

Deloitte.



**What does the future hold
for technology, media,
and telecommunications?**
Explore the 2019 Predictions

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Prediction 1

5G: The new network arrives

“It will likely take years for 5G to replicate 4G’s marketplace dominance, in the same way that it took several years for 4G to displace 3G.”

The key trends that Deloitte predicts for 5G:

- 2019 will be the year in which fifth-generation (5G) wide-area cellular mobile networks arrive at scale, with 25 operators around the world expected to have launched 5G services in at least part of their territory (usually cities).
- A further 26 operators should launch (again with the focus on cities) in 2020. In the UK, all four operators (EE/BT, Vodafone, O2 and 3 UK) are planning to launch 5G services between 2019-20. It will be many years however before 5G rollout is complete.
- Approx. 20 handset vendors will launch 5G-ready handsets in 2019 (with the first available in Q2).
- Approx. 1 million 5G handsets (out of a projected 1.5 billion smartphone handsets sold in 2019) will be shipped by year end. UK 5G smartphone shipments may total about 50k, and in 2020 will range between 2-3 million.
- One million 5G modems (also known as pucks or hotspots) will be sold, and around a million 5G fixed cellular mobile access devices will be installed.
- At the end of 2020, we expect 5G handset sales (15–20 million units) to represent approximately 1% of all smartphone sales, with sales taking off in 2021, the first year in which retailers will sell more than 100 million 5G handsets.

What are the three major applications of 5G wireless technology in 2019 and 2020?

- 1) 5G will be used for truly mobile connectivity, mainly by devices such as smartphones.
- 2) 5G will be used to connect “less mobile” devices, mainly 5G modems or hotspots: dedicated wireless access devices, small enough to be mobile, that will connect to the 5G network and then connect to other devices over Wi-Fi technology.
- 3) Finally, there will be 5G fixed-wireless access (FWA) devices, with antennas permanently mounted on buildings or in windows, providing a home or business with broadband in place of a wired

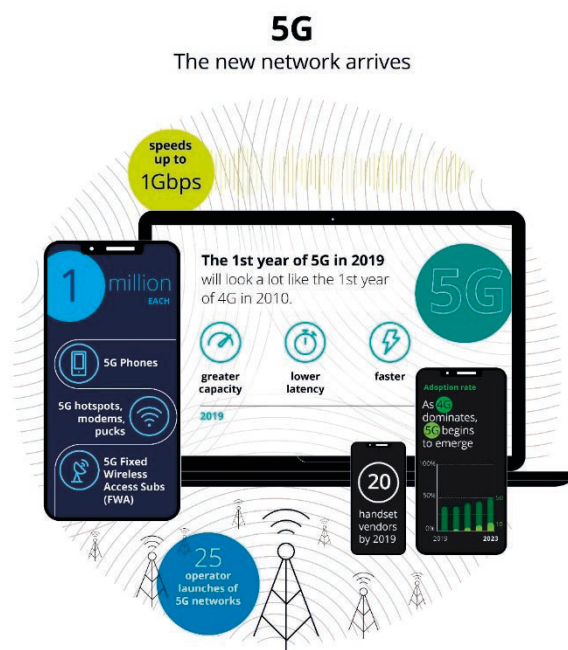
connection. In the UK two operators may launch FWA services in 2019 or 2020.

Will 5G impact 4G rollout?

5G spend may simply replace prior spend on 4G rollout. One study predicted that 5G might cause capex to jump from 13% to 22% of revenue for only a limited rollout¹. But as 2018’s field trials progressed, many operators in North America, Europe, and Japan re-evaluated cost, and releasing public guidance that capex intensity for 5G would be more or less flat with their 4G spending².

As far as spectrum goes, early signs are that operators’ spectrum costs will be closer to the 4G experience than the 3G. Based on some early auctions, the prices for 5G spectrum, depending on the frequency band, are consistent with those for 4G spectrum: all auctions in the six countries in figure 3 have been for less than £0.16 MHz pop, and two were under a penny. In the UK the price for 5G spectrum is £0.13 MHz pop³.

5G is the connectivity technology of the future – even if its adoption curve may be relatively shallow in the next 12 to 24 months. It will likely take years for 5G to replicate 4G’s marketplace dominance, in the same way that it took several years for 4G to displace 3G.



Prediction 2

Artificial Intelligence: From expert-only to everywhere

The trouble with AI, however, is that to date, many companies have lacked the expertise and resources to take full advantage of it.”

The key trends that Deloitte predicts for Artificial Intelligence:

- In 2019, companies will accelerate their usage of cloud-based artificial intelligence (AI) software and services.
- Among companies that adopt AI technology, 70% will obtain AI capabilities through cloud-based enterprise software, and 65% will create AI applications using cloud-based development services.
- By 2020, penetration rates of enterprise software with integrated AI and cloud-based AI platforms will reach an estimated 87% and 83%, respectively, among companies that use AI software. Cloud will drive more full-scale AI implementations, better return on investment (ROI) from AI, and higher AI spending. Importantly, we will see the democratization of AI capabilities—and benefits—that had heretofore been the preserve only of early adopters.

What is AI?

AI consists of multiple technologies. At its foundation are machine learning and its more complex offspring, deep-learning neural networks. These technologies animate AI applications such as computer vision, natural language processing, and the ability to harness huge troves of data to make accurate predictions and to unearth hidden insights. The recent excitement around AI stems from advances in machine learning and deep-learning neural networks—and the myriad ways these technologies can help companies improve their operations, develop new offerings, and provide better customer service at a lower cost.

Why aren't companies taking full advantage of AI?

The trouble with AI, however, is that to date, many companies have lacked the expertise and resources to take full advantage of it. Machine learning and deep learning typically require teams of AI experts, access to large data sets, and specialized infrastructure and processing power. Companies that can bring these assets to bear then need to find the right use cases for applying AI, create customized solutions, and scale them throughout the company. All of this requires a level of investment and sophistication that takes time to develop, and is out of reach for many.

What are the benefits to investing in AI and which companies are taking full advantage?

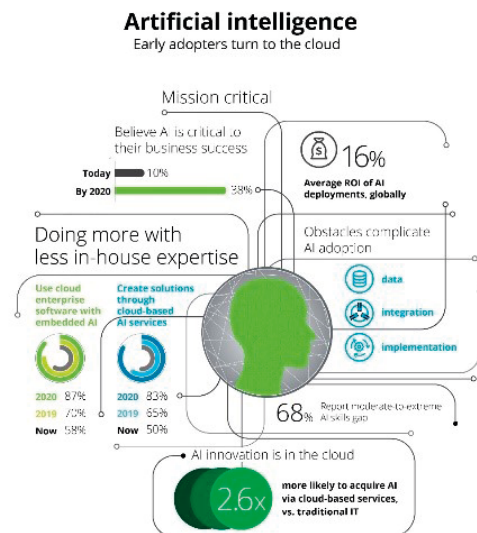
For the reasons above, AI's initial benefits have accrued mainly to pioneers with the required technical expertise, strong IT infrastructure, and deep pockets to acquire scarce and costly data science skills—most notably the global “tech giants.” They have the resources to engage in bidding wars for increasingly expensive AI talent. They have also invested billions in infrastructure, including massive data centres and specialized processors. For example:

- Google has designed its own AI-specific chips to accelerate machine learning in its data centres and on IoT devices.
- Amazon has used machine learning to drive recommendations for many years. The company is using deep learning to redesign business processes and to develop new product categories, such as its virtual assistant.
- China's BATs—Baidu, Alibaba, and Tencent—are investing heavily in AI while expanding into areas previously dominated by US companies: chip design, virtual assistants, and autonomous vehicles.
- These tech giants are using AI to create billion-dollar services and to transform their operations. To develop their AI services, they're following a familiar playbook: (1) find a solution to an internal challenge or opportunity; (2) perfect the solution at scale within the company; and (3) launch a service that quickly attracts mass adoption. Hence, we see Amazon, Google, Microsoft, and China's BATs launching AI development platforms and stand-alone applications to the wider market based on their own experience using them.

