



Vodafone IoT Barometer 2017/18

A detailed insight into how the Internet of Things is transforming the world of business, and what the future holds.

The future is exciting.

Ready?



With the Barometer entering its fifth year, it seemed like a good time to review how far the Internet of Things (IoT) has come since the first edition — and to look forward to what's in store for the next five years. What we found was adopters are pushing ahead with their plans, with IoT seen as critical to success.

When we first started publishing the Barometer in 2013, IoT was still very much in its infancy — we were still calling it M2M, and adoption was just 12%. Since then, the proportion of companies using it has more than doubled — reaching 29% in 2017. And those that have adopted IoT are pushing ahead at scale, spending more on IoT than 12 months ago. Many have also dramatically increased the number of devices they have connected. The proportion of companies embracing IoT on a massive scale — over 50,000 connected devices — has doubled since 2016.

There's a reason they're expanding projects and investing more: IoT delivers. Nearly all of the companies that have adopted IoT have already seen a return on their investment. Those returns can be significant — where adopters reported an increase in revenue, the average was 19%. And we found that there's a correlation between scale of adoption and return on investment (ROI) achieved. Among those with up to 100 connected devices, 28% are seeing "significant return or benefit"; that rises to 67% of those with over 50,000 connected devices.

Adopters also have great expectations for the future of IoT. The majority think that IoT will have an enormous or sizeable impact on the whole economy in the next five years. And almost three-quarters of adopters agree that digital transformation is impossible without IoT.

New low-power connectivity options, like Narrowband-IoT (NB-IoT), will be key to making that possible. 28% of those that plan to adopt IoT in the future are already investigating Low-Power Wide Area Network (LP-WAN) technologies, with their promise of increased network coverage and greater cost efficiency. That's exciting as we believe it will drive the next wave of IoT adoption. But realising the potential will require more skills than most companies currently have. That's why we've seen adopters increasing their use of partners to deliver and/or manage their IoT solutions.

IoT isn't new anymore. But it's still early days in terms of its potential. So even if you haven't started yet, you could still be an early adopter in your sector, and reap all the benefits that go with that. New tools, technologies and networks are making it easier than ever to build and manage IoT solutions.

Looking back over the five years of the Barometer it's amazing to see how far IoT has come, but I can still honestly say, there's never been a more exciting time to be involved.



Erik Brenneis

Director, Vodafone Internet of Things
and CEO of Vodafone Global Enterprise

If you have any questions about the findings of this year's Barometer — or how you can push forward your own IoT initiatives, please contact us at iot@vodafone.com, or connect with us on Twitter at [@VodafoneIoT](https://twitter.com/VodafoneIoT).



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Defining the Internet of Things

The Barometer is an in-depth global study into how enterprises are using IoT technologies. IoT connects objects, turning them into “intelligent” assets that can communicate with people, applications and each other. It enables things like cars, buildings and machines to communicate about their status and environment.

Other terms include machine-to-machine (M2M), Industrial Internet of Things and Industry 4.0. Often, instead of the technology, people talk about specific applications, such as: smart cities, connected vehicles, smart grid, smart meters, smart homes, connected health and so much more.



The analyst view

This year, Tom Rebbeck of Analysys Mason has provided an additional perspective on the findings of the Barometer. Tom leads Analysys Mason's Enterprise and IoT research practice, drawing on more than 16 years of experience in the telecoms sector.



Executive summary

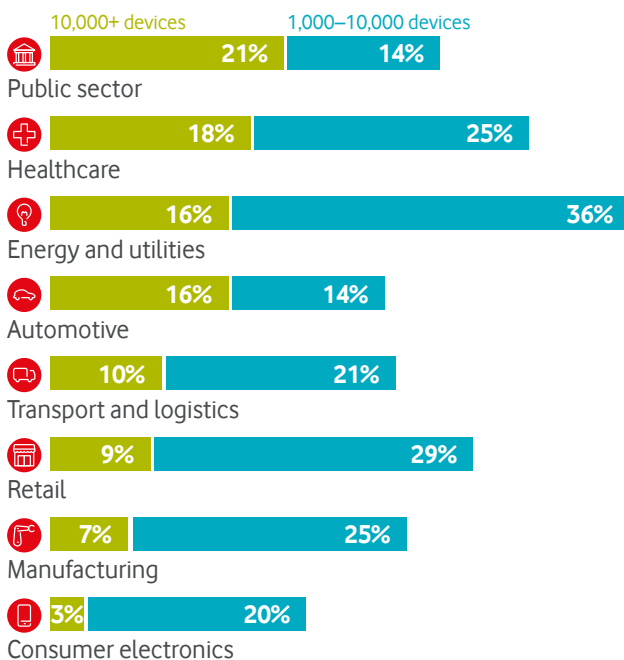
1. State of the market

- **The proportion of companies using IoT (adopters) has more than doubled.** Adoption has risen from 12% in 2013 to 29% in 2017. Transport and logistics (19% to 27%) and retail (20% to 26%) have shown the largest year-on-year gains from 2016.
- **Organisations using IoT are doing more of it.** 84% agree that “Our adoption/use of IoT solutions has grown in the last 12 months.” 12% of adopters now have at least 10,000 connected devices, and the share with over 50,000 connected devices has doubled, from 3% to 6%.
- **The benefits go way beyond cost-cutting.** Adopters are using IoT to cut costs, reduce risk and increase revenue. But the main focus is on increasing efficiency (55% of adopters).
- **Adopters are getting more sophisticated.** They’re embedding IoT within their business processes — 46% have integrated it with core systems, such as enterprise resource planning (ERP).

2. The benefits

- **Those with the most connected devices are seeing the biggest gains.** 95% of adopters said they are achieving tangible benefits from adopting IoT. 28% of those with under 100 devices report a significant return. That goes up to 67% among those with over 50,000 connected devices.
- **Return on investment can be significant.** Where organisations reported an increase in revenue from adopting IoT, it averaged 19%. And where they reported a reduction in costs, the average was 16%.
- **Success is driving increased investment.** 88% of adopters that report seeing significant benefits from IoT say they’re spending more on IoT now than 12 months ago.
- **IoT is enabling new and increased revenue.** More than half (51%) of adopters say IoT is increasing revenue or opening up new revenue streams.
- **IoT is driving business transformation.** 49% of adopters are using IoT in conjunction with analytics to improve business decision-making. 74% agree that digital transformation is impossible without IoT.

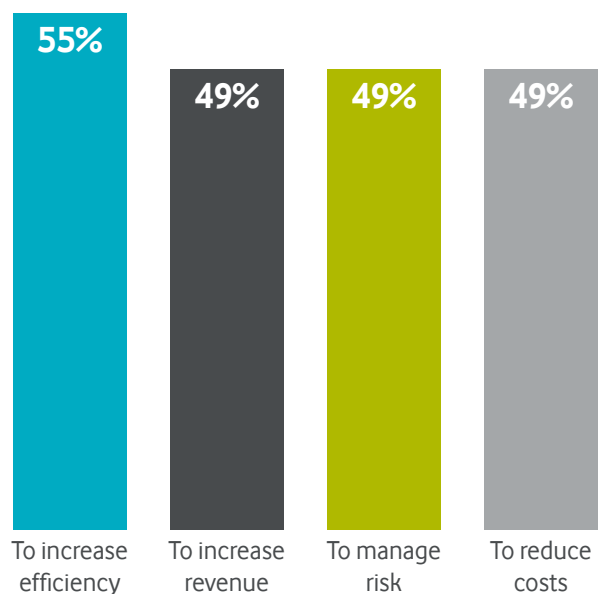
Number of connected devices



Those organisations that have adopted IoT are connecting more devices.



Why adopters are using IoT



Efficiency is the most common reason behind companies using IoT. But it's just one of the benefits.



3. Moving forward

- **Security is still a concern.** It probably won't be a surprise to hear that security remains a worry. But of those with larger IoT programmes — at least 10,000 connected devices — only 7% say security is their top concern. Compare that with 19% for those with smaller programmes. This suggests that the issues are solvable, just not everybody has the expertise and resources to do it, yet.
- **Adopters are looking for partners to fill their skill gaps.** Insufficient resources/skills is the fourth biggest barrier to adoption. 75% of adopters have increased their use of partners to deliver/manage IoT projects.
- **Adopters want connectivity that's secure, reliable and pervasive.** The top considerations when choosing connectivity for IoT projects are security (75% of adopters) and network coverage (74%).
- **New connectivity options could drive the next wave of adoption.** 28% of those considering IoT are looking at LP-WAN, with its promise of greater coverage and cost efficiency. And 40% are investigating 5G.

4. The next five years

- **Adopters have high expectations.** 79% think that IoT will have an enormous or sizeable impact on the whole economy in the next five years. 78% say that about the impact on the competitiveness of individual businesses.
- **IoT will be even more integrated.** 79% of adopters say that in five years, over 50% of business processes will include IoT sensing/control systems.
- **IoT will drive adoption of artificial intelligence (AI).** 79% think that more than half of enterprises will be using AI and machine learning (where computers learn from their own experience) to make sense of IoT data.
- **Concerns about security will have lessened.** 72% of adopters expect security and privacy concerns will be greatly reduced, opening the way for increased use of IoT.
- **Partnerships will flourish.** 80% of adopters think many companies will be collaborating with other companies in the same industry to build joint IoT solutions. 82% think many companies will be collaborating with companies in different industries.

Changing attitudes to IoT

We're more positive about the potential of IoT than we were 12 months ago



The profile of our IoT projects has increased in the last 12 months



IoT is intrinsically linked to analytics, AI and other critical digital initiatives

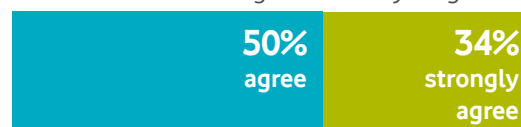


Companies are moving forward with IoT. 67% of adopters say it's already mission-critical.



Opinions on the future of IoT

We're optimistic about the possible business outcomes of connecting almost everything



In five years, over 50% of business processes will include IoT sensing/controls



IoT will be critical for the future success of any organisation in our sector



Where will IoT be in five years? 79% say it will feature in over 50% of all business processes.



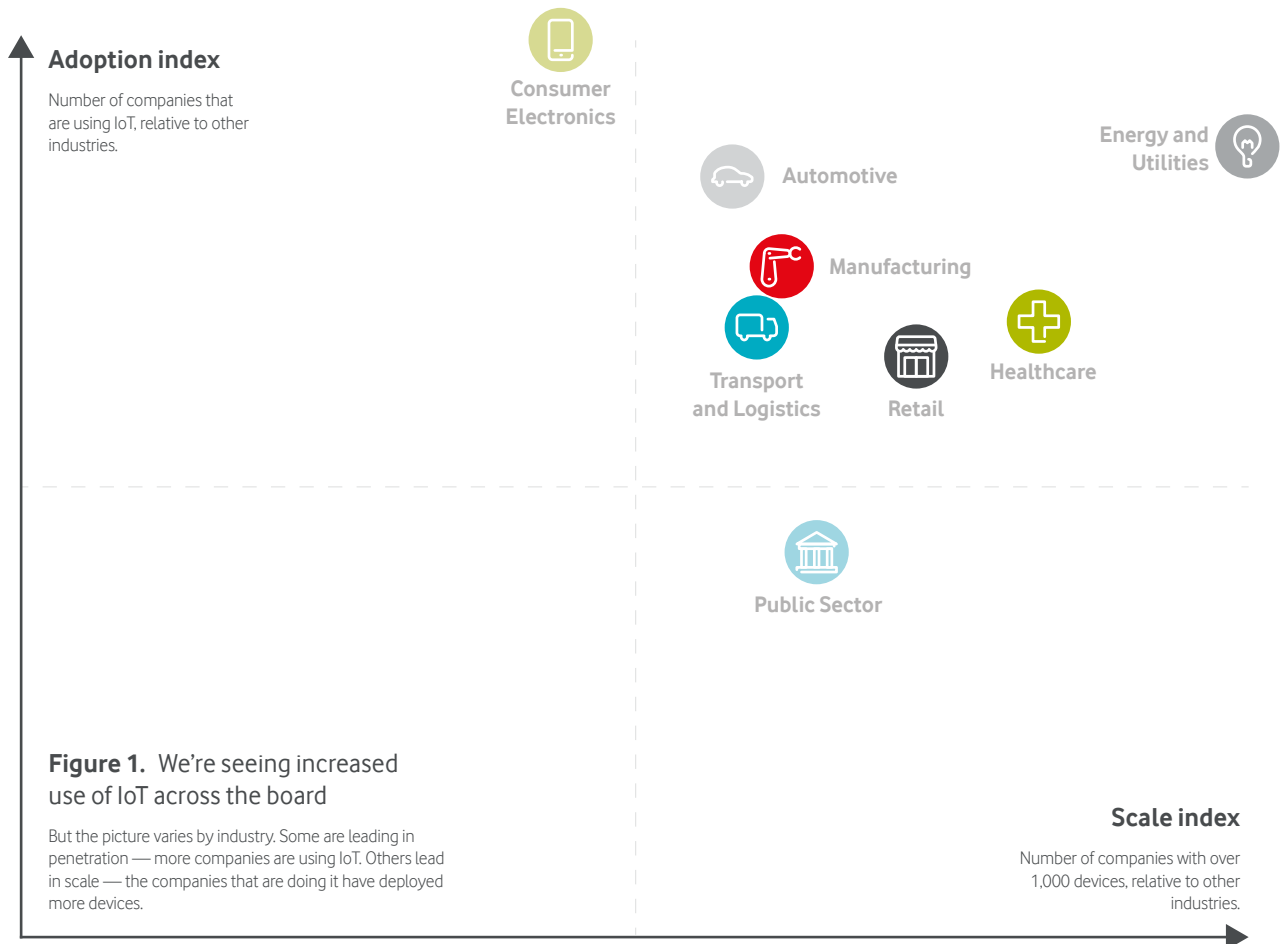
1 State of the market

Organisations that have adopted IoT are increasing their use and integrating it with their core systems.

