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Policy paper

Ministerial foreword

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As the Secretary of State responsible for tech, I have the privilege of overseeing one of the UK's most important sectors - important not just for its value to the UK economy, but also for its potential to change the world for the better. In my first six months in this role I've seen the cutting-edge work under way in the UK, from cloud computing to virtual reality.

This government is committed to seeing this enormous potential fulfilled - to ensuring the UK is the best place to start and grow a digital business, trial a new technology, or undertake advanced research - and that the UK digital sectors remain world-leading. This requires supportive regulation but also first-class digital infrastructure and an advanced skills base.

And this approach must go hand-in-hand with ensuring the benefits are felt across the economy, throughout society and in every corner of the country. Every individual and every business should have the skills and confidence to seize the opportunities of digital technology and have easy access to high-quality internet wherever they live, work, travel or learn.

In January the government published its Industrial Strategy green paper, which set out our ambition to build an economy which works for everyone by building on the UK's strategic strengths and tackling our underlying weaknesses. This Digital Strategy applies this framework to the digital economy across the whole country. It will boost our world-leading digital sectors and overcome barriers to growth and innovation, creating more of the high-skilled, high-paid jobs of the future. It will deliver the first-class digital infrastructure and advanced skills base that businesses across the country need to be able to take advantage of digital tools. And it will close the digital divide - to ensure that everyone is able to access and use the digital services that could help them manage their lives, progress at work, improve their health and wellbeing, and connect to friends and family.

At its core, that is the ambition of this Strategy - to create a world-leading digital economy that works for everyone. It is part of this government's Plan for Britain, strengthening our economy for the long term as we take advantage of the opportunities that leaving the European Union provides.

But publishing this Strategy is just the start, and delivering its ambitious vision will require a joint effort. Government has worked closely with the tech community to put this Strategy together, and I am establishing a new forum to ensure our relationship continues to flourish. I hope it will mark the beginning of a new phase of close engagement between Government and the tech sectors, and am looking forward to working side-by-side to make our digital economy both stronger and fairer.

The Rt Hon Karen Bradley MP

Secretary of State for Culture, Media and Sport



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Executive summary

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Our Plan for Britain

This government's Plan for Britain is a plan to build a stronger, fairer country that works for everyone, not just the privileged few. This means building an economy that works for everyone, and making sure that wealth and opportunity are spread across the country. It means building a nation that stands tall in the world and is set up to succeed in the long term. And it means building a country in which future generations have the chance to do better than their parents and grandparents today.

In January, we outlined a critical part of our plan for post-Brexit Britain. Our industrial strategy will see government stepping up to back businesses to invest for the long term. It involves building on Britain's strategic strengths and tackling our underlying weaknesses, creating the conditions where successful businesses can emerge and grow. Its objective is to improve living standards and economic growth by increasing productivity and driving growth across the whole country.

Our digital strategy now develops this further, applying the principles outlined in the Industrial Strategy green paper to the digital economy. The UK has a proud history of digital innovation: from the earliest days of computing to the development of the World Wide Web, the UK has been a cradle for inventions which have changed the world. And from Ada Lovelace - widely recognised as the first computer programmer - to the pioneers of today's revolution in artificial intelligence, the UK has always been at the forefront of invention. Today, this history translates into a world-leading digital economy. We have great strengths in FinTech - more people work in UK FinTech than in New York FinTech, or in the combined FinTech workforce of Singapore, Hong Kong and Australia¹ - video games, EdTech and many other sectors. Our excellence in deep research and our creative thinking provides us with a crucial competitive advantage: we have three of the world's top 10 universities, and 12 of the top 100.² Of the G7 countries, the UK has the most productive science base and we rank first in many key global measures of research quality.³ In government, we have led the world in transforming our services and systems, using digital technology to make them easier, simpler and cheaper. Now, as we prepare to leave the European Union, our Strategy will create an economy which is resilient to change and fit for the future.

A digital strategy for a digital economy

Our digital strategy is formed of seven strands, summarised here and developed in more detail throughout the document.

Building world-class digital infrastructure for the UK

For businesses to thrive and grow, government needs to create the conditions and set the framework for investment in widespread and up-to-date infrastructure. Digital infrastructure is a critical component of this: digital connectivity is now a utility, and modern life is increasingly impossible without it. Connectivity drives productivity and innovation, and is the physical underpinning of a digital nation.

We are determined that no part of the country or group in society should be without adequate connectivity. We will continue our work to complete the roll-out of 4G and superfast broadband by 2020, but we will also implement a **Universal Service Obligation**, giving every individual, business and public premise across the country the right to request an affordable high speed broadband connection.

And we are ambitious for the opportunities afforded by the next stage of broadband and mobile rollout, so we will invest over £1 billion to accelerate the development and uptake of **next generation digital infrastructure** - including full fibre and 5G.

We will also support consumers in getting the best deal in digital connectivity. We will ensure **adverts for broadband** accurately reflect the speeds and technology actually on offer for the majority of customers, so that people know what they are getting and can better find the most competitive deal. And we know that real-world, day-to-day connectivity in the places we live, work and travel matters, so we will roll out **free Wi-Fi** on trains, and in more public places.

Read more about connectivity (<https://www.gov.uk/government/publications/uk-digital-strategy/1-connectivity-building-world-class-digital-infrastructure-for-the-uk>).

Giving everyone access to the digital skills they need

If we want to increase our overall prosperity, to enjoy higher real wages, and if we want more opportunities for young people to get on, we have to raise our productivity. In a digitally-driven economy, that means ensuring that everyone has the skills they need to flourish, with nobody left behind.

We need to support everyone to develop the skills they need to participate in the digital economy and help all businesses harness the productivity benefits of digital innovation. To do this, we will ensure adults in England who lack core digital skills **will not have to pay to access the basic digital skills training they need**, mirroring the approach taken for adult literacy and numeracy training. And, as jobs and whole industries are disrupted by digital innovation, we need to make sure those affected have the support they need to adapt. We will establish a **new Digital Skills Partnership**, working together with partners who are passionate about making a difference and who share our ambitions to tackle the digital skills gap. **The Partnership will play a crucial role in helping people access digitally-focused jobs at a local level**, bringing together technology companies, local businesses, local government and other organisations to identify digital job vacancies and take action to help people move into these jobs.

We also need a strong pipeline of specialist skills - from coding to cyber - to support the tech industry and drive productivity improvements across the economy. We will deliver coding in the National Curriculum, from Key Stage One onwards, and **we will take forward the recommendations of the Shadbolt Review** to ensure computer science students have the real-world, up to date skills needed in the digital economy. To help more young people from a wider range of backgrounds consider a career in tech, we will **support the National Citizen Service (NCS) in piloting new ways to include digital skills and careers in NCS programmes**.

Read more about digital skills (<https://www.gov.uk/government/publications/uk-digital-strategy/2-digital-skills-and-inclusion-giving-everyone-access-to-the-digital-skills-they-need>).

Making the UK the best place to start and grow a digital business

Our industrial strategy involves identifying our strengths and building on them. The digital economy is a vital part of that: as we build a great, global trading nation, we will remain a world leader in innovation, building and using the most advanced technology that delivers incredible content and services. We have some of the most exciting start-ups in the world, and some of the strongest technology clusters. We want to build on that: we want the UK to be the best place to start and grow a digital business.

To achieve this we need flourishing ecosystems and strong technology sectors, spread across the UK. In 2014 there were almost 200,000 digital businesses in the UK. They supported 1.4 million jobs across whole country⁴ - the fastest growing digital hubs from 2010-14 were Southampton, West Cornwall and Dundee.⁵ Tech City UK's Tech North (<http://technorthhq.com/>) programme is helping to catalyse the development of the tech ecosystem around the seven northern cities of Hull, Leeds, Liverpool, Manchester, Newcastle, Sheffield and Sunderland - while the Northern Powerhouse's tech businesses produce £9.9 billion GVA, with Manchester identified as the biggest cluster outside of the South East.⁶ There are similar programmes underway in other parts of the country, such as Tech East, and Croydon Tech City.

We already have globally leading sectors in artificial intelligence, cyber security, FinTech, gaming, virtual reality and GovTech. And our fusion of digital and creative expertise also gives us the leading edge in many other sectors including design and advertising. Government programmes are supporting the UK's development of the Internet of Things (IoT) and Autonomous Vehicle technologies. HealthTech and EdTech both provide major underexploited economic opportunities to the UK, as well as helping to create the world-class public services that our people deserve.

To create the right conditions for growth, we will work with independent regulators to encourage **innovation-friendly regulation** that creates a positive context for the adoption of new technologies as well as giving them democratic legitimacy and a world-leading framework in which to operate, from drones to data. At Autumn Statement 2016 we announced that we would invest an additional **£4.7 billion by 2020-21 in R&D funding**, the biggest increase in public R&D investment of any parliament since 1979, to ensure British business remains at the cutting edge of scientific and technological discovery. Our Industrial Strategy green paper began a consultation on the priority challenges for a new Industrial Strategy Challenge Fund, which will help the UK capitalise on its strengths in science and innovation such as robotics, clean energy and biotechnology. We welcome the work of Professor Dame Wendy Hall, Regius Professor of Computer Science at the University of Southampton, and Jerome Pesenti, Chief Executive of BenevolentTech, who will undertake a **review of how we can create the conditions for the artificial intelligence industry** to thrive and grow in the UK.

