



Connecting a smarter world

Connecting every machine to
transform lives and businesses

The future is exciting.

Ready?



Your path to the connected business

The Internet of Things (IoT) is transforming every industry. From smart thermostats helping utilities companies offer better value to connected cars enabling manufacturers to offer new services, many businesses are already benefitting from IoT — and we're only just beginning to understand its full potential.

Welcome to the world of IoT

Whatever sector you're in, your business can benefit — in all kinds of ways. Connecting your products or the assets around your operations can help you generate new revenue streams, build closer relationships with your customers, cut costs, improve safety, reduce downtime, improve sustainability, and make better decisions every minute of every day.

Businesses around the world are recognising the potential that IoT offers them. In fact, 85% of companies we spoke to agreed IoT will be “critical” for the future success of any organisation in their sector.¹

But if you're just beginning to explore the fast-moving world of IoT, what's the first step?

This document gives you a look at some of the most important IoT applications in nine areas: automotive and transport (including logistics), healthcare, industrial and manufacturing, insurance, retail, smart buildings, smart cities, utilities and agriculture. To help you appreciate what's possible, we've included details and case studies on a range of applications that are delivering businesses the most impact and the quickest return on investment (ROI).

What is the Internet of Things?

IoT technologies make it possible to connect assets of all kinds — everything from industrial machinery to heart monitors, streetlights to cars. These assets are equipped with sensors that monitor their environment, and with a network connection so they can communicate. Businesses can use IoT to gather data about what's happening in their operations in real time, supporting decision making.

Retail

With digital signage, stores can offer products tailored to their customers' shopping baskets, or even the weather outside. **Discover more about how IoT is revolutionising the in-store experience.**

Automotive and transport

Connected cars, buses and trucks are ushering in new value-added services for consumers and drivers. **See how IoT is changing the automotive ecosystem.**

1. Vodafone IoT Barometer 2017/18

Utilities

IoT helps utilities companies balance supply and demand, improve customer service and drive operational efficiencies.

Read how IoT is transforming the utilities sector.



Smart buildings

Connected buildings can create a smarter working environment for staff, improve efficiencies and help building owners protect their assets. **Learn how smart buildings are transforming how we live and work.**



Healthcare

IoT technology is changing the way healthcare is delivered. **See how the health sector is using IoT to improve patients' lives.**



Agriculture

IoT sensors and devices are helping farmers boost yields, lower costs and inform decisions. **Learn how the data IoT devices collect is transforming agriculture.**



Smart cities

Smart infrastructure gives city councils granular control over things like street lights to optimise energy efficiency and simplify maintenance. **Learn how IoT is making our cities more attractive places to live.**



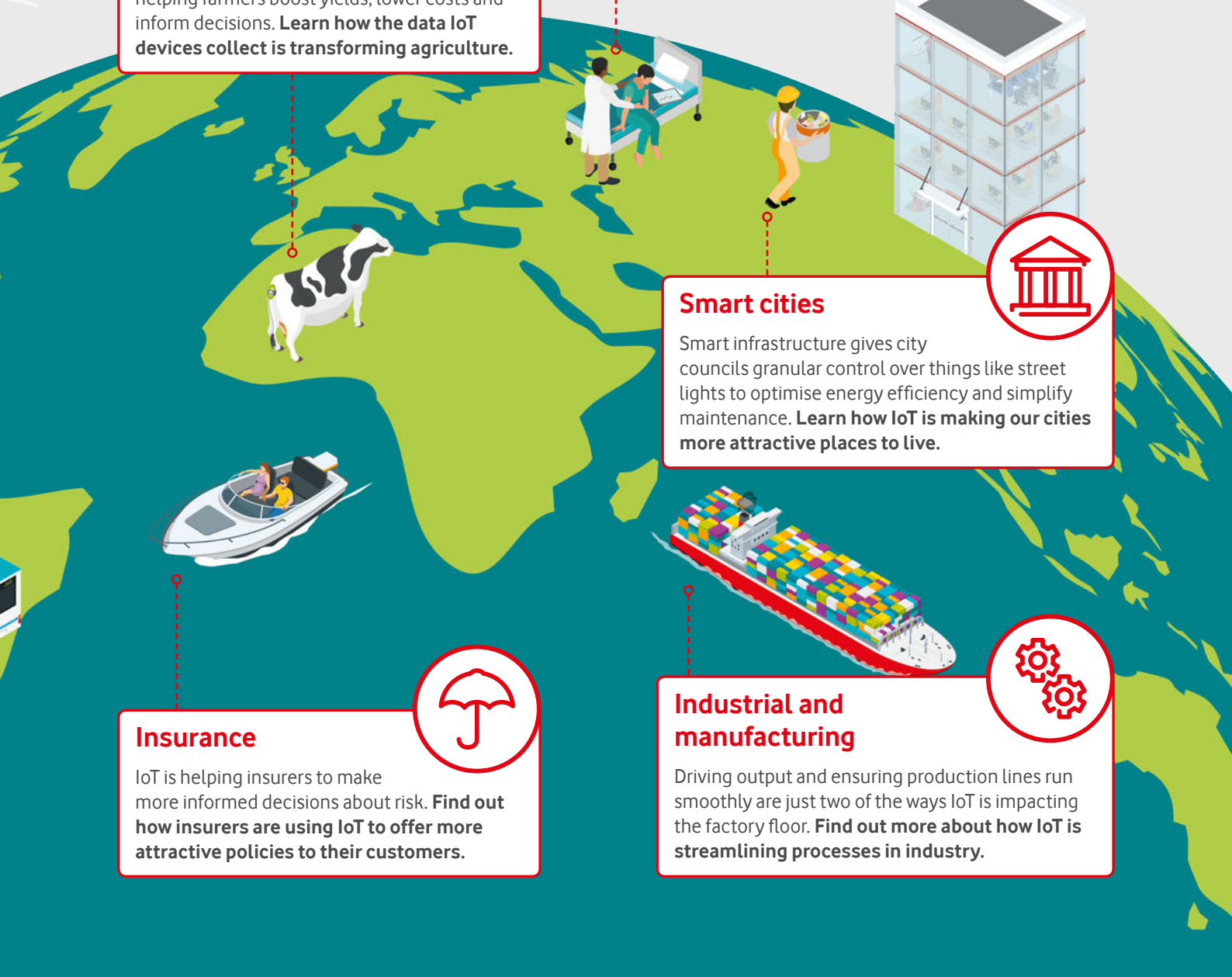
Insurance

IoT is helping insurers to make more informed decisions about risk. **Find out how insurers are using IoT to offer more attractive policies to their customers.**



Industrial and manufacturing

Driving output and ensuring production lines run smoothly are just two of the ways IoT is impacting the factory floor. **Find out more about how IoT is streamlining processes in industry.**



Automotive and transport

The connected vehicle is the most important automotive innovation in a generation. But we're also seeing an overhaul of the entire automotive ecosystem that's changing the way we think about transport.

Connected cars

For today's drivers, IoT connected vehicle features like navigation and in-car Wi-Fi are at the top of the wishlist. And for manufacturers, connected cars are an unmissable opportunity to create deeper, more profitable relationships with these customers.

The connected vehicle encompasses many different value-added services — for instance, monthly infotainment subscriptions, maintenance alerts that push drivers back to the dealership, and stolen vehicle recovery. And demand for these vehicles isn't likely to stop growing any time soon. It's estimated that over 380 million connected cars will be on the road by 2021.²

To learn more about how IoT is reshaping the automotive industry, read our white paper "Connected, Automated, Shared".



Commercial fleet management

Commercial fleet operators — whether they're running company cars, delivery vans, buses, taxis or trucks — are being squeezed from all sides by driver shortages, high running costs and increased customer expectations.

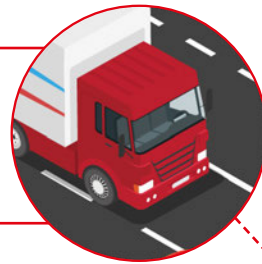
By adopting an IoT fleet management system that tracks how and where vehicles are being driven, operators can improve vehicle and driver utilisation, prevent breakdowns and theft, reduce accidents and insurance premiums, cut running costs through route optimisation, and even improve customer service by giving the public better access to travel information.

Usage-based insurance

Usage-based insurance (UBI) is creating the potential for manufacturers to build relationships with insurers to offer drivers a more complete service. Find out more in our [Insurance section](#).

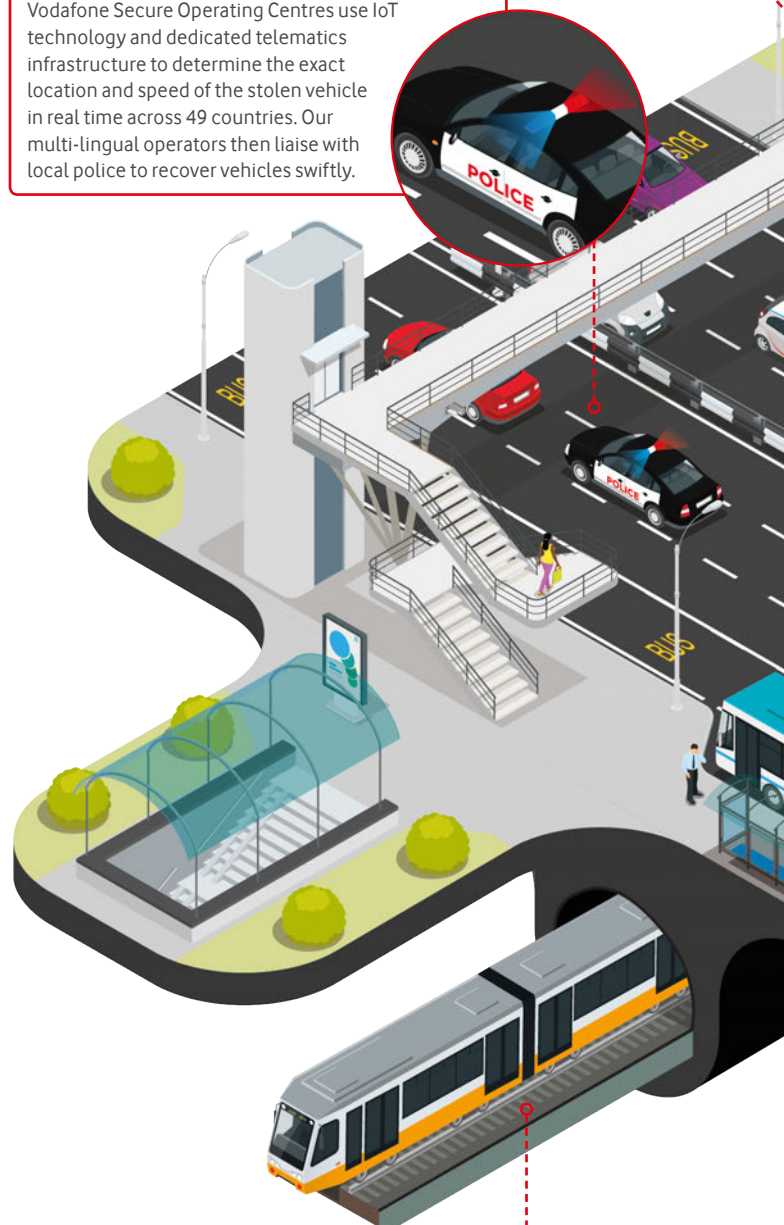
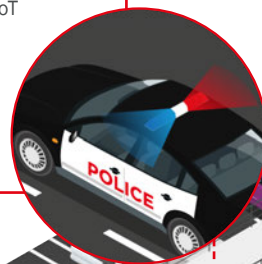
Tracking fleet vehicles