Those organisations that already have IoT programmes in place are looking to do more of it. And for many, that means integrating IoT with core business systems, like ERP and CRM.

84% of adopters agree that their adoption/use of IoT solutions has grown in the last 12 months.

82% of adopters agree that, “IoT isn’t a standalone technology, it’s intrinsically linked to analytics, artificial intelligence (AI) and other critical digital initiatives.”



Five years of continued growth

Our first Barometer was published in 2013. IoT has come a long way since then. It's gone from niche to mainstream, and typical deployments have gone from hundreds of devices to thousands.



29%

of organisations globally and across all industries have adopted IoT.

Adoption has more than doubled in five years

In 2013, we found that 12% of organisations had already launched IoT (we called it M2M back then) projects. That figure now stands at 29%. But that's not all. As we illustrate later in this report, many adopters have been committing more resources to IoT — increasing their spending and connecting more devices. For many of them, IoT has become critical to how they operate and the services they provide to their customers.

Adoption is up in every industry compared to five years ago. From manufacturing to healthcare, farming to consumer electronics, almost every sector is being impacted by IoT. In the automotive sector, adoption has risen from 19% in 2013 to 34% in 2017. In 2013, we saw 11% adoption in manufacturing and consumer electronics. Today, manufacturing is at 30% and consumer electronics 40%.



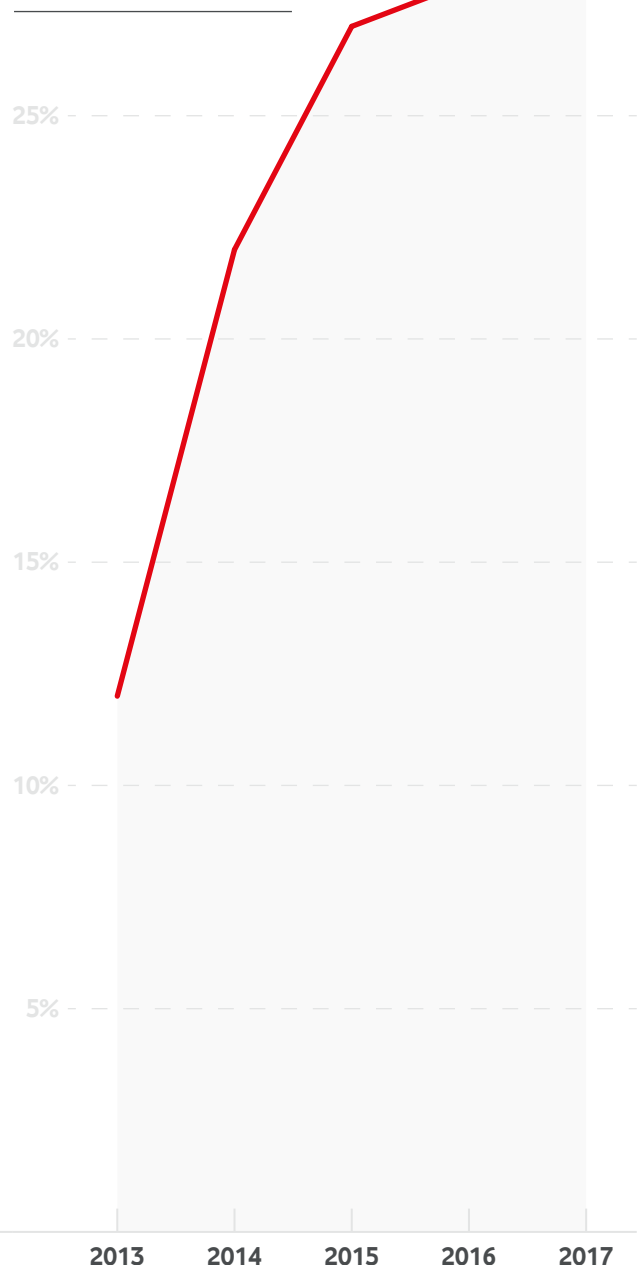
Regional picture: Global progress in IoT adoption

In 2013, adoption in the Americas was 14%. Now it's 27%. Adoption in Europe has increased from 11% to 26% in the same time frame. But it's the Asia-Pacific region that has seen the biggest uplift. In 2013, adoption was 12%, it's now ahead of the pack at 36%.

As the diagram right shows, IoT experienced accelerated growth at the outset. This was driven by large organisations, such as original equipment manufacturers (OEMs), which realised early on that IoT would prove critical to their success. Since then, adoption has continued to grow at a consistent pace. It will be interesting to see what impact new connectivity options, like LP-WAN and 5G, have on adoption.

Figure 2. Adoption continues to grow

Percentage of organisations already using IoT, 2013–2017.



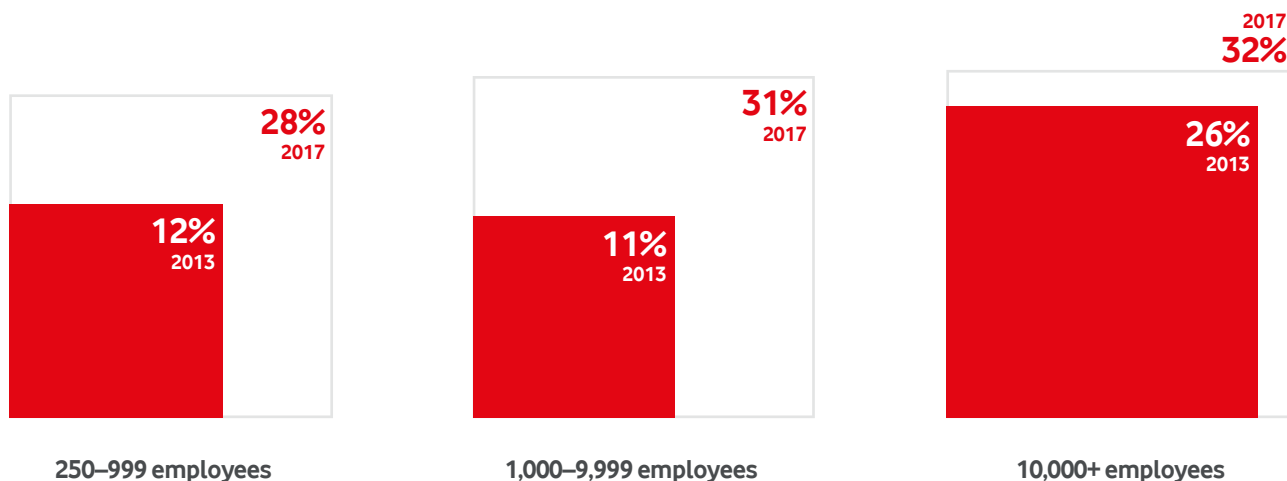


Figure 3. Adoption by organisation size

Large organisations have maintained their lead, but smaller companies are now much closer.

More adopters are seeing significant ROI

Even back in 2013, when organisations were just setting out with IoT, the vast majority (94%) reported that they were seeing at least some benefits from their projects. And around a third (36%) reported a significant return. In 2017, organisations are still reaping the benefits of investing in IoT. 95% of adopters now say they're seeing tangible benefits from IoT. And they're more likely to see bigger benefits — over half (53%) report a significant return.

53% of adopters report significant ROI from IoT in 2017. That compares with 36% in 2013.

Adopters are redefining their businesses

Today, adopters are working on how they can integrate IoT within their business to drive change. That can mean more investment and more devices, but also bigger returns on investment.

“If you stand still in the stock market space, more innovative, younger companies can come in and overtake you ... the company decided to become more future-proof ... You can't avoid IoT as part of that.”

Financial services organisation, Germany

The analyst view

It may be that we are approaching the end of a phase of IoT. Companies have put in place solutions that can solve relatively simple problems — low-hanging fruit. Often these are point solutions that do not require complex integrations or the support of a wide range of stakeholders in an organisation. The next phase may be precisely these more complex projects, and these will take time.

While large enterprises are more familiar with IoT and the benefits it affords, we believe there is still a lack of awareness among SMEs. Raising awareness among SMEs and delivering affordable, off-the-shelf solutions will contribute to the next wave of adoption.

We also believe that once there is greater awareness and understanding of LP-WAN, there will be a new wave of growth. Technologies such as LP-WAN will open up the IoT market to accommodate new applications that have not benefited from connectivity due to barriers such as cost, power consumption and propagation.

As these solutions become simpler, and easier to implement, they probably won't be thought of as “IoT” applications — they will just be new retail or manufacturing or logistics technologies. IoT may gradually fade as a separate concept.

Adopters are pushing ahead

IoT isn't just about automating processes. Adopters are using it to create completely new services and to transform their businesses. That's why investment and the number of connected devices are growing.

 **67%**

of adopters say their IoT projects are mission-critical to their business.

The organisations using IoT are doing more of it

85% of adopters believe that IoT will be critical for the future success of any organisation in their sector — that sentiment is even stronger in retail (95%) and consumer electronics (91%). That could explain why, compared to 12 months ago, 81% of adopters say they're spending more on IoT and 78% have more live projects.

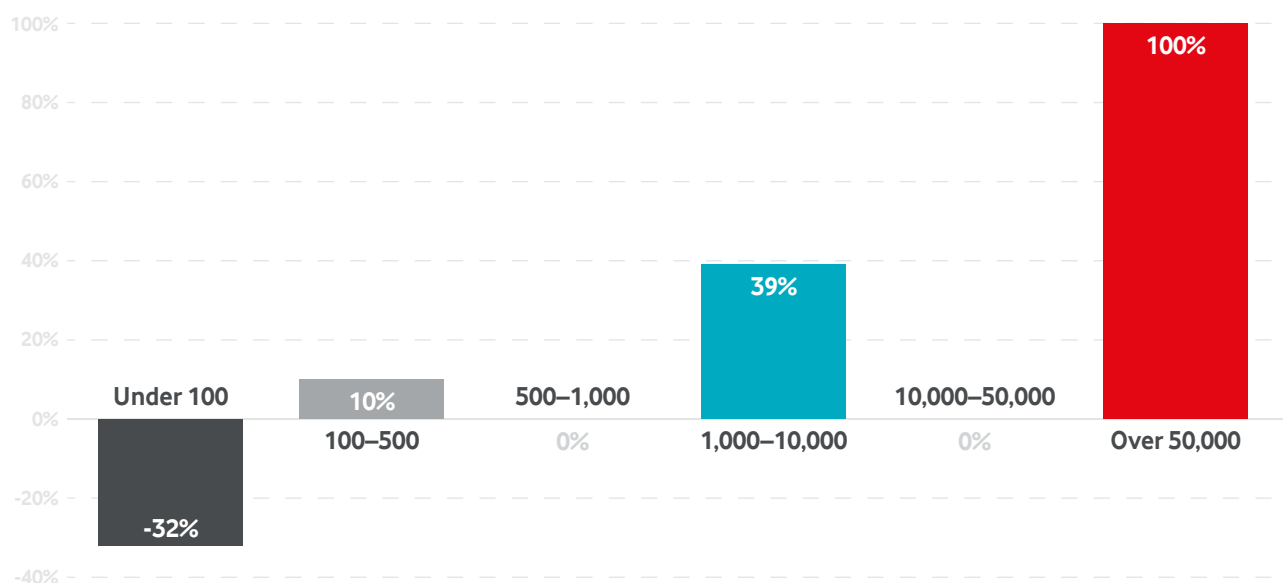
Many of the organisations that have adopted IoT have recognised the benefits and are committing on a greater scale. In 2016, 28% of adopters had more than 1,000 connected devices; in 2017, that's risen to 37%. And twice as many adopters have embraced IoT on a massive scale — more than 50,000 devices — since 2016. We're seeing bigger, more integrated programmes spanning business functions.

