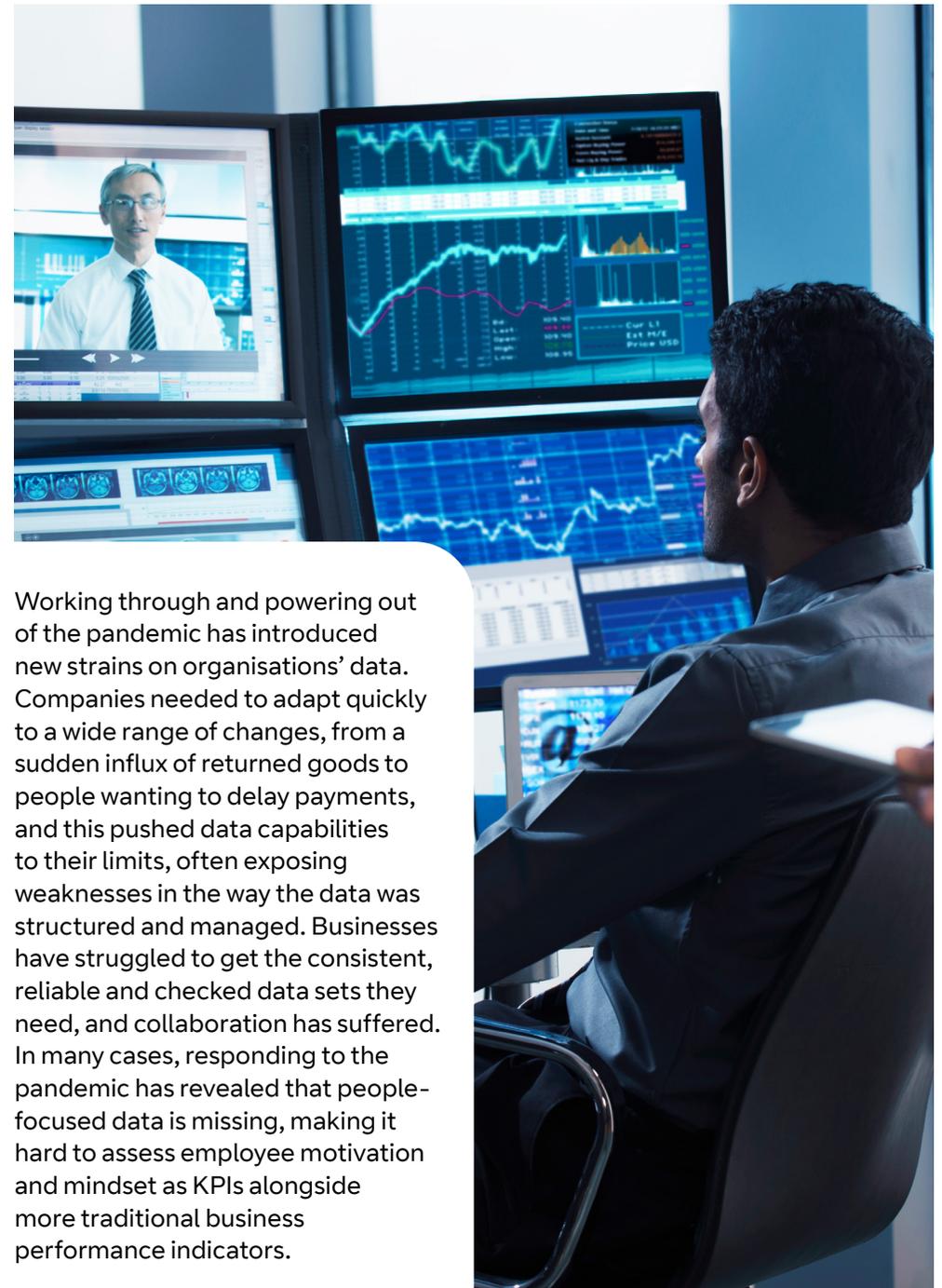
Working through and powering out of the pandemic has introduced new strains on organisations' data. Companies needed to adapt quickly to a wide range of changes, from a sudden influx of returned goods to people wanting to delay payments, and this pushed data capabilities to their limits, often exposing weaknesses in the way the data was structured and managed. Businesses have struggled to get the consistent, reliable and checked data sets they need, and collaboration has suffered. In many cases, responding to the pandemic has revealed that people-focused data is missing, making it hard to assess employee motivation and mindset as KPIs alongside more traditional business performance indicators.