Joining them are big enterprise software companies that are integrating AI capabilities into cloud-based enterprise software and bringing them to the mass market. Salesforce, for instance, integrated its AI-enabled business intelligence tool, Einstein, into its CRM software in September 2016; the company claims to deliver 1 billion predictions per day to users. SAP integrated AI into its cloud-based ERP system, S4/HANA, to support specific business processes such as sales, finance, procurement, and the supply chain. S4/HANA has around 8,000 enterprise users, and SAP is driving its adoption by announcing that the company will not support legacy SAP ERP systems past 2025.

A host of start-ups is also sprinting into this market with cloud-based development tools and applications. These start-ups include at least six AI “unicorns,” two of which are based in China. Some of these companies target a specific industry or use case. For example, CrowdStrike, a US-based AI unicorn, focuses on cybersecurity, while Benevolent.ai uses AI to improve drug discovery.

The upshot is that these innovators are making it easier for more companies to benefit from AI technology even if they lack top technical talent, access to huge data sets, and their own massive computing power. Through the cloud, they can access services that address these shortfalls—without having to make big upfront investments. In short, the cloud is democratizing access to AI by giving companies the ability to use it now.



Prediction 3

Smart Speakers: Growth at a discount

“In many workplaces, including hospitals, theatres, factories, chemical labs, and restaurant kitchens, smart speakers could make operations safer and more precise.”

The key trend that Deloitte predicts for smart speakers:

- The industry for smart speakers—internet-connected speakers with integrated digital assistants—will be worth £5.6 billion in 2019, selling 164 million units at an average selling price of £34⁴.

How does our prediction compare to smart speaker sales in 2018?

Our prediction compares to 2018 sales of 98 million units at an average price of £35, and a total industry revenue of £3.4 billion. This 63% growth rate would position smart speakers as the fastest-growing connected device category worldwide in 2019, and lead to an installed base of more than 250 million units by year-end⁵.

However, sales growth is slowing: in Q2 of 2018, smart speaker sales increased 187% year on year⁶.

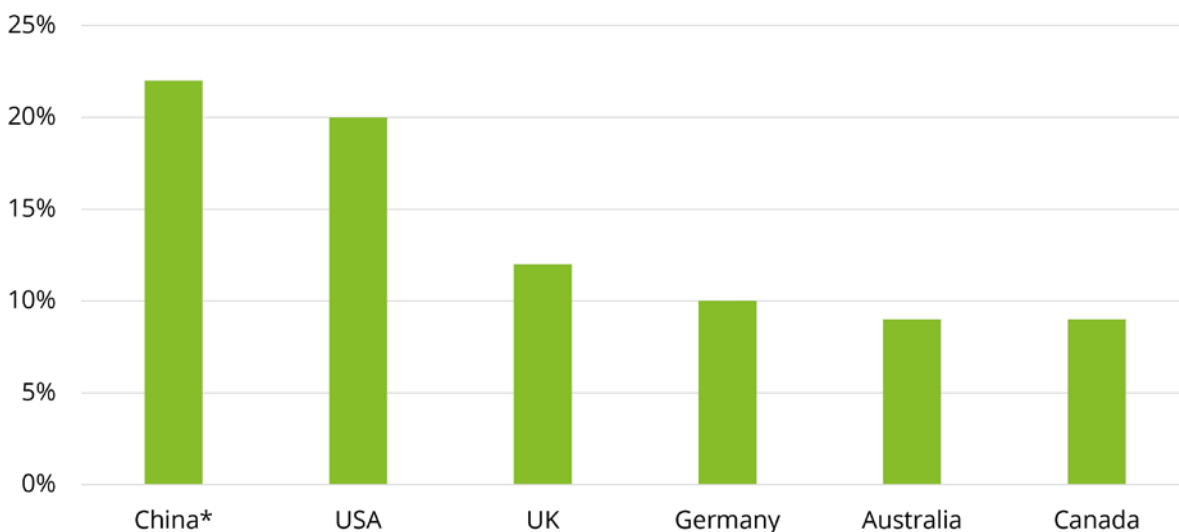
Which countries are adopting smart speakers at a faster rate?

The UK is expected to be the third largest smart speaker market in 2019, after the US and China. The UK is expected to represent about 8% of all shipments in 2019⁷.

According to our research, the smart speaker was the device with the sharpest growth in ownership in the year to mid-2018 in six of the seven markets in which they were available from multiple major brands (urban China, the US, Japan, the UK, Canada, and Australia, with only Germany lagging)⁸.

As of mid-2018, penetration of smart speakers was highest in urban China, with 22% of adults having access to a smart speaker, followed by the US, with 19% and the UK with 12% of adults having access to one⁹.

Figure 1: Urban China and the United States lead in smart speaker ownership



Source: Australia/Canada/China/Germany/UK/US edition, Deloitte Global Mobile Consumer Survey, June 2018. Base: Respondents aged 18–75 years residing in Australia: 2,000, Canada: 2,000, Germany: 2,001, UK: 4,000, US: 2,003. Respondents aged 18–50 residing in urban China: 2,000

Smart speakers have, literally, a world of opportunity for growth in non-English-speaking countries. At the end of 2017, 95% of sales were to English-speaking markets¹⁰, specifically the United States and the United Kingdom. By early 2019, however, these speakers will be spreading their linguistic wings to customers speaking Chinese, French, Spanish, Italian, and Japanese.

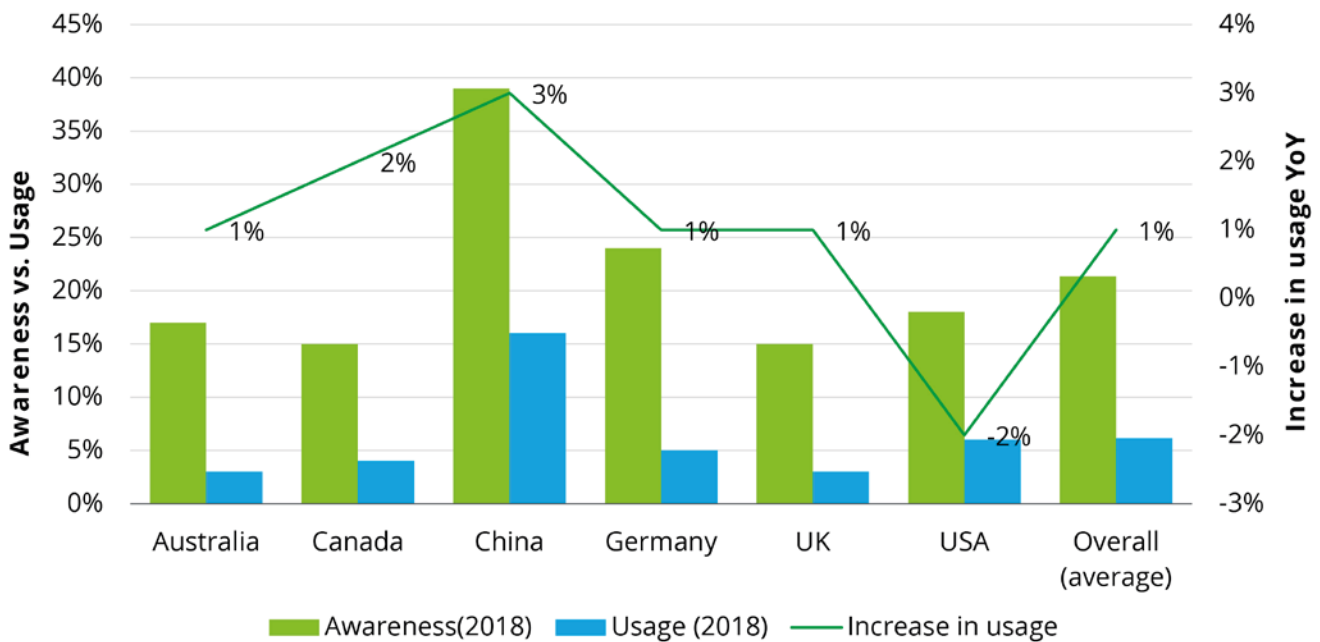
In addition to wider language support, smart speakers are improving in speech recognition accuracy, enhancements that can be applied and amortized across a widening range of devices.

Smart speakers' complexity and build cost are also declining, partly due to a reduction in the number of microphones required per device.

How can different companies and industries use smart speakers?