Vodafone fleet telematics enables car rental and leasing companies to track the whereabouts of their vehicles — and ensure they're being driven with care.



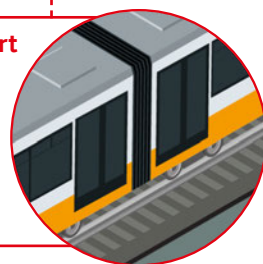
Recovering stolen vehicles

Vodafone Secure Operating Centres use IoT technology and dedicated telematics infrastructure to determine the exact location and speed of the stolen vehicle in real time across 49 countries. Our multi-lingual operators then liaise with local police to recover vehicles swiftly.



Providing connectivity on public transport

IoT technology enables public transport providers to manage and secure their vehicles more effectively. And they can also offer Wi-Fi on the go. Passengers' expectations to be able to consume media anywhere is met — and service providers can sell advertising space on their free Wi-Fi.



2. <http://uk.businessinsider.com/connected-car-forecasts-top-manufacturers-leading-car-makers-2015-3>

Pricing according to service

In the new "car as a service" era, PON, the Dutch distributor of Porsche, has launched its 'Share a Porsche' initiative. Developed with Vodafone Automotive, the scheme uses Vodafone's telematics solutions and IoT connectivity to enable a group of friends to share one of Porsche's luxury vehicles at a fixed monthly rate.



Keeping drivers informed

Porsche's Car Connect service, developed by Vodafone Automotive, enables customers to access and control their Porsche wherever they are and at any time. The solution provides safety, security and vehicle management; from journey information, to protecting from theft or loss. The solution also assists customers in case of emergency, thanks to the crash deployment alert which is transmitted to Vodafone's Secure Operating Centres.



Providing internet in vehicles

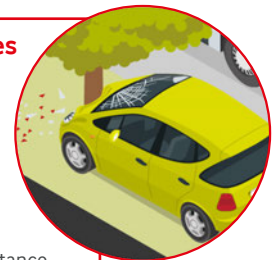
Vodafone remote hubs are a convenient and secure way to deliver Wi-Fi and streaming media for passengers. The IoT-enabled hubs run as full web servers, enabling businesses to add functionality such as GPS tracking and video on-demand.



Improving accident response times

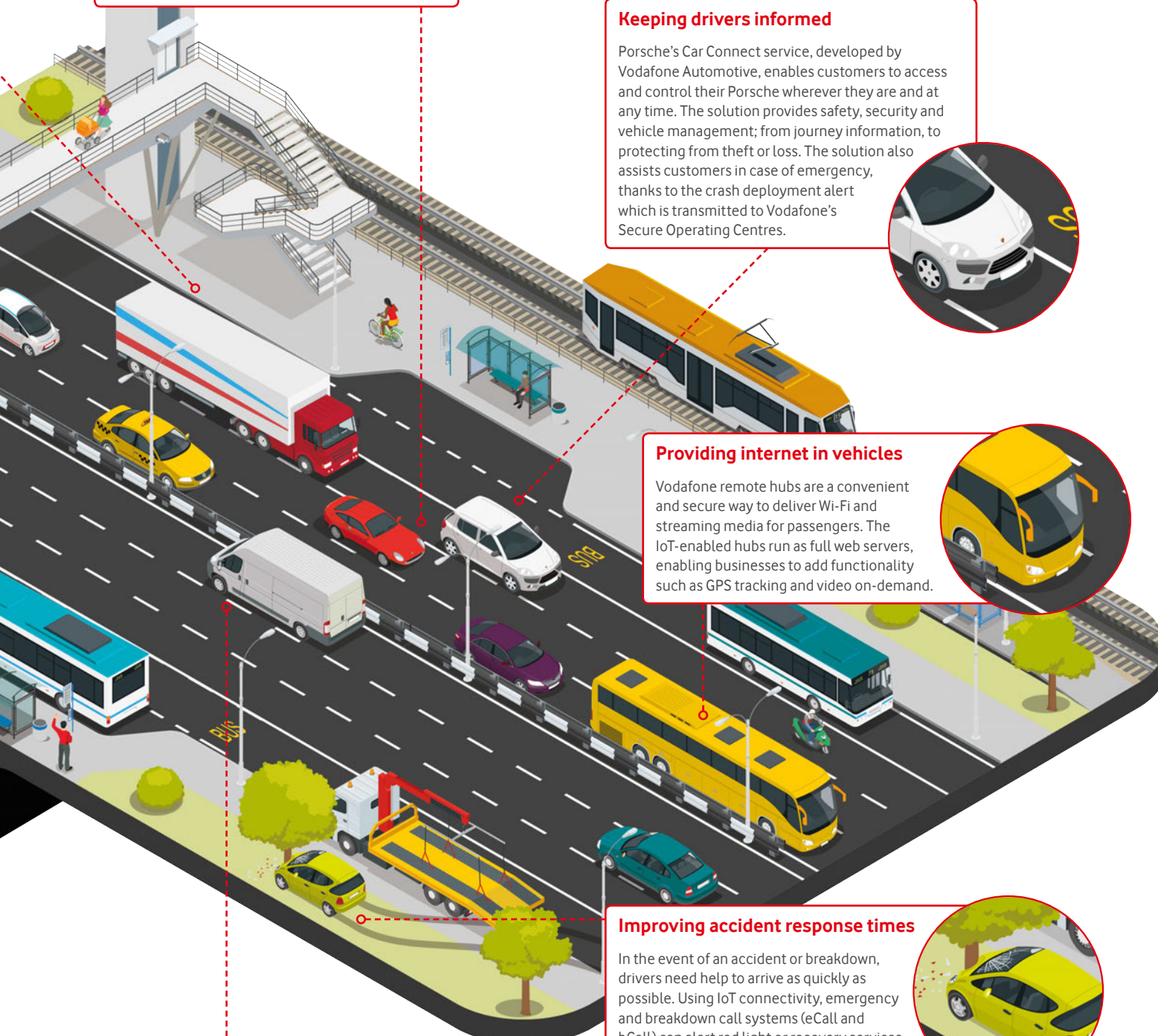
In the event of an accident or breakdown, drivers need help to arrive as quickly as possible. Using IoT connectivity, emergency and breakdown call systems (eCall and bCall) can alert red light or recovery services automatically.

IMA Italia Assistance monitors roadside assistance operations in real time across the Italian motorway network thanks to Vodafone IoT.



Reducing road accidents

NanoDriving uses Vodafone IoT technology to power its camera-based driver monitoring service. One firm with a fleet of 1,000 vehicles saw accidents drop by half within 12 months.



Healthcare

IoT is transforming the healthcare sector. By connecting medical devices and sensors, IoT enables patients to receive more personalised care and live more independently. It's also improving the effectiveness of clinical trials and ensuring cold chain integrity.

Connecting medical devices

Using IoT-powered mHealth solutions, medical staff can remotely monitor, consult with and even treat patients, avoiding the need for the sick and infirm to travel to a hospital or clinic. This not only results in better care through more accurate data collection, but also lower costs and better utilisation of limited clinical resources — vital in a world with an ageing population and more chronic conditions to manage.

Independent living

IoT is helping vulnerable people live more independently in their own homes for longer, without the need for round-the-clock care. IoT-enabled wearables and sensors allow families and carers to keep an eye on their relatives, for instance locating them should they get lost, or raising the alarm if a person suffers a fall. Connected medicine cabinets can even remind patients to take medication.

Connected devices are also helping tackle the isolation and loneliness that immobile patients can suffer. Norwegian company No Isolation is addressing this issue with the AV1 robot equipped with a camera, microphone and speaker — enabling children with long-term illnesses to stay connected to their friends and classmates.

Clinical trials

IoT-enabled applications are already aiding in the research and development of new drugs and treatments, allowing clinicians to remotely collect and continuously monitor trial data, enabling deeper insight and faster reallocation of resources.

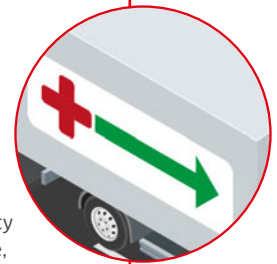
Supply chain

Tracking devices and sensors in containers can naturally help prevent loss and theft. But just as importantly, they enable organisations to prove the authenticity of shipments to tackle counterfeiting, and make it easy to verify the condition of delicate stock. For example, it's possible to show that the correct temperature has been maintained throughout the cold chain — providing evidence of compliance with industry regulations.

Transforming cold chain management

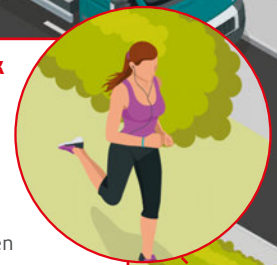
Any hospital or pharmaceutical company knows the importance of proper drug storage. Using IoT you can track shipments of medication end to end, verifying that drugs are stored at the correct temperature and waste is kept to a minimum.