The barriers to big data success

Achieving all the 'successes' of big data takes investment in the right tools and a sound data infrastructure. Without it, you're not going to see the benefits of big data and analytics. But your business will be hungry for results, so you'll have to balance developing capacity with demonstrating value. There may well be a time lag though between getting your data infrastructure in good order and being able to collect, curate and label the data needed to use AI and machine learning effectively.

Making this data-driven environment a reality involves moving how we deal with data from an art to a science. This culture shift needs to set data analytics firmly within emerging legal and ethical frameworks, so that the results that are used in the models that power AI and machine learning are transparent, reproducible and traceable.

In many companies, data is seen as a separate 'department', when it really needs to run through every aspect of an organisation - people, culture and skills. Achieving this is likely to involve a broad programme of upskilling and empowering your workforce to make everyone a digital citizen who knows the importance of data and looks after its accuracy whenever they come into contact with it.

What if you could…

Build a data infrastructure that's ready for any analytics or AI challenge?

Focus initially on getting the 'plumbing' right by creating an infrastructure that discovers data in your enterprise quickly, then brings it together seamlessly and instantly. Moving from rigid, on-premise infrastructure to cloud computing will give you the flexibility and scalability that will set you up to get maximum value from your big data investments. From there, move on to building a data environment that can run experimental data tasks alongside business as usual ones. This cloud-based model will let you explore new ideas easily, at low cost and will mean you can scale up successful experiments quickly so they can deliver value as soon as possible.

Really know your customers and be able to personalise and customise services?

With a strong data infrastructure in place you'll know all your processes and platforms across every aspect of your business. You'll have the freedom to quickly create customised products and services by modelling, questioning and experimenting with your data. You'll be able to zoom out to understand large-scale issues and zoom in to understand an individual or customise an experience.

Create an environment that values data every step of the way?

Get everyone in your organisation to recognise that data is your biggest asset by making data an integral part of your culture and skills. Focus on breaking your data talent out of current silos and spread it evenly throughout your organisation with a broad programme of upskilling and awareness. You'll create a data-skilled workforce that curates accurate data across its use journey.

The total amount of data created in the world is forecast to increase dramatically in the coming years, reaching

175

zettabytes in 2025

(Source: Statista, 2020)

Forging ahead with 5G

Where we are now

**The 5G-enabled world we see today is just the beginning.**

What most of us are noticing right now is the rapid growth of mobile bandwidth, but this is just one step on the journey to a connected 5G world. Dig deeper into the possibilities of 5G and you find a communication environment that has so much potential it can be hard to imagine. 5G will carry huge amounts of data much faster. It'll reliably connect devices that are embedded into our lives, and it'll process high volumes of data with minimal delay.

5G's potential is already coming to life. Based on 5G technology, sophisticated and flexible services are springing up that are reliable and have ultra-low latency. From ambulances that bring a virtual A&E department to patients in the community, to automated production lines that identify their own faults then help to fix them, use cases set the challenges and 5G is meeting them — even exceeding them, with developments like network slicing and edge computing.

And, as industries search for ways to operate safely and effectively throughout the pandemic, 5G is emerging as the smart choice in many scenarios. Where businesses need new technology and wireless connectivity to be in place more quickly than solutions that need cabling. Where organisations need new ways to collaborate remotely, 5G is often a better option than wi-fi for supporting collaboration between sites because it's easier to manage, offers macro-area coverage and high-speed mobility. And 5G-enabled augmented reality headset use is a way of bringing remote expertise to sites safely, because of its lower latency.