In many workplaces, including hospitals, theaters, factories, chemical labs, and restaurant kitchens, smart speakers could make operations safer and more precise (see side bar for more information). We believe that in the long term, the number of smart speakers in the workplace might exceed that in homes, and the value of the tasks they do may be orders of magnitude greater than playing music or checking the weather

Figure 2: Voice recognition on smartphone



Are users also engaging with their smartphone voice assistants?

Demand for smart speakers will likely be driven by utility. It is worth noting in this regard that, even though digital voice assistants, which are core to smart speakers, have been available on a range of devices for several years—and are installed on tens of billions of consumer devices today—the majority appear to be little used. According to our research, most voice assistants on smartphones, tablets, and computers have never been used.

The majority of owners who have used a voice assistant have used a smart speaker, since they cannot be controlled without using the voice feature. The challenge is not just getting people to try out voice assistants, but their general (historic) disinterest in voice recognition per se. Awareness of the smartphone's voice recognition capability is low (averaging 21%), and usage is even lower (averaging 6%)¹¹.

Industry Applications of Smart Speakers

A speaker could be installed in every room in a house or a hotel, every office in a building, every classroom in a school, or every bed in a hospital.

Several hotel chains have undertaken mass deployments of smart speakers, whose applications include serving as in-room concierges. The Marriott International Group plans to deploy Amazon's and Alibaba's smart speakers in some of its hotels; 100,000 units will be deployed in China alone. The Wynn Las Vegas has installed smart speakers in all 4,748 of its rooms. If this trend continues, many of the world's estimated 187,500 hotels and 17.5 million guest rooms could feature smart speakers or voice control within the next decade.

Drive-through restaurants could use voice automation to take orders. This would free up workers from having to manually process orders. In the United States alone, there are more than 12 billion drive-through orders per year.

One hospital in Sydney, Australia has piloted the use of smart speakers as an upgrade to a bedside call button. Unlike a call button, smart speakers allow patients to specify requests. The smart speaker can handle simple tasks, such as turning on the television, lowering the blinds, or turning down the lights, via voice commands from the patient, saving time and labor.

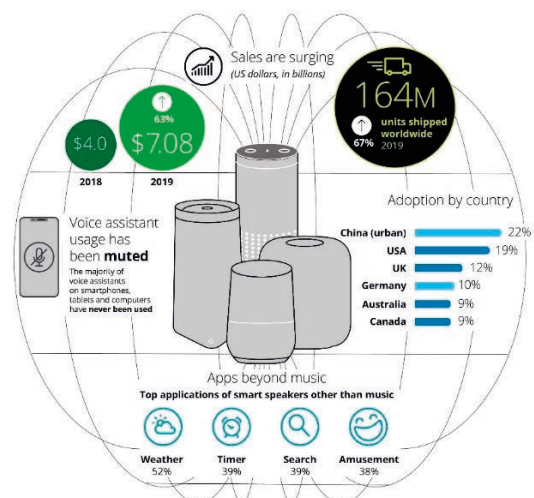
If a patient just needs an additional pillow, a junior staff member could get it, leaving nurses and doctors to focus on tasks that require their specialized skills. If a nurse or doctor were needed, the patient could describe their symptoms, which would enable the staff to prioritize requests. The appropriate medical staff member would be notified, and the patient would be reassured (via the speaker) that someone was on the way.

The availability of a voice assistant does not guarantee it will be used. As of mid-2018, the majority of voice assistants integrated into devices are dormant in UK. For example, 88 per cent of 16-75 year olds have a smartphone, but only 34 per cent have ever used any voice assistant on this device, and a mere nine per cent use this functionality daily¹².

The smart speaker has plenty of potential. But it will take years for its true impact to be felt. Mass adoption has yet to happen, voice recognition accuracy has plenty of scope for improvement, and there are still relatively few apps available.

Smart speakers

The world's fastest-growing connected device



Prediction 4

Radio: Revenue, reach, and resilience

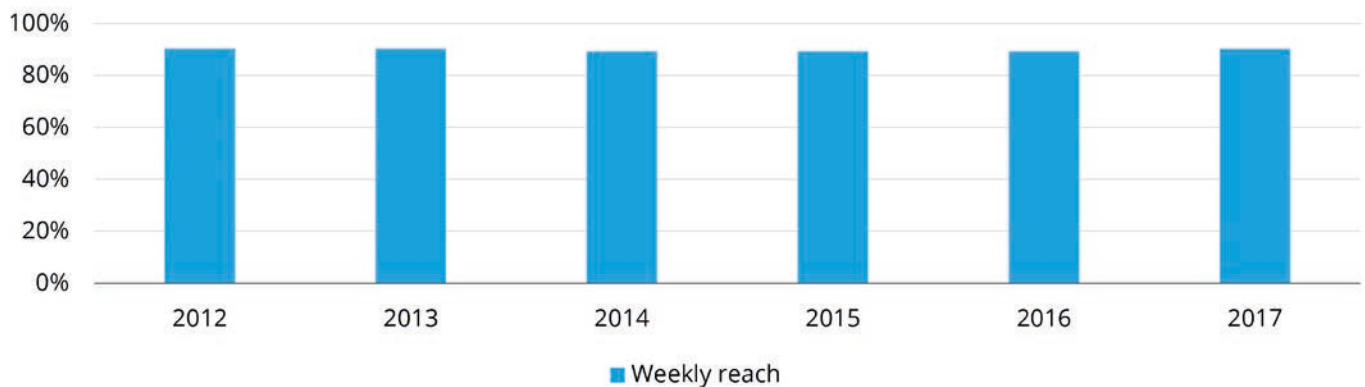
“In Q1 2018, not only was radio ad spending in the UK up 12.5% year over year, but radio advertising was the fastest-growing type of advertising, outpacing even internet advertising.”

The key trends that Deloitte predicts for radio are:

- In 2019, global radio revenue will reach £31.6 billion, a 1% increase over 2018¹³.
- Radio’s weekly reach will remain nearly ubiquitous, with over 85% of the adult population listening to radio at least weekly in the developed world (the same proportion as in 2018). Combined, nearly 3 billion people worldwide will listen to radio at least weekly¹⁴.

- Adults in developed countries will listen to an average of 90 minutes of radio a day, similar to 2018.
- Finally, we expect that unlike some other forms of traditional media radio will continue to perform well among younger demographics. Radio is likely to reach 90% of adults in the UK on a weekly basis in 2019, similar to prior years.