With Vodafone's Managed IoT Connectivity Platform, ASD Healthcare has the reliable, global connectivity it needs to support its IoT-enabled refrigeration solution across the world.



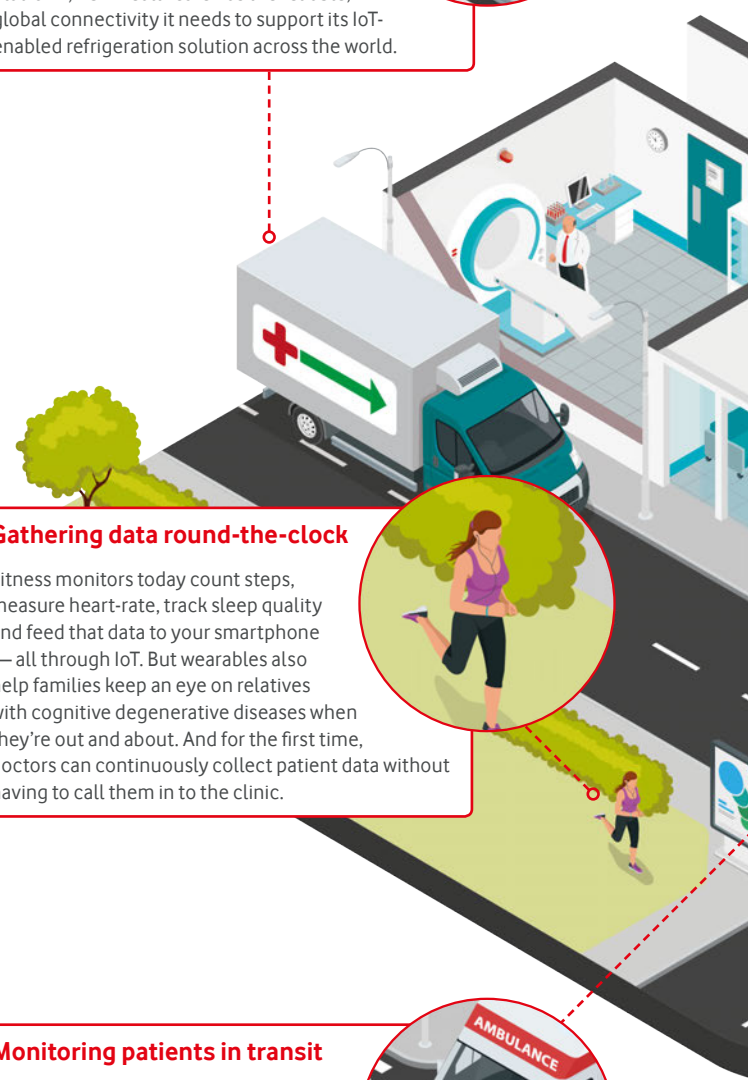
Gathering data round-the-clock

Fitness monitors today count steps, measure heart-rate, track sleep quality and feed that data to your smartphone — all through IoT. But wearables also help families keep an eye on relatives with cognitive degenerative diseases when they're out and about. And for the first time, doctors can continuously collect patient data without having to call them in to the clinic.



Monitoring patients in transit

Paramedics are using IoT to wirelessly transfer critical patient evaluations to the hospital ahead of arrival, helping to ease the transfer from ambulance to emergency room.



Ensuring emergency equipment is in prime condition

Battery-powered defibrillators can save lives in the event of a sudden cardiac arrest. Medic Assist's IoT-enabled defibrillator constantly monitors the status of the device, sending alerts in case of failure. This ensures its devices are in prime condition should they be needed.



Keeping blood sugars under control

Diabetacare's IoT-enabled glucometer is helping thousands of diabetics to manage their condition. The connected meter helps doctors track patients' blood-sugar levels remotely. Controlling blood-sugar levels is key to reducing the long-term health risks associated with diabetes.



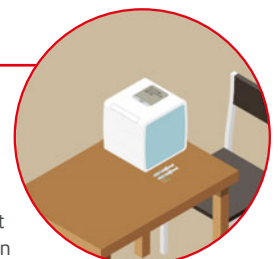
Helping vulnerable people live independently

Healthcare doesn't have to mean hospital. Thanks to IoT-powered sensors, family members and carers can accurately monitor long-term illnesses. They can also receive alerts of any unusual activity, such as lights left on overnight or signs of a fall, so vulnerable patients can continue living in their own home and maintain their independence.



Encouraging patients to take medication on time

HealthBeacon's unique connected sharps disposal system uses Vodafone IoT technology to help with medical adherence: it reminds patients to take injectable medication at the same time every day, helping them to build up a routine and better manage their condition. This topic is covered in greater depth in our white paper, *The Missing Link in Healthcare*.



Industrial and manufacturing

From the factory to the warehouse, IoT can cut downtime, improve safety and speed up your supply chain.

Smart factory

On the factory floor, time is money — that's why utilisation is so important. IoT enables manufacturers of all kinds to drive output and product quality up. Sensors embedded in production line machinery can identify impending parts failure, enabling maintenance to be scheduled without unplanned downtime. IoT can track stock levels, alert to any delays in inbound parts or materials shipments, and help orchestrate production to minimise delays and waste.

Supply chain automation

Tracking vehicles, shipping containers and pallets as they move from suppliers through manufacturing to distributors and retailers delivers a host of benefits. It enables manufacturers to tackle loss and theft, give customers more accurate delivery estimates and recover stolen assets. The end result is reduced waste and a better customer experience.

Site safety and security

Factories and warehouses can be dangerous places. IoT can help manufacturers fulfil their duty of care to keep employees and visitors safe. Connected monitors worn by staff can automatically alert managers to falls or other accidents and guide first responders to precisely the right location. IoT-enabled cameras can be fitted anywhere around a site without the need for a power source and give an instant view of any hazardous areas, as well as raising the alarm in the event of a break-in, fire or flood, thereby lowering insurance premiums.

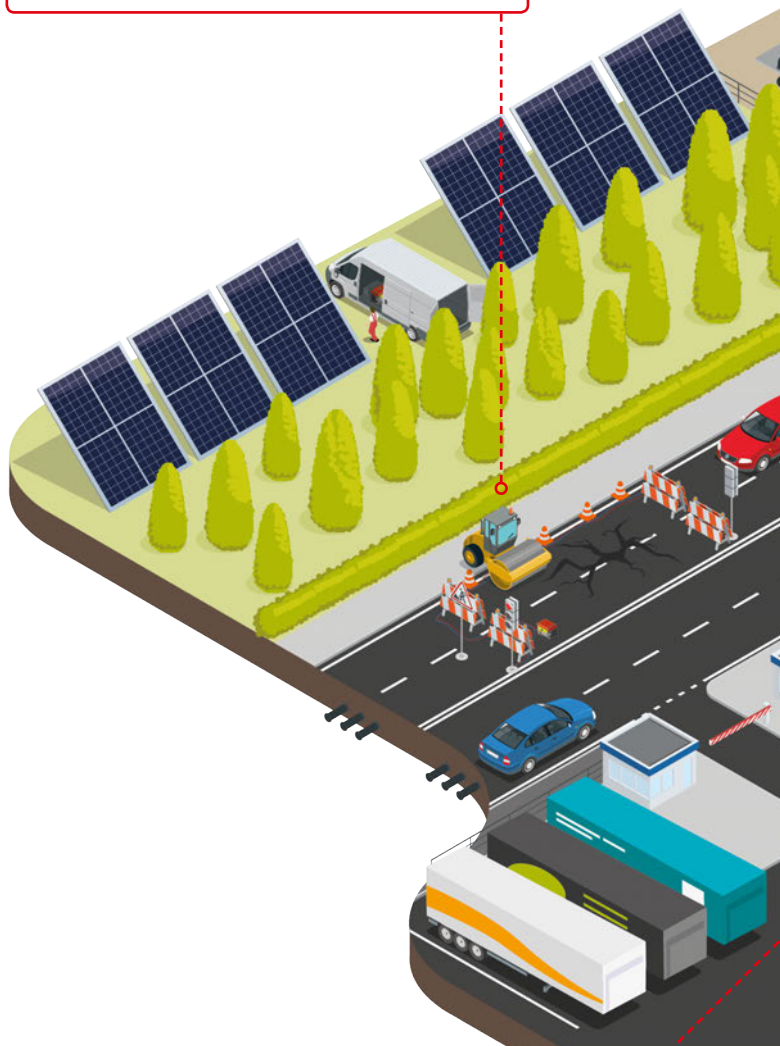
Connected products

IoT doesn't just help improve operations. Manufacturers can build connectivity into products themselves, enabling new features that improve the customer experience, supporting over-the-air updates to reduce the need for costly recalls, and gathering data about real-world usage that can guide future product development.

More dramatically, IoT enables manufacturers to move beyond selling products at all. Using IoT, manufacturers can shift to offering business outcomes as a service, with the price based on metered usage: a concept called servitisation. For customers looking to shift from capex to opex, as-a-service models are incredibly attractive.

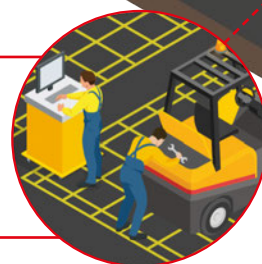
Introducing servitisation

IoT has the potential to transform the manufacturing business model. Instead of making a one-off sale, manufacturers can offer their products as pay-as-you-use services, delivering long-term, predictable revenue and forging stronger customer relationships. Karcher is doing that today — it uses Vodafone's IoT services to offer a fleet management solution for professional cleaning services.



Improving customer engagement

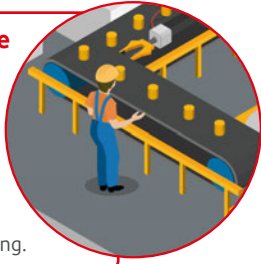
Nearly three quarters of UK manufacturers (74%) say servitisation would help them satisfy their customers' requirements.³



3. www.barclayscorporate.com/content/dam/corppublic/corporate/Documents/Industry-expertise/annual-manufacturing-report-2017.pdf

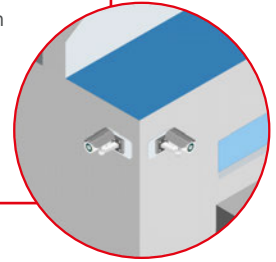
Minimising equipment downtime

With Vodafone's service, Feintool can measure the condition of equipment it deploys on customer sites and give early warning signals about potential failures. Customers heavily rely on this equipment, and as a result can better plan for downtime and skip unnecessary servicing.