The 5G inhibitors

Like AI, 5G offers possibilities we've yet to imagine. Add in all the current myths about 5G, and it makes planning and bringing to life concrete use cases that much harder. Does 5G mean the end of 4G and wi-fi? What are 5G's practical limitations right now? A clear picture of what's possible today is essential before you begin to plan your 5G future.
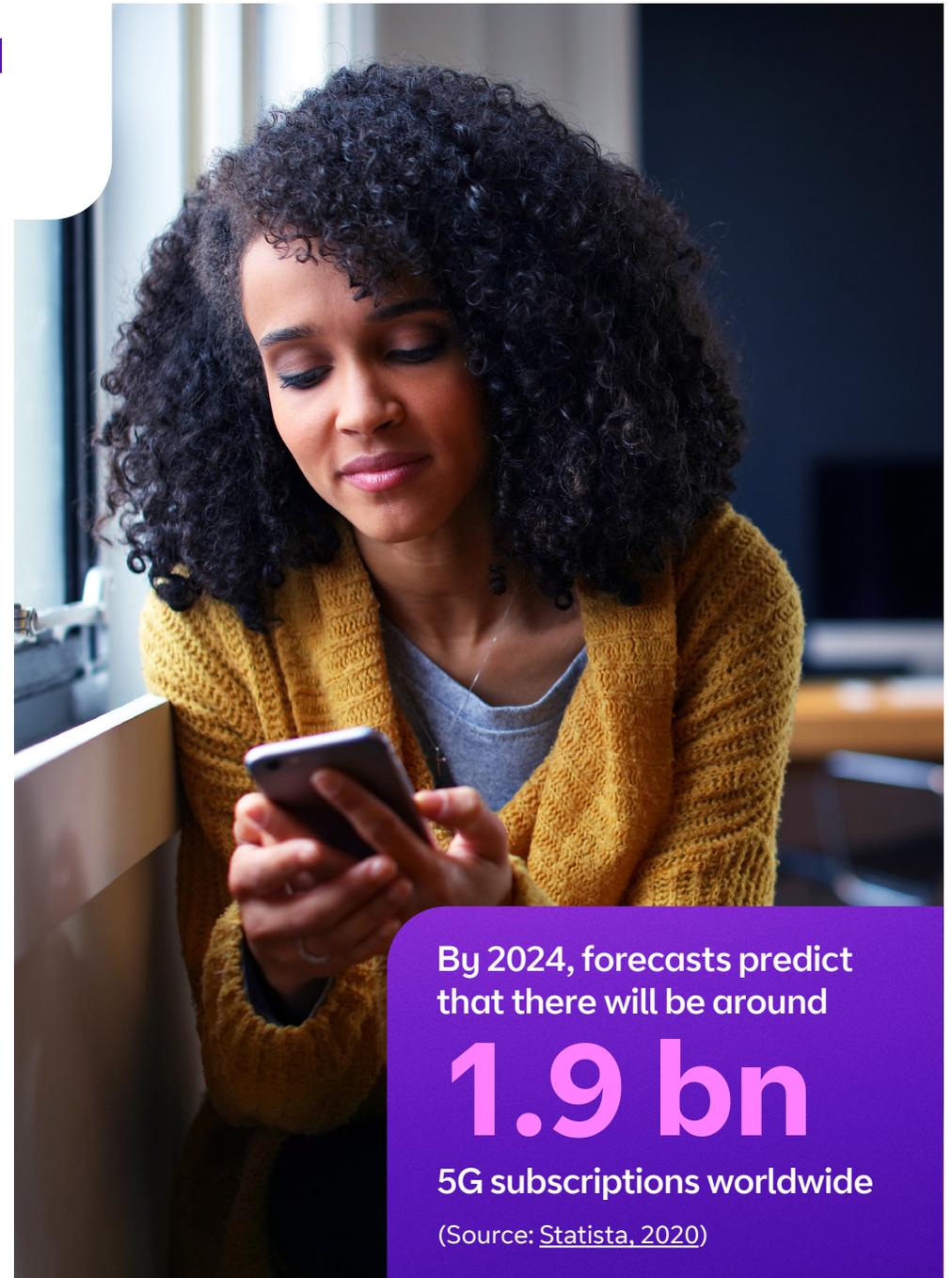
By 2024, forecasts predict that there will be around

1.9 bn

5G subscriptions worldwide

(Source: Statista, 2020)

Without collaboration and co-innovation, 5G will struggle to make the leap from individual use cases to an essential part of daily life. It requires a collaborative ecosystem of network operators, device vendors, core network vendors, application developers, politicians, cloud providers, academia, industry bodies as well as government and regulators to work to a strategic roadmap that fits their individual areas of expertise together like a jigsaw puzzle. Making 5G a part of daily life is going to take new skills and new combinations of expertise that we won't be able to source without pooling our efforts. It's a challenge, but without this

ecosystem, technological dead-ends and knowledge silos could easily develop that could hold back 5G development for years.