Regional picture: The Americas is doing IoT at scale

While Asia-Pacific is now leading the way in terms of adoption, it's organisations in the Americas that are doing it on the biggest scale. 19% of adopters from the Americas have at least 10,000 connected devices, compared to 13% in Europe and 7% in Asia-Pacific.



Figure 4. Change in scale of adoption by number of connected devices, 2016–2017



Year-on-year change in share of companies in each band, based on number of connected devices.

Adopters' expectations of IoT are growing

Adopters are committing to IoT because they've already experienced, often significant, benefits (see page 13) and they have high expectations of more to come (see page 30). Back in 2013, 48% of organisations yet to adopt IoT said that their investments would be based on expected cost savings, making this the biggest driver of IoT. But, even then, adopters were finding that faster decision-making (cited by 43% of adopters) and improved customer services (36%) topped cost savings (34%) in terms of actual benefits.

Today, companies are investing in IoT because they understand that it's a driver of improvements across the business. 49% of adopters are using IoT to cut costs, but the same proportion are already using it to increase revenue. That could be by augmenting existing products (45% of adopters) — for example, providing connected car services — or by enabling adopters to offer entirely new services (48%), such as packages built around usage-based pricing models or predictive maintenance offerings.

The most common driver for IoT that we're seeing is increased efficiency. 55% of adopters say they're using IoT to increase efficiency by making better use of their assets and resources. That could mean improving or automating existing processes, like stock reordering.

IoT has the potential to have an impact on every part of the business — and to transform it entirely. Almost half (45%) of adopters say they're already using it to support large-scale business transformation.

“When you use electricity, you only see the brand name on your monthly bill ... but with IoT devices, with tangible new services that are good value for our customer, we have many more ways into people's houses.”

“... we try to deliver IoT that will help us reposition ourselves and sell security, comfort and energy-efficient services ... something that we wouldn't be able to do before digitalisation.”

Electricity producer/distributor, Italy

I think as cost gets driven down, industrial will be the biggest [IoT market] ... I think consumer [IoT] will happen but it will happen through business, it will happen through insurers, through any business that is going to go and incentivise a consumer to purchase; and, a smaller proportion will be directly to consumers.

Home protection service provider, US

Adopters are integrating IoT into their businesses

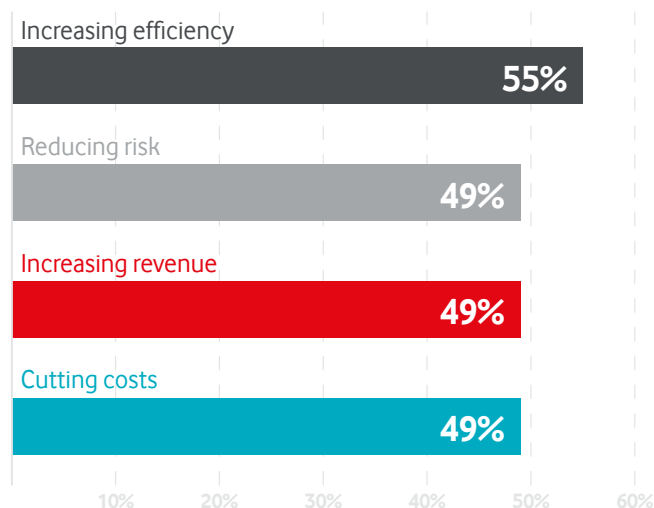
As expectations have grown, adopters have become more sophisticated in their use of IoT. Yes, they're continuing to trial and launch new initiatives — 78% say they have more live IoT projects now than 12 months ago. But IoT is an established technology, with 82% of adopters saying their IoT projects are no longer standalone, they are integrated with each other and into their business.

77% of organisations believe that the sophistication of their IoT architecture has increased in the last 12 months.

Adopters are integrating IoT with wider digital initiatives to meet their business objectives. 49% say they're using it with data analytics platforms to support decision-making. 46% have integrated it with core systems, such as enterprise resource planning (ERP). And as such, it's now seen by many as a core part of their IT infrastructure. So much so, in fact, that many no longer even talk about it as IoT — 19% of organisations say they never refer to their initiatives as “IoT projects”. Instead, they talk about a wide range of business transformation projects: from improving utilisation to streamlining customer experiences.

82% of adopters agree that, “IoT isn't a standalone technology, it's intrinsically linked to analytics, artificial intelligence (AI) and other critical digital initiatives.”

Figure 5. Organisations expect benefits across the board, but improved efficiency is the biggest goal



Percentage of adopters already using IoT to increase efficiency, reduce risk, increase revenue and/or cut costs.

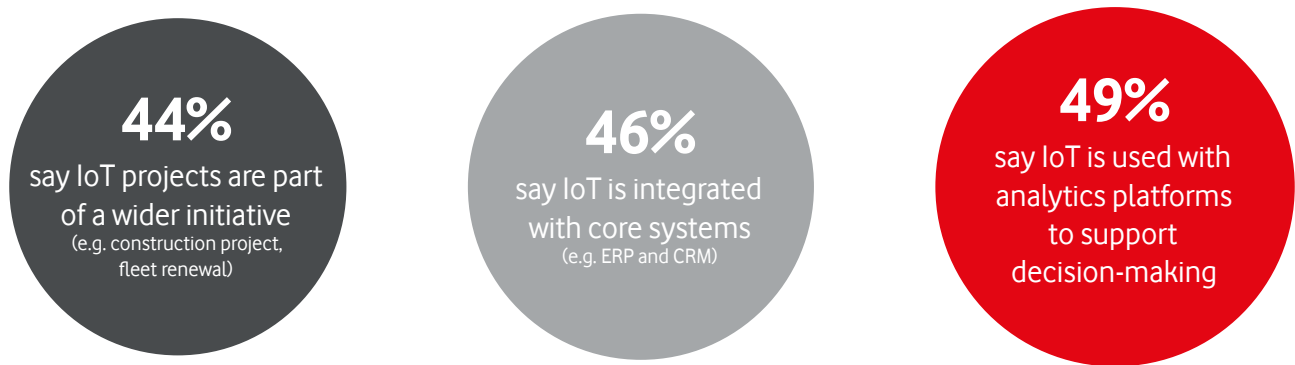


Figure 6. Adopters are making more sophisticated use of IoT and integrating it with core systems

Extent of IoT integration with other projects, systems and analytics.

IoT adopters are also digital leaders

Adopters recognise that committing to IoT and integrating it within their business is fundamental to their digital transformation. Two-thirds of all organisations — three-quarters of adopters — agree that, “Digital transformation is impossible without IoT.”

They’re right to think like this. The organisations that have adopted IoT are the ones leading the way in digital transformation. 81% of adopters say their digital strategy is generating measurable business value, compared with 65% of organisations considering IoT (considerers). And over three-quarters (76%) say they’re seen as one of the most innovative players in their market, compared with just over half (54%) of considerers.

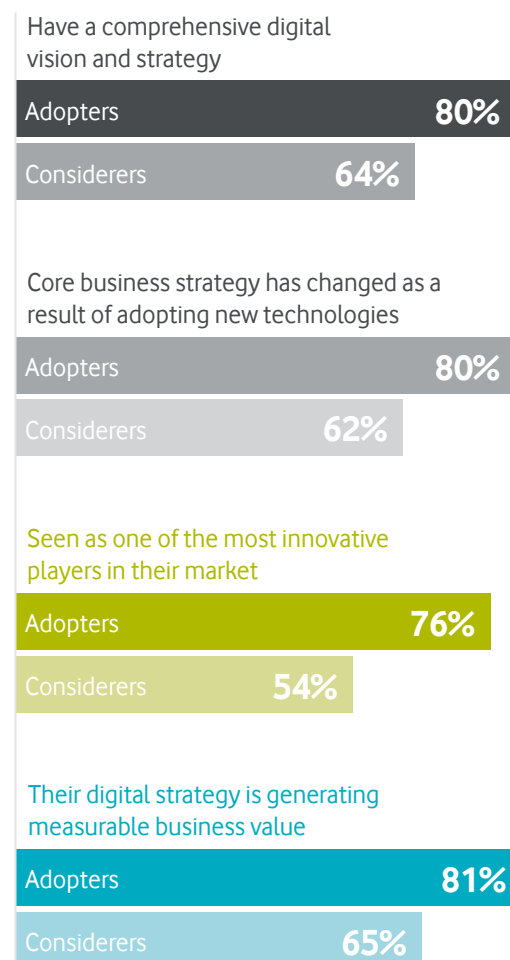
The analyst view

It seems that it is tough to generalise about IoT — even firms that are similar in size and in the same industry are at different stages.

China is an interesting market to watch. Current levels of take-up are low — lower than in Europe or North America — but awareness of IoT and interest in adopting solutions is high. If this interest results in projects, we could see some sectors in China overtake European firms.



Figure 7. IoT adopters are more confident about their digital strategies



How organisations perceive their digital maturity — IoT adopters vs considerers.



Healthcare

Adoption

19% (2014) 27% (2017)

9.2% year-on-year growth in adoption

Healthcare saw a small uplift in adoption in the last year, increasing from 24% in 2016 to 27% in 2017. But those who have already adopted IoT are scaling up. 44% of adopters now have more than 1,000 connected devices — that's up 22 percentage points on 2016.

86% of adopters in healthcare are using more connections than 12 months ago.

Adopters in healthcare are committing to IoT and building it into business as usual. 49% say they've already integrated IoT with core systems — that's ahead of the figure for all industries of 46%. 80% say IoT isn't a standalone technology — it's intrinsically linked to analytics, AI and other critical digital initiatives.

Improving operational efficiency

So what are healthcare organisations using IoT for? The main aim of everyone working in this sector is, of course, delivering the best possible quality of patient care. This is getting harder to achieve with the resources available as populations age. Many organisations are looking to IoT to help by improving operational efficiency.

53% of healthcare organisations are using IoT to increase efficiency.

Over half (54%) of adopters in healthcare are using IoT to improve/automate existing processes. Take the example of a healthcare organisation located in New Zealand. It's using IoT to improve the operation of its ambulance service. Dispatchers now receive real-time updates on the availability and location of nearby ambulances and hospitals with capacity.

"Having these sensors — having these processes and systems feeding live data to inform our staff — transforms our whole clinical practice."

Healthcare organisation, New Zealand

The condition of the patient can be tracked and transmitted to all parties involved so that medical staff at the hospital know what to expect before the patient arrives. The system also automatically updates the patient's medical record. That means all patient records can be managed from a central hub. This isn't the only way that IoT is helping the organisation improve patient care.

The company has also introduced a home-based tele-health IoT application that enables it to remotely monitor patients through small devices such as heart monitors. This initiative has helped to reduce the number of calls made by patients, helping to alleviate pressure on emergency support vehicles.

Generating revenue

IoT isn't just about operational efficiency though. 58% of healthcare adopters are already using it to offer new services. And 59% are using it to increase revenue.

59% of adopters in healthcare are using IoT to increase revenue: creating new products, differentiating existing products and offering new services.

Healthcare organisations operating in the private sector can offer patients greater independence by using connected wearables — and also see revenue increase by offering this new service. And hospitals stand to gain from greater throughput as more care can be delivered remotely.

The analyst view

Although the benefits of IoT in healthcare have been well documented, it has been difficult for healthcare organisations to move beyond proof of concepts and trials to scalable IoT deployments. Long-standing barriers of funding and reimbursement, market fragmentation and regulation have stood in the way. The Barometer results are encouraging. They show that healthcare organisations are beginning to overcome these barriers and can demonstrate the positive impact of IoT on patient outcomes, cost savings and operational efficiency.

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Who's covered? Healthcare covers any organisation specialising in medical products or healthcare services — from occupational health providers and hospitals to pharmaceuticals companies.

2 Business benefits

95% of respondents to our survey that have adopted IoT reported benefits. Those that take IoT beyond a project and integrate it within their business are more likely to reap the biggest rewards.