Figure 1: Weekly radio reach in UK

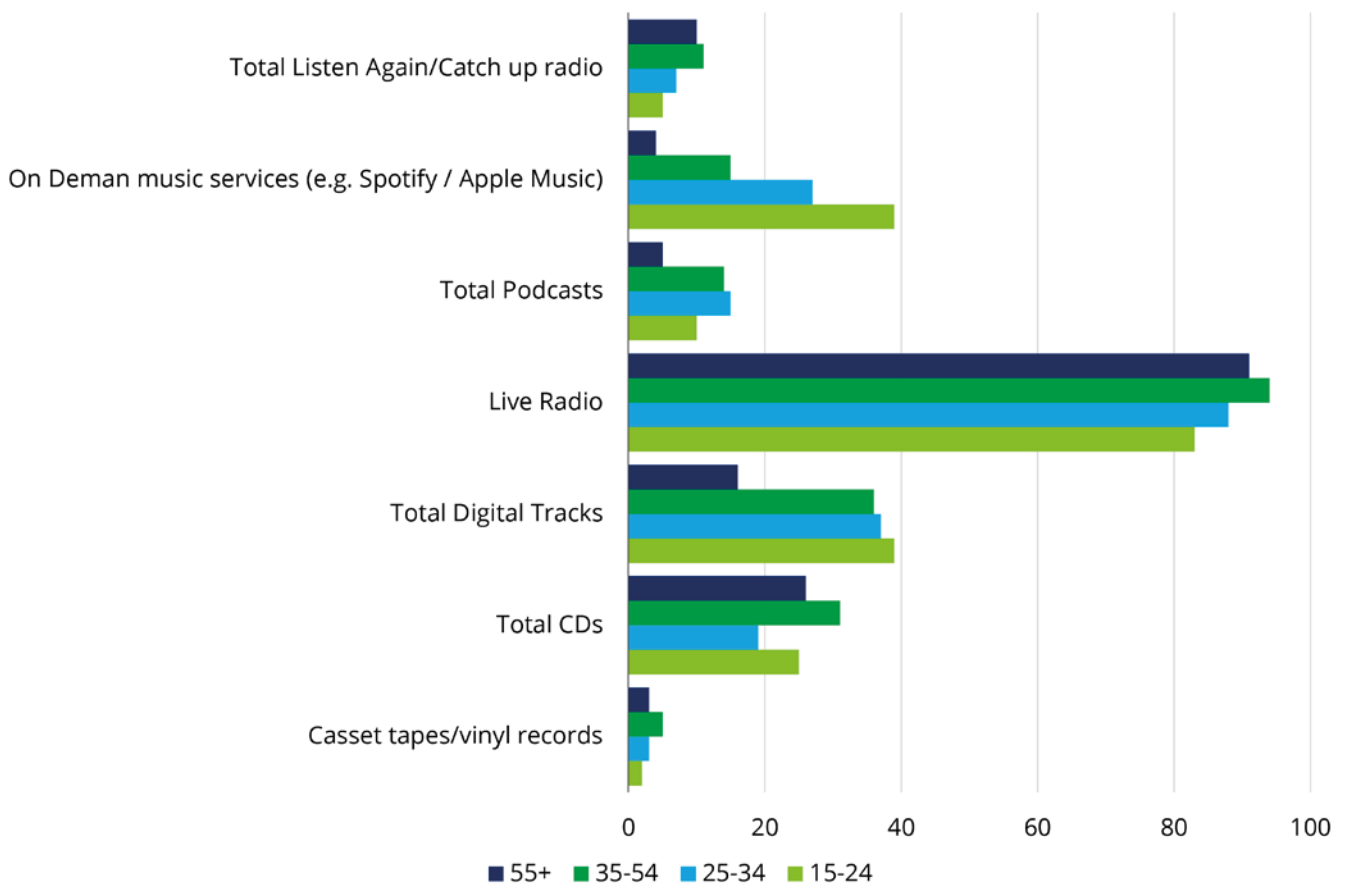


Source: Ofcom, Communications market report 2018

Who is listening to the radio?

The vast majority (83%) of 15-24 year olds in the UK listen to radio. The proportions are yet higher among 25-34 year olds (88%) and 35-54 year olds (94%). Radio listening remains far more popular among all age groups than on-demand services, usage of which peaks at 39% among 15-25 year olds (see Figure 2).

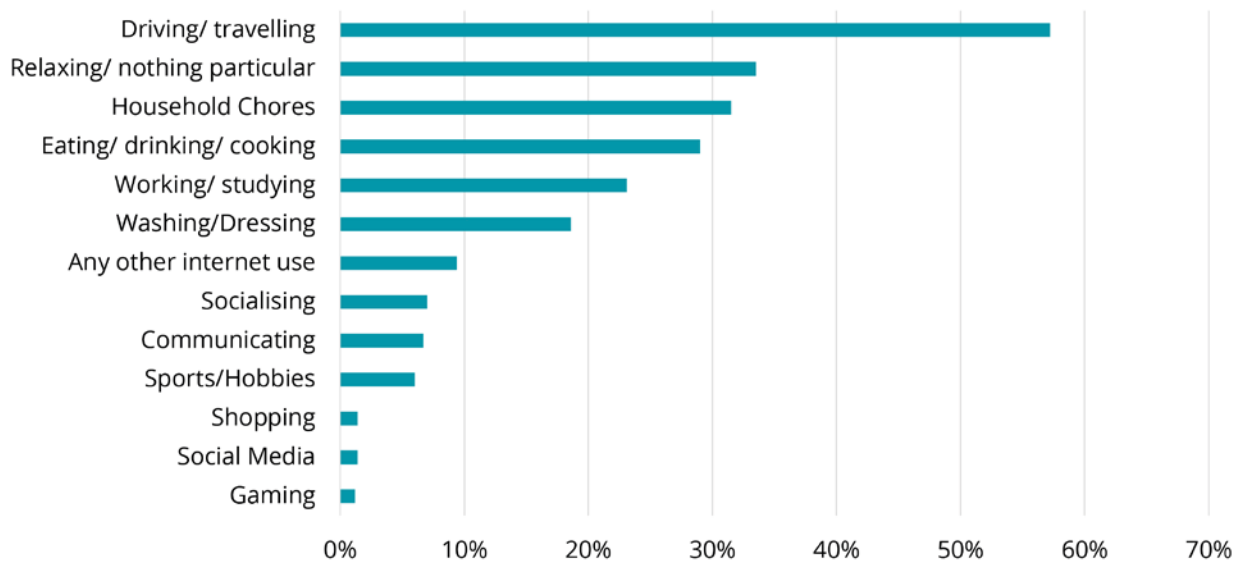
Figure 2: Audio reach by age group



How does radio reach stay stable?

Radio's resilience is largely due to its role as a background accompaniment to existing activities. Nearly 60% of all adults listen to the radio while driving or travelling. At home, one in every three radio listeners does so while doing another physical task, such as cooking, eating or doing household chores. Radio may also be in the background even when playing video games or shopping.

Figure 3: Live radio by activity

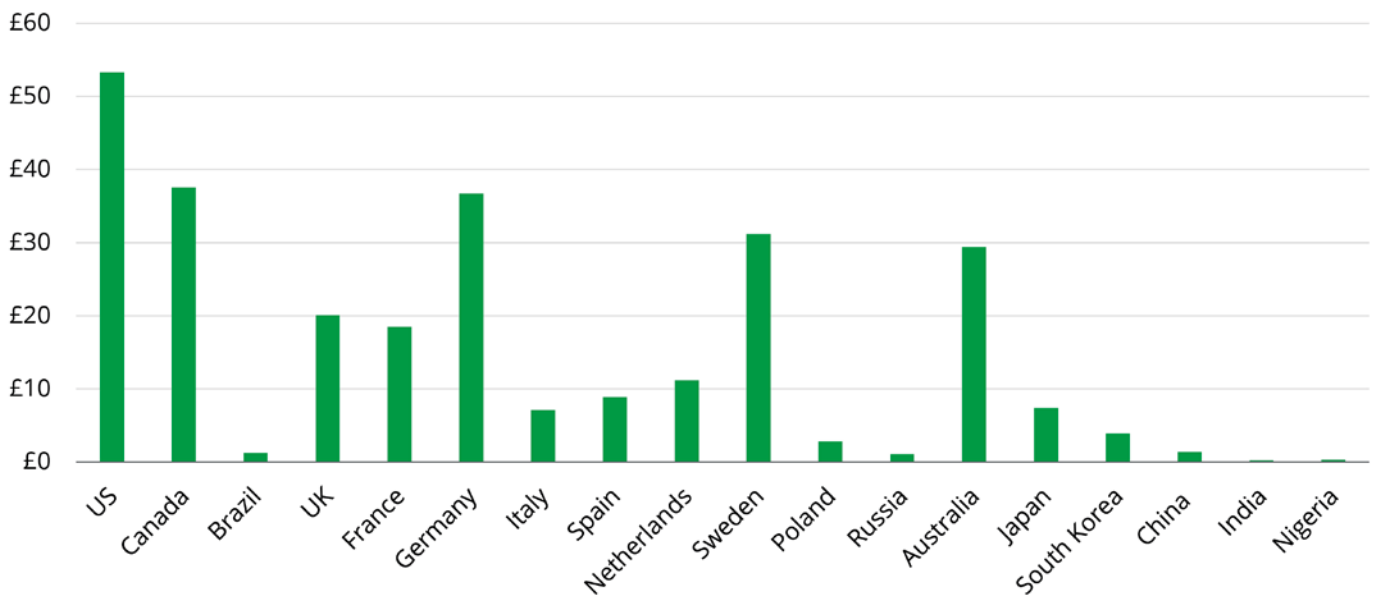


Source: RAJAR Midas audio survey, Spring 2017
https://www.rajar.co.uk/docs/news/MIDAS_Spring_2017.pdf

In Q1 2018, not only was radio ad spending in the UK up 12.5% year over year (after a lengthy period of decline), but radio advertising was the fastest-growing type of advertising, outpacing even internet advertising¹⁵.