The UK is already a world centre for finance, and home to a great deal of investment finance. Overall, investment in UK technology businesses is buoyant. A record £1.57 billion of equity finance was invested in the digital sectors in 2015, more than four times the level of investment in 2011. We want to see this continue, and we have announced a number of steps to help businesses to secure the finance they need to grow throughout their life. In addition to these actions, we will work to establish a network of **UK Tech Hubs in five developing countries**. Working alongside the existing hub in Israel, these hubs will boost our impact in emerging digital economies around the world.

Read more about the digital sectors (<https://www.gov.uk/government/publications/uk-digital-strategy/3-the-digital-sectors-making-the-uk-the-best-place-to-start-and-grow-a-digital-business>).

Helping every British business become a digital business

The UK's global competitiveness will increasingly depend on not just a flourishing digital sector, but on all our businesses using the best digital technology and data to drive innovation and productivity. We need to help all businesses become as productive and competitive as those who are in the vanguard: adopting digital technologies will be crucial to this. To make sure businesses have the knowledge and means to access this technology, we will work to focus existing initiatives, and plug gaps where there are specific challenges. On top

of the skills and infrastructure improvements already outlined, at Autumn Statement 2016 we announced £13 million funding to create a private sector-led **Productivity Council**. The Council will drive engagement to improve productivity across the economy, including through appropriate use of digital technologies. We want to help more UK businesses export, including by negotiating preferential rates with a number of e-marketplaces that are exclusive to government-referred clients.

Read more about the wider economy (<https://www.gov.uk/government/publications/uk-digital-strategy/4-the-wider-economy-helping-every-british-business-become-a-digital-business>).

Making the UK the safest place in the world to live and work online

A safe and secure cyberspace is an essential requirement for an inclusive, prosperous digital economy. It will give people the confidence to be part of the digital world, as well as giving the UK a significant competitive advantage.

To secure our technology, data and networks from the many threats they face and to keep our businesses, citizens and public services protected, we will support the **National Cyber Security Centre** to provide a single point of contact for companies, particularly those that form part of Britain's 'critical national infrastructure'. And we will introduce a new approach of **Active Cyber Defence**, using the skills, knowledge and technical expertise of GCHQ working with the country's ISPs (internet service providers) to provide a new level of protection for British cyberspace. To ensure that the UK has a pipeline of cyber skills that meets its current and future needs we will run **a national after-school programme for the most talented students, cyber as well as apprenticeships, and adult retraining**.

We also recognise that creating a safe and secure cyberspace for children requires some particular actions. So, to stop children's exposure to harmful sexualised content online, we will continue to support companies to roll-out **family-friendly filters** to all broadband customers and introduce **age verification** controls for access to online pornographic material provided on a commercial basis in the UK.

Read more about a safe and secure cyberspace (<https://www.gov.uk/government/publications/uk-digital-strategy/5-a-safe-and-secure-cyberspace-making-the-uk-the-safest-place-in-the-world-to-live-and-work-online>).

Maintaining the UK government as a world leader in serving its citizens online

From personalised services in health, to safer care for the elderly at home, to tailored learning in education and access to culture - digital tools, techniques and technologies give us more opportunities than ever before to improve the vital public services on which we all rely.

The UK is already a world leader in digital government,⁷ but we want to go further and faster. The new Government Transformation Strategy published on 9 February 2017 sets out our intention to serve the citizens and businesses of the UK with a better, more coherent experience when using government services online - one that meets the raised expectations set by the many other digital services and tools they use every day. So, we will continue to develop single cross-government platform services, including by working towards 25 million **GOV.UK Verify** users by 2020 and adopting new services onto the government's **GOV.UK Pay** and **GOV.UK Notify** platforms.

We will build on the 'Government as a Platform' concept, ensuring we make greater reuse of platforms and components across government. We will also continue to move towards common technology, ensuring that where it is right we are consuming commodity hardware or cloud-based software instead of building something that is needlessly government specific.

We will also continue to work, across government and the public sector, to harness the potential of digital to radically improve the efficiency of our public services - enabling us to provide a better service to citizens and service users at a lower cost. In education, for example, we will address the barriers faced by schools in

regions not connected to appropriate digital infrastructure and we will invest in the **Network of Teaching Excellence in Computer Science** to help teachers and school leaders build their knowledge and understanding of technology. In transport, we will make our infrastructure smarter, more accessible and more convenient for passengers. At Autumn Statement 2016 we announced that the National Productivity Investment Fund would allocate **£450 million from 2018-19 to 2020-21 to trial digital signalling technology on the rail network**. And in policing, we will enable police officers to use **biometric applications to match fingerprint and DNA from scenes of crime and return results** including records and alerts to officers over mobile devices at the crime scene.

Read more about digital government (<https://www.gov.uk/government/publications/uk-digital-strategy/6-digital-government-maintaining-the-uk-government-as-a-world-leader-in-serving-its-citizens-online>).

Unlocking the power of data in the UK economy and improving public confidence in its use

As part of creating the conditions for sustainable growth, we will take the actions needed to make the UK a world-leading data-driven economy, where data fuels economic and social opportunities for everyone, and where people can trust that their data is being used appropriately.

Data is a global commodity and we need to ensure that our businesses can continue to compete and communicate effectively around the world. To maintain our position at the forefront of the data revolution, we will implement the **General Data Protection Regulation** by May 2018. This will ensure a shared and higher standard of protection for consumers and their data.

Read more about data (<https://www.gov.uk/government/publications/uk-digital-strategy/7-data-unlocking-the-power-of-data-in-the-uk-economy-and-improving-public-confidence-in-its-use>).

A framework for action

The digital economy moves quickly, and so must we. In this strategy we set out our areas of focus, and the actions we will take now. But our strategy is a framework, not a single document. In our Industrial Strategy green paper, we highlighted the importance of strong business leadership to the success of sectoral policies in the UK and elsewhere. So we proposed an ‘open door’ challenge to industry to come to government with proposals to transform their sectors through ‘sector deals’. The door is open to our digital industries as it is to others, and, as we said in the green paper, we want to hear how government and industry can collaborate to enable growth in new sectors of the future that emerge around new technologies and new business models.

This digital strategy is therefore a first statement in an ongoing conversation between digital businesses and government: as we develop our industrial and digital strategies, we will continue to build on that conversation and to strengthen our support. To facilitate this, the Secretary of State for Culture, Media and Sport will convene a forum for government and the tech community to work together to support the growth of the UK digital economy. The plans and proposals outlined in this strategy, and those we will develop together over the coming years, will deliver a thriving, inclusive, outward-looking digital economy in the UK, with the benefits and opportunities spread across every region, and every community. By putting each of the elements of this strategy in place, we will cement our position as a world-leading digital economy and ensure it works for everyone.

This is a strategy for the whole of the UK. The digital revolution is not limited to one place or idea - it is penetrating the length and breadth of the UK, from Cornwall to the Highlands, from Wales to Northern Ireland, and we are determined to ensure that nowhere is left behind. In Glasgow, the city council is changing the way we run and think about cities, exploring how we can use technology to make our streets safer and to save and generate energy. In South Wales, collaborative communities of digital entrepreneurs such as Method 4 and Welsh ICE have put the region on the map as a hotspot for tech innovation. Belfast is a leader in cyber

security. It is these numerous, diverse centres of creativity and innovation that will underpin our digital future. We will work with the devolved administrations across the UK to champion digital success wherever we find it, and work together to ensure that the benefits of digital are felt across the country.

A modern Industrial Strategy

The Industrial Strategy green paper published on 23 January 2017 sets out the following 10 pillars on which to build a new Industrial Strategy. Each of these has a strong digital component which government will ensure is leveraged as we develop the new Industrial Strategy.

1. **Science, research and innovation**, where we must become a more innovative economy, and do more to commercialise our world leading science base to deliver growth across the UK
2. **Skills**, where we must help people and businesses to thrive by ensuring everyone has the basic skills needed in a modern economy; by building a new system of Technical Education to benefit the half the population who do not go to university, boosting STEM skills and numeracy, and raising skill levels in lagging areas
3. **Infrastructure**, where we must upgrade our performance on digital, energy, and transport infrastructure, and must better align central government infrastructure investment with local growth priorities
4. **Supporting businesses to start and grow**, where we must ensure that businesses across the UK can access the finance and management skills they need to grow; and create the conditions to enable firms to invest for the long term
5. **Procurement policy**, where strategic government procurement can drive innovation and enable the development of UK supply chains
6. **Trade and inward investment policy**, where government policy can help boost productivity and growth across our economy including by increasing competition and helping to bring new ways of doing things to the UK
7. **Affordable energy and clean growth**, where we need to ensure that we both keep costs down for businesses, and secure the economic benefits of the transition to a low carbon economy
8. **Sectoral policies**, where we must both build on our areas of competitive advantage, and help new sectors to flourish, in many cases challenging existing institutions and incumbents
9. **Spreading growth across the country**, whether it is investing in key infrastructure projects to unlock growth, increasing skill levels, or backing local innovation strengths, the Industrial Strategy will create a framework to build on the particular strengths of different places and address factors that hold places back
10. **Creating the right institutional framework**, in some places and sectors there may be missing institutions which we could create, or existing ones we could strengthen: be they local educational institutions, trade associations or financial networks

Note: What do we mean by the ‘digital sectors’ and ‘digital economy’?