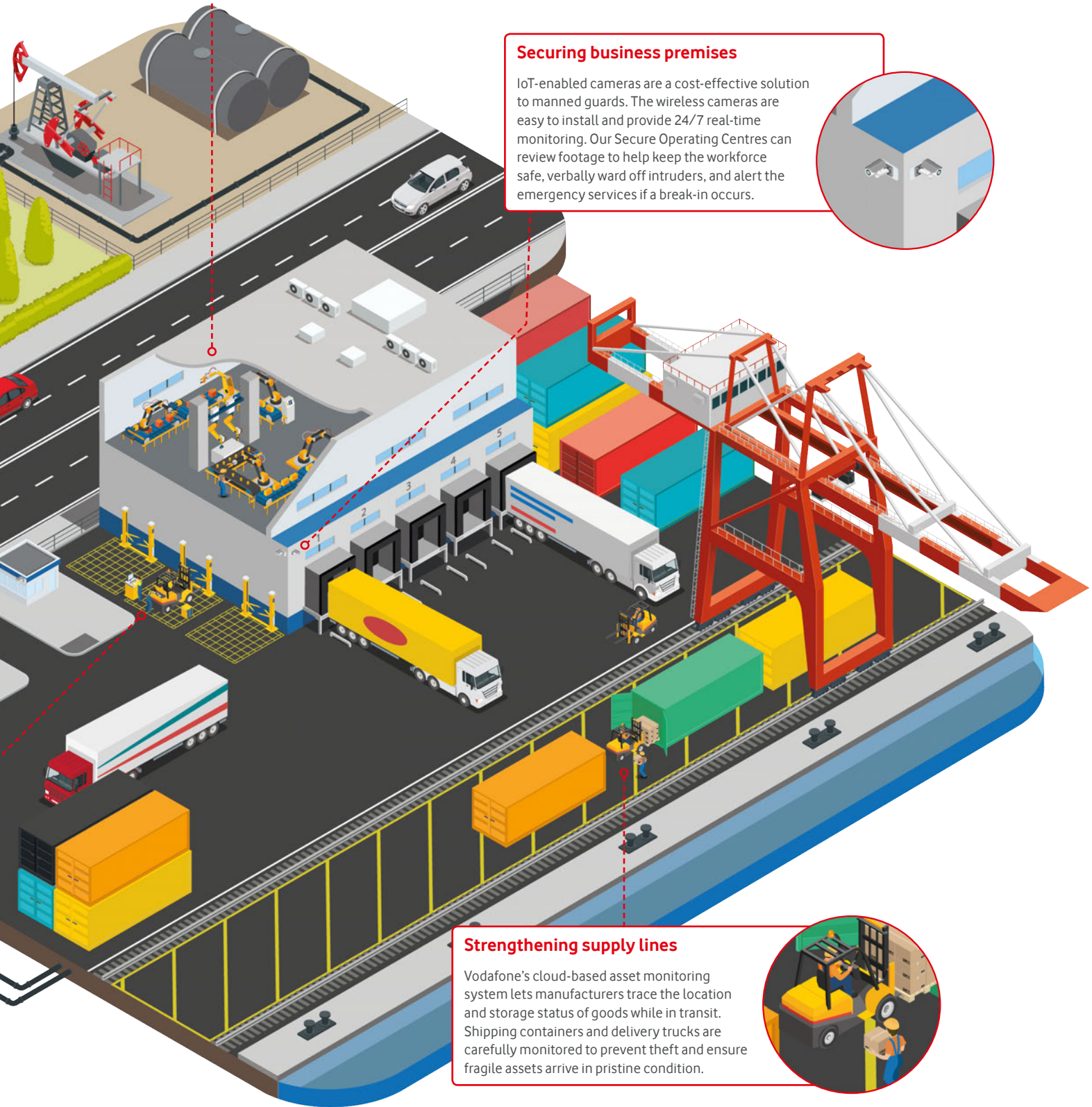
Securing business premises

IoT-enabled cameras are a cost-effective solution to manned guards. The wireless cameras are easy to install and provide 24/7 real-time monitoring. Our Secure Operating Centres can review footage to help keep the workforce safe, verbally ward off intruders, and alert the emergency services if a break-in occurs.



Strengthening supply lines

Vodafone's cloud-based asset monitoring system lets manufacturers trace the location and storage status of goods while in transit. Shipping containers and delivery trucks are carefully monitored to prevent theft and ensure fragile assets arrive in pristine condition.



Insurance

IoT is already transforming automotive insurance. And it's set to expand to other industries — having a similar impact for home, contents and health insurance. In the future, insurers will be the single touchpoint to monitor and manage customers' risk — and all this data will feed into a single portal.

Car

Usage-based insurance (UBI) is taking off for cars: analysts expect nearly 50% of the world's vehicles to be covered by a usage-based policy by 2030.⁴ And that's no surprise given the potential benefits. Customers — particularly younger drivers — get an affordable policy that rewards them for good driving and puts them in control. Insurance used to be an annual process, but with the help of IoT it's becoming a more flexible, usage-based experience.

Home

IoT in the home doesn't just mean digital assistants and smart fridges — it's making homes safer, more secure places. Remote real-time video surveillance can alert homeowners and police to possible break-ins — and provide evidence in the event of vandalism. IoT-enabled temperature sensors provide fast alerts in the event of a fire. And flood detection systems mean leaks can be detected even if there's no one at home.

All of this reduces risks for insurers, meaning they can offer more competitive cover, tailored policies and lower premiums for homeowners. And the cost of in-home connectivity could be split with partnering utilities companies investing in smart meter rollouts.

Contents

Contents insurance can vary widely — covering anything from jewellery to bikes. And some of these items are at a high risk of being stolen. Discrete IoT devices can be installed in belongings such as TVs or boats so customers can track their location and have a higher chance of recovering stolen items. This is enabling insurers to offer more competitive rates without shouldering any additional risk.

Health

Many people already have wearable IoT devices that they use to track their fitness. These can monitor exercise levels, blood pressure and heart rate, for example. They're now increasingly being used by healthcare providers to remotely monitor patients with long-term illnesses. The data these devices gather is helping reduce risks for insurers. They have greater scope to tailor policies and can deliver better offerings and services to their customers.

Preparing for any event

IoT sensors can provide early warning that a fire has started in a property or a water pipe has burst. This means action can be taken before major damage is done — mitigating the risks of high claims costs.



Basing premiums on more accurate health data

IoT sensors in wearable devices collect valuable data on policyholders' health and can help accurately monitor long-term illnesses. Information on heart rate and blood pressure, for example, can also help insurers analyse risk more accurately. As a result, they can confidently offer lower premiums and deliver more tailored policies. And these devices could be promoted through partnerships with gyms and corporate employee wellness programmes.

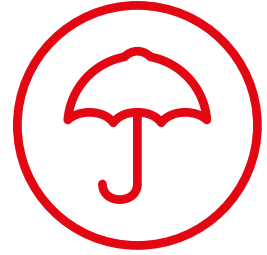


4. www.insurancebusinessmag.com/uk/news/breaking-news/50-of-worlds-vehicles-to-be-insured-with-telematics-by-2030-68705.aspx

Receiving security alerts

IoT-enabled video surveillance cameras can send policyholders alerts when a predefined event happens — for instance when a window is smashed or someone approaches their house at midnight. And emergency services can be called automatically if needed.

The risk of a successful burglary is lowered as a result, and insurers can provide customers with a more tailored, cost-effective contents policy.



Monitoring valuable items

If a valuable item, such as a boat, is installed with IoT sensors, it can tell the owner whether the engine is running or turned off. Policyholders could receive an alert if the vehicle is turned on at an unexpected time, for instance in the middle of the night or when the owner's mobile device isn't near the boat. This can help lower the risk of these valuable possessions being stolen, enabling insurers to offer more competitive premiums and policies.



Encouraging safer driving

Telematics devices can monitor key driving factors, such as speed and braking distance, and real-time driving behaviour.

Vodafone delivers the telematics service for Admiral Insurance, giving it data it can use to deliver safe driving tips, offer rewards and lower premiums for good drivers. And in Germany, Vodafone is working with Württembergische Versicherung to offer personalised policies and improve road safety.



Tracking high-risk possessions

Installing IoT sensors in high-risk items such as bikes allows policyholders to track their location at all times. If an item leaves a predefined perimeter, the owner can be automatically alerted. And all this can be monitored from a mobile app. Access to this data helps insurers better assess risk, and lower premiums as a result.



Retail

Retailers are using IoT to revolutionise the shopping experience by building in-store engagement, enhancing their marketing, monitoring footfall and maximising supply chain visibility.

Today's consumers expect to be able to research a product online, try it out in-store and then purchase it from their mobile. And they expect their whole shopping experience to be consistent and joined up, no matter where it begins or ends. IoT is playing a big role in helping retailers meet these expectations and bring the digital and physical worlds together.

Digital signage

Retailers are competing to connect with customers, by offering more timely and relevant messages. Digital signage enables retailers to deliver regularly updated and personalised content to shoppers, based on the time of day, the weather outside or even the contents of their trolley. And it's delivering tangible benefits — digital signage generates a 32.8% growth in repeat buyers.⁵

Connected devices for staff and customers

IoT is reshaping the shop floor. By equipping sales staff with IoT-connected tablet devices, retailers can make it easy for them to serve customers from anywhere in the store. Sales staff get access to up-to-the-minute information on product availability, shopper history and upcoming offers, as well as instant payments. Customers want instant solutions and exceptional experiences — and this doesn't stop when it comes to trying on clothes. IoT-enabled mirrors are allowing retailers to communicate with their customers and personalise their experience on a new level.