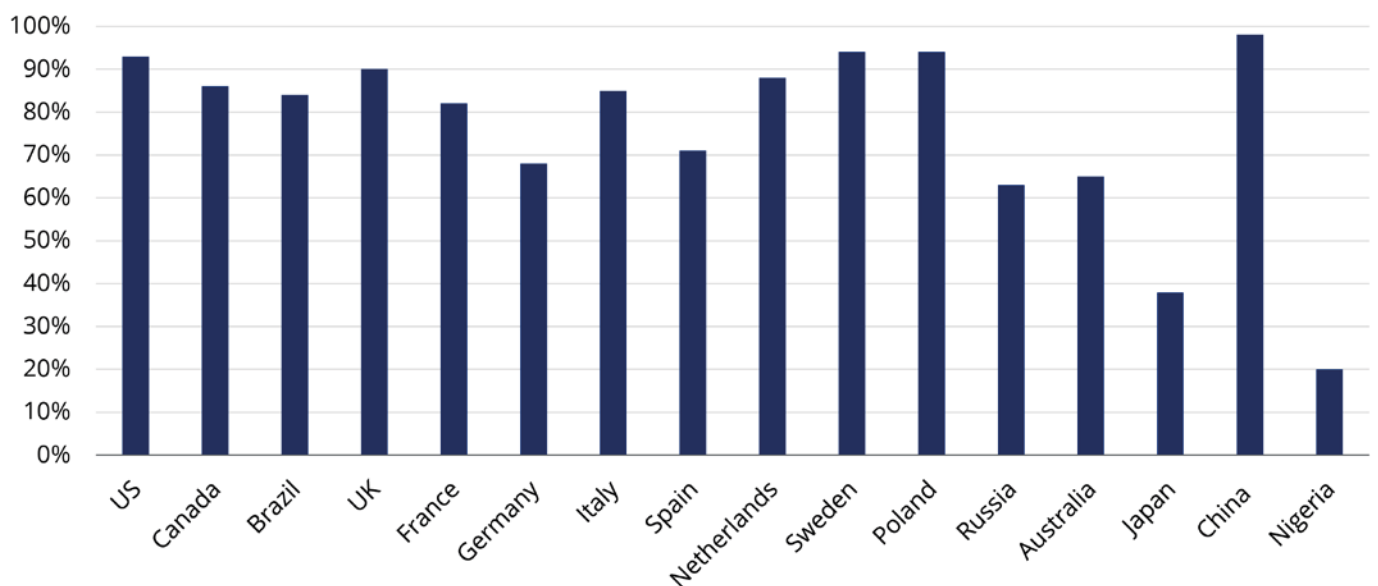
When considering radio's attractiveness to advertisers, it is important to note that radio's popularity varies significantly from country to country in both reach and revenue generated per capita (see Figures 4 and 5). Interestingly, there seems to be no clear correlation between radio reach in each country and industry revenues.

Figure 4: Radio listeners in different countries generate variable amounts to the radio industry



Sources: The International Communications Market 2017, Ofcom, December 18, 2017; Canadian Radio and Telecommunications Commission data; Statista.

Figure 5: Radio reach varies among countries



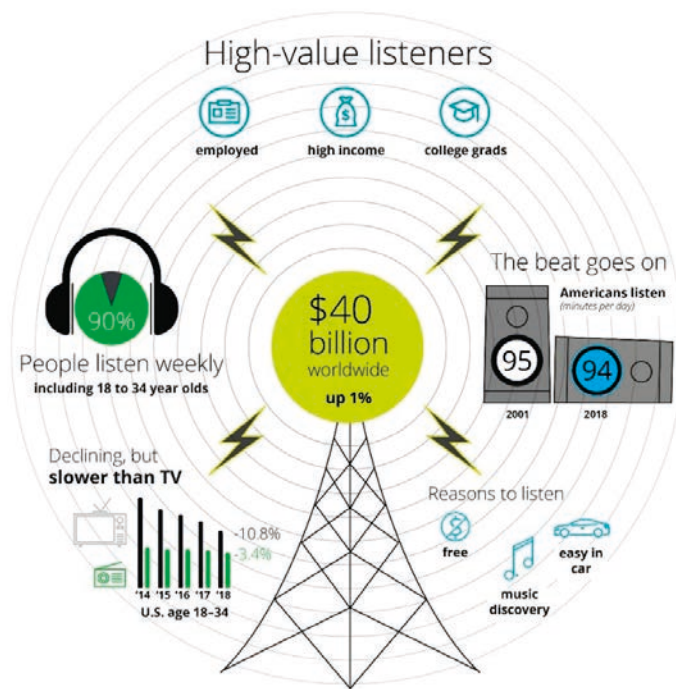
Sources: The International Communications Market 2017, Ofcom, December 18, 2017; Nielsen for the United States; Numeris for Canada.

By some metrics, radio compares favourably to TV. For example TV watching in U.K. by the youngest demographic has decreased 42% since 2010.

Radio has no such existential crisis or looming demographic cliff. In 2017, radio attracted about 6% of global ad spending (about 9% in North America), and in 2019, it will likely be around 6% again¹⁶.

Radio

Reliable revenue, reach, and resilience



Prediction 5

3D printing growth accelerates again, but remains niche

“There are likely to be multiple, specialised areas where 3D printing is highly competitive and suited to needs. One such example is bionic prosthetic limbs for children”

The key trends that Deloitte predicts for 3D printing:

- 3D printing’s growth phase is likely to return in 2019. We predict that sales related to 3D printing by large public companies—including enterprise 3D printers, materials, and services—will surpass £2.1 billion in 2019 and £2.4 billion in 2020.
- This area of the industry is poised to grow at approximately 12.5% in each of those years, more than double its growth rate just a few years ago.

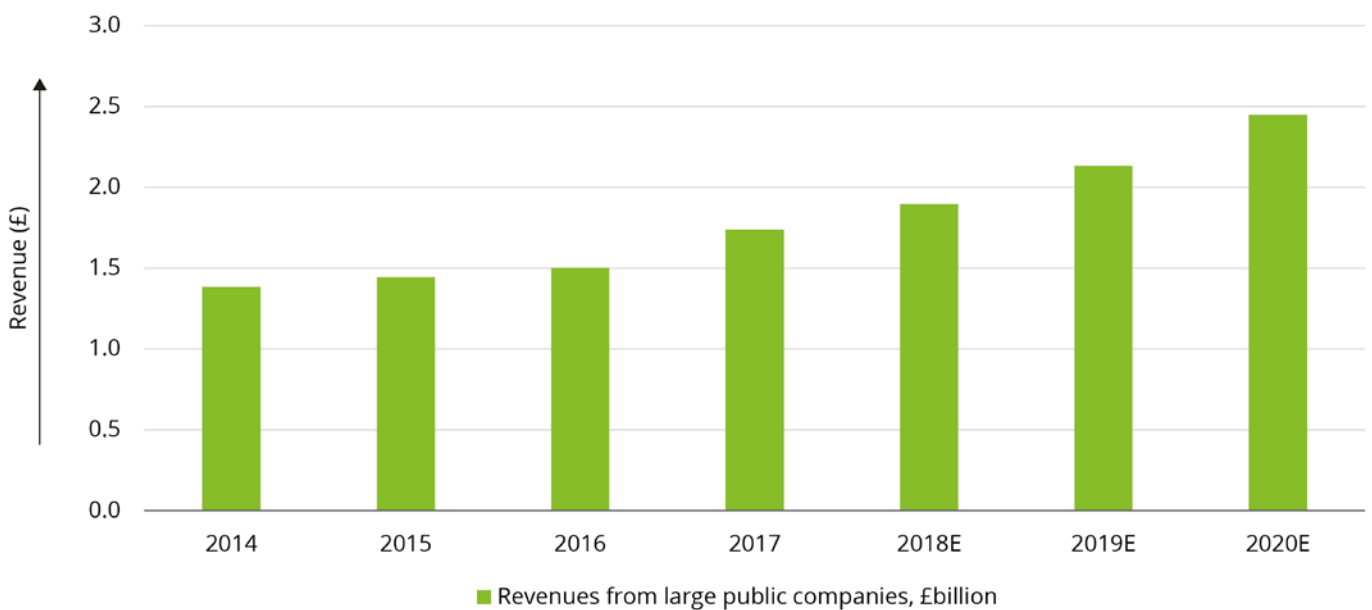
Why is 3D printing on the rise now?