The definition of digital sector used throughout this document was developed by the OECD using the UN Standard Industrial Classifications (SICs) and has the advantage of international comparability. The 'digital sector' can be measured by the output and employment of the industries within it.

The OECD identifies the activities of digital sectors (Information, Communication and Technology (ICT)) as follows: "The production (goods and services) of a candidate industry must primarily be intended to fulfil or enable the function of information processing and communication by electronic means, including transmission and display." However, there are many people working in digital occupations which are not within digital sectors and many more making use of digital technology to do their work (for example, through e-commerce). This is what the concept of the digital economy encompasses.

For statistical purposes, the government defines the digital economy as "all jobs in the digital sector, as well as all those working in Digital Occupations in non-digital sectors." However, there is not an internationally accepted definition of the digital economy.

1. UK FinTech: On the cutting edge (<http://www.ey.com/Publication/vwLUAssets/EY-UK-FinTech-On-the-cutting-edge/%24FILE/EY-UK-FinTech-On-the-cutting-edge.pdf>) ↩
2. Times Higher Education World University Rankings 2016-17 (<https://www.timeshighereducation.com/world-university-rankings>) ↩
3. Elsevier, International Comparative Performance of the UK Research Base (<https://www.gov.uk/government/publications/performance-of-the-uk-research-base-international-comparison-2013>) ↩
4. DCMS Sectors Economic Estimates ↩
5. Tech Nation 2016, Tech City UK (http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf) ↩
6. The Digital Powerhouse, May 2016 (<https://www.swipe.to/vertical/3188n>) ↩
7. UN E-Government Survey 2016 (<https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2016>) ↩



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Policy paper

1. Connectivity - building world-class digital infrastructure for the UK

Published

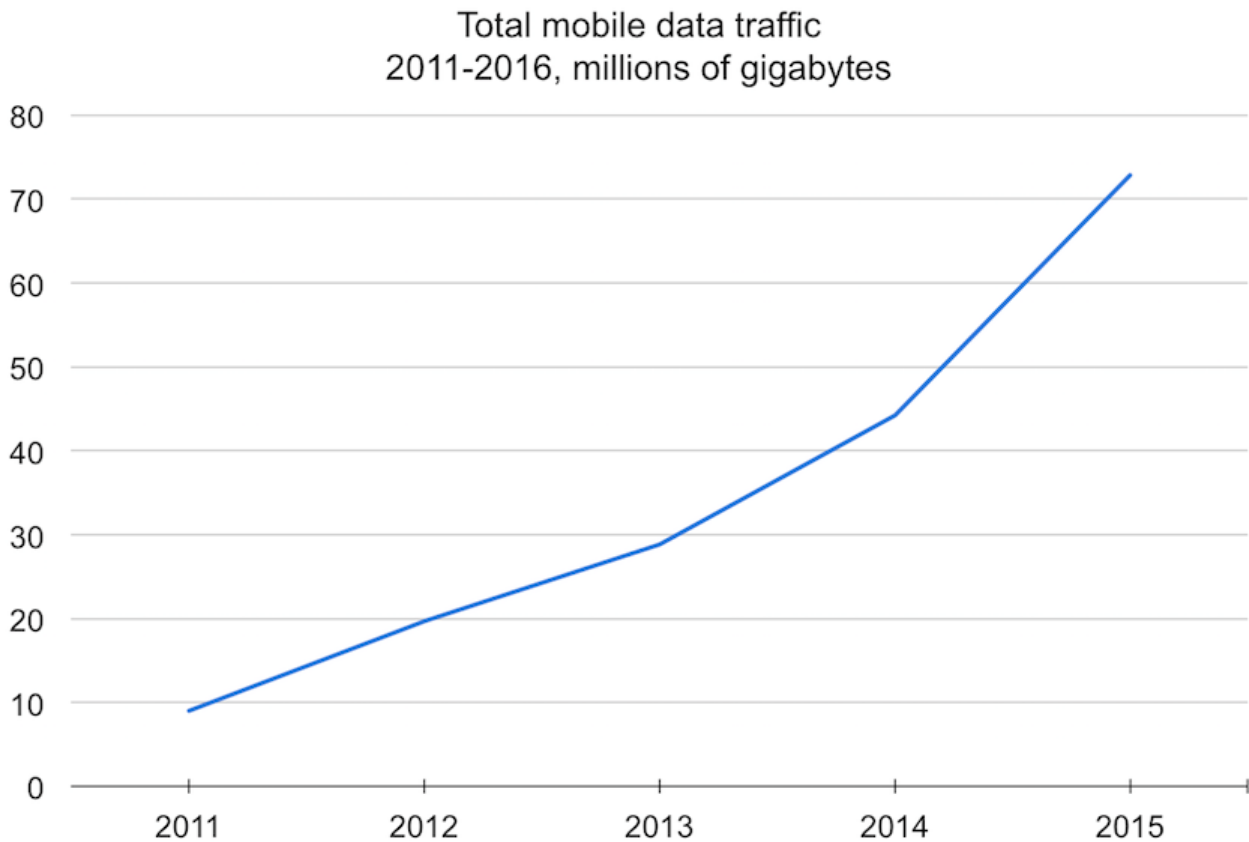
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Networks of the future: full fibre and 5G

By 2020, the volume of global internet traffic is expected to be 95 times that of 2005, and connected devices will outnumber the global population by nearly seven to one.¹ In the UK, fixed internet traffic is set to double every two years,² while mobile data traffic is set to increase further at a rate of 25% to 42% per year.³



Source: Ofcom Connected Nations 2016

The UK's digital infrastructure must be able to support this rapid increase in traffic, providing coverage with sufficient capacity to ensure data can flow at the volume, speed and reliability required to meet the demands of modern life. Broadband and mobile must be treated as the fourth utility, with everyone benefiting from improved connectivity. This will play a crucial role in ensuring that everyone, wherever they live and however they connect, can make full use of digital services and benefit from participation in the digital economy. Improved connectivity also increases innovation and productivity across the economy, bringing significant economic rewards. Independent research suggests increased broadband speeds alone could add £17 billion to UK output by 2024.⁴

We will also look at connectivity in a more holistic way. There are a range of technologies that can provide next generation connectivity, from fixed line broadband, to mobile, wireless, and satellite connections. But for most people, it is the quality of connection that matters, not the means of delivery. Instead of focusing on the type of technology, we will focus on what consumers - households and businesses - need and want as they go about their lives where they live, work and travel in this digital age.

Business connectivity

World-class digital connectivity is increasingly vital for businesses in the UK. For example, in a CBI survey, 81% of firms said that they see more reliable mobile connectivity as essential.⁵ Now more than ever, we need to support them to grow and compete in a global environment, and to reach new customers and markets online.

We have already helped connect over 42,000 businesses through the Connection Voucher scheme. Over 80% of SMEs now have access to superfast broadband (based on Ofcom's higher measure of download speeds of at least 30 megabits per second (Mbps)) up from 68% coverage a year ago. But it is clear that more needs to be done. Business connectivity continues to lag residential connectivity, whilst 8% of small businesses, mainly in rural locations, do not have access to broadband speeds of 10Mbps or above.

We are determined to close the gap with residential properties and drive up the quality and reliability of coverage for businesses. This means ensuring that businesses are at the forefront of future broadband roll-out, including full fibre. In December 2016, we published a Call for Evidence on full fibre roll out and will publish its findings, and next steps, alongside the summary of the findings of the **Business Broadband Review**, in spring of this year.

We are also working with Ofcom to ensure the market structure for broadband delivery is right. This includes increasing transparency on the location of digital infrastructure, so that local businesses can work with the communications industry to ensure that they get the connectivity they need to thrive.

To ensure this work is fully co-ordinated, we will establish a new **Business Connectivity Forum**, chaired by the Department for Culture, Media and Sport, that will bring together business organisations, local authorities and communications providers to develop specific solutions to the issues faced by businesses in accessing fast, affordable, reliable broadband. The Forum is a recommendation of the Business Broadband Review, and further detail on its remit and membership will be set out in the Review's Summary of Findings.

Effective regulation

It is essential that we continue to create conditions that encourage investment in the UK's digital infrastructure. A strong, stable regulatory regime is at the heart of this, with Ofcom - the UK's independent communications regulator - protecting the interests of consumers, by promoting competition. Strong competition will help ensure

the private sector meets consumers' needs and demands, keeps pace with technological change, and provides commercial investment in digital infrastructure.