Supply chain tracking

Retailers can benefit from many of the same IoT supply chain systems as manufacturers, enabling them to track the movement of stock from end to end, reducing shrinkage and damage. Pallet tracking reduces the chances of theft and improves the likelihood of recovery. And IoT has further supply chain benefits for retailers — for example, enabling supermarkets to prove the provenance of goods from field to fork or from factory to clothes hanger.

Retailers can extend this connected and automated supply chain right up to the point of sale. Connected cabinets are a new kind of vending machine that can monitor storage conditions and stock levels, ensuring that products, such as beverages, are always stocked and always at the optimum temperature. What's more, in-store IoT gives retailers deeper insight into customer behaviour, enabling them to analyse which displays encourage customers to browse for longer.

Digital mirrors

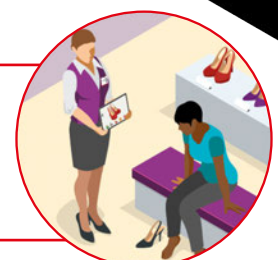
Mango's virtual fitting rooms enable shoppers to request different colours and sizes onscreen, and even see a selection of accessories.

Digital mirrors can also be used for advertising. The Admirr platform, targets customers by delivering messages via displays, which use Vodafone's IoT connectivity to update content as and when needed. Admirr has installed thousands of its IoT-enabled smart mirrors in restaurants, hotels and cafes.



Transforming the shopfloor

Retailers can personalise their customers' shopping experience by providing sales floor staff with IoT connected tablets.

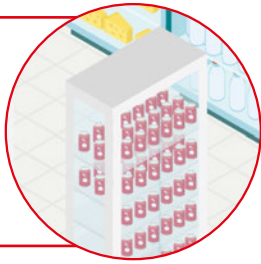


5. www.digitalsignagetoday.com/whitepapers/digital-signage-statistics-infographic/



Enabling better asset control

Vodafone's end-to-end Connected Cabinets solution helps retailers keep an eye on stock levels in vending machines; monitor energy consumption and interior temperature in freezers; and even track customer engagement.



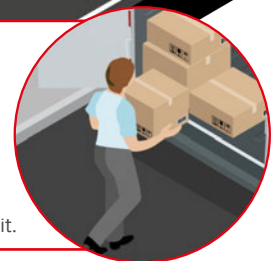
Making digital currencies convenient

Bitcoin services allow people to buy and sell Bitcoin digital currency using the cash machines it manufactures. The cash machines use Vodafone cellular-managed IoT connectivity, which enables them to be installed quickly, and monitored, wherever they're placed.



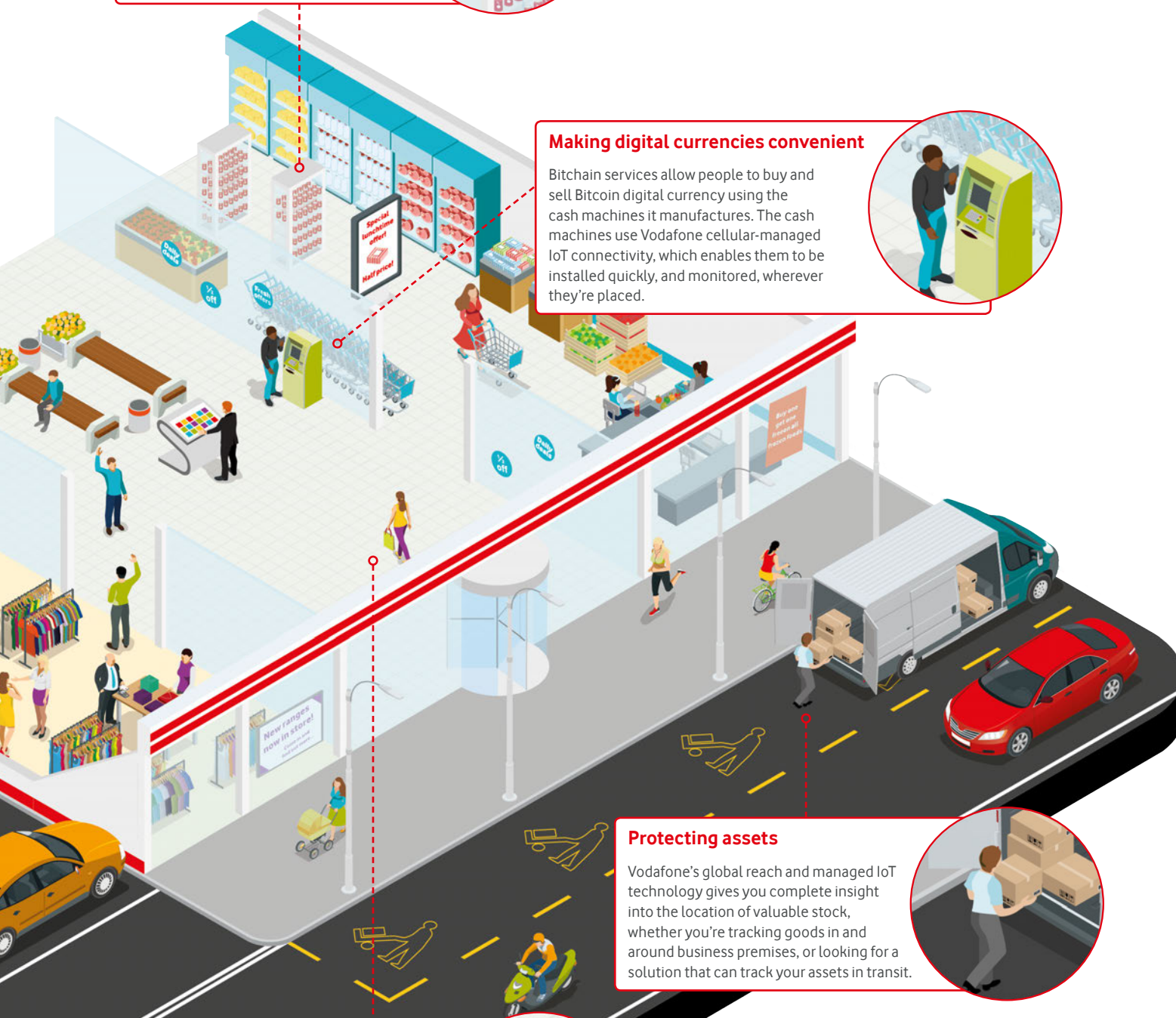
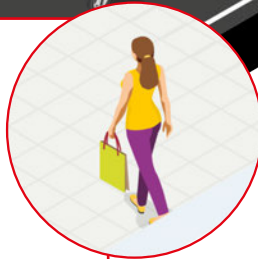
Protecting assets

Vodafone's global reach and managed IoT technology gives you complete insight into the location of valuable stock, whether you're tracking goods in and around business premises, or looking for a solution that can track your assets in transit.



Understanding customer trends

With Vodafone's Digital Buildings, IoT-enabled sensors and cameras measure footfall in real time. This data helps retailers identify customer trends, ensure they've got the optimal number of shop floor staff on duty, and find out which marketing initiatives drive the most customer traffic.



Smart buildings

IoT can help make the buildings in which we live and work more comfortable, efficient and secure.

Smart building systems

Commercial buildings are complex, and keeping systems like elevators, boilers, lighting, air conditioning, and access control functioning smoothly is a labour-intensive task. IoT can connect these systems and monitor their health in real time, enabling the building owner or service provider to manage them more effectively. And they can also help improve building security and give business insight. With Vodafone's Digital Buildings, customers gain a detailed insight into dwell time, footfall and signs of a break-in. And any preventative maintenance can be scheduled without causing disruption to occupants.

In the home, the opportunity is around convenience. Smart home features enable the home to adapt to the occupants' needs: turning on lights, ovens and entertainment systems as the owner walks in the door. Delivering these experiences is a great opportunity for providers to delight their customers.

Energy management

Building systems such as lighting and heating can be incredibly energy intensive, both in the home and in commercial properties. Automating these systems — for instance, turning off lights when a building is empty, or automatically adjusting air-conditioning — can save money and deliver compelling ROI. IoT-enabled energy management tools can sense the environment and follow business rules to govern energy use automatically.

Safety and security

Security cameras, intruder and fire alarms, motion detectors and access controls are an important part of commercial building infrastructure. But these systems are often proprietary, costly and unintelligent. IoT-based surveillance systems, like Vodafone's Digital Buildings, are easier to deploy — even without any power or network cabling — and feature advanced automation features that means they can, in many cases, replace the cost of manned guards.

Safety and security devices are one of the fastest-growing areas of the smart home market, too. These include not only burglar alarms and smoke alarms that alert the homeowner to events even when they're away from the property, but a range of solutions to keep families safe: smart baby monitors, assisted living devices for the infirm, and trackers for pets and children. Creating these products and services is a huge opportunity for manufacturers.

Making energy management easy

Smart meters enable individuals and businesses to increase energy efficiency and reduce bills. Users can see monthly projections, view energy consumption by asset, and even track how much power their solar panels are generating. And this data can help them make more informed decisions about using any spare capacity and allocating resources.



Maintaining elevators efficiently

Kone partnered with Vodafone to create a remote-monitoring solution that improves maintenance and reduces the disruption of service to users. IoT sensors monitor elevator health in real time and send regular reports to service technicians so they can pre-empt downtime.



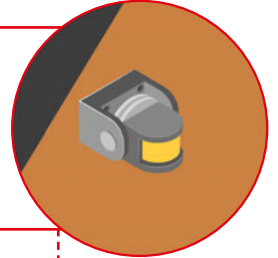
Monitoring the use of office space

Vodafone's Digital Buildings can help organisations analyse how effectively they're making use of their physical space. For example, they can see how many of their desks are in use at any particular time. And they can measure typical footfall through their sites.



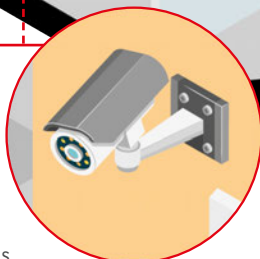
Improving car parking

IoT sensors in parking spaces can see when a space has become free and direct drivers to vacant spots. That means less time wasted driving around car parks, and less frustrated employees and visitors.