What if you could…

Provide the high-speed, low-latency universal connectivity to underpin all your data-exploitation activities?

5G is the linchpin of an ecosystem that has data at its heart, and it'll help you get the most from other emerging technologies that are maturing right now. Augmented intelligence, data rich environments, the Internet of Things, agile

automation, robotics and augmented / virtual reality all need 5G to power the fourth industrial revolution, known as Industry 4.0.

Use extended reality technologies to make the most of valuable expertise?

Embrace augmented reality (AR) in your production environments to increase the speed and reduce the costs of repairs. With AR headsets, operatives can carry out guided maintenance and operations with the remote support of experts who can guide them on unfamiliar equipment or configurations, ideal for operating during the pandemic. Look to virtual

reality to create more realistic training environments for situations where it's too hazardous to train people with physical simulations.

Improve monitoring and maintenance within your manufacturing environment?

Use a network of IoT sensors on your products, equipment and facilities to monitor what's happening during production in real-time. Track items around your site and exercise almost instantaneous control over machinery to prevent damage in production. Transform how your factory handles maintenance with a network of IoT sensors that flag up when maintenance is needed, so you can schedule work when it'll cause the least disruption. 5G-compatible IoT sensors and devices may be in their infancy right now, but will gather pace.
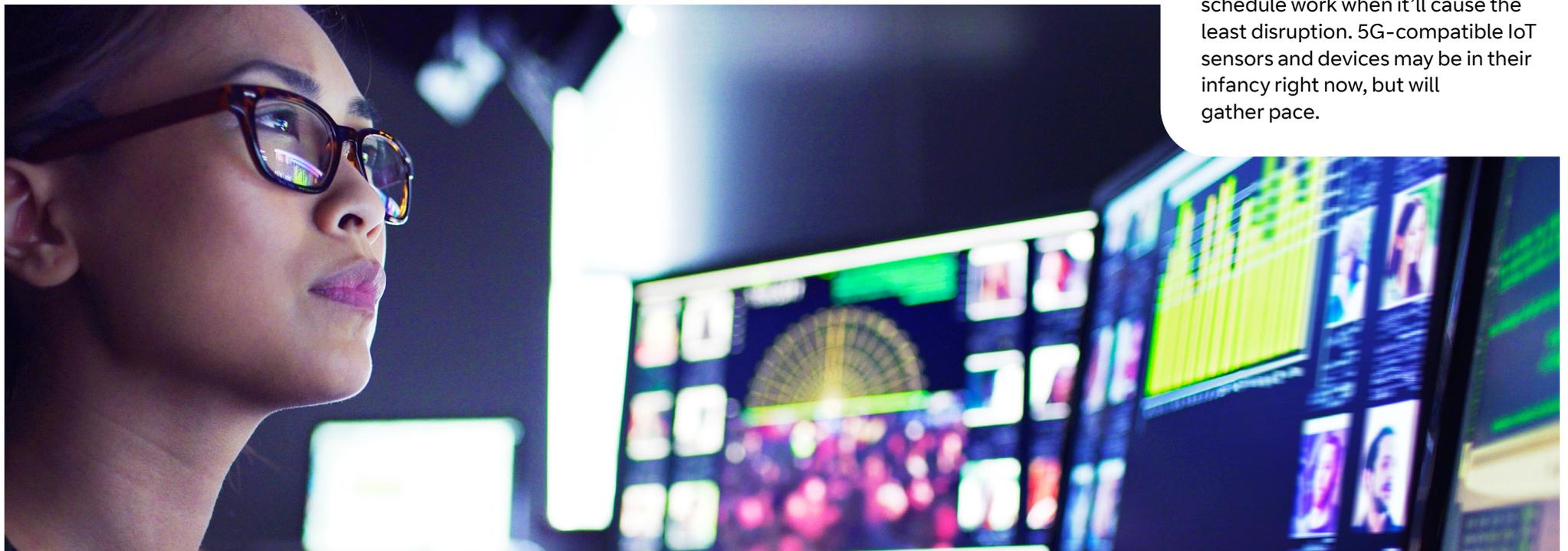
Building a connected future with the Internet of Things

Where we are now

The Internet of Things is supporting a whole new way of living and working.