We are also using regulation to make it faster and cheaper for operators to build and develop digital infrastructure:

- the **Access to Infrastructure Regulations** ensure digital communications providers can access other providers' physical infrastructure, across a range of sectors, on fair and reasonable terms
- reforms to **mobile planning laws** in England have reduced planning requirements, allowing new sites to be developed quicker and a greater number of small cells to be deployed
- reforms to the **Electronic Communications Code**, made through the Digital Economy Bill, will further encourage an efficient use of infrastructure by promoting site sharing

We will continue to make it easier to build digital infrastructure, for example through **exploring options around planning and wayleave agreements**. And we will ensure that our regulatory framework recognises and supports the fact that the infrastructure required to deliver connectivity is converging - particularly as we prepare for the roll out of 5G.

Improved regulation of the consumer market will also play an important role in improving connectivity. We are working with regulators and industry to ensure that **advertising for broadband** more accurately reflects the actual speeds consumers can expect to receive, rather than a headline 'up to' speed available only to a few, and accurately describes the technology used, using terms like 'fibre' only when full fibre solutions are used. There should not be a gap between what is promised by providers and what is experienced by the consumer. The non-statutory Advertising Standards Authority has already made some progress in ensuring that broadband prices are made clearer and costs to consumers are not hidden, and we will continue to work with them to ensure that the advertising of communications is accurate and fair.

Working with local communities

Local communities are best placed to identify the connectivity needs of their local area. It is therefore important that they are able to work with communications providers to shape the roll-out of digital infrastructure.

We will encourage a locally-led approach by supporting partnerships between residents and local community bodies, including schools and public libraries. A range of tools and advice - including on government's Go Superfast Checker (<http://gosuperfastchecker.culture.gov.uk/community-led-schemes/>) website - are now available to make it easier for communities to identify their connectivity challenges and to establish community broadband solutions. This support includes examples of delivery models, technologies, financing options and case studies from similar communities in the UK.

Broadband Delivery UK (BDUK) also supports local authorities who want to jointly fund investment with communities to enable new infrastructure projects to go ahead. This is done in a number of different ways, for example by extending the scope of existing contracted plans by sharing the full cost of going further into high-cost areas.

Better connectivity for all

Broadband

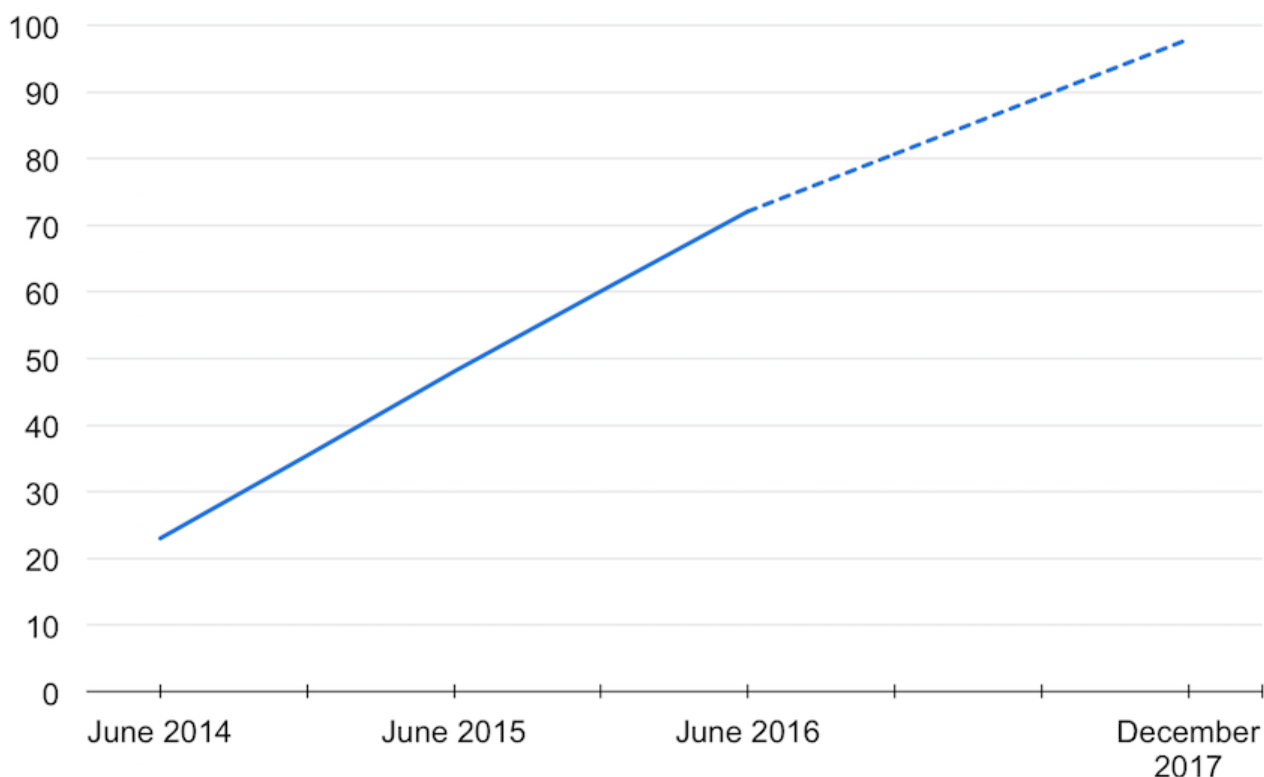
£1.7 billion of public funding is already being invested in delivering broadband across the country. Over 90% of UK premises can now access superfast broadband, and we are on track to reach 95% of UK premises by December 2017. Through strong contractual value for money requirements, we have released additional funds to extend delivery, with 600,000 more premises expected to benefit by 2020.

We recognise that there will always be some premises that cannot be connected on a commercial basis. For families, public services and businesses in these hardest to reach areas, we want to ensure that everyone can access fast, reliable broadband. This is why we have committed to introducing a **new broadband Universal Service Obligation (USO)** (<https://www.gov.uk/government/news/government-plans-to-make-sure-no-one-is-left-behind-on-broadband-access>) by 2020. The USO will give every individual, business and public premise across the country the right to request an affordable high speed broadband connection, at a sufficient speed for an average family to make full use of the internet, up to a reasonable cost threshold. The legislation to enable us to do this - the Digital Economy Bill (<http://www.publications.parliament.uk/pa/bills/cbill/2016-2017/0045/17045.pdf>) - is currently before Parliament. In December Ofcom published technical advice to government on the factors that will help inform the design of the broadband USO. We will carefully consider Ofcom's findings before consulting on secondary legislation in early 2017. The terms of the USO will be regularly reviewed to ensure it keeps pace with consumers' changing needs.

Mobile

The licence obligations arising from the December 2014 agreement between the government and industry have already locked in investment of over £5 billion to improve mobile coverage. Ofcom's 2016 Connected Nations Report shows that 99% of UK premises now have indoor voice coverage and 96% have indoor 4G data coverage. And the report notes that 4G geographic coverage has increased substantially over the past year from 48% to 72% and this is set to increase yet further.

By the end of 2017 we expect 98% of the UK's landmass to have 4G data coverage



Source: Government estimates

As the recent National Infrastructure Commission report on the future of mobile connectivity set out, it is essential that outdoor mobile services - such as basic talk, text and data - are available wherever we live, work and travel. All four Mobile Network Operators each now have a legally binding obligation to reach at least 90% landmass coverage by the end of this year. Ofcom is responsible for enforcing these obligations and, through the Digital Economy Bill, will have the power to fine companies that do not meet them. By the end of 2017 we therefore expect 98% of the UK's landmass to have 4G data coverage and at least 98% of UK premises to have indoor 4G coverage from at least one operator.

But we also recognise that we must go further to make better coverage and quality a reality for everyone across the UK. Government understands that the everyday experience of connectivity is important, not just the statistics. Where necessary to meet our ambitions, we will consider whether future auctions of radio spectrum should include commitments to increase coverage and reliability. Through the Digital Economy Bill we are also giving consumers greater clarity on services in their area by giving Ofcom powers to share data on coverage and network performance. Empowering consumers with better information will help them make informed choices on the best network for them and will promote competition to deliver improved connectivity for consumers.

Transport

Commuters on the UK's train networks expect good connectivity on the move. Wi-Fi is being rolled out on trains across the UK, and we forecast that 90% of passenger journeys on Department for Transport-franchised lines will benefit by the end of 2018. We are taking steps to drive progress towards faster and more reliable free Wi-Fi across the train network. In new rail franchises, train operators will be required to tackle 'not-spots' on their routes and deliver high-speed connectivity to ensure Wi-Fi is fast and reliable across routes serving the majority of their passengers, so they can send emails, browse the web and social media, and make calls using Wi-Fi calling.

Coverage on UK motorways is high, with 97% receiving voice coverage from all operators.⁶ But significant improvements are needed to ensure there is a reliable connection across other major roads, not only so that consumers can make a call while on the move or in an emergency, but also as a means of enabling applications from real-time traffic alerts to emerging technologies such as connected and autonomous vehicles and smart motorways.

The **Emergency Services Mobile Communication Programme** is an important step in this process. By opening up this infrastructure for commercial use as far as possible we will extend coverage across the UK, including improving commercial coverage on roads.