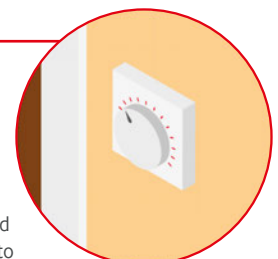
Securing buildings and delivering insight

Smart cameras and alarms send property owners live smartphone updates, wherever they are in the world. Vodafone Digital Buildings provides 24/7 insight into security incidents and critical business factors such as dwell time and footfall.



Transforming the home and workplace

Whether automatically switching off the lights when the last employee leaves the office, or enabling homeowners to turn off their central heating while out and about, IoT gives customers the flexibility to control what goes on at home or in the office remotely.



Smart cities

IoT is the driving force behind the smart cities of the future, but it's also providing the foundation for improving all kinds of public services now.

Connected street lighting

Lighting and maintenance account for as much as a third of council energy budgets.⁶ IoT-enabled street lights, for example, can be set to brighten when cars or pedestrians are nearby and dim when the area is quiet. These intelligent lighting systems also make it easier to identify blown bulbs — this reduces the workload for maintenance crews as repairs can be automatically scheduled when needed. All of this makes it possible to reduce energy use and light pollution, cut carbon emissions and improve citizen safety. And there are other benefits too — the sensors in smart lighting can be used to collect data on air quality, for example, helping you put in place effective environmental measures.

Smart roads and parking

IoT can help solve congestion issues in today's busy urban environments. Using road sensors and digital signage, IoT smart transport systems can route drivers away from congestion in real time. Smart parking can help reduce blackspots too, guiding drivers to the nearest available space — the benefits can be huge, given that nearly a third of commuter traffic comes from drivers looking for parking spaces.⁷ And there's no need to dig up roads to implement the IoT sensors, installation in parking bays or meters is easy.

Using IoT to reduce road congestion can deliver many benefits. As well as improved air quality, the increased availability of parking can drive retail footfall, and it can make your city more attractive to businesses.

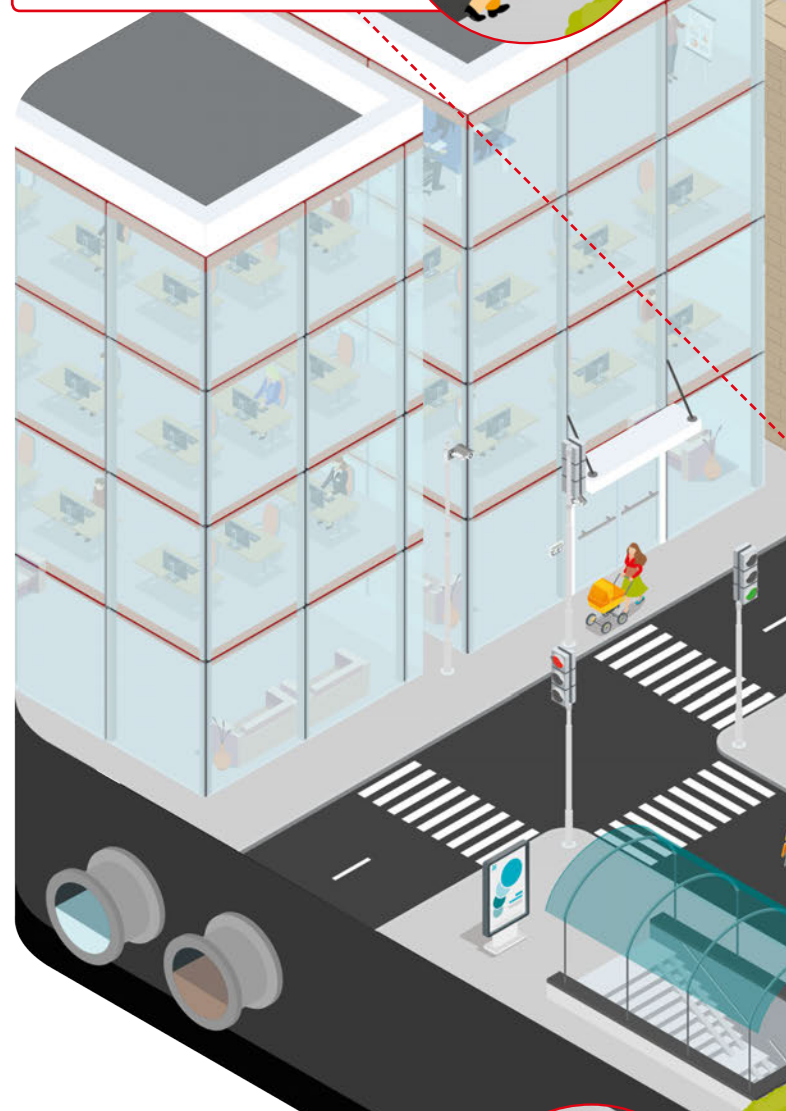
Public safety and crime

IoT can help keep citizens safe from dangers both natural and man-made. IoT connected cameras can be installed easily, even in rural or remote areas, helping detect floods and other threats to public safety, as well as crimes such as fly-tipping. With high-quality footage, night vision and automatic number plate recognition, they can increase the chances of a successful prosecution. Connected devices worn by council workers and law enforcement can help not only guide staff to where they're needed, but give them a way of calling for help in an emergency.

Mobile asset tracking also helps improve public safety — IoT-enabled sensors can pinpoint the location of your high-value, portable assets in real time.

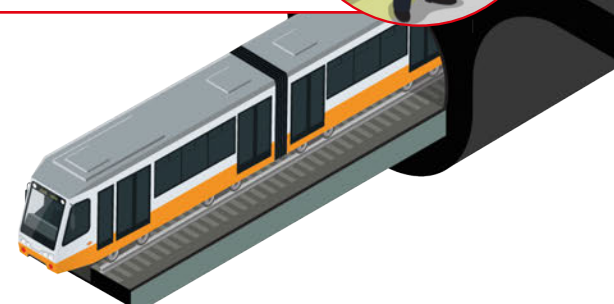
Tackling waste management

Ecube Labs has partnered with Vodafone to create the world's smartest bin. Using IoT technology, it wirelessly communicates fill levels in real time so councils can plan waste management collections more effectively and keep bins from overflowing.



Safeguarding lone workers

Vodafone IoT trackers can ensure lone workers such as police officers or social workers, stay safe in the field. Users can summon help by pressing a panic button or if the device detects a fall. The notification includes GPS data, making it easier for respondents to locate the user.



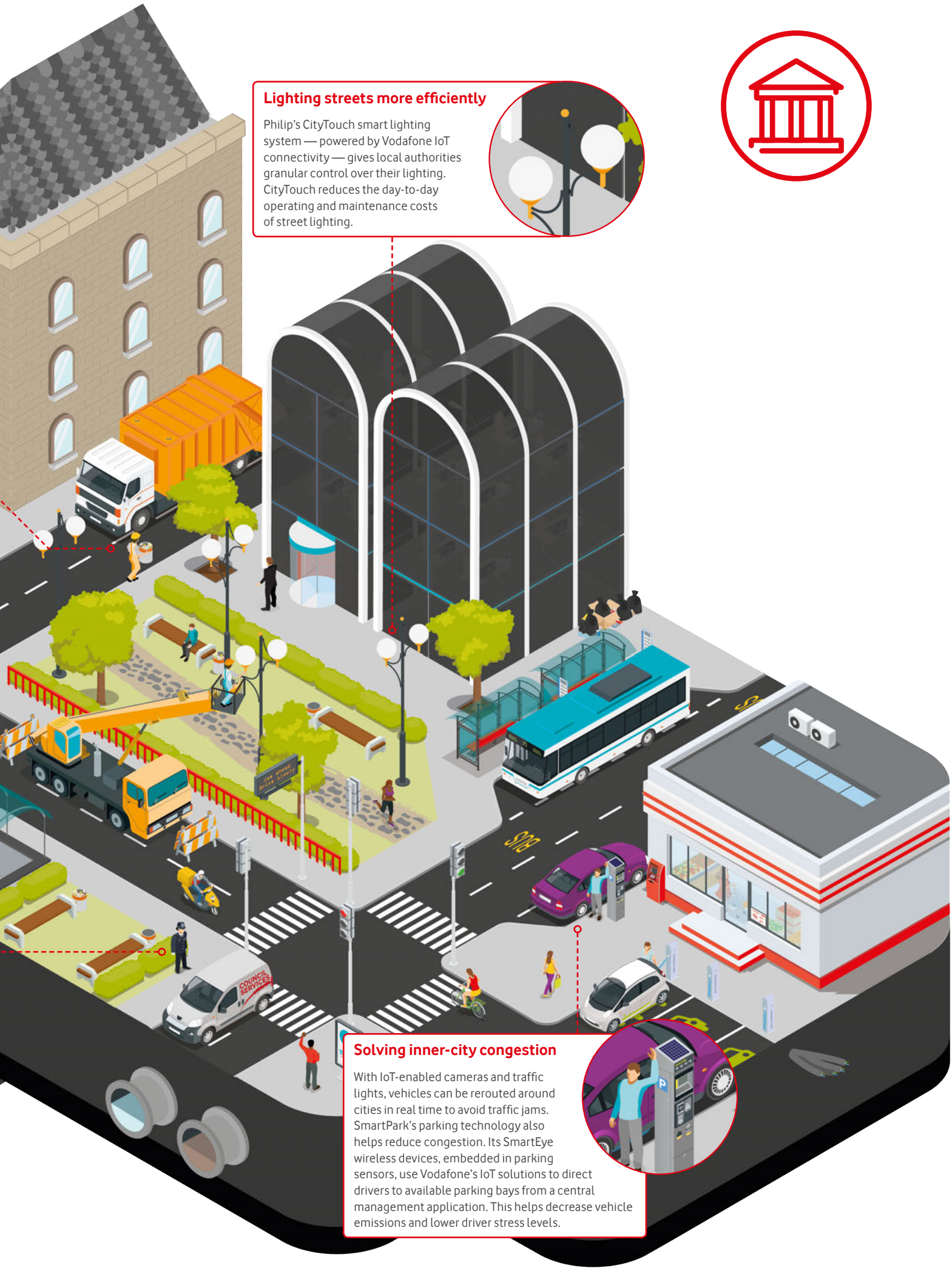
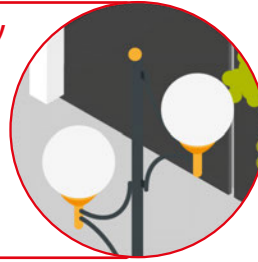
6. www.greeninvestmentbank.com/media/5243/gib-market-report-low-energy-streetlighting-feb-2014-final.pdf

7. www.bbc.com/future/story/20140611-can-we-ever-end-traffic-jams



Lighting streets more efficiently

Philip's CityTouch smart lighting system — powered by Vodafone IoT connectivity — gives local authorities granular control over their lighting. CityTouch reduces the day-to-day operating and maintenance costs of street lighting.