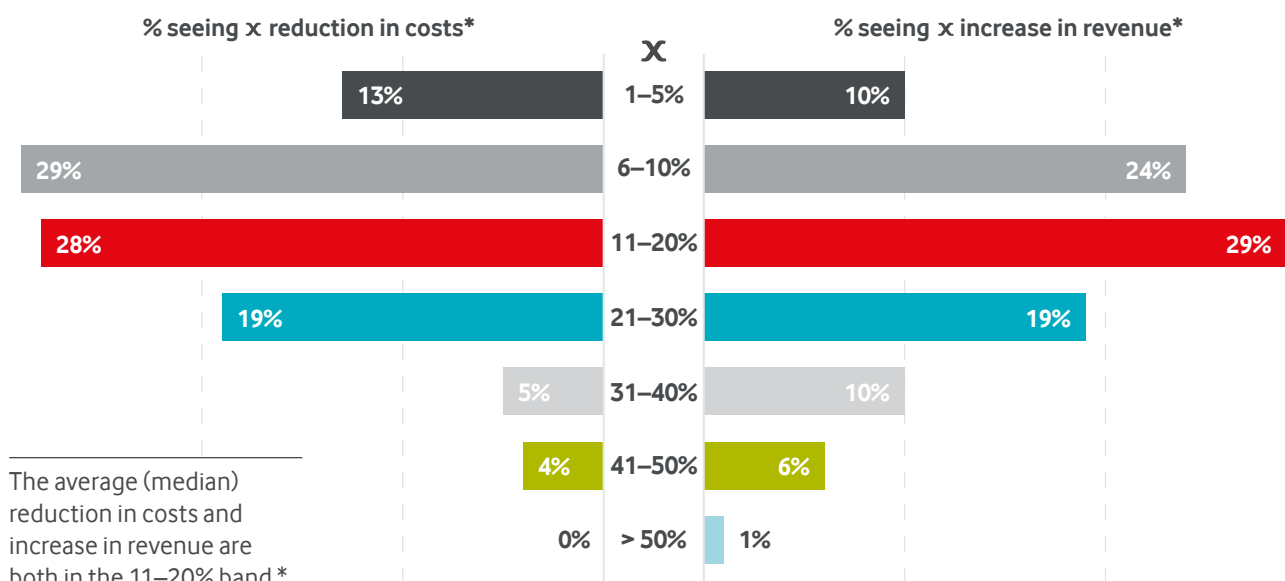
Organisations can achieve a significant return on their IoT investments. 29% of adopters who said they'd achieved cost reductions, saved more than 20%. But IoT isn't just about reducing costs. It's also helping organisations increase revenue and find new revenue streams. And some organisations are reporting that it's helping them completely transform their businesses.

51% of adopters say IoT is increasing revenue or generating new revenue streams.

36% of IoT adopters that reported an increase in revenue, saw it grow by more than 20%.

29% of IoT adopters that reported cost reductions, saw decreases of more than 20%.

Figure 8. ROI can be significant



*Reduction in costs/increase in revenue reported by adopters experiencing them. (Due to rounding, figures do not total 100%)

The secret of success

There are significant benefits to be achieved from adopting IoT. And it's the organisations that are scaling up that are most likely to achieve them.

 **88%**

of adopters reporting significant returns have more live projects now than 12 months ago.

There are benefits whatever size your IoT programme. Organisations just starting out and trialling IoT within a narrow set of parameters can realise big returns. But, as we reported last year, it's the organisations that are fully embracing IoT and integrating it within their businesses that are achieving the greatest benefits. It's still the case today.

That said, the number of devices an organisation has provides a strong indication of how committed it is to IoT. And it's the organisations that are now embracing IoT on a bigger scale that are realising the biggest returns. In 2017, 28% of adopters with under 100 devices report a significant return. But 67% of adopters with more than 50,000 devices say they've seen significant benefits.

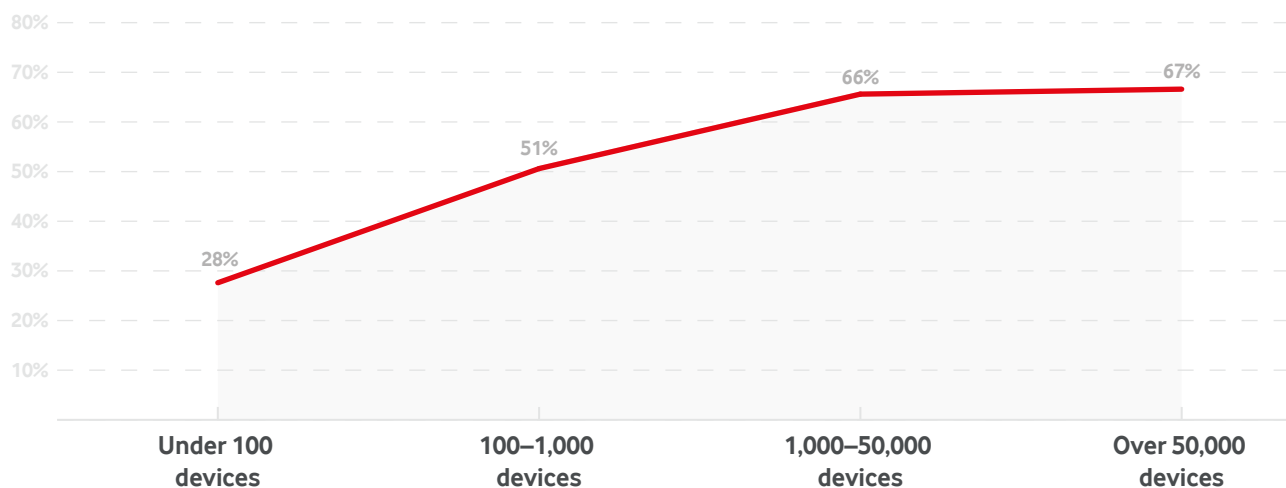
88% of adopters that report seeing significant benefits from IoT say they're spending more on IoT now than 12 months ago.

66% of adopters with over 1,000 connected devices reported significant ROI in 2017 — that's up from 61% in 2016.

Every industry, every organisation has its own story. It all depends on the organisation and what it's trying to achieve. A manufacturer might only have ten connected devices, but each with dozens of sensors monitoring a vital production line. This could be reducing downtime and increasing throughput, making a critical contribution to profitability. IoT could be more integrated and critical to this business than one selling wearables or operating smart street lighting, which could have tens, even hundreds, of thousands of connected devices.

There are benefits whatever the size of your IoT programme. But they grow substantively the more you commit to transforming your business with IoT.

Figure 9. Adopters with more connected devices are more likely to report significant returns



Percentage of adopters that say IoT has provided significant benefits based on the number of devices they have connected.

From efficiency to transformation

IoT programmes can deliver healthy cost savings. But they can also help companies to transform their business and create new sources of revenue.

 **51%**

of adopters in the automotive sector report that IoT is helping them improve brand differentiation.


The most commonly seen benefits of implementing IoT are: better business insights, reduced costs, and improved employee productivity. But there's a fairly even spread across the sorts of benefits seen. A significant proportion of adopters also report increased revenue and enhanced customer/user experience.

From working on IoT projects with many organisations, we've seen that the benefits can snowball. Once you have IoT sensors in place, the possibilities open up. Organisations are putting IoT devices in place to do a specific job, but then branching out and using their sensors to capture other valuable data. Take smart street lighting for example. The main objective might be to save on energy and costs, but sensors in street lights can also be used to monitor weather conditions or traffic, or to help improve the safety of residents. And once the lamp post is connected, it can also be used to provide other services, from city-wide Wi-Fi to advertising.

Regional picture: IoT is increasing market competitiveness in Asia-Pacific

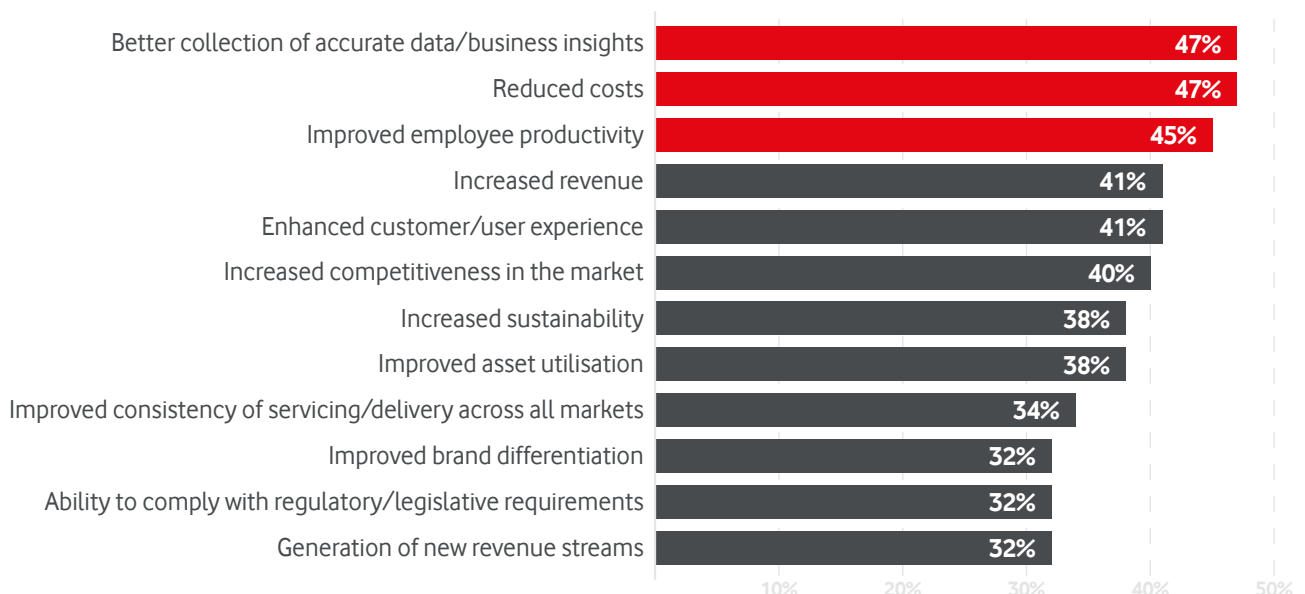


A benefit of IoT often cited by organisations in Asia-Pacific is increased competitiveness in the market. Over half (53%) of Asia-Pacific companies said they're seeing this, compared with around a third in the Americas (35%) and Europe (33%).


“... we can also sell information back to the insurer to say, ‘Hey, this is the true risk profile of this person ...’”

Home protection service provider, US

Figure 10. Adopters report a wide range of benefits



Percentage of adopters reporting each benefit.

What size of return can you expect?

The level of returns that organisations are achieving isn't small change. Where organisations reported a reduction in costs, it was 16% on average — and 29% achieved reductions of more than 20%. Where they reported an increase in revenue, it was 19% on average — and over a third (36%) achieved an increase of over 20%.

19% Where organisations saw an uplift in revenue from implementing IoT, the average increase was 19%.

16% Where organisations saw a reduction in costs from implementing IoT, the average saving was 16%.

“Our target last year was to get a 30% increase in our revenue by implementing our IoT project throughout our operation — we reached this target at the end of the year ... This year, our expectation is to get a 60% increase on the sales figures obtained in 2015.”

Global transport and logistics company, China

The analyst view

Traditionally the primary motivation for deploying IoT has been to achieve operational efficiency and cost savings, and while this may still be true, there are other factors that have grown in importance. For example, in cities, there is a focus on more efficient use of city infrastructure. But there is also a growing realisation of the interrelationship between efficient infrastructure and the attraction of business investment and people. Attracting and retaining human capital is critical to the businesses that in turn help the city to thrive.

While ROI from IoT projects can be viewed in purely quantitative terms, there is also a growing focus on qualitative measures: how IoT improves the lives of employees or citizens and helps businesses retain employees or customers.

We have seen some interesting examples of unintended benefits — or at least unintended beneficiaries — of IoT investments. For example, one smart city project tracked recycling bins, only emptying them when necessary. This system worked so well that the waste management company, a private contractor, didn't need to buy an additional lorry, as it had planned to, avoiding an investment of over £250,000. However, the project had been funded by local government — the contractor had not invested anything. This points to a broader issue with IoT of how to get different stakeholders to invest in systems that may indirectly benefit them.

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Transport and Logistics



After plateauing from 2015 to 2016, adoption in transport and logistics is back on the rise. It increased from 19% in 2016 to 27% in 2017. 80% of adopters say their adoption/use of IoT solutions has grown in the last 12 months, and 72% are now spending more on IoT.

Reducing costs and driving efficiency

The primary objectives for IoT in transport and logistics are cost savings and efficiency. 52% say they're already using IoT to reduce operating costs, and 50% say they're using it to make the best possible use of assets and resources. But these aren't minor changes they're making to find small improvements. IoT is helping many of them transform their operations.

46% of transport and logistics companies are using IoT to support large-scale business transformation.

A global transport and logistics company we interviewed provides an example of how IoT is being used to drive efficiency. It's using sensors in its warehouses and trucks to give it constant, up-to-date information on stock location. This enables its head office to centrally control inventories at each warehouse. It also helps it plan routes to avoid traffic jams and lets it provide clients with timely updates in the event of any unexpected delays — due to traffic accidents, for example.

"In the past, once an issue was found in our transportation, we took around one hour to settle the issue on average — currently, the required time is just 25–30 minutes."

"Our warehouses and clients are distributed across China, so transmission of data must be able to happen anywhere, anytime. The network must be able to cover every city and its urban areas, as well as every highway."

Global transport and logistics company, China

The company's use of IoT enables it to transport more goods each day, resulting in a 20% enhancement in operational efficiency. On top of this, customers are happier as they're better informed about delivery times. And the company believes there are greater gains to be made by making better use of the data collected to inform business strategy.

54% of transport and logistics companies are seeing reduced costs. 51% are benefiting from improved employee productivity.

Network coverage is critical

For this type of asset tracking solution to be effective, organisations need reliable and far-reaching mobile connectivity. That explains why the biggest driver in the choice of connectivity for transport and logistics companies is network coverage.