3D printing, also known as additive manufacturing, was heavily hyped in its early days. In 2014 industry revenues of £1.6 billion were twice 2009 revenues. But industry revenue growth in 2015 and 2016 slowed to a mere 5% per year.

3D printing is experiencing the predicted inflection because companies in multiple industries are using it for more than just rapid prototyping. 3D printers today are capable of printing a greater variety of materials. There is more 3D printing in metal and less plastic printing. Plastic is fine for prototypes and certain final parts, but the trillion-dollar metal-parts fabrication market is the more important market for 3D printers to address.

Between 2017 and 2018, a 3D-printing industry survey showed that, although plastic was still the most common material, its share in 3D printing fell from 88% to 65% in just one year, while the share of metal printing rose from 28% to 36%. At that rate, it seems probable that metal will overtake plastics and represent more than half of all 3D printing as soon as 2020 or 2021.

Figure 1: Growth in the 3D-printing market has inflected upward



Source: Deloitte analysis of public company filings and analyst estimates.

3D printers create objects faster than they used to, and they can print larger objects (build volume). Building a part one ultrathin layer at a time is an inherently slow process. But printers are getting faster. While print time does vary by the complexity of the shape being made, the quality of the print job, and/or the materials being used, the 3D printers on the market in 2019 are twice as fast, broadly speaking, compared to 2014 models.

A few years ago, a typical high-end metal printer could only build an object that was smaller than 10 x 10 x 10 centimetres, or a cubic litre. In 2019, multiple printers are available with a 30 x 30 x 30-centimeter volume, or nine cubic litres.

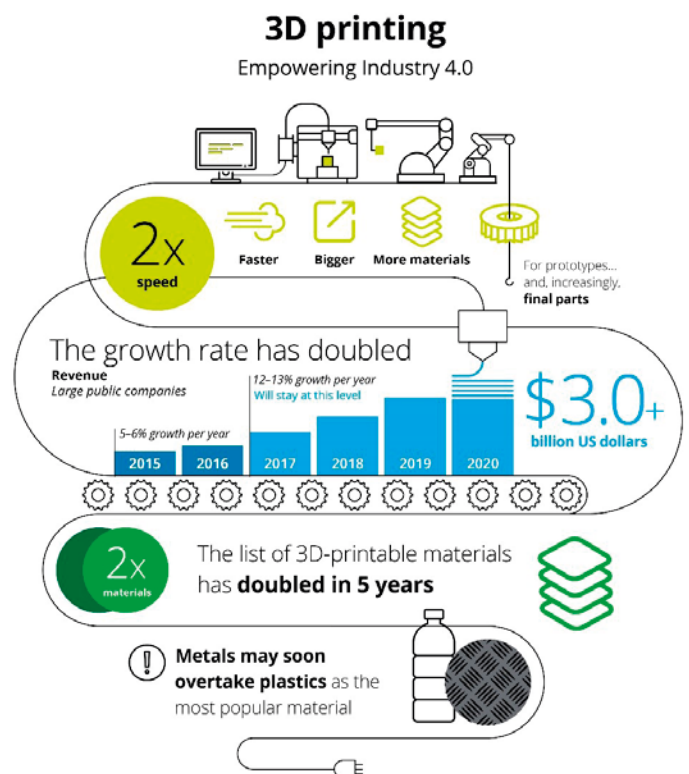
What will this mean for traditional manufacturing?

3D printers are unlikely to replace traditional manufacturing techniques, as in many cases 3D printing—is still more expensive per part than using traditional machines. 3D printers are also far slower taking hours per part instead of minutes (again excluding finishing and post-processing of various kinds).

There are parts that can only be made with 3D printing, as well as situations in which part volumes are so low that neither traditional nor subtractive manufacturing is optimal. These are the markets that are driving some of the growth that we predict for 3D printing.

What's next for 3D printing?

There are likely to be multiple, specialised areas where 3D printing is highly competitive and suited to needs. One such example is bionic prosthetic limbs for children. Providing these for children is highly costly, not just because of the base price (about £10,000), but also because of the need to replace these frequently as children grow. In the UK this has meant that few children under nine years old would be offered a bionic hand. Lower cost prosthetics are available. For example a hook would cost about £600, but this often leads to the child being teased. A 3D-printed hand, offering equivalent functionality to a traditional bionic prosthetic, may cost a mere £20. Further, this hand could be readily customised, featuring the colours of a child's favourite pop group or football team.



Prediction 6

China, by design: World-leading connectivity nurtures new digital business models

“China is well-known for being the world’s technology manufacturer; it is now becoming a leading designer of digital products, services, and business models.”

The key trends that Deloitte predicts for China’s telecommunications networks:

- In 2019, China’s telecommunications will be leading and, most likely, in the medium term.
- China’s communications infrastructure will provide a foundation for the gestation and maturation of multiple new industries, each of which could generate tens of billions of dollars in revenue annually by 2023.
- 600 million people will use their phones to make mobile payments as of the start of 2019, about 550 million people will regularly use their smartphones to shop online, and about 200 million people will use bike sharing services through their phone.
- China will have the world’s largest fibre-to-the premise (FTTP) deployment by a significant margin.
- At the start of 2019, China is likely to have over 330 million full-fibre connections, representing about 70% of the world’s total. At this point, the UK is likely to have 500,000 – 1 million full fibre connections.
- 600 million people in China will use their phones to make mobile payments as of the start of 2019.
- Approx. 550 million people in China will regularly use their smartphones to shop online in 2019.

What are the key factors supporting our predictions?

China’s strengths in connectivity will likely be a key factor in enabling it to diversify from manufacturing technology to developing—and executing—new digital business models.

For starters, China is likely to have the world’s largest 4G network, measured by base stations and subscribers. At the start of 2019, it will have almost 5 million 3G/4G base stations and 1.2 billion 4G subscribers. There are about 40,000 base stations in the UK and there were 58.4 million 4G subscribers in June 2018. Only India could rival China’s billion-plus subscribers; as of the end of 2017,

India had about 238 million 4G subscribers.

Over the coming years, China is also poised to become one of 5G’s leading markets, enabled in large part by the volume and density of the 4G network that the country has already built out. China had almost 2 million cell sites in early 2018, and is expected to launch 5G on a wide-scale basis by 2020 and to be the leading 5G market, with 430 million subscribers, by 2025.

What does this mean for China’s tech future?

China’s world-leading fixed and mobile telecommunications networks should enable it to become the leading location for developing and deploying applications requiring hyper-fast speeds of 500 megabits per second or more.

The upshot of all this connectivity should be business model innovation: step changes in connectivity over the past few decades have always enabled and catalysed new business models, whilst disrupting existing ones.

Of course, connectivity alone isn’t enough to support new business models; a base of users—potential customers—must also exist. But the recent upgrades to China’s telecommunications networks have already provided a foundation for massive digital user bases, which are the largest in the world by a margin.

These include:

- The world’s largest base of fixed and mobile internet users, with more than 825 million people projected to be online at the start of 2019. With a population of 1.4 billion, there is scope to connect further hundreds of millions more users.
- The world’s largest base of mobile internet users—more than 800 million—with almost all of these (97.5%) using the mobile web.

How does the magnitude of mobile payments in China vary from the UK?

Our prediction of 600 million people in China will use their phones to make mobile payments as of the start of 2019 compares with 531 million mobile payments users at the end of 2017 and 474 million at the end of 2016. The largest platform, AliPay (owned by Alibaba), alone had 520 million users in February 2018.

In a typical day, 3% of all phone owners in the UK purchase a product online and 3% of all phone owners pay for a product/ service in store.

The value of mobile payment transactions in China reached 81 trillion yuan (£10.1 trillion) in the first 10 months of 2017. This compares with an estimated £39 billion worth of mobile transactions in the US during the same period. In 2013, 3.8 billion transactions in China took place via nonbanking apps; in 2016, the volume was nearing 100 billion.