Solving inner-city congestion

With IoT-enabled cameras and traffic lights, vehicles can be rerouted around cities in real time to avoid traffic jams. SmartPark's parking technology also helps reduce congestion. Its SmartEye wireless devices, embedded in parking sensors, use Vodafone's IoT solutions to direct drivers to available parking bays from a central management application. This helps decrease vehicle emissions and lower driver stress levels.



Utilities

Connected devices are pivotal to the future of the utilities sector. IoT is already enabling utilities companies to align supply and demand, secure their infrastructure and enhance customer relationships.

Smart metering

Millions of smart meters are installed in business and residential properties, giving customers accurate bills and saving utilities providers the cost of manual meter reading. Smart meters enable utilities to offer innovative new pricing models and branch out into smart home services. At a grid-wide scale, utility companies can use smart meter data to better align supply and demand and detect problems. The emergence of Low-Power Wide Area (LPWA) technologies, such as Narrowband IoT (NB-IoT), make it economically viable to deploy large numbers of low-cost, long-life sensors.

Infrastructure monitoring

But smart meters are just the start. For water and gas utilities, IoT sensors can help detect and isolate leaks from pipelines and tanks, as well as monitor the health of machinery in pumping stations to enable more efficient maintenance scheduling. Monitoring water quality — for pH levels or contamination — can be done remotely, eliminating the need for manual checks. And the benefits don't stop there. Using IoT to collect data and monitor your assets helps to secure water supplies and keep your people safer.

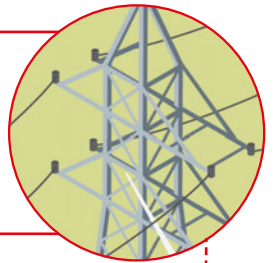
In electricity generation, IoT can monitor the output and condition of wind turbines and solar farms, improving uptime and capacity planning. And in transmission and distribution, smart grid technologies not only provide the kind of real-time monitoring that traditional SCADA systems offer, but also support microgeneration inflows from distributed renewables.

Site security

Many of the most important assets in the utilities industry are located remotely: substations, gasometers and reservoirs, for instance. They're frequently targets for vandals. Smart cameras and connected alarms offer a cost-effective way to improve security and safety at remote sites, without the expense of manned guards. With Vodafone's Digital Buildings, you can predefine events you want to know about — and only get alerts when you need to action something.

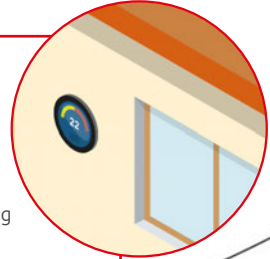
Alerting engineers to risks

IoT-enabled cameras can send remote images of critical infrastructure and provide early warning signs of threats, such as flooding. Images can be viewed centrally, or on engineers' mobile devices as they travel.



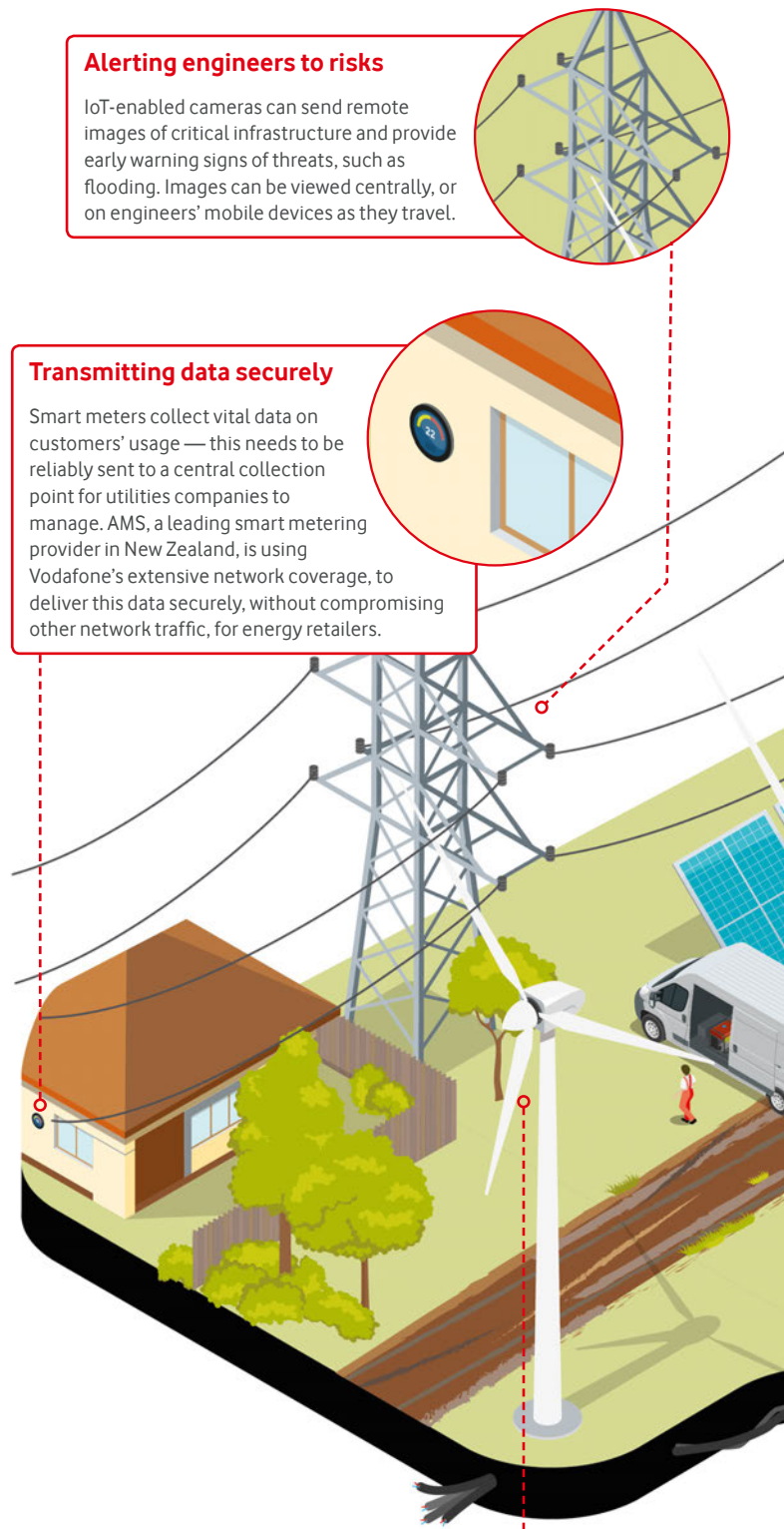
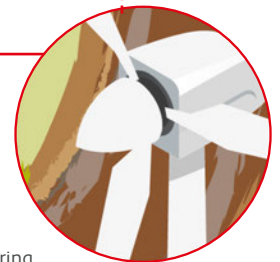
Transmitting data securely

Smart meters collect vital data on customers' usage — this needs to be reliably sent to a central collection point for utilities companies to manage. AMS, a leading smart metering provider in New Zealand, is using Vodafone's extensive network coverage, to deliver this data securely, without compromising other network traffic, for energy retailers.



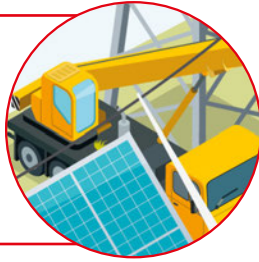
Connecting grid systems

ScottishPower turned to Vodafone for specialist support as it looked to integrate new smart grid technologies from renewable sources such as wind and solar power. Vodafone helps ScottishPower by operating and enhancing remote monitoring data systems across more than 110,000 km of overhead lines and underground cables.



Enhancing fleet management

One international power company chose us to manage a full IoT fleet management service for 1,500 of its cherry-pickers. Our end-to-end solution enabled the company to reduce downtime, cut costs and optimise routine servicing.



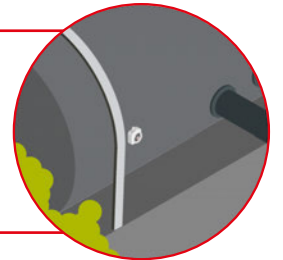
Protecting mobile workers

With mobile WAN, lone workers are always connected in the event of an emergency. Their location can be tracked if they can't communicate. It's even possible to get alerts on their health.



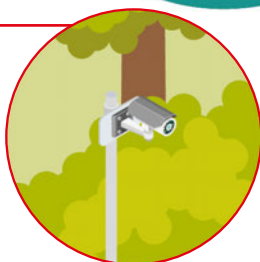
Ensuring high water quality

IoT sensors in rivers and reservoirs detect the levels of pollutants, helping ensure that water is safe to drink. Geo-aware sensors in rivers can pinpoint where pollution is most concentrated.



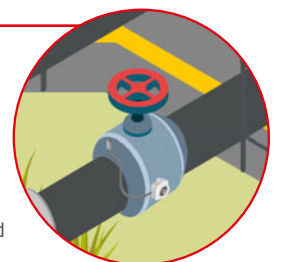
Monitoring remote sites

Vodafone offers the latest smart camera equipment from leading manufacturers with world-class IoT connectivity to secure reservoirs, substations and other remote locations. With Vodafone's Digital Buildings, property owners receive alerts about the events that matter most to them.



Keeping down costs

NB-IoT enables utilities and energy providers such as Aguas de Valencia to connect billions of devices in remote areas at an affordable price. And because the sensors are designed for low power consumption, they can function in the field for over a decade.



Agriculture

IoT is transforming the way farmers collect data on their crops, livestock and machinery — and it's enabling them to make more informed decisions about the future. This is having a significant impact on agricultural efficiencies and yields, and it's giving farmers more control and visibility of their business.