78% of transport and logistics adopters consider network coverage very important when selecting IoT connectivity — putting it ahead of security.

The analyst view

Fleet management and logistics have been early adopters of IoT technology as the business case was relatively easy to prove and payback was rapid. However, until now, IoT has mostly involved tracking the vehicle, but not the item being transported. This is set to change.

We see a number of companies using LP-WAN technologies in pallets to enable much more accurate tracking of the item itself. This allows them to track the location of a pallet within a warehouse. Some are also monitoring the exact conditions of the pallet, in terms of temperature, humidity, vibration and so on.

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Who's covered? Transport and logistics covers all organisations involved in the transportation of goods or people, as well as related service providers.

3 Moving forward

Organisations face some critical decisions as they seek to push ahead with their IoT projects.

Security has topped the list of concerns since the first Barometer in 2013. And it's still there. But the results of this year's survey suggest organisations are looking to tackle the issue head on — and getting more optimistic.

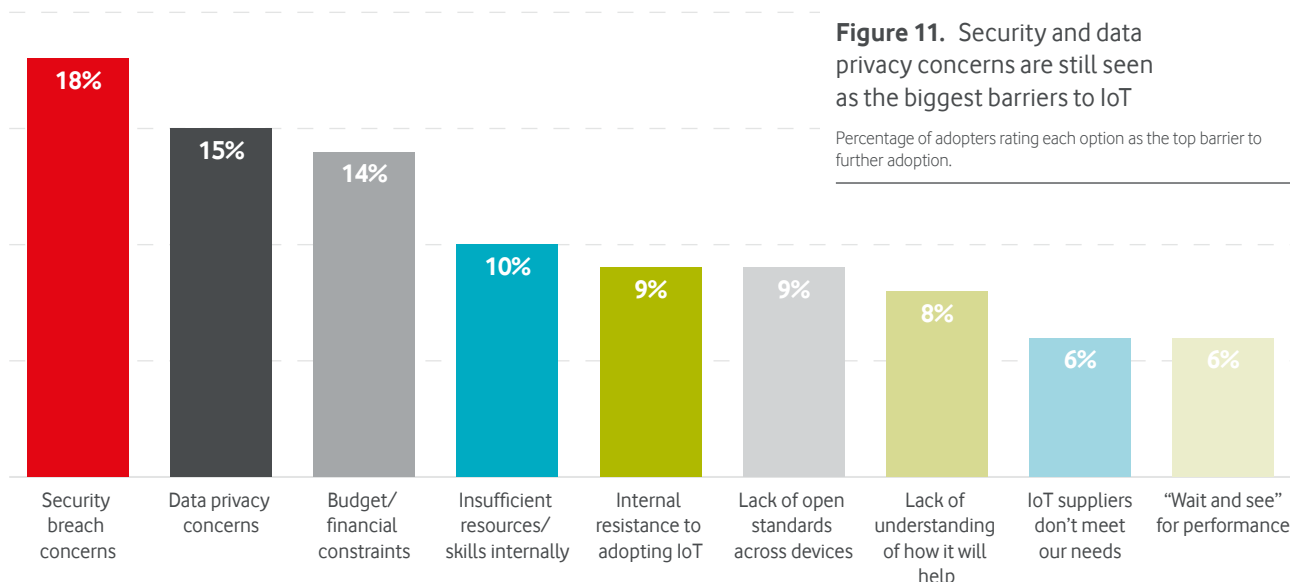
And security isn't their only consideration. Making the right connectivity choices is vital to managing budgets, handling privacy concerns, and achieving the reach and reliability needed by organisations as they scale up their involvement in IoT.

Moving forward isn't just about having the right technology. It's about having the right people too. Adopters are building IoT ecosystems to give them the skills they need.

67% of adopters say their IoT applications are mission-critical and a breach could be disastrous.

74% of adopters consider network coverage when selecting connectivity options for IoT projects.

75% of adopters have increased their use of partners to deliver/ manage IoT-based solutions.



Effective security can be an enabler

As organisations roll out more complex IoT programmes to deliver mission-critical services, security becomes ever-more important. But adopters aren't letting the risks deter them, they are tackling them.

 **7%**

of adopters with larger IoT programmes — at least 10,000 connected devices — say security is their top concern, compared with 19% of those with fewer connected devices.

Security is a priority

What do organisations cite as their biggest concerns in the early days of any new technology? Security is always near the top of the list. And so it is with IoT. This year, 18% of adopters say security is their top concern. But that means that for 82%, while it's probably still an issue, it's less of a concern than things like internal resistance and insufficient skills. And for those doing IoT at a greater scale, which possibly have more experience, it's even less of a concern: just 7% of organisations with 10,000 or more connected devices say security is their top concern.

As organisations roll out more complex IoT programmes to deliver mission-critical services, security becomes ever-more important. A security incident could see vital systems taken offline — possibly even held to ransom. It could result in the costs and embarrassment of lost customer data. And then there's data confidentiality and privacy to consider. Even something as innocuous as temperature data could be sensitive: imagine a batch manufacturer, where temperature information could give away details of production processes or volumes.

But adopters aren't letting security concerns deter them. They recognise the importance of security to the success of IoT. And that's why they're making it a priority — 82% say security is a critical factor in IoT decision-making. They don't see it as a limiting factor, but rather as an enabler that gives their business the confidence to push forward.

79% of adopters agree that IT security is an enabler, giving businesses the confidence to do more.

“... an attack or virus is now something that can be taken as a ‘fact of life’. We can't avoid it. The solution is to sort out more and more ways to address the attacks.”

Global transport and logistics company, China

“[Operating in] the stock exchange business, we know how important data security is. The big worry is creating new entry points to the network with IoT.”

Financial services organisation, Germany

Regional picture: Asia-Pacific is the most confident about security

IoT adopters in Asia-Pacific have the greatest confidence in security. 83% say they have adequate skills to manage IoT security, some way ahead of Europe (70%) and the Americas (65%). That could be because more of them say they're taking steps to address security concerns:

- Over half (56%) are recruiting IoT security specialists, compared with 49% in the Americas and 37% in Europe.
- 59% are working with specialist security providers (41% in Europe; 40% in the Americas).
- And they're maintaining a focus on security. 48% of organisations in Asia-Pacific scan for vulnerabilities after launch, compared with 39% in the Americas and 34% in Europe.

Adopters are taking steps to get the right security skills

Adopters are investing in the skills and processes to manage IoT security effectively. Around three-quarters (73%) of adopters say they have adequate skills to manage IoT security. And a similar proportion (75%) say they have adequate processes to manage IoT security. Of course, that still leaves a quarter of adopters with work to do.

Even those businesses yet to roll out IoT are fairly confident in their ability to manage security — 50% of considerers believe they have the adequate skills.

Adopters have stepped up training to help manage the security risks associated with IoT. In 2016, 42% reported that they were training existing staff to improve their ability to deal with security. That's increased to 48% in 2017. And more adopters are now recruiting IoT security specialists — 46% in 2017, compared to 41% in 2016.

Adopters are seeking help from specialists

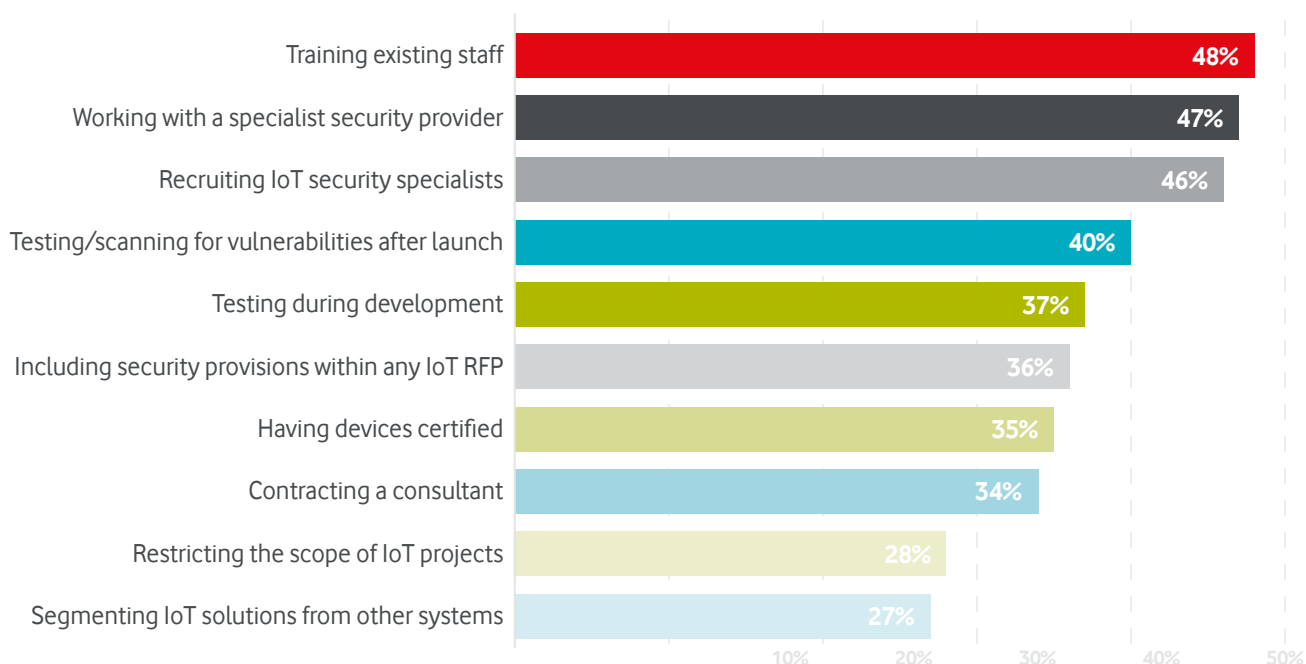
Adopters are also increasingly working with third-party experts. 47% are now working with specialist security providers, up from 40% in 2016. As they roll out larger, more complex IoT programmes, they're more likely to seek the help of these specialists (55% of those with 10,000+ devices; 42% of those with under 100).

76% of adopters are confident their suppliers have the skills to mitigate IoT security risks effectively.

"To further promote IoT adoption in our company as well as among our partners/clients, the key is system integrations and security assurance."

Global transport and logistics company, China

Figure 12. Organisations are taking positive steps to tackle security concerns



What organisations are doing to improve security (percentage of adopters).

Security isn't a case of once and done

Organisations need to think through all their security requirements at the beginning of a project. And it makes sense to test that the measures put in place are effective. 37% of adopters test the security of their IoT during development — it should be more.

But the task of securing IoT doesn't end when it's up and running. The threats organisations face from cybercriminals are constantly evolving. And so is the infrastructure you need to protect as you add more IoT devices and continue your digital transformation. So, it's encouraging to see that 40% of adopters are testing and scanning for vulnerabilities after launch.

75% of adopters cite security as a factor when choosing connectivity for IoT projects, making it their number one consideration.

"We have monthly or quarterly meetings over predictive security, looking at the different learnings and the different ethics of international scenarios where things have fallen through."

Healthcare organisation, New Zealand



Security isn't a point solution — it needs to be end-to-end

When asked who bears most responsibility for ensuring data security, 43% of adopters said the platform/hosting provider, 27% the connectivity provider, 21% the systems integrator, and 20% the device user. 38% replied "us, the business".

The point here is that most organisations think of securing data where it resides. But in practice, to keep IoT data safe, security needs to be end-to-end. Your data centre or the cloud, your network and your IoT devices all need to be secure. And that means having a clear sight across your whole IoT system. Today, some organisations are struggling to achieve that — 59% of adopters say IoT devices are difficult to secure and manage in the field.

54% of adopters say the IoT data they collect has no value to a hacker. Some sensors are collecting very basic information on the state of a machine, for example. But just because the data is of no value, that doesn't mean you can relax your security. The breach of an IoT system could act as a stepping stone to another system — that's a concern for 68% of adopters.

It's worrying then that just 27% of adopters say they segment their IoT solutions from other systems — a measure that could mitigate much of this risk.

68% of adopters are concerned that a breach of an IoT system could act as a stepping stone to other systems.

Figure 13. Two-fifths of adopters think they bear the most responsibility for data security



20%

Device user



21%

Systems integrator



27%

Connectivity provider



38%

Us, the business



43%

Platform/
hosting provider

Who bears the most responsibility for IoT data security? (Percentage of adopters.)

Transparency is the key to data privacy

Like security, data privacy is a key concern for organisations. While often used synonymously, they are quite different. The device manufacturer capturing usage data without informing the user, and possibly selling it, is at risk of being accused of a privacy violation. No hacking is required. Equally, a hack might be used to disable systems or hold data to ransom — neither of which necessarily infringe privacy.

The secret to handling data privacy is transparency, control and respect — being clear, internally and with customers, about why you're collecting data and how you're going to use it, giving customers control and respecting their preferences. 71% of adopters say they're open with their users about what IoT data they collect and how they use it. Of course, much of the data collected by IoT sensors doesn't infringe on privacy at all — think of weather data, for example. But it seems unlikely that 29% of companies would only be collecting this sort of data.