Networks of the future: full fibre and 5G

We have to encourage the market towards ubiquitous ultrafast services but balance the additional benefits of increasing speed against the costs today of providing the infrastructure. Government has an important role to play to accelerate and de-risk the deployment of the next generation of digital infrastructure - setting the structures; supporting experimentation and testing; helping to reduce the costs; and above all for leadership and setting ambition. **At Autumn Statement 2016 we made a clear commitment to digital connectivity, including the allocation of £740 million from the National Productivity Investment Fund to support the market to roll out of next generation digital infrastructures.**

Delivering ultrafast speeds

There are existing networks that are capable of delivering ultrafast speeds (at least 100Mbps). Trials have demonstrated that G.Fast can provide ultrafast connections to premises up to around 300 metres from the cabinet - around 70% of premises. Cable (primarily provided by Virgin Media) is capable of delivering at least

200Mbps now, and there are plans to increase that speed. And the next iterations of each - XG.Fast and DOCSIS 3.1 - will give consumers even faster speeds.

Full fibre

Whilst there are a number of interim technologies giving connectivity at ever faster speeds, we believe that the future of high-speed and high-quality connectivity lies in deeper, more extensive fibre networks. To promote this, we will invest **£400 million in a new Digital Infrastructure Investment Fund, which we anticipate will be more than matched by private sector investors**. This new fund will catalyse the market for alternative full fibre providers by ensuring that they can access the finance they need to help scale the UK market for full fibre broadband.

We are also making further public funding available for the roll-out of full fibre broadband networks in partnership with local authorities across the UK. In December we published a Call for Evidence (<https://www.gov.uk/government/consultations/call-for-evidence-extending-local-full-fibre-broadband-networks>) to ask stakeholders to consider and provide information on a series of options to support this deployment. The Call for Evidence has now closed, and further detail on next steps will be published at the Spring Budget 2017.

Public owned or funded networks, such as the Janet academic and research network, and Network Rail, offer another potential route to increase fibre connectivity. We will look at how these can be opened up to provide vital 'backhaul' infrastructure. This could help reduce the cost of fibre roll-out and consequently increase business and residential connectivity in hard to reach areas.

Our 5G Strategy

5G is the next generation of mobile connectivity, and is currently in development. It is expected to represent a significant upgrade: providing ultrafast, low latency, and more reliable mobile connectivity, able to handle our ever-increasing data requirements. This should present huge opportunities to boost productivity and grow the economy. In addition to giving consumers and business users high quality connectivity, it will also support the development of the Internet of Things: the rapidly-increasing number of connected devices, from connected cars to digital health applications. New fibre infrastructure will play a crucial role in the future deployment of 5G, which is likely to require extensive use of small cells (essentially mini base stations), connected to the core network by backhaul (usually a fibre connection).

We want the UK to take a leading role in the development and roll-out of 5G. If the UK is going to be at the forefront of the 5G revolution it will require concerted action from government, industry, academia and local areas both to develop the technology and deploy the networks to support it. We are developing a 5G Strategy, to be published at Spring Budget 2017, which will set out our vision for the next generation of mobile connectivity, and the steps we will take to realise that vision.

5G and fibre testbeds

As part of the £740 million of investment in digital infrastructure announced at Autumn Statement 2016, we will fund a coordinated programme of integrated fibre and 5G trials to help make sure that we are in the best possible position to exploit the considerable potential of 5G and future digital services for UK consumers and businesses.

Spectrum for connectivity

Better use of radio spectrum will also facilitate further investment and innovation in 5G technologies. We will deliver on our commitment to **free up 750 MHz of public sector spectrum** in bands below 10 GHz by 2022, having already made over half (384 MHz) available to use since 2010.

This includes continuing the approach set out in the 2014 Spectrum Strategy

(https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/287994/UK_Spectrum_Strategy_FINAL.pdf) of charging government departments a market-based fee for their spectrum use, encouraging spectrum sharing and wherever possible making suitable spectrum available for advanced communications technologies such as 5G.

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- Department for Culture Media & Sport (<https://www.gov.uk/government/organisations/department-for-culture-media-sport>)

See more information about this Policy paper (<https://www.gov.uk/government/publications/uk-digital-strategy>)

Policy paper

2. Digital skills and inclusion - giving everyone access to the digital skills they need

Published

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For the UK to be a world-leading digital economy that works for everyone, it is crucial that everyone has the digital skills they need to fully participate in society.

Although we live in an increasingly online world, a significant part of the population remains digitally excluded. One in 10 adults has never used the internet¹ and many more are missing out on the opportunities the digital world offers, whether through lack of connectivity, digital skills or motivation. We must continue to address this digital divide between those who have been able to embrace the digital world and those who have not.

We also need to turn our attention to those who have basic digital skills and connectivity, but lack the confidence and knowledge to make the most of the digital economy, whether at work or beyond. Many jobs have a digital element, and it is predicted that within 20 years 90% of all jobs will require some element of digital skills.² Effective digital skills provision is essential to ensure the workforce is prepared for this and future technological changes.

And as the digital economy grows, there will be even greater demand for people with specialist digital skills. At present, the UK has a supply of specialist skills that scores well above the EU average³, but to keep ahead we will have to keep improving. As we leave the European Union, it will be even more important to ensure that we continue to develop our home-grown talent, up-skill our workforce and develop the specialist digital skills needed to maintain our world leading digital sector.

We must also enable people in every part of society - irrespective of age, gender, physical ability, ethnicity, health conditions, or socio-economic status - to access the opportunities of the internet. If we don't do this, our citizens, businesses and public services cannot take full advantage of the transformational benefits of the digital revolution. And if we manage it, it will benefit society too. Our approach to delivering these objectives focuses on three strands:

1. ensuring that we continue to tackle the root causes of digital exclusion and that everyone can increase their digital capability to make the most of the digital world
2. developing the full range of digital skills that individuals and companies across the country need in an increasingly digital economy, and supporting people to up-skill and re-skill throughout their working lives.
3. strong collaboration between the public, private and third sector to tackle the digital skills gap in a co-ordinated and coherent way, so the sum is greater than the parts and everyone everywhere has better access to the training they want

Digital capability for all

More than ever before, services, including public services and business transactions, are moving online. We want everyone to be able to use these digital services so they can reap the financial, health and social benefits they offer.

For those lacking basic digital capability, the reasons for this exclusion are often complex. Research suggests that there are four key barriers, and more than one may affect individuals at any one time:

- access: the ability to connect to the internet and go online
- skills: the ability to use the internet and online services
- confidence: a fear of crime, lack of trust or not knowing where to start online
- motivation: understanding why using the internet is relevant and helpful

Government is already working with industry and the voluntary sector, to increase the digital capability of those who are digitally excluded, as well as those who are online but lacking the confidence and knowledge to make the most of it. For example:

- in 2014-15, we provided **£85 million in digital skills training up to Level 2**
- over £9.5 million has been spent to support almost 800,000 people to gain basic digital skills, through the **Future Digital Inclusion** and **Widening Digital Participation** programmes; and we will be investing a further £2.5 million in the remainder of the year to support over 150,000 more people⁴
- we have recently delivered **free Wi-Fi across all libraries in England** through Arts Council England
- we created the Digital Training and Support Framework (<https://www.contractsfinder.service.gov.uk/Notice/c887d39a-626d-43a4-982a-e39bf5de6048>) to ensure government can efficiently and effectively procure the necessary support, such as basic digital skills training or assistance to use an online government service, for citizens who have insufficient digital skills, confidence or access

And government will continue to work with partners to ensure that small businesses and charities have the skills they need to make the most of the digital economy.

But we need to do more to make sure we build a country that works for everyone and where no-one is left behind. Far too often there is a correlation between where people live, their socio-economic circumstances and whether they have basic digital capability. Unemployed adults, for example, are 5% more likely to lack the basic digital skills than the national average, and 24% more likely to lack these skills than high earners.⁵ In August 2016, 22% of adults in Blackburn had not used the internet in the last three months, compared with 7% of adults in Surrey.

To close this divide we must take a more targeted approach to digital inclusion. As a first step, we will:

- explore whether there are new ways to galvanise the sector to tackle digital exclusion. Therefore, we will **undertake a feasibility study this year on the viability of using outcome commissioning frameworks, such as payment by results or social impact bonds, to tackle digital exclusion**. This study will build the evidence base on whether there is sufficient appetite from investors, delivery partners and local authorities for this approach, and support the development of future innovative projects
- **develop the role of libraries in improving digital inclusion** to make them the 'go-to' provider of digital access, training and support for local communities. To do this we will work alongside national partners such as Good Things Foundation, who recently passed the milestone of having supported two million learners and aim to support an additional one million people to know the basics of the internet by 2020
- use the newly created **Council for Digital Inclusion**, which brings senior leaders from the private and charity sectors together with government, to increase collaboration and deliver initiatives to help more citizens to confidently go online and take advantage of the internet

- invest **£1.1 million through the NHS on projects to support digital inclusion**. This will help the most excluded groups (such as homeless people, people with disabilities, people with mental health problems, and prisoners) to develop their digital skills so they can feel confident using online tools to manage their health

Throughout this we will regularly assess our targets and metrics to make sure they are fit for purpose and accurately measure discrepancies in digital capability between different demographic groups. This will ensure we are enabling all groups to overcome barriers to full digital inclusion.