Security

Farmers have expensive equipment, livestock and crops they need to protect from damage and theft — and it can't all be within eyesight at all times. IoT-enabled visual surveillance systems and sensors can keep farm owners informed of any suspicious activity with real-time alerts. And farmers can set criteria so they only get alerted when something noteworthy has happened — not every time a tractor engine starts.

Equipment

If a combine harvester has a major fault or a tractor is stolen from a barn, that season's yield is at risk. IoT sensors and telematics devices in this machinery can monitor and track its location and send notifications to the farm owner if it leaves a predefined perimeter.

Livestock

IoT sensors can be used in a variety of ways to help keep livestock healthier and increase meat and dairy yields. Sensors can collect data to help improve nutrition levels and devices can monitor animals' movements to increase the success of calving. IoT is helping farmers achieve better quality meat and dairy produce.

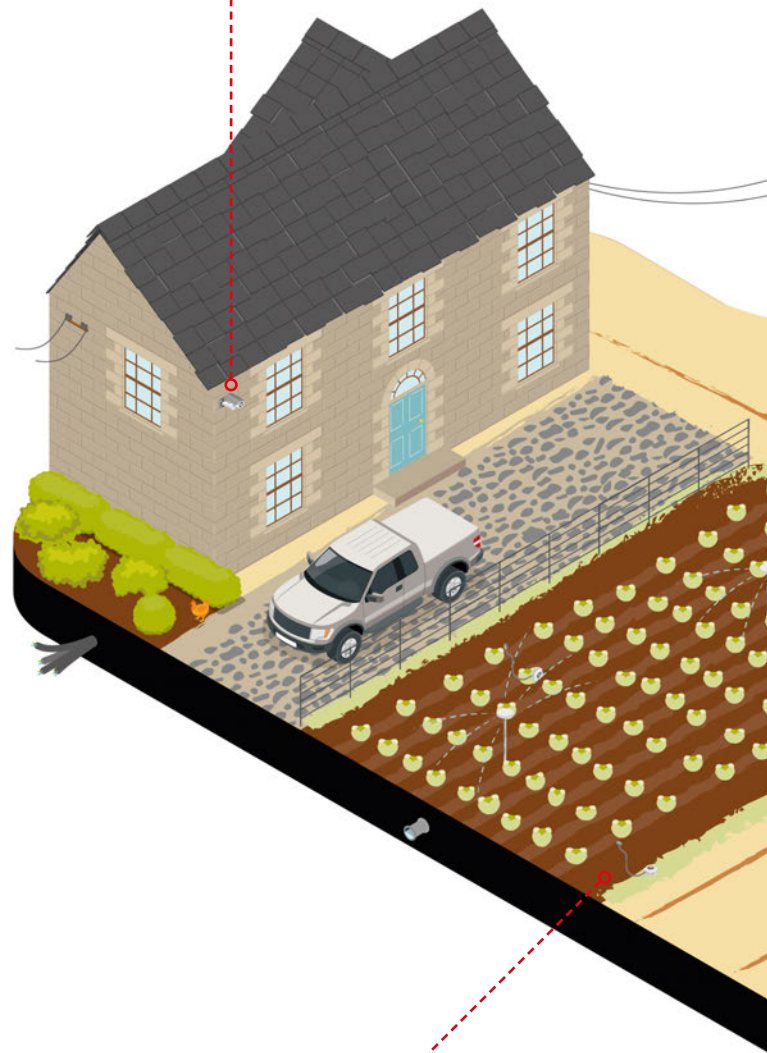
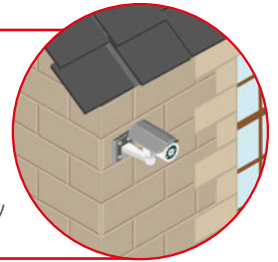
Crops

A heavy storm or prolonged drought can take its toll on a farm's crop yield for years to come. IoT can help farmers make better decisions for future crops by collecting data on key factors such as extreme weather and soil conditions. It can inform their plans for crop rotation, irrigation and harvesting — and increase yields as a result.

NB-IoT is a LPWA network technology that enables sensors to communicate using low bandwidth and low battery power. With its promise of increased network coverage and greater cost efficiency, NB-IoT is opening the door to IoT for farms of all sizes.

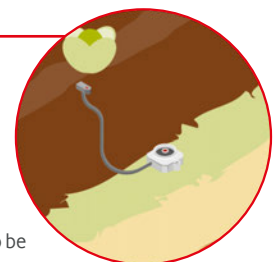
Getting alerts that matter

With Vodafone's Digital Buildings, IoT-enabled cameras can collect data on the comings and goings at any building — no matter how remote. And farmers can set predefined criteria for actionable alerts they want to receive.



Measuring crop data

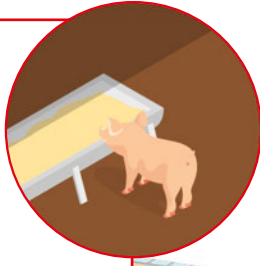
IoT sensors enable farmers to measure soil conditions such as moisture, pH levels and temperature. With NB-IoT, they can do that at scale, with sensors as far as 10 km away from each other. And as the batteries don't need changing for over 10 years, they don't need to be constantly excavated.





Enhancing herd performance

The KEENAN In-Touch system is helping to maximise yields across the globe. The fibre mix it produces is highly digestible. And the IoT-enabled system provides unprecedented levels of data analysis to improve the performance of livestock.



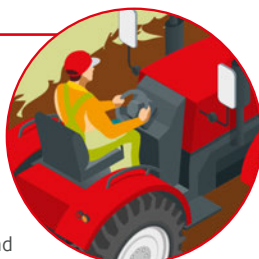
Increasing productivity

Prompt Softech is working with the Indian dairy industry to improve milk yields, through its Automatic Milk Collection System. This solution, powered by Vodafone IoT, weighs and analyses the milk locally, sending the data to a centralised record. This is driving up yields and increasing milk quality across the country.



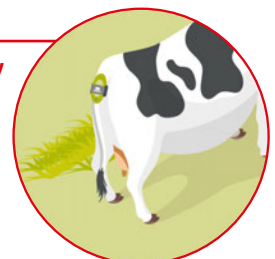
Boosting productivity and protecting assets

With GPS and IoT technology, farmers can not only track down stolen vehicles, they can also track vehicles across their fields and plant seeds with incredible precision — ensuring optimum spacing and depth, and improving yields. And the future of self-driving tractors will mean farmers could raise a crop from sowing to harvest without touching it.



Improving livestock mortality

Calving is a stressful time for farmers, and mortality rates are high. Moocall has developed a remote monitoring IoT device for pregnant cows to target this issue. The sensor detects when a cow is close to labour and alerts the farmer.



Making it happen

The six key elements of any IoT deployment.

1. Connected devices sense their environment

It all starts with the assets — the things that you want to monitor and control. Whether they're small or large, mobile or fixed, in their thousands or a one-off, there's an IoT solution that's right. Equipping these assets with connected sensors gives you the power to monitor their behaviour or environment and communicate any changes you wish to make.

2. Network connectivity carries IoT data

The network is at the heart of the IoT. Without connectivity, you cannot get the information you need. Often, this connectivity takes the form of a SIM card, meaning the IoT device can communicate via high-speed, reliable, cellular networks. But other forms of connectivity, such as satellite, fixed-line or NB-IoT, may suit your needs.

3. Data is held securely in the cloud

IoT devices gather vast amounts of data — so you need to be sure you have a secure place to store it all, and not have to worry about limited capacity. Cloud storage enables you to scale up and down on demand. And you can access it securely from any location.

4. The management platform aggregates data and controls devices

The data generated by your IoT devices is communicated securely to a central platform, hosted in the cloud, that gathers and processes the data, and allows you to manage and monitor your entire IoT estate.

5. Applications use IoT data in business processes

The value of IoT comes from being able to analyse the information you receive and respond automatically and in real time. As a result, your IoT management platform needs to be able to integrate with other business systems — such as ERP, CRM or work scheduling tools.

6. Professional services keep everything running smoothly

IoT solutions can quickly become highly complex, given the number of moving parts. You'll need to plan each stage of your deployment carefully and identify where investments are prioritised. That's where the choice of provider — and their professional services capability — is critical. You'll want an experienced partner, that operates where you do business, understands your industry and knows IoT.



Why Vodafone

IoT projects can be challenging. At Vodafone, we aim to make it easy. Here are three reasons why you should partner with us.

1 Unrivalled IoT experience

Vodafone has more than 1,400 dedicated IoT experts that you can rely on. We've been delivering IoT solutions to our customers for more than 25 years and have 68 million IoT connections.

Vodafone has consistently been recognised for our IoT expertise, by our clients and peers. We've been highly rated by leading industry analysts such as Analysys Mason — and we've been positioned as a Leader in the Gartner Magic Quadrant for Managed Machine-to-Machine Services for four consecutive years.

2 Global networks you can rely on

Vodafone has mobile operations in 26 countries, partners with mobile networks in 55 more, and fixed broadband operations in 17 markets. Vodafone has 465 million mobile customers and 13.7 million fixed broadband customers.

Our scale doesn't just give you the confidence that we operate wherever you do business — it means we can offer the exceptional levels of service you need.

3 The solutions to simplify IoT projects

We have delivered IoT applications for organisations of all sizes and across all industries, so we know how to make your IoT solution deliver maximum value for you.

We partner with the world's leading connected device makers to offer a wide range of out-of-the-box IoT solutions that take the complexity out of IoT deployment.

But even when you need a customised solution, our team of experts will ensure your business takes advantage of best practices and methodologies for IoT implementation to ensure you achieve maximum ROI.

Follow us on:



@VodafoneIoT



Vodafone IoT



IoT adoption has more than doubled since the first Barometer in 2013, and adopters are using it to transform their businesses.

Find out more about what's happening in the world of IoT and how it can help you — no matter where you are on your IoT journey.

www.vodafone.com/business/news-and-insights/white-paper/iotbarometer

To find out more about how Vodafone can help you make the most out of IoT, or to book a free innovation session with one of our IoT experts, contact us at iot@vodafone.com, call us on **07444 325793** or visit www.vodafone.com/iot

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