Thanks to affordable silicon chips and sensors, plus widespread wireless networks it's now possible to connect anything to the internet, making it part of the Internet of Things (IoT). From something as small as a pill to something as large as an aeroplane, devices are 'talking' to each other, communicating real-time data without involving humans. The IoT is creating a more digital world that's smarter and more responsive.

Wearable devices are tracking your movements and your vital signs. Smart cars are monitoring how you drive, communicating with other vehicles and the roads you're using. Smart cities are increasingly managing their own infrastructure to improve life for residents, influencing everything from parking to crime detection. And in industry, the IoT is increasing efficiency in smart factories, from proactively deploying maintenance crews before equipment fails to reducing energy consumption and automating whole production lines.

The coronavirus pandemic is accelerating IoT adoption, as companies become more digitally orientated to evolve and adapt to new ways of remote and socially distanced working. Organisations are using off-the-shelf IoT solutions to maintain critical operations and help safeguard employee safety and health. They're using smart wearable devices and workforce tracking systems to keep employees apart, and vision-based control systems with infrared imaging to detect fevers. Remote asset control is monitoring and controlling equipment remotely, and IoT maintenance tools are reducing the need for in-person visits. And a lot of thought is going into how the IoT can help businesses operate more efficiently to improve their medium-term prospects. There's a particular focus on how to optimise the availability, performance and quality of equipment.
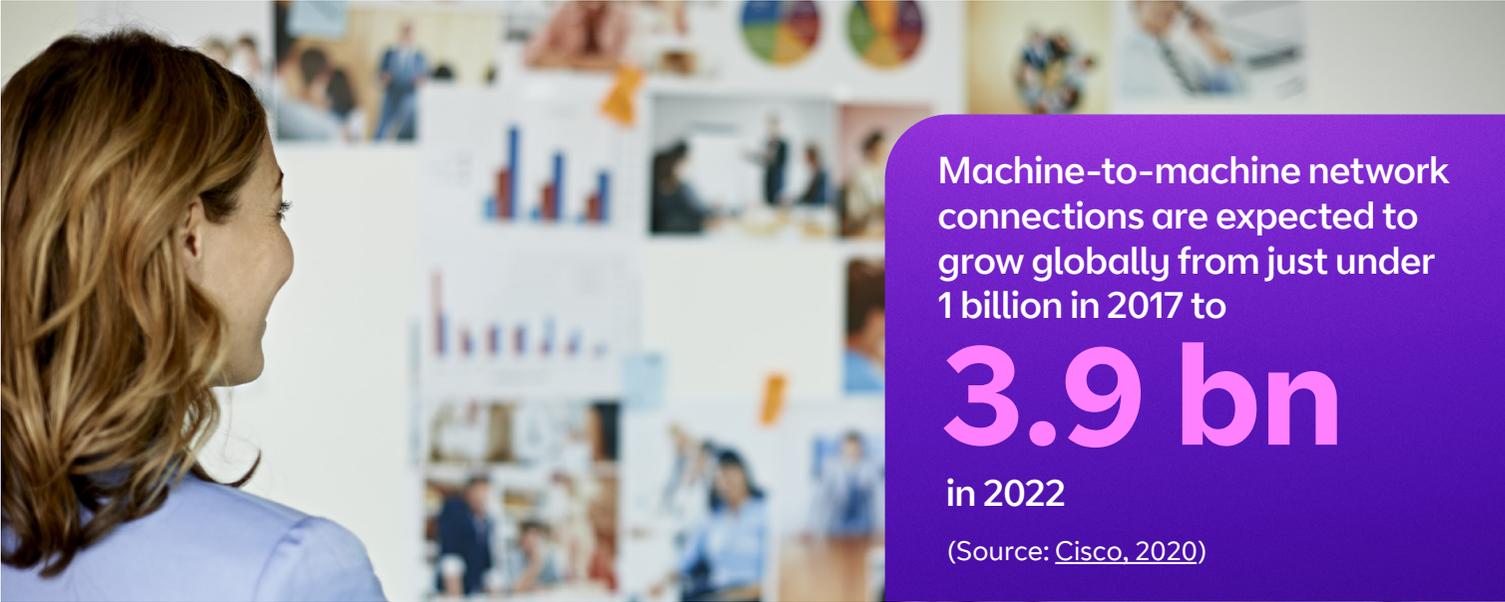
> **Machine-to-machine network connections are expected to grow globally from just under 1 billion in 2017 to**
>
> # 3.9 bn
>
> **in 2022**
>
> (Source: Cisco, 2020)

Obstacles to the IoT

The beauty of the IoT is the power of the devices themselves, capable of running sophisticated applications and delivering almost instantaneous reactions. But these devices rely on edge computing for the low latency and lower dependence on the cloud that makes them more responsive and robust — and this may mean reconfiguring your legacy infrastructure.