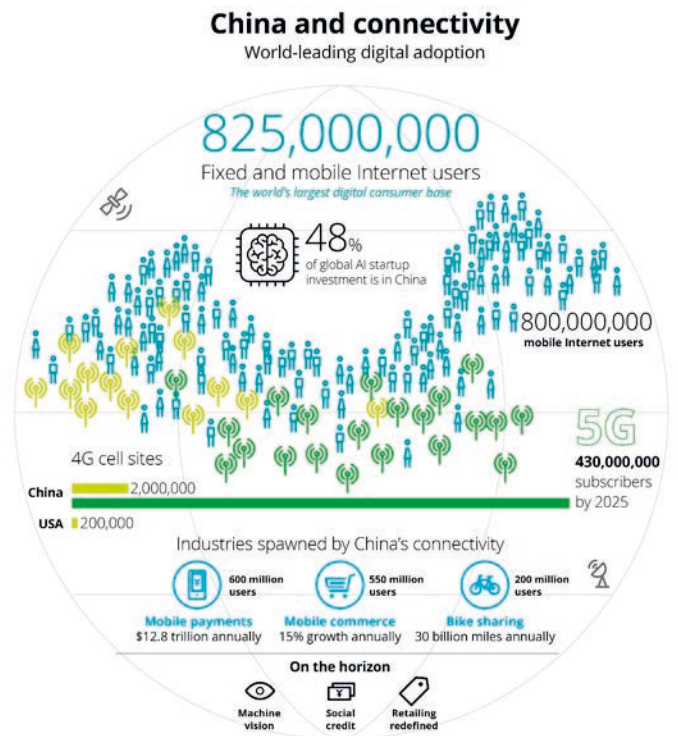
In 2017, 506 million Chinese regularly used their smartphones to shop online, a 15% increase over 2016. This positions China as having the largest base of mobile commerce users in the world.

Is China the world's leading technology manufacturer?

China is well-known for being the world's technology manufacturer; it is now becoming a leading designer of digital products, services, and business models as well. Its world-class communications infrastructure is likely to be a key enabler of this shift. It should position China well to become the premier nation for the development of applications that rely on hyper-fast connections.

The ubiquity of fibre and high-speed mobile in China also provides a vast base of beta testers and users. Indeed, the sheer size of China's market, as well as users' receptiveness to trying out new ideas, may make it the venue of choice for trying out new digital concepts.

China's strengths in connectivity should also catalyse the development of AI-based applications. AI depends on access to data sets—the larger, typically, the better. Thanks to the country's 1.2 billion 4G subscriptions, 825 million internet users, 600 million mobile payments users, and 200 million bikesharers, China's data sets are unparalleled in size. If these data sets deliver better algorithms, competitive advantage may follow.



Prediction 7

China inside: Artificial intelligence will run on Chinese semiconductors

“In 2019, the global semiconductor industry will likely focus more support on the needs of AI.”

The key trends that Deloitte predicts for Chinese semiconductors:

- Revenues for semiconductors manufactured in China will grow by 25% to approximately £87 billion in 2019 from an estimated £67 billion in 2018.
- This increase is so the country can meet the increasing domestic demand for chipsets driven in part by the growing commercialization of Artificial Intelligence (AI).

What are the current conditions that make China's future dominance in semiconductors more likely?

1) Domestic demand. China is the largest global consumer of semiconductors, importing about £158 billion worth each year. China's economic growth and its population (which includes 800 million internet users) support strong domestic demand, which in turn drives the majority of foreign suppliers' profits. While much of the developed world is nearing saturation for PCs and mobile devices, China's demand for chips has continued to grow. Indeed, vendors have grown increasingly dependent on demand from China, and more global investors are underwriting its future. This shift has helped enable China to have more control over how foreign manufacturers can access its domestic market.

2) State support. China's growth rate is higher than most developed countries, and it is the second largest economy in the world. This has enabled state and private companies to build significant reserves. The country is able to have much tighter market coordination as many of China's largest companies are state controlled. There have also been many new government led initiatives that have supported the increase:

- In 2014, the State Council of China announced the 'National Guidelines for Development and Promotion of the Integrated Circuit Industry'. The plan addressed the technology gap between Chinese manufacturers and global leaders and was supported by a £17 billion fund led by government-backed businesses.
- In 2015, China announced its 'Made in China 2025' plan, which aims to grow domestic production of core technological components—including semiconductors.

- At the end of 2017, China had plans to build at least 14 new chip foundries.
- In 2018, China is expected to spend £10 billion on fabrication equipment to become the world's second-largest buyer.

3) Growing demand for Artificial Intelligence. In 2019, the global semiconductor industry will likely focus more support on the needs of AI. Advances in AI are one of the driving forces for the industry, with an anticipated 5–6% growth rate over the next two decades. These trends are coming together with China's strategic efforts to develop semiconductor independence and move AI into the centre of its economic future. By 2018, the country led the world in patents for deep learning. China has declared that its future is to be driven by advanced technologies, with AI as a key ingredient.

4) Onshoring foreign operations and hiring foreign talent.

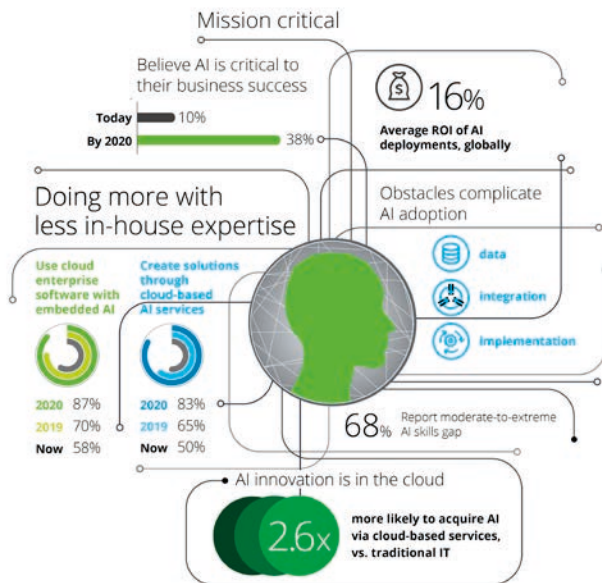
In June 2018, Japan's SoftBank Group announced that it would sell a majority stake in the Chinese operations of Arm Limited, a leading provider of semiconductor designs (including the Cortex line of chips for the iPhone), to a Chinese investment fund. Led by Hopu Investment Management Co. and backed by a Chinese sovereign wealth fund and Beijing's Silk Road Fund, the group acquired 51% of Arm Limited's Chinese business for £612 million. The move will give China more access to Arm's designs. Notably, about a fifth of Arm's 2017 earnings came from Chinese demand.

Yangtze Memory Technologies has invested £19 billion to build China's first advanced memory chip factory and has recruited thousands of engineers away from foreign chipmakers. The company recently announced progress on its 32-layer NAND memory chip—a good sign, though still behind the state-of-the-art 64-layer chip that other memory manufacturers are achieving. Similarly, to advance its 14 nm efforts, SMIC hired a senior executive from Taiwan's TSMC, the world's largest contract foundry and one that is considered to be two to three generations ahead of SMIC. Meanwhile, TSMC has begun constructing a foundry in Nanjing to gain a stronger foothold in the Chinese market.

5) Chip design and intellectual property (IP). Chinese designs and IP for chip architectures are now globally competitive. Huawei designed its new mobile chipset at 7 nm and claims that it performs better and uses less energy than its top competitor. The Huawei system-on-a-chip also boasts AI cores and claims to be the world's fastest modem—in time for early 5G deployments. Although the chip is manufactured in Taiwan by TSMC, it signals that Chinese companies can produce specs at the bleeding edge of technology.

Artificial intelligence

Early adopters turn to the cloud



Source: Deloitte State of AI in the Enterprise, 2nd Edition, 2018 and Deloitte Florida Consumption Models Study, 2018.

Prediction 8

Quantum computers: The next supercomputers, but not the next laptops

“Quantum computing has been hovering on the horizon for decades. But the discipline is poised to celebrate an important milestone: the achievement of “quantum supremacy”.”