How libraries deliver improved digital access and literacy

Libraries have an important role to play in making sure everyone, in every part of the country, makes the most of the digital economy. Libraries tackle the barrier of access by providing a trusted network of accessible locations with free Wi-Fi, computers, and other technology. Over half of UK residents have a library card and 35.8% of people living in the most disadvantaged areas visit their library.⁶

With over 14,000 trained library staff, supported by volunteers, libraries also make significant inroads towards tackling the combined barriers of skills, confidence and motivation by offering skills training; helping people to understand the benefits that using the internet and accessing online services can bring; and increasing their confidence of the digital world by guiding them on their journey to become regular users of the internet.

In 2014-15, 192,000 people were supported by almost half a million digital skills sessions across the library network.⁷ Public libraries work in partnership with charities and private partners such as Halifax, BT, and Barclays to improve the lives of some of the most socially and digitally excluded people. Libraries also support transformative initiatives like code clubs, Code Green (<https://librariestaskforce.blog.gov.uk/2016/03/14/code-green-cracking-the-code/>) and the innovative Make It Digital (<http://www.bbc.co.uk/makeitdigital>) in partnership with the BBC.

Libraries are also increasingly helping people develop higher level digital skills. Several libraries across the country host makerspaces and FabLabs – places where people can learn new skills, and collaborate on projects. Makerspaces also are democratising access to the latest technology, making high-tech equipment like 3D printers and laser cutters available to everyone. We will bring together people from across sectors to collaborate and support the expansion of makerspaces in public libraries in England.

Digital skills for a digital economy

Individuals, businesses, government and other organisations must take steps now to ensure that we have the skilled and capable workforce needed in an increasingly digital world. As our modern industrial strategy sets out, a lack of digital skills is not only a barrier to people fulfilling their potential, but also a barrier to a more productive economy.

Digital skills embedded in education

We are already making progress to ensure that the next generation have the digital skills they need for work. In 2014, England was the first country in the world to mandate teaching coding to children at primary and secondary schools.⁸ The introduction of computing in the national curriculum means that our school children will be taught the knowledge and skills that employers will need.

For the computing curriculum to be successful teachers need to be well-equipped and supported to deliver it. That is why we have provided funding for the **Computing at School Network of Teaching Excellence in Computer Science**, whose network of over 350 Master Teachers can provide continuing professional development to teachers needing to further develop their computing expertise. We will also continue to encourage computing graduates into teaching, by providing generous bursaries of up to £25,000, and, in partnership with the British Computing Society, scholarships worth £27,500 for those training to be a teacher in 2017/18.

Outside the formal curriculum there has been a number of new innovative initiatives providing young people with opportunities to develop their digital skills. For example:

- there are now over 5,000 Code Clubs, using volunteers and top quality online material to give young people the opportunity to learn how to code
- the Raspberry Pi Foundation is providing low-cost, high performance computers to learners alongside outreach and education to make more young people access computing and digital making
- the BBC Make it Digital programme partnered with over 25 organisations to provide the micro:bit (a pocket sized codeable computer) to every child in year 7 or equivalent across the UK to inspire them to develop their interest and digital creativity and get them creating technology and not just consuming it

The National Citizen Service working with Raspberry Pi to prepare young people for the workplace

Though young people are often thought of as ‘digital natives’, according to a recent Capgemini study, almost half of senior decision makers do not believe young people know how to use digital skills for work.

The National Citizen Service (NCS) helps 16 and 17 year olds to build skills for work life, take on new challenges and make new friends. The Government is committed to the expansion of the NCS so it becomes a rite of passage for all young people. In 2016, NCS reached 93,996 young people and with a high rate of engagement from young people that most need support, NCS is uniquely placed to help young people to engage with the digital economy.

We will therefore support National Citizen Service and the Raspberry Pi Foundation to take forward a pilot that will test new ways to include digital skills and careers in NCS programmes. This could include hands-on coding experience, digital making, digital entrepreneurship and contact with creative technology-focused businesses to inspire participants to consider a career in the sector.

Our Industrial Strategy green paper set out our plans to create **a proper system of technical education** to benefit the half of young people who do not go to university and to provide new, better options for those already in the workforce. The reforms will create 15 prestigious technical routes, as set out in the Skills Plan, encompassing both college-based and employment-based learning and providing a clear path to skilled employment. **Relevant digital skills will also be included in all of these routes**, meaning that everyone joining the workforce will have the digital skills required whatever job they choose. The government will work with the Institute for Apprenticeships and Technical Education and industry professionals to determine what digital content will be included in the new technical education routes.

Lifelong learning

The rapid pace of technological change means digital techniques and technologies are also constantly evolving. The pace of technological change makes it difficult to predict the nature of digital skills that will be needed in future. Requirements will change quickly so we will need to up-skill people across their working

lives. It is therefore essential for people to continue to develop their digital skills after they have left formal education.

We will ensure that adults who lack core digital skills can access specified basic digital skills training free of charge, where it is made available by providers as part of the publicly-funded adult education offer. This will mirror the approach taken for adult literacy and numeracy training. Through this we will ensure everyone has access to the support they need to realise the benefits of the digital world. We will consult on the detail of this offer shortly.

Digital skills for digital jobs

To develop and maintain our position as a leading global digital economy, we will also need to develop a range of specialist digital skills to fill specific digital jobs. An estimated 1.2 million new technical and digitally skilled people are needed by 2022 to satisfy future skills needs.⁹

At present, the UK has a supply of specialist skills that scores well above the EU average, but there are still significant improvements that must be made. For example, despite the growing need for workers with specialist digital skills, computer science graduates have the highest unemployment rate of any degree course at 10% after 6 months graduating,¹⁰ which is in part due to some graduates not leaving with the technical or professional skills needed by employers. To tackle this and the other specialist skills challenges, we are taking action across further, higher, and employment based education.

Our reform of the technical education system will see the creation of a **specialist digital route**, with employers setting standards and specifying the knowledge, skills and behaviours that individuals will need. We have already seen employers collaborating with government in the development of **digital apprenticeship standards**, with 13 standards having already been approved for delivery and more still in development.

We have also introduced new innovative **digital degree apprenticeships**. These include a degree which is an integral part of the apprenticeship and are designed by groups of employers to make sure apprentices achieve full occupational competence. They will provide the much needed skills that industry needs. The Degree Apprentices earn a wage while doing a job in their chosen profession.

Ada, the **National College for Digital Skills**, opened in September 2016 and is supported by investment of £13 million from Government and £18 million from the Greater London Authority. The college will train 5,000 students over the next five years for a wide range of digital careers, such as software and database developers, user experience designers and tech entrepreneurs. We will fund Ada to develop a primarily online learning platform by summer 2017, which will pilot innovative techniques, gamified content and peer-to-peer elements to develop coding skills. Ada is also working with private sector organisations such as Bank of America Merrill Lynch, Deloitte and IBM. Google is partnering with the college to launch the Higher Level Apprenticeship in Digital Innovation Program. This will open up software engineering careers to students who want to experience working for a tech company, while at the same time studying towards a foundation degree in Computer Science.

We have already committed **£20 million to launch an institute to improve the quality of digital skills provision in the UK**. This funding will be released through a competition run by HEFCE, inviting consortia from universities and business to set up an independent institute which will champion innovative ways to increase digital skill provision in higher education.

We will build on this work over the coming months by:

- taking forward the key recommendations from the **Shadbolt Review of Computer Science Degree Accreditation and Graduate Employability**. In particular, we will seek to increase the number of students undertaking work experience to develop their professional skills and will develop a revised degree course accreditation system

- developing a **common digital skills language** to help industry articulate the digital skills they are seeking in a widely understood way and to provide digital careers information in a way school children and graduates can fully understand
 - working with the **Data Skills Taskforce** to help implement key elements of the Analytic Britain report - Securing the Right Skills for the Data-Driven Economy, which makes a number of recommendations on data analysis skills
-

Enabling a more diverse digital workforce

Women are underrepresented in both the uptake of digital qualifications and in digital roles. Just 17% of people who work in the tech sector and only 9.5% of students taking computer science A level courses are female. Yet women make up almost half of the workforce.¹¹ As we take forward our plans to boost digital skills in the workforce, we must ensure this imbalance is addressed.