The sheer number of devices you'll be dealing with as you build your IoT network will also need careful management or on-boarding and securing hundreds or even thousands of devices could overwhelm your resources. The scale of the task overall is huge. For manufacturing alone, there are already over ten million sites globally. Analysts estimate that manual provisioning and on-boarding of just one device can take more than 25 minutes. So, assuming a conservative 100 devices per site, that would equate to about 240,000 full-time employees working standard hours for a year! It's clearly a costly and impractical process that's prone to mistakes that could lead to security breaches.

Stepping into the world of edge computing to make Industrial IoT a reality opens up new cybersecurity vulnerabilities that businesses must plan for from the beginning. The edge environment is so new that there's little standardisation, so there are a lot of security unknowns to navigate. Threats will also come from the merging of two worlds that have traditionally had a protective divide: as operational technology and information technology meet, cyberattacks on operational technology will become more common.

What if you could…

Create a network that's ready to support anything your IoT plans include?

Start by building a modernised LAN that can collect data from multiple sources, exploring ways to create direct connectivity between plant systems and the edge server. Build in flexibility and choice with vendor-agnostic solutions that deliver access to cloud environments and compatibility with 4G and 5G applications and technology. Look to SD-WAN technology and enhanced security to support your edge computing. And explore intent-based networking to move away from the complexity of the technology to focus on the customer and user experience.

### Securely and automatically on-board, establish and manage IoT devices?

Choose Zero Touch Orchestration (ZTO) to automatically order, package and deploy multiple services at the edge, so you can scale and benefit from the many advantages of the IoT. Use Zero Touch Attestation to securely on-board a wide portfolio of third-party devices, and Zero Touch Bootstrapping to automatically provision your cloud management server and prepare the protocols, firmware, applications and device management agents for each device. Zero Touch Connection connects devices to your network infrastructure without needing to provision them in the network cloud or on the device. And Zero Touch Device Management adds an abstraction layer between the networking and device protocols to simplify the in-life management of components.

Implement security specifically designed to protect in an IoT world?

Mix two security stances: keeping out undesirable guests and creating clear visibility of device and network behaviours to detect abnormalities. Profile your assets and determine their importance to your business as part of a risk-based security strategy, identifying vulnerabilities and limiting the effects of any intrusions. Build in visual and graphical analytics tools to spot data patterns and identify threats to the network, making the most of AI-based big data analytics techniques that support human decision making. And test your defences regularly with simulated attacks.

BT and innovation
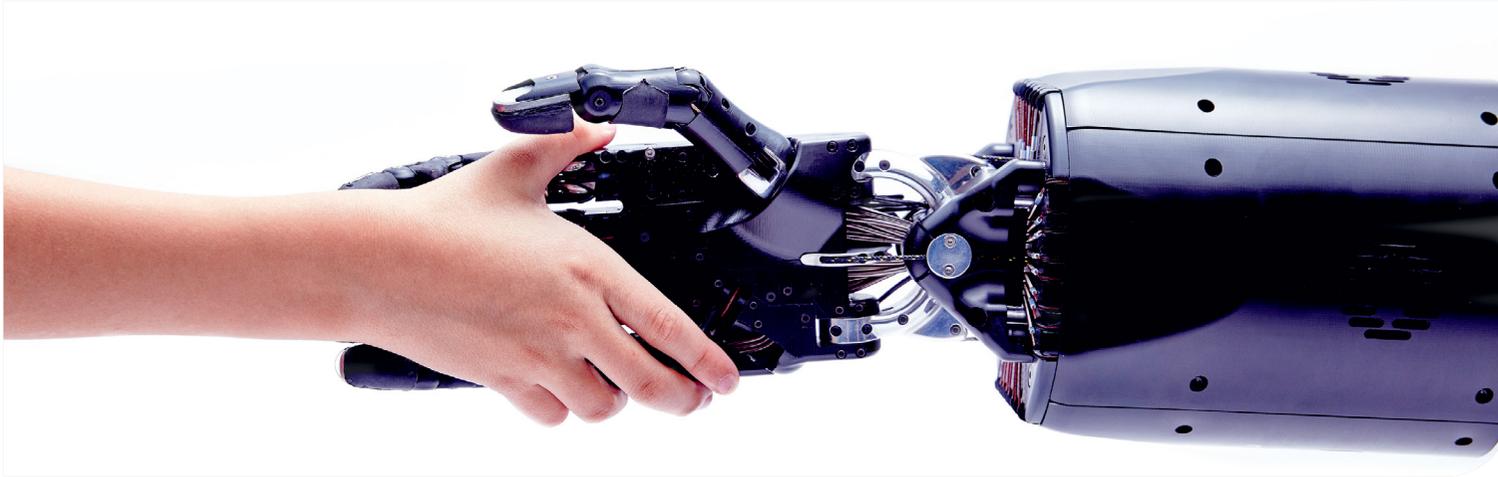
A commitment to innovation is part of our DNA. We've invested £2.5bn in research and development over the last five years, making us the third largest investor in R&D in the UK. Our 13,000 scientists and technologists worldwide have filed over 10,000 patents since 1990 to push forward the boundaries of what we can help our customers achieve.