71% of adopters say they're open with their users about what IoT data they collect and how they use it.



“... before launching we did market research with 1,000 individuals and we asked this question, ‘How do you feel about the security of your data relating to the market.’ Actually, just 12% of them were a bit scared about this security ... a really huge percentage were indifferent to this problem.”

Electricity producer/distributor, Italy



The analyst view

We have seen a shift in attitudes towards security in the past few years. Previously, security was seen as important, but was not given much prominence within an organisation. Now, we are seeing security receive senior management attention. Firms have seen the damage — both financial and reputational — that security breaches can cause.

IoT is a key part of this as it creates so many new potential points of entry into a system. For example, Target's 2013 breach, where millions of credit card details were stolen, was traced back to hackers entering through the heating, ventilation and air conditioning (HVAC) system — essentially an IoT solution. Increasingly, firms implementing IoT solutions are asking about security early on in the project and insisting that it is built in by design.





Energy and Utilities

Adoption

13%
(2013)

35%
(2017)

20.1% year-on-year
growth in adoption

The energy and utilities industry is in the top three for adoption. Over a third (35%) of organisations are already using IoT. But the big story here is one of adopters doing more IoT. Over half (53%) of adopters have more than 1,000 connected devices — that's an increase of 17 percentage points on 2016. And it puts them some way out in front in terms of scale — across all sectors, the comparable figure is 37%.

84% of adopters in energy and utilities say that their adoption/use of IoT solutions has grown in the last 12 months.

Uptake in energy and utilities has largely been instigated by regulatory requirements. In the 2014 Barometer, we explained that this was why smart grid and smart metering solutions were the most widely adopted among our respondents at the time.

40% of adopters in energy and utilities say IoT has increased their ability to comply with regulatory and legislative requirements.

These solutions haven't just helped them stay compliant. They're also helping them increase efficiency and reduce costs. 54% say they're already using IoT to optimise the use of assets, and 48% to reduce operating costs. That's some way in front of the use of IoT to manage risk or increase revenue (both at 38%).

Smart home and office solutions — such as intelligent heating and connected security solutions — provide the potential for new services and revenue streams. But the focus, at present, remains on operational efficiency.

51% of adopters in energy and utilities are using IoT to improve and automate existing processes.

One energy company, operating primarily in oil and gas in the US and Canada, is using IoT to remotely monitor the pressure levels of its customers' oil wells. That means engineers don't have to be dispatched regularly to manually check valves — they can monitor as many as ten oil rigs at once. That has resulted in greater efficiency for the company, and the self-controlled valves have reduced the risks of human error. Having set aside around a third of its annual IT spend for IoT processes, the company predicts that its systems will now be revenue generating — with only repair costs to factor into the budget. The IoT has also opened up potential new revenue streams. The company believes there's an opportunity to analyse the data it collects, package it and sell it as a solution.

"Before, someone had to go out and read the gauge [for the oil-well valve] ... by the time it reached the decision makers, the information was outdated ... [Now] no matter where I am, I can log in and see all the rigs ..."

"... the equipment we bought has already paid for itself and now we're making money."

Oil and gas company, US and Canada

The analyst view

Utility organisations will face a period of increasing change and uncertainty. This is the result of a growing three-way tension between the need for security of supply, for prices to be kept at an affordable level, while ensuring environmental sustainability (including reducing greenhouse gas emissions). The growing diversification and uptake of new technologies are fundamentally changing the economics of providing utility products and services, disrupting well-understood historical business models.

This typically means that utility companies are either vertically integrated or have to work more closely and in concert with others to deliver services to consumers.

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Who's covered? Energy and utilities covers any organisation involved in the production or supply of energy or telecoms.

As deployments grow, so do connectivity demands

As adopters connect more devices, often outdoors and in remote locations, they want connectivity that has reach and can handle complexity. But it also needs to be cost-effective and secure.

 **74%**

of adopters consider network coverage when selecting connectivity for IoT projects.

More devices, more network variety

Having the right connectivity is important. And as adopters increase the number and variety of devices and tackle more challenging projects, their connectivity demands are growing. IoT projects are extremely diverse, and their connectivity needs are accordingly varied.

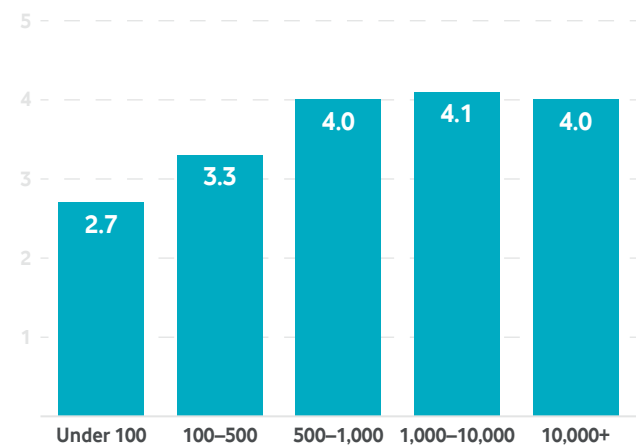
Organisations need to determine the best connectivity options for any given use case. But they rarely rely on just one. Even organisations with smaller implementations — of under 100 devices — use three connectivity options on average. When they reach just 500 connected devices, organisations typically require four connectivity options to give them the required coverage and resiliency.

“[Network] security is the most important thing and costs are last ...”

Financial services organisation, Germany

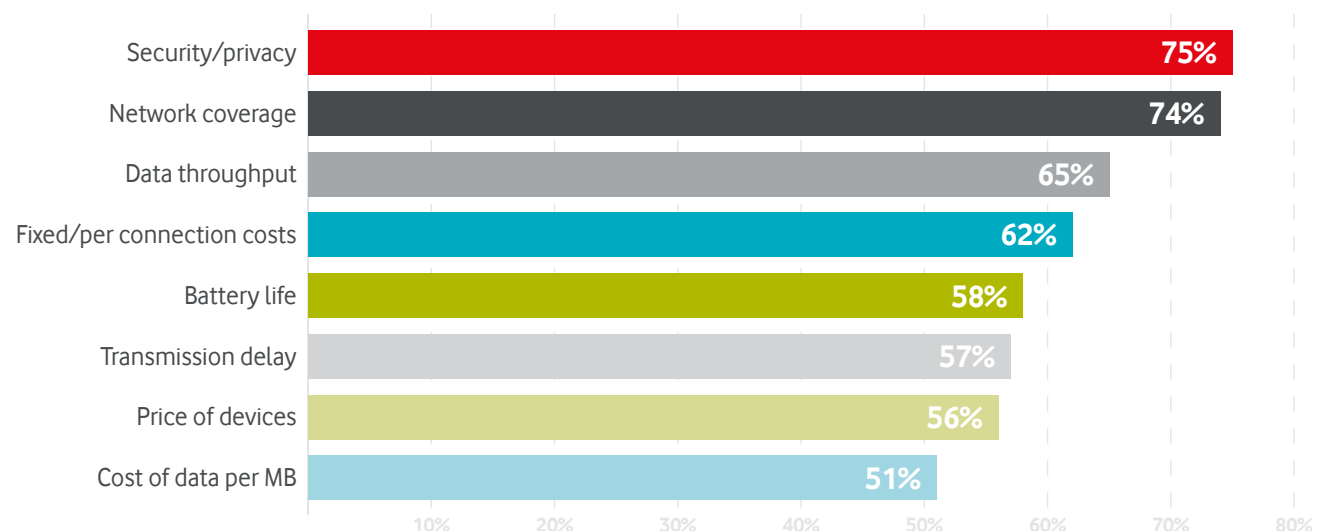


Figure 15. Organisations are using multiple forms of connectivity, from fixed to LP-WAN



Average number of connectivity options (fixed line, cellular, Wi-Fi, other short-range wireless, LP-WAN, satellite) used, by number of IoT devices.

Figure 14. Security and network coverage are the biggest considerations when choosing IoT connectivity

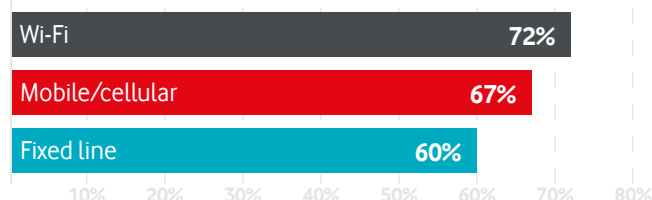


Percentage of factors considered very important by adopters when choosing IoT connectivity.

Will new connectivity options open the door to IoT?

The traditional choices for IoT connectivity have been Wi-Fi, cellular and fixed line. And these remain the most commonly used options.

Figure 16. Wireless connectivity types remain the dominant options



Percentage of adopters using each connectivity option for IoT projects.

But organisations are also considering new connectivity options, including 5G and LP-WAN, which are being developed with IoT in mind. These use:

- Protocols designed to make connecting lots of devices easier, and cheaper for low-bandwidth applications.
- Transmission technologies that enable high bandwidth and exceptionally low latency.
- Chipsets that are optimised to reduce power demands, extending the operational life — especially important when device size and serviceability are issues.

Organisations are familiar with GSM technology and have been through the evolution from 2G to 3G and then 4G. So it's unsurprising that of emerging connectivity options, 5G is the one the most organisations are considering — over a third are already investigating what it could offer. While 5G holds great promise, many probably see it as an incremental upgrade and so are less concerned about compatibility and training issues. On the other hand, LP-WAN technologies, such as NB-IoT, look like more of a leap. But even so, nearly a quarter of all respondents are considering them for their IoT projects. That's a strong start for this new technology.

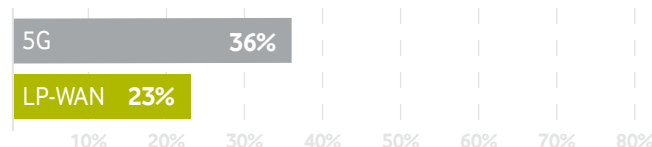
“ZigBee, maybe, is more affordable, but it is not a real standard — as we've seen by integrating some devices. It has a delay ... that makes it difficult sometimes for integration.

We are also interested in LoRa and Narrowband-IoT ... Narrowband-IoT would be the best. I mean, it would be like a 4G communication protocol ... we look with real interest to Narrowband-IoT.”

Electricity producer/distributor, Italy

Even organisations that already have IoT programmes up and running are showing an interest in LP-WAN (16% of adopters). But there's even greater interest among those organisations yet to embrace IoT. 28% of considerers are investigating LP-WAN. That could potentially spell a new wave of IoT adoption.

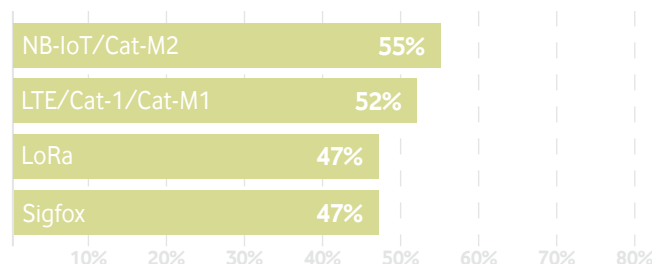
Figure 17. Organisations are already thinking about 5G and LP-WAN



Percentage of organisations (adopters and considerers) considering each new connectivity option for IoT projects.

LP-WAN technologies under consideration include Sigfox and LoRa, but out in front is the newer NB-IoT.

Figure 18. Of organisations considering LP-WAN, 55% are investigating NB-IoT



Of those organisations (adopters and considerers) considering LP-WAN for their IoT projects, the percentage considering each different connectivity option.

The analyst view

We are forecasting up to 3.5 billion connections on LP-WAN networks by 2025, but today — there are probably fewer than 100 million connections globally. There are a number of challenges facing the LP-WAN market — the most obvious is technology fragmentation. But all of these areas are developing rapidly and there are encouraging signs.

One thing that is exciting to see is the new types of application that are being developed using LP-WAN technology. We all know about applications like smart metering, but we are also seeing developers explore some innovative new ideas in retail, building monitoring, consumer electronics and other areas.

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Retail

Adoption

10%
(2013)

26%
(2017)

21.1% year-on-year
growth in adoption

Interest in IoT is flourishing

Adoption of IoT in retail rose by six percentage points over the past year — from 20% in 2016 to 26% in 2017. And those organisations that are doing IoT are doing more of it. 38% now have more than 1,000 connected devices, up 16 percentage points on 2016. 91% agree that their adoption/use of IoT solutions has grown in the last 12 months.

90% of retail organisations say they have more live IoT projects now than 12 months ago — that compares to 78% across all industries.

Retail companies are increasingly positive about the potential of IoT. 91% of adopters say they're more positive about the potential of IoT than 12 months ago (79% across all sectors). And 94% say the profile of IoT has increased in the last 12 months (82%). That's being driven by positive experiences with IoT. 98% say they're seeing at least some return from their investment in IoT — with 53% seeing a significant return. They think IoT is critical to their future competitiveness and that's why they've increased their investments.