The key trends that Deloitte predicts for quantum computing:

- Quantum computers are not likely to replace classical computers for decades, if ever. This implied, the quantum computer market of the future will be about the same size as the supercomputer market—approximately £40 billion per year.
- This contrasts with the £79 billion revenue for classical computing devices, which span everything from consumer smartphones up to enterprise supercomputers¹⁷.

What is quantum computing and how does it vary from traditional computing?

Quantum computing has been hovering on the horizon for decades. But the discipline is poised to celebrate an important milestone: the achievement of “quantum supremacy”, that is a case where a quantum computer will be able to perform a certain task that no classical (traditional transistor-based digital) computer can solve in a practical amount of time or using a practical amount of resources.

A quantum computer consists of and is measured by its volume of quantum bits, or qubits, which are the equivalent of a transistor in a classical computer. Today’s quantum computers contain only physical qubits. It takes an estimated 1,000 physical qubits to make a single logical qubit—that is, a qubit that is fault-tolerant and error-corrected—and this goal is currently still far out of reach. A universal or general quantum computer (which is what is needed to be able to solve a much larger and wider set of problems), in turn, requires hundreds of logical qubits, and therefore hundreds of thousands of physical qubits.

As of 2018, quantum computers containing both 20 physical qubits and 19 physical qubits exist whose performance specifications are known and published. Public announcements of devices with 50, 72, and even 128 physical qubits have also been made, but none of these have yet published their specs, so their level of control and error are not known.

When will quantum supremacy be achieved and what will happen if/when it is?

It is believed that quantum supremacy will be achieved with a machine that has 60 or more physical qubits, but progress is slow, since it gets increasingly harder to add physical qubits as their number increases. Nonetheless, by 2020, a quantum computer of more than 60 physical qubits will almost certainly have been developed and its specs published, and it is likely that the first proof of quantum supremacy achieved.

When quantum supremacy is achieved, little will change in the near term. It is a conceptual turning point, but quantum computers will remain difficult to build, awkward to house, and challenging to program, and certainly not ready for the commercial market any time soon. But progress in the domain will continue and quantum computing holds a great deal of scientific and economic promise.

The first commercial general-purpose quantum computers are likely to appear in over a decade’s time - in the 2030s. The 2020s will likely be a time of progress in quantum computing, but it is not likely to be until the 2030s that the larger market is able to develop¹⁸.

Why should leaders not ignore quantum computing?

In the 2020s quantum computing will generate revenue, but it will be on a lower scale. The Noisy Intermediate Scale Quantum (NISQ) computing market—using what could be considered early-stage quantum computers—will bring in hundreds of millions of dollars per year.

At the same time, the quantum-safe security industry is also likely to earn hundreds of millions each year.

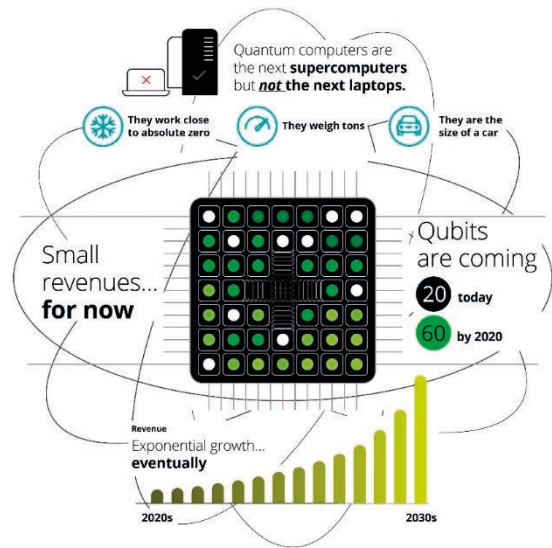
Few CIOs are likely to be submitting budgets for quantum computing in the next two years. But that does not mean that leaders should ignore this field. Quantum computing is advancing rapidly, and its impact is likely to be large. So business and technology strategists should monitor progress on the evolution and potential implications of quantum computing starting now.

It's not just quantum computing itself that is important, but also the innovations that quantum computing is prompting in traditional computing. The prospect of quantum computers is galvanizing the classical computing industry, with many advances occurring in the use of classical computers to simulate quantum techniques.

Indeed, quantum computers will be one of the largest “new” technology revenue opportunities to emerge over the next decade. In fields where quantum supremacy has been achieved, whole industries will be transformed.

Quantum computing

A bright, yet distant, future



Contacts



Sam Baker

Partner, Deloitte Monitor,
Technology, Media &
Telecommunications

Email Sam

+44 20 7303 7016



Paul Lee

Partner, Head of Global
Research, Technology, Media
& Telecommunications

Email Paul

+44 20 7303 0197



Amrita Rancchod

Insight Manager for
Technology, Media &
Telecommunications

Email Amrita

+44 20 7077 0358



Julie Barrett

Marketing Lead for
Technology, Media &
Telecommunications

Email Julie

+44 20 7007 4426



George Parrett

Press Officer for Technology,
Media & Telecommunications

Email George

+44 20 7007 7285

Endnotes

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4. The sources for our forecast include Canalys, "<https://www.canalys.com/newsroom/smart-speaker-installed-base-to-hit-100-million-by-end-of-2018>" Smart speaker installed base to hit 100 million by end of 2018," July 7, 2018, and David Watkins, "<https://www.strategyanalytics.com/access-services/devices/connected-home/smart-speakers/market-data/report-detail/smart-speaker-price-tiers-by-units-asp-value-forecast-by-region-2014-2023>" Smart speaker price tiers by units, ASP & value forecast by region 2014–2023," Strategy Analytics, July 5, 2018.
5. This prediction focuses on smart speakers; the underlying voice assistant technology will also be integrated into smartphones, as well as a growing range of other devices, in 2019.
6. In Germany, the smart speaker was the second-fastest growing device category after smart TVs. Deloitte, Australia/Canada/China/Germany/UK/USA edition, *Deloitte Global Mobile Consumer Survey*, June 2018. Base: All respondents aged 18–75 residing in Australia (2,000), Canada (2,000), Germany (2,001), the United Kingdom (4,000), the United States (2,003); all respondents aged 18–50 residing in urban China (2,000).
7. <https://www.canalys.com/newsroom/smart-speaker-installed-base-to-hit-100-million-by-end-of-2018>.
8. In Germany, the smart speaker was the second-fastest growing device category after smart TVs. Deloitte, Australia/Canada/China/Germany/UK/USA edition, *Deloitte Global Mobile Consumer Survey*, June 2018. Base: All respondents aged 18–75 residing in Australia (2,000), Canada (2,000), Germany (2,001), the United Kingdom (4,000), the United States (2,003); all respondents aged 18–50 residing in urban China (2,000).
9. Ibid.
10. <https://www.canalys.com/newsroom/smart-speaker-installed-base-to-hit-100-million-by-end-of-2018>.
11. In Germany, the smart speaker was the second-fastest growing device category after smart TVs. Deloitte, Australia/Canada/China/Germany/UK/USA edition, *Deloitte Global Mobile Consumer Survey*, June 2018. Base: All respondents aged 18–75 residing in Australia (2,000), Canada (2,000), Germany (2,001), the United Kingdom (4,000), the United States (2,003); all respondents aged 18–50 residing in urban China (2,000).
12. Ibid.
13. Radio is defined as AM/FM broadcast, both digital and analogue, satellite radio, and internet streams of AM/FM radio. Revenue includes advertising revenues, subscription fees, and public license fees where those exist.
14. With over a billion people in the developed world, radio's reach will be about 900 million. Its 98 % reach in China adds another billion. The rest of the developing world of 4 billion will have at least another billion listeners, although we do not have exact reach data for all of them.
15. <https://www.radiocentre.org/fastest/>
16. <http://www.zenithmedia.com/wp-content/uploads/2017/07/Global-Intelligence-03.pdf>
17. For 2018, the market for consumer smartphones is worth US\$500 billion; it is US\$200 billion for PCs, US\$100 billion for tablets and other mobile consumer devices, US\$150 for data centers, and US\$32 for supercomputers.
18. <https://www.forbes.com/sites/tiriasresearch/2017/10/23/quantum-will-not-break-encryption-yet/#1455e4237319>.



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