We take an open approach to innovation, working in close collaboration with our customers and strategic partners or specialist innovators such as universities, government organisations, standards bodies and technology companies. Our innovation scouting teams are always scanning the horizon for ideas

and expertise generated by third party organisations that we can incorporate into our search for the next technological breakthrough. Based in the two leading technology hotspots, our Silicon Valley and Israeli teams meet with over 400 companies a year.

Our investment in innovation supports long-standing research partnerships with over 40 leading universities and business schools around the world, including the Massachusetts Institute of Technology (MIT), Cambridge University, Tsinghua University in Beijing, and our joint research centre in the UAE (EBTIC). Our own BT Labs at Adastral Park are also

critical to our success as a leading global innovator. Our globally recognised centre for telecoms research and a key source of UK Intellectual Property is an important national asset, and our 4,000 scientists, IT experts, engineers and collaboration partners based there continue to push the boundaries of innovation.

In practical terms, this philosophy puts us at the forefront of innovation across industries around the globe. In 5G, we're working at the cutting edge of practical development, from powering smart factories through to supporting autonomous vehicles. We're building on our seven-year run of winning best 4G

network with confirmation that, in early 5G benchmarking, we are once again ahead of the competition for coverage and speed.

When it comes to big data, we refine our solutions on our own business. By applying the latest in emerging technologies to a wide range of data, we've transformed our field force optimisation capabilities and can predict where specialist engineers will be needed, and when. This improved forecasting ability has saved us millions of pounds by driving down costs, cutting wastage and boosting efficiency.

In the IoT arena, we use our innovation to prepare customers to take advantage of Industry 4.0 every day. We make their network edge digitally ready, from the LAN and SD-WAN through to fixed and wireless networks. Our security protects businesses as IT and OT converge, supporting the automatic ordering, packaging and deployment of multiple services at the edge.

And in AI, as a global network operator we implement technologies that analyse traffic and data flows worldwide, processing over 2.1 billion events an hour. Our security teams

use our powerful visual analytics tools and virtual reality and digital twin technologies to build a rich environment for research into what's around the corner.

Our research team are working towards incorporating blockchain technology and quantum computing into our defensive strategy, as well as building automated, self-healing defence systems akin to the human immune system.

Innovation is part of our commitment to you, embedded in our contractual agreements. Our aims are always to make your business more agile, to identify and exploit new revenue-generating opportunities, improve your business processes to

optimise cost and efficiency and to manage your innovation as effectively as possible.

We've created an innovation process that drives bright ideas from concept through to operation using a range of services. Our Applied Technology Centre develops your concept and refines your proposition, and you can co-innovate with start-ups through our Infinity Lab programmes. We run hackathons to rapidly develop prototype solutions and our development centres across the UK, US, India and China mean you can tap into a global talent pool of specialist software developers. And we offer bespoke hothouses focused on creating working prototypes that are 'business case ready'.

Innovate with us

To explore how we're turning innovation into better business for organisations, please visit our insights page, and to find out more about how our innovation can support your business, get in touch with your account manager.

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