81% of organisations in the retail sector think it will be critical for the future success of any organisation in their sector — the figure for all sectors is 74%.

96% of adopters in retail say they're spending more on IoT than 12 months ago.

Benefits across the supply chain

The possible applications of IoT within retail are immense. 63% of adopters in retail are using IoT to improve/automate existing processes. It can have an impact on streamlining the supply chain — helping retailers track stock from farm to fork. And digital signage is helping enhance interactions with customers. In hospitality, it can help improve customer experience through the deployment of tablets in rooms, and digital keys.

63% of adopters in retail are using IoT to augment the products they sell, and 59% to offer new services. One interesting use case we're seeing for IoT is the installation of vending machines at airports. And this isn't just for food — cosmetic brands are getting on board. IoT means you can put a vending machine and enable payment anywhere.

The tipping point

It's possible that we're reaching a tipping point for IoT in retail. There's huge positivity about IoT in this sector, but our experience suggests it's still very much at the start of its journey. That could help explain why retailers are more likely than organisations in other sectors to look for help in developing and designing new solutions.

76% of retail organisations seek help in developing and designing a solution, compared with 63% across all sectors.

The analyst view

Interest in how to use aggregated data to provide a more personalised customer experience is growing. IoT is also instrumental in the retail supply chain, providing more efficient inventory management.

Cost and complexity are still the biggest barriers to adoption. The largest retailers are in a position to invest in new technologies and support the cost of customisation and integration. This is still a challenge for smaller retailers.

Off-the-shelf solutions will have a significant impact as the market develops. But while the technology works, there is still a learning curve for retailers to optimise the technology and use the data generated effectively.

Retailers must find the right balance, offering customers the benefits of IoT — speed of service, convenience and personalisation — without appearing intrusive.



Who's covered? Retail covers any business involved in the sale of goods or services in store or online, and includes hospitality, tourism, banking and insurance.

Creating IoT ecosystems

As IoT becomes more mission-critical, organisations are realising they can't do it on their own. They're looking for partners to fill the skills gap. And they're forming collaborations with other companies to drive innovation.

Organisations seek help to get started

One-in-ten (10%) adopters say insufficient resources/skills internally is the biggest barrier to wider adoption of IoT. To address that, many are looking to providers for support. That could include technology consultants, systems integrators, hardware providers or communication service providers, for example.

75% of adopters have increased their use of partners to deliver/manage IoT-based solutions.

Adopters are most likely to look for support from providers at the start of an IoT project. 50% say they need help in creating a business case, while 63% need help developing and designing the solution. Beyond that they need help in securing data and implementation. But they feel less inclined to seek it for ongoing management or to measure ROI.

This could, of course, reflect where organisations are on the IoT maturity curve. They're still designing and implementing, albeit now on a larger scale. When they're further up the line, the realities of ongoing maintenance and tracking ROI may become more obvious.

Regional picture: Asia-Pacific committed to collaboration

53% of Asia-Pacific companies using IoT collaborate with companies and partners. And 92% think that the most successful projects will involve collaboration between multiple organisations. The comparative figures for the Americas are 42% and 72%. And for Europe, 47% and 77%.



4th

Insufficient resources/skills internally is the fourth biggest barrier to adoption or wider adoption of IoT.

Success requires collaboration

As with any major project, the best results are achieved by fostering a culture of collaboration between organisations and providers. But organisations aren't just looking to collaborate with partners to help them push ahead with IoT. Almost half of adopters say they collaborate with their partners — and with other companies.

48% of adopters collaborate with other companies and partners.

Usage-based insurance provides a good example of this. Here, telematics is providing the basis for OEMs and insurance companies to work together for the benefit of both parties. The manufacturers can offer drivers access to a competitive insurance product through a built-in usage-based insurance (UBI) device. Insurance companies become the default choice for smart insurance.

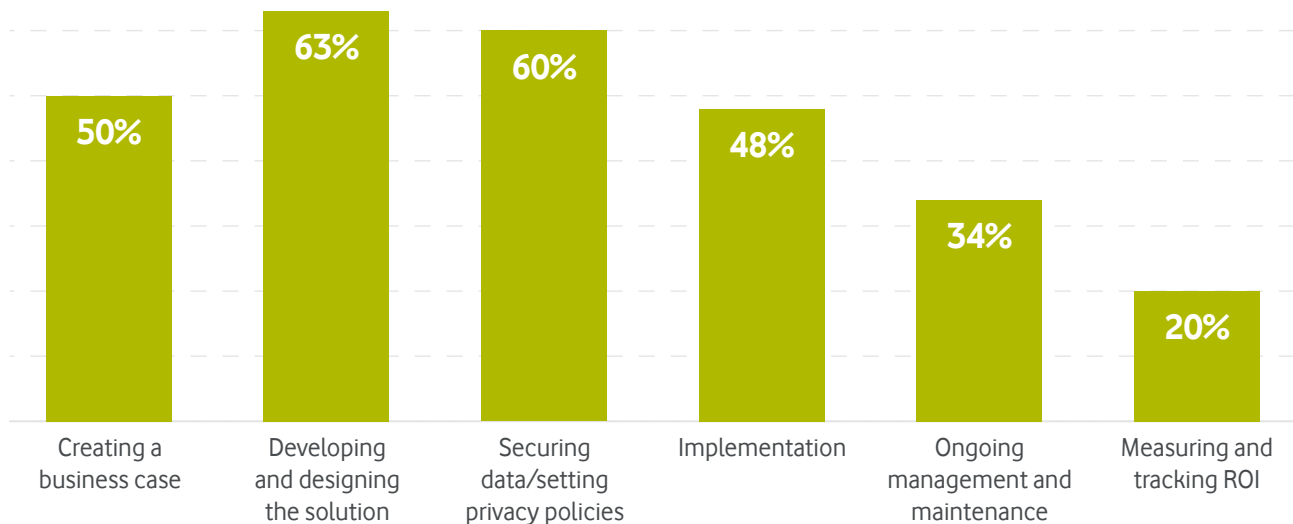
By collaborating, organisations can strengthen their own propositions and bring new solutions to the market that they wouldn't have been able to do on their own. It's a trend that's set to continue. 81% of adopters think that in five years the most successful IoT projects will involve collaboration between multiple organisations — both inside and outside their industry.

“... bringing in the right people who understand commercial- and consumer-grade systems helped a lot.”

Healthcare organisation, New Zealand



Figure 19. Adopters seek support throughout the IoT lifecycle, but mostly at the outset



The stages at which adopters say they require the most support from an IoT provider.

Finding the right partner?

We asked adopters what their top three factors were when selecting a partner — overall, cost was only put in the top three by 21% of adopters.

- **Technology leadership.** The most important factor for adopters when choosing a partner is technology leadership — 65% say this is important to them. That makes sense. You need a provider that can keep you up to date with the latest trends — one that understands how IoT integrates with cloud, mobility and artificial intelligence, and other new technologies.
- **Track record.** 57% of adopters look for a track record of delivering IoT projects. With adopters pushing forward and integrating IoT within their businesses, they want a safe pair of hands to work with.
- **Reach and scale.** 56% say reach and scale are important to them. Adopters are now seeking to connect more devices, and looking to IoT to transform their businesses. They need providers that can support that vision — that can manage global IoT deployments involving tens of thousands of connected devices.

Overcoming internal resistance to IoT

Making a success of IoT isn't just about having the right technology and partners. It needs commitment from within the organisation. 17% of adopters with 10,000 or more connected devices say internal resistance is their top concern, putting it top of the list of barriers to wider adoption for this group. Anything that promises significant change is likely to unsettle some people. IoT is transforming the way businesses operate, so it's little surprise it's meeting some internal resistance.

It's essential that those leading IoT programmes win the support of their business leaders. As with any major transformation programme, success can rest or fall on how engaged the senior leadership team is.

The analyst view

IoT is new for many organisations. They do not have the skills or expertise to build IoT solutions and they may not have the budget to invest in complex bespoke systems. This is especially true for smaller companies. They want systems that are simple to implement and to use. If we are to realise the forecasts of billions of devices, this cannot mean millions of IT consulting projects. Companies trying to sell IoT solutions need to work on making it as easy as possible for the users.



“... they must be a globally reputable company and have rich experience in implementing IoT projects ... They should also know our industry very well and ... their solutions and devices ... must be easy to scale up and upgrade if needed.”

Global transport and logistics company, China

“... the key areas of frustration revolve around senior/middle management cultures, on them relying on past experience and older processes.”

Healthcare organisation, New Zealand



Automotive

Adoption

19%
(2013)

34%
(2017)

12.3% year-on-year
growth in adoption

Committing at greater scale

In 2017, IoT adoption in the automotive industry stands at 34%, up from 32% in 2016. That means it remains in the top three sectors in terms of IoT adoption.

The automotive industry is also out in front in terms of IoT scale. 16% of adopters in the sector have 10,000 or more connected devices, compared to 12% across all industries. And much of that scale has been added in the last year — there was a 13 percentage point increase from 2016 in businesses with 10,000 or more.

82% of adopters in the automotive industry say they're using more IoT connections now than 12 months ago.

In our experience, OEMs have led the way. It's typical for connected cars to now have up to 100 sensors — and that's likely to double in the next few years. These sensors are handling a range of tasks. They're providing information to manufacturers so that they can improve the efficiency of engines and improve safety, as well as enabling connected entertainment services.

But while OEMs are taking a lead, we expect IoT to become increasingly critical to franchise dealers and parts manufacturers. And it's also enabling companies involved in after-sales to improve and devise new services.

A competitive edge

IoT is having a bigger impact in terms of competitiveness and performance in the automotive industry than elsewhere. 47% of adopters in the automotive industry say it's generating new revenue streams — it's 32% across all sectors. And the same proportion say it has increased their competitiveness in the market — 40% across all sectors. One of the biggest benefits of IoT flagged up by adopters in the automotive industry was brand differentiation, which ranked much lower in other sectors.

51% of adopters in the automotive industry say IoT has improved brand differentiation — that compares to just 32% across all sectors.

Open to collaboration

Decision makers in the automotive sector are more open to collaboration than in other sectors. 36% strongly agree that the most successful IoT projects will involve collaboration between multiple organisations, compared to an average across all sectors of 28%. Over half (55%) say they're already collaborating with other companies and partners.

IoT is the perfect vehicle for enabling collaboration within and outside of the sector. Once sensors are fitted in a vehicle, there's scope for offering a wide range of services. That might mean collaborating with a media or telecommunications company to provide infotainment, or with an insurance company to offer usage-based insurance and breakdown services.

"... if you purchase a car in five years' time you'll be looking for certain key features which won't be possible to provide without IoT. Today, if you buy a car and if you live in an area where there is a lot of congestion, you need a real-time traffic information system telling you how to avoid traffic jams ... We went to the board and told them about the new system based on IoT and car data and said we would lose sales unless we had that feature. Once people have that feature they don't want to give it up ... so we implemented it swiftly within all car lines."

Car manufacturer, Germany

The analyst view

It has become increasingly difficult for vehicle manufacturers to differentiate their products in terms of performance, reliability and price. They are now seeking new means of differentiation, and technology is a critical part of this; increasingly that technology needs connectivity.

As an example, both Volkswagen and Vauxhall have run advertising campaigns for cars that were as much about the Wi-Fi connectivity that was incorporated into the car as about the car itself.

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Who's covered? Automotive covers any business involved in the development, design, manufacturing, marketing and selling of vehicles, as well as related after-sales, such as servicing, insurance and breakdown services.

4 The next five years

Adopters are already seeing significant benefits from IoT. But will we still be talking about IoT as a disruptive technology in 2022? Many adopters say it will have become business as usual, but they expect it to be delivering even more in five years' time.

IoT has come a long way since we launched the first Barometer in 2013. Back then we weren't even talking about IoT — it was M2M. So what will we be talking about in the tenth edition? Adopters have great expectations.

With new technologies, such as NB-IoT and IoT platforms, making IoT ever-more attractive, our 2022 Barometer will almost certainly report a continued rise in adoption. It will probably say that we're still seeing more and more interesting collaborations. But what will it be called? Will IoT be so intrinsic to how IT works and how businesses run that the term itself is no longer used?

79%

of adopters think that IoT will have an enormous or sizeable impact on the whole economy in the next five years.

79%

of adopters say that over 50% of business processes will include IoT sensing/control systems by 2022.

72%

of adopters expect security and privacy concerns will be greatly reduced, opening the way for much-increased use of IoT.

78%

of adopters think that by 2022 regulation will exist that forces companies to disclose breaches of IoT data.

82%

of adopters believe many companies will be collaborating with companies in different industries to build joint IoT solutions.


IoT in 2022: A glimpse into the future

IoT will be business as usual

Some technologies come and go. But other technologies change the world around us and become part of the fabric of our lives — smartphones for one. A few technologies, like cloud computing, quickly move from bold and new to being the norm. And we think that by 2022 we'll be saying the same about IoT.