There are already a number of programmes doing valuable and innovative work to help more women into tech. These include:

- the CyberFirst Girls competition (<https://www.ncsc.gov.uk/articles/gchq-cyberfirst-girls-competition>), a competition run by GCHQ to inspire and encourage young girls to consider a career in cyber
- the TechFuture Girls (<https://www.techfuturegirls.com/>) programme, an out-of-the-box after-school club that has been specifically designed to encourage girls to stay engaged in IT
- Code First: Girls (<http://www.codefirstgirls.org.uk/>), which runs professional courses and networking events to help increase the number of women in tech
- Techmums (<http://techmums.co/>), a five week course to help mums learn basic digital skills
- Mums in technology (<http://www.mumsintech.co.uk>) - A baby friendly coding school that offers a flexible way of learning
- Microsoft's DigiGirlz events (<http://news.microsoft.com/en-gb/2016/11/22/digigirlz-girls-just-likely-boys-use-tech-help-world-says-microsoft-uk-ceo/#sm.001cj9z1z13i9fc2xre2qoyv998d3>), which aim to encourage young women to get involved in science, technology, engineering and maths
- the SheMeansBusiness (<https://shemeansbusiness.fb.com/uk/>) Partnership (by Facebook in collaboration with Enterprise Nation) that aims to deliver digital skills training to over 10,000 female entrepreneurs across the UK
- FDM Getting Back to Business (<http://www.fdmgroup.com/wp-content/uploads/FDM-GB2B-Recruitment-Brochure-2016.pdf>) programme, which supports women looking to return to work after an extended career break

We will build on these by supporting further development of the **Tech Talent Charter**. The Charter outlines key measures that encourage organisations to think differently in support of a more diverse tech workforce. It will provide an impetus for change across the sector by providing organisations with tangible actions and principles they can adopt and embed into their organisations as outlined in the Charter for example adopting best practice guidelines for job descriptions. We have also set an ambition for **50% of students at Ada, the National College for Digital Skills, to be women by 2020**.

Alongside this work, we will ensure there is also relevant targeted support for other underrepresented groups, such as people with disabilities and those from minority background or lower socio-economic areas. This is not only the right thing to do, but it will play an important role in meeting our digital skills shortages.

Cyber security skills

Despite our world leading cyber security expertise, we also have a cyber security skills shortage. We need to address the systemic issues at the heart of this shortage. In order to understand these issues and identify the actions needed to address them, we are developing a **Cyber Security Skills Strategy**, with input from industry and academia, to build on existing work and ensure that the UK has the required skills to keep the economy secure from cyber threats. The strategy will set out the UK's long term plans to develop a self-sustaining pipeline of talent.

Alongside development of the strategy, we are undertaking immediate work to address some of the known issues, including:

- an extra-curricular Cyber Schools programme for 14-18 year olds to provide specialist cyber security education for highly motivated students
- higher and degree-level apprenticeships for critical sectors
- a retraining programme to help those looking to change careers and join the cyber security profession, for which we have already run a 50-strong pilot
- certifying university degrees to ensure high-quality courses are identified and promoted
- accreditation of continuous professional development of teachers to ensure quality teaching
- a professional chartered body on cyber security to help set standards for the profession

Working together: A more collaborative, coordinated and targeted approach to digital skills

Government is by no means the only provider of digital skills training, and nor should it be. Employers and companies - national and local - all have a role to play in developing the digital skills and businesses need to thrive in the digital economy.

Business-led digital skills programmes

Many companies are already doing innovative work on addressing the digital skills challenge some of which have already been mentioned. This is very welcome. These are just some of the many current initiatives:

Microsoft recently launched a programme to train 30,000 public servants in a range of digital skills and alongside this launched a Cloud Skills Initiative to train 500,000 people in advanced cloud technology skills by 2020 and announced plans to make free online digital literacy training available to everyone in the UK.

Google recently offered five hours of free digital skills training to anyone in the UK who is seeking to develop their digital skills. More information on Google's Digital Garage initiative is available in Chapter 4.

Amazon Web Services (AWS) re:Start is a free training and job placement programme for the UK to educate young adults as well as military veterans, reservists, and their spouses, on the latest software development and cloud computing technologies. AWS re:Start also offers work placements to 1,000 people as part of the programme.

Lloyds Bank's 23,000 Digital Champions currently work with digital skills charities to deliver digital skills training across the community where it is most needed. Lloyds also produces two important, large-scale annual reports (the Business Digital Index and the Consumer Digital Index), which track the digital capabilities of small businesses and charities, as well as the digital and financial capabilities of adults across the UK.

Barclays runs the Digital Eagles programme to help people develop their digital skills and confidence so they are able to fully take advantage of all things digital, including, but not restricted to, digital banking.

BT fund and run the Barefoot Computing Project which provides free cross-curriculum computer science resources and volunteer-led CPD workshops to help primary school teachers with no previous computer science background feel confident in delivering the curriculum. Working in collaboration with BCS, The Chartered Institute for IT, the project has already reached 33,000 teachers and through them, 1 million primary school children since its launch in September 2014.

HP currently runs its Digital Schools Awards programme which provides a pathway and resources for schools seeking to do more with digital technology. In the UK and Republic of Ireland more than 2000 schools have already signed up involving over 350,000 students.

The **Accenture** Skills to Succeed Academy is an innovative online learning solution designed to help young people build their employability skills and confidence. Through partnerships with the Department for Work and Pensions (DWP), National Careers Service, Careers Wales and Skills Development Scotland, the scheme has already reached more than 100,000 people across the UK.

Cisco's Networking Academy programme provides IT skills and career building material and support for learning institutions and individuals.

O2 aims to help 20 million people engage better with technology by 2020 through its online safety partnership with the NSPCC; through opening up digital skills, social action and work experience opportunities for young people through its GoThinkBig platform; and through helping customers live smarter and more sustainable through connected devices.

Apple's Everyone Can Code is a new approach to coding that lets everyone learn, write and teach coding and helps build apps that bring ideas to life. Apple Teacher Program is a free professional learning program designed to support and celebrate education using Apple products for teaching and learning. Apple retail hold regular free workshops for people of all experience levels along with youth programs such as Apple Summer Camp and Apple Field Trip.

Samsung Digital Classrooms offer an engaging and collaborative educational environment for nurturing the talent of the future. In schools classrooms are provided with a suite of Samsung technology as well as teacher training, connectivity and maintenance support. Samsung Digital Academies provide vocational training and qualifications in technology for young people to open opportunities for employment.

Sky Academy Skills Studios provide a half-day interactive experience giving 8-18-year olds the chance to come behind the scenes at Sky and make their own TV report, linked to topics they are studying at school. Sky Academy Careers Labs provide a full day careers experience to 16 to 19-year-olds offering the chance to learn about jobs in media, business and technology.

All of these initiatives and programmes are hugely welcome. However, the sheer number of programmes and offers can make it difficult for some people to know which training opportunities best suit their needs. Some programmes focus on basic digital skills for individuals; others focus on digital training for businesses. There can often be several programmes operating in one area - and sometimes none in others.

Government has no desire to centrally control these valuable initiatives and activities. But there is an opportunity for government to play an important role in convening and providing coherence to all those active in this area. **We will therefore establish a new Digital Skills Partnership, working together with partners who are passionate about closing the digital skills gap.** The Partnership will bring together technology companies, local businesses, local government, charities and other organisations. It will facilitate coordination between the various programmes, including the sharing of knowledge and best practice. The Partnership will also examine options for improving the coherence of digital skills provision, for example by setting ambitions

for increasing the level of certain types of training on offer and agreeing how it can be targeted where it is needed most. In doing so, it will make it easier for individuals to find the training that's right for them, and to ensure that training opportunities are available across the country.

New digital skills commitments

To support the strategy and the aspiration of the Digital Skills Partnership, a number of organisations have committed to being even more ambitious in extending their reach and scale of their programmes:

Lloyds Banking Group as part of its Helping Britain Prosper Plan has pledged to train face to face 2,500,000 individuals, SMEs and charities on digital skills, including internet banking, by 2020.

Barclays has pledged to expand the number of Digital Eagles, there are currently 16,000, with a focus in 2017 on cyber skills. In addition to this, in 2017, Barclays has pledged to grow its UK Eagle Lab network by up to 100% (which would be a total of up to 18 sites) which supports high growth tech businesses and the wider digital enablement of their local communities; teach basic coding to 45,000 children; assist up to 1,000,000 people with general digital skills and cyber awareness; and will run an extensive and nationwide range of webinars and face to face training events, covering cyber security, data analytics and digital marketing, for SMEs.

Google has pledged to launch a Summer of Skills programme in coastal towns across the UK. It will develop bespoke training programmes and bring Google experts to coach communities, tourist centres and hospitality businesses across the British coasts. This will accelerate digitisation and help boost tourism and growth in UK seaside towns. This new initiative is part of a wider digital skills programme from Google that has already trained over 150,000 people.

BT has pledged to reach a further 500,000 children by end of 2017/18 academic year through its Barefoot Computing Project programme. BT has also pledged to offer 750 work placements to disadvantaged young people not in education or employment across the UK in 2017, to help improve their tech literacy.

Accenture, in recognition that digital skills are key to employability, is partnering with FutureLearn, and has pledged to create a brand new Digital Skills Programme, which maximises effective learning through online collaboration. Over the coming months, Accenture will work with a number of partners, who collectively have a reach of over 100,000 people across the UK, to scale the programme nationally.

HP has pledged to introduce in the UK its HP Graphics Education Programme. This will empower the next generation of digital printing graduates with the skills they need to work in the rapidly changing digital printing space. HP will share content and knowledge with selected schools, institutions and partners and open HP's demo and training centres to the most talented students through dedicated Summer Camps. HP Inc has also pledged to expand its Learning Studios initiative to more schools across the country. This will equip these schools with the latest education technologies with appropriate support to teachers and help improve IT skills, expose students to innovative skills and concepts such as design thinking, three dimensional design, and social entrepreneurship. The HP Foundation has also pledged to bring to the UK a free online learning platform - HP LIFE to improve business, IT and digital skills for disadvantaged groups in the UK. It aims to reach 6000 new UK users over the next 5 years.