We're already seeing tiny IoT devices that can last for years. These are enabling companies to connect all manner of devices virtually transparently. And as devices get smaller, more robust and long-lasting — and connectivity gets faster, more cost-effective, and becomes virtually ubiquitous — the possibilities are almost unlimited.

71% of adopters think that by 2022 we'll no longer be talking about IoT, it will just be business outcomes.



"I can confidently say that all the parties involved in our industry would like to, and need to, invest more and more in IoT. IoT can help each party get more accurate monitoring of the workflow — this would help the enterprises sustain their businesses."

Global transport and logistics company, China

But usual will be very different

Even now, in 2017, most large enterprises have integrated their IoT projects with core systems and initiatives to drive digital transformation. By 2022 organisations will take it for granted that vending machines, vehicles and HVAC systems can be monitored and controlled remotely. In fact, it's likely that unconnected systems will be considered antiquated. Whether or not we'll have reached the point where we can beckon our self-driving car from our connected jacket is hard to predict, but we can state with confidence that IoT will be core to millions of business processes.

79% of adopters say that over 50% of business processes will include IoT sensing/control systems by 2022.

Today, 49% of adopters are using analytics with their IoT data to improve business decision-making. As the number of devices increases, so will the volume of data. We believe that over the next five years we'll see a massive increase in the use of AI and machine learning to analyse all this data and turn it into actionable intelligence. This will drive a shift from diagnostic, towards predictive and prescriptive analytics. That will help enable businesses to become more outcome-driven, improve customer experiences and achieve even greater ROI.

79% of adopters think that more than half of enterprises will be using AI and machine learning to make sense of their IoT data by 2022.

Some things won't go away

The number of bank robberies has been falling for years. But there are still criminals, and banks still fall victim. The problem hasn't gone away; it's merely been displaced. While we'd love to predict that all IT security worries will be resolved in five years' time, cybercriminals are likely to still be a problem in 2022 — despite the superior resources of governments and large enterprises. But the organisations that we interviewed were confident that IoT security concerns will be less significant.

72% of adopters expect security and privacy concerns will be greatly reduced, opening the way for much-increased use of IoT.

Since 2013 when we began the IoT Barometer, security and privacy have been two of the biggest concerns for organisations considering adopting IoT. But companies are tackling the threats: they are training staff (48%) and actively scanning for vulnerabilities (40%). 35% are having their devices certified, and we expect that to increase.

81% of adopters expect certification of devices to be the norm by 2022.

Organisations' efforts to improve security have partly been driven by increased regulation around data protection and privacy — especially the introduction of the General Data Protection Regulation (GDPR) in the EU. That has put an even greater onus on companies to be more transparent about what data they capture and what they do with it, and how they secure it. The need for greater oversight and control of IoT systems and the data that they gather — combined with the increase in the number of devices — is likely to drive more companies to start using an IoT platform.

74% of adopters believe that at least one country will have introduced a law giving citizens ownership of all their data, including that from IoT devices.

Partnerships will still be key to success

Few organisations have all the skills and resources necessary to launch a successful IoT project on their own. By 2022, the skills required to build, deploy and manage IoT solutions will be more widespread — they'll almost certainly be on the syllabus of many IT degree courses. But if we're still seeing usage growing quickly and new applications emerging, as we believe we will, then there's still likely to be a gap. The increased demand for cybersecurity experts has been predicted for years, but availability still lags requirements. It takes time for society to adapt to significant changes in the job market.

That's one of the reasons more organisations will work together to realise the full potential of IoT. Companies will turn to partners to help them understand where IoT can improve their business, develop solutions, deploy and manage devices, integrate IoT with other systems, and improve their analytics capabilities. But they'll also collaborate with other companies in the same industry and other industries to deliver innovative new solutions that wouldn't have been possible otherwise.

80% of adopters think many companies will be collaborating with companies in the same industry to build joint IoT solutions. 82% think they'll be collaborating with companies in different industries.



The analyst view

If you are looking at IoT in 2022, we would expect the value chain of IoT solutions to break down into its component parts, much as a PC can be built using standardised commodity parts. This will make it simpler, faster and cheaper to build IoT products. And we think many of the standards battles that we are currently seeing will have been played out.

Partly in consequence of this, we would expect adoption of IoT solutions to be much more widespread than the current 29% in Vodafone's survey — the vast majority of large enterprises will have adopted IoT solutions (though many of these won't be thought of or referred to as "IoT").

In terms of the applications and use cases, while we can anticipate many of them, we think we are also in for a number of surprises — ideas that we cannot imagine now but that will seem obvious when they happen. We have seen this in communications — from SMS to Snapchat. As IoT becomes more mass market, the same sort of unexpected developments will happen.



Next steps

We've talked a lot about how IoT is becoming intrinsic to the fabric of some businesses. But that doesn't mean it's too late to get started. IoT is some way from reaching its full maturity. There are big gains to be achieved by companies rolling out even the smallest of programmes. And, as devices become more sophisticated and new networking options come on line, IoT has never been more accessible.

If you have started, you'll see the benefits increase as you do more and as you move away from point solutions. The biggest benefits will come when organisations can make full use of the data they're collecting from IoT. Standardisation will go a long way to making that easier. And it will also make it easier for companies to forge the sorts of collaborations that will take IoT to the next level.

Further reading

IoT Barometer

- **2016 IoT Barometer:** vodafone.com/business/iot/the-iot-barometer-2016
- **2015 M2M Barometer:** vodafone.com/business/iot/the-m2m-adoption-barometer-2015-07-08
- **2014 M2M Barometer:** vodafone.com/business/iot/the-m2m-adoption-barometer-2014-07-02
- **2013 M2M Barometer:** vodafone.com/business/iot/the-m2m-adoption-barometer-2013-06-26



Securing the Internet of Things

Our white paper, "Securing the Internet of Things" will help you understand IoT security better. It provides tips on how you can secure your IoT data. Ultimately, every organisation is different and many of the risks you face when you adopt IoT will be unique. The security measures you put in place should align to those risks, your attitudes and your budgets.

- vodafone.com/business/iot/securing-the-iot-your-six-biggest-questions-answered



NB-IoT white paper

Our white paper, "Narrowband-IoT: pushing the boundaries of IoT", gives technical decision makers an overview of NB-IoT, the communications technology that will underpin industrial-grade IoT deployments.

- vodafone.com/business/iot/narrowband-iot-pushing-the-boundaries-of-iot



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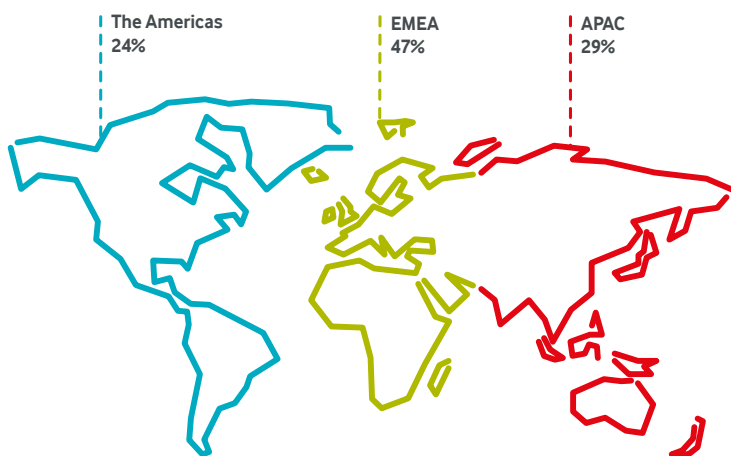
About the research

This year, we interviewed more businesses than ever: 1,278 qualified respondents. These respondents were carefully selected to represent a selection of:

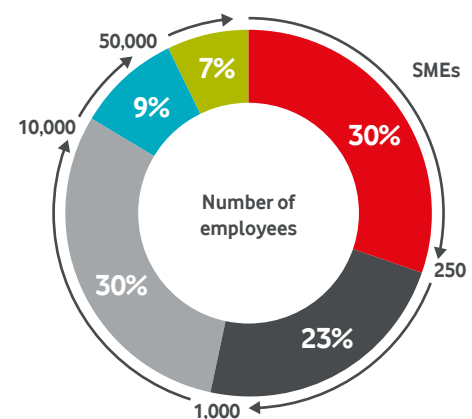
- **Regions:** We surveyed 13 countries across all major regions: US (214), Brazil (98), Ireland (54), UK (126), Germany (133), Italy (97), Spain (96), South Africa (94), China (102), India (109), Japan (40), Australia (48), and New Zealand (67).
- **Industries:** Respondents came from retail, manufacturing, energy and utilities, healthcare, transport and logistics, automotive, consumer electronics, and the public sector.
- **Company sizes:** We had responses from decision makers in a range of organisations, from SMEs to some of the largest multinationals. 17% had 10,000 or more employees.
- **Roles:** We only surveyed qualified decision makers at senior manager level or above, but they represented a mix of departments. 37% of our respondents were from IT functions; 7% were from sales and marketing; and 8% from finance. 13% were board or C-level.

All figures have been rounded to the nearest 1%.

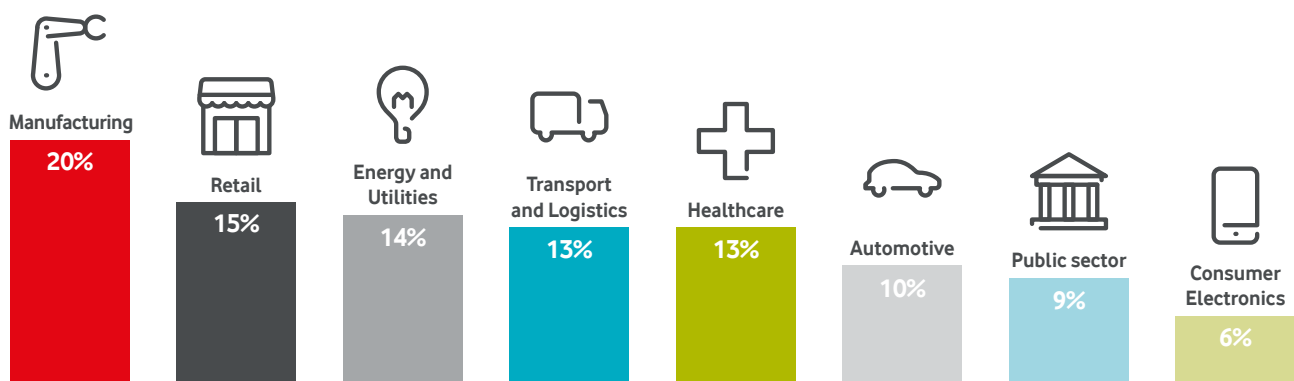
Split of respondents by region



Split by business size



Split of respondents by vertical sector



Contributors

Analysys Mason

Analysys Mason is a global consultancy and research firm specialising in telecoms, media and technology for more than 30 years. Since 1985, Analysys Mason's consulting and analyst teams have played an influential role in key industry milestones and helping clients around the world through major shifts in the market. Our consulting and research divisions continue to be at the forefront of developments in digital services and transformation, and are advising clients on new business strategies to address disruptive technologies. Our experts located in offices around the world provide local perspective on global issues.



Tom Rebbeck, Research Director, leads Analysys Mason's Enterprise and IoT research practice, drawing on more than 16 years of experience in the telecoms sector. He is a specialist on IoT and other enterprise services, and has written widely on the role for operators as telecoms markets develop. As well as published research, he has worked on projects for a range of clients — including operators, regulators, industry bodies and vendors. Many of these projects have been supported by original research, such as expert interviews and customer surveys. Tom joined Analysys Mason from Telefónica, where he had helped develop and launch a number of services across Telefónica's worldwide footprint.

Find out more at analysysmason.com

Circle Research

Circle Research is the B2B market research company. Circle was founded in 2006 as an alternative to traditional research agencies who are consumer focused and deliver bland, uninspiring, academic outcomes. Our mission is to uncover hidden truths about your target market and help translate these into marketing and commercial success.



Based in London, we work globally with ambitious B2B firms, including half of the Top 10 B2B Superbrands. In 2016, we won the Market Research Society's Best Agency Award.

Circle is part of the Next 15 Group PLC.

Learn more at circle-research.com, or follow us on Twitter @circle_research

Vodafone IoT

Vodafone Internet of Things (IoT) connects machinery, vehicles and other business assets to the network, delivering new functionality and enhanced services. Supported by more than 1,300 dedicated employees, Vodafone's end-to-end IoT solutions make it easy for businesses to deliver and deploy IoT solutions across multiple territories. We have been highly rated by prominent industry analysts including Analysys Mason, Current Analysis and Machina Research. We have also been positioned as a Leader in the Gartner Magic Quadrant for Managed Machine-to-Machine Services.



For more information, visit vodafone.com/iot

vodafone.com/iot

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