Cisco, through its Cyber Badge programme, is pledging to extend its Cyber Detective project by providing cyber security training to children aged 16-18 through free interactive online courses, and certification following successful completion of tasks related to the training. In the first instance, Cisco are aiming to reach over a thousand students through this new programme.

IBM ran three successful Summer Schools for Primary School Computing events in Warwick, Manchester and London in 2016 to help equip teachers to teach the computing curriculum more effectively. IBM has pledged three more summer schools in 2017.

The Partnership will also play a crucial role in helping people access digitally-focused jobs at a local level. We will explore how to identify digital vacancies area-by-area, and where possible look to make this data available to local authorities, combined authorities, LEPs and others. We will encourage and support local partnerships of government and business to make use of this data to tackle digital skills shortages in their area. Actions to address these shortages could include local firms offering more digital apprenticeships, or careers advice and work experience to local schools. It could also include national and international firms making training packages available to local partnerships. By identifying and acting on digital skills shortages at a local level, we will help more people across the country to access the training and information they need to move into highly-skilled, well-paid digital jobs across the economy.

Case study: Approach to identifying local skills needs in Leeds

With over 15,000 digital jobs, Leeds is one of the UK's largest centres for the digital economy outside London. Leeds is benefitting from rapid growth of established digital firms such as SkyBet, aql, Call Credit, EMIS and TPP, as well as start-ups and scale ups, and also organisations with large digital teams such as Asda, DLA Piper, big financial services firms, and the NHS.

Leeds City Council convened the Leeds Digital Board, a group of digital employers, education and training providers, and the Leeds City Region LEP to work together to promote and grow the sector, and to tackle skills gaps.

The first step was to understand the issues. The Leeds-based big data consultancy, Bloom, were commissioned to identify digital employers. They collated data from Companies House, a scrape of company websites, twitter data and existing lists to identify all the businesses in Leeds undertaking digital projects. Analysis of skills gaps and vacancies was undertaken by Herd, a Leeds firm who run a job board for tech.

This analysis was used to develop the Leeds Digital Skills Action Plan. This sets out a range of short term measures to connect skilled people to digital jobs, such as the Leeds Digital Jobs Fair, promoting Leeds at jobs fairs in London, and twelve week "bootcamps" to get people job-ready for the digital sector. It sets out measures to develop the future talent pipeline, including graduate schemes, digital apprenticeships, degree apprenticeships, initiatives to encourage more women to pursue careers in tech, and the ambition for a code club in every Leeds school.

1. Internet users in the UK: 2016

(<https://www.ons.gov.uk/businessindustryandtrade/itandinternetindustry/bulletins/internetusers/2016>), ONS statistical bulletin ↩

2. Review of publicly funded digital skills qualifications (<https://www.gov.uk/government/publications/review-of-publicly-funded-digital-skills-qualifications>), Skills Funding Agency

(<https://www.gov.uk/government/organisations/skills-funding-agency>) ↩

3. Digital Economy and Society Index (<https://ec.europa.eu/digital-single-market/en/human-capital-desi-dimension-2>) ↩

4. Through funding for the "Future Digital Inclusion" and "Widening Digital Participation" programmes. ↩

5. According to estimates in the Basic Digital Skills UK Report 2015 (http://s3-eu-west-1.amazonaws.com/digitalbirmingham/resources/Basic-Digital-Skills_UK-Report-2015_131015_FINAL.pdf), 23% of people in the UK aged 15+ lack one or more of the 5 basic digital skills; compared with 28% of those who are unemployed, and 4% of those with an income of £75,000+. ↩
6. Taking Part 2015/16 quarter 4 statistical release, DCMS (<https://www.gov.uk/government/statistics/taking-part-201516-quarter-4-statistical-release>) ↩
7. Digital Skills Partnerships in Libraries (<https://librariestaskforce.blog.gov.uk/2015/12/17/digital-skills-partnerships-in-libraries/>), Libraries Taskforce Blog ↩
8. D5 London: teaching children to code (<https://www.gov.uk/government/publications/d5-london-summit-themes/d5-london-teaching-children-to-code>) ↩
9. Sector insights: skills and performance challenges in the digital and creative sector, UK Commission for Employment and Skills (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/433755/Skills_challenges_in_the_digital_and_creative_sector.pdf), June 2015 ↩
10. Higher Education Statistics Agency data, 2014/15 Academic year - Table E (https://www.hesa.ac.uk/files/dlhe_1415_table_E.xlsx) ↩
11. The Women in IT Scorecard 2016 (https://www.thetechpartnership.com/globalassets/pdfs/research-2016/womeninit_scorecard_2016.pdf), The Tech Partnership (<https://www.thetechpartnership.com/>) ↩



- Department for Culture Media & Sport (<https://www.gov.uk/government/organisations/department-for-culture-media-sport>)

See more information about this Policy paper (<https://www.gov.uk/government/publications/uk-digital-strategy>)

Policy paper

3. The digital sectors - making the UK the best place to start and grow a digital business

Published

Contents

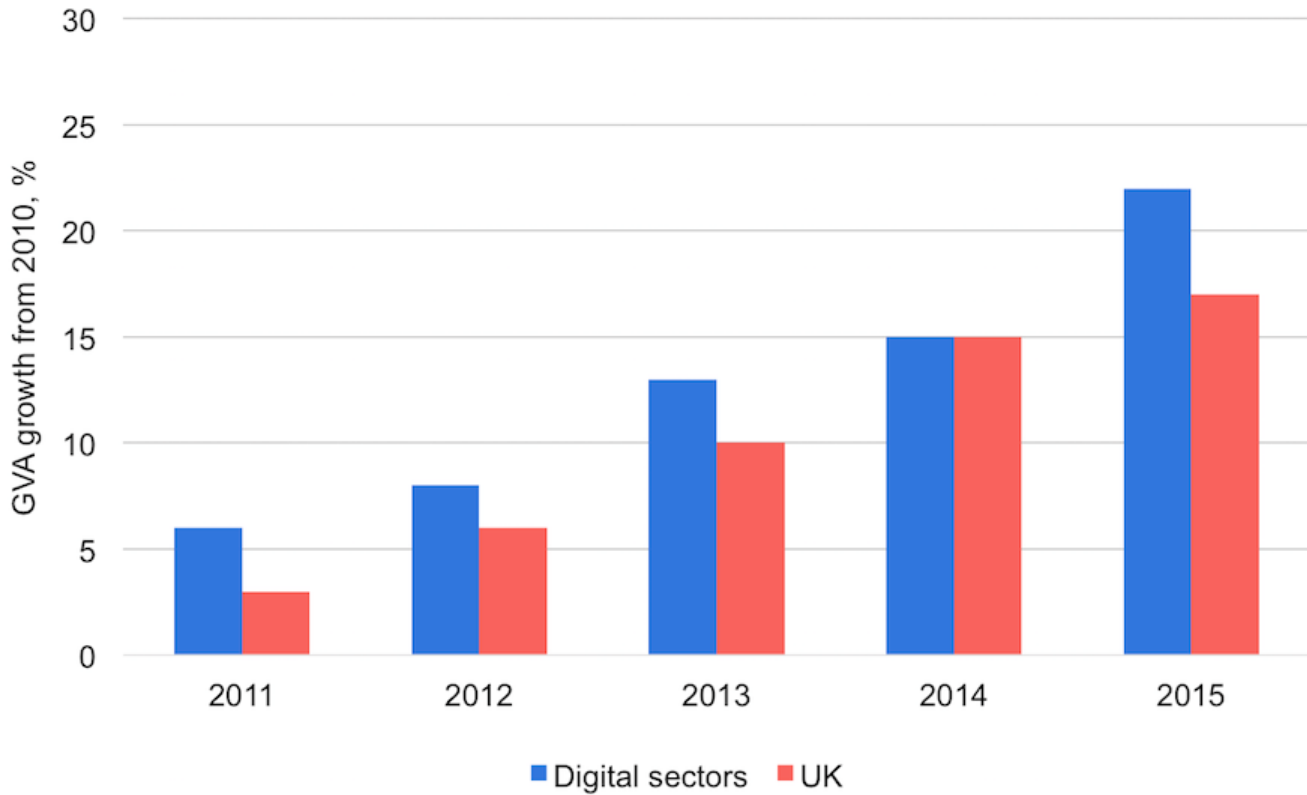
- Supporting innovation
- Supporting digital businesses
- Widening procurement
- Spreading the growth across the whole country

Digital sectors contributed £118 billion to the economy in 2015: over 7% of the UK's gross value added (GVA),¹ and exports of digital goods and services now amount to over £50 billion.² Tech City UK estimates that the digital sectors are creating jobs 2.8 times faster than the rest of the economy.³ The UK is home to growing digital clusters across the country, including Reading and Bracknell, Bristol and Bath, Manchester and Birmingham, as well as emerging clusters in Southampton, Cornwall and Dundee.⁴ As well as the 'core' digital sectors, technology is transforming other sectors across the economy to create emerging fields such as EdTech, FinTech and HealthTech where the UK is already leading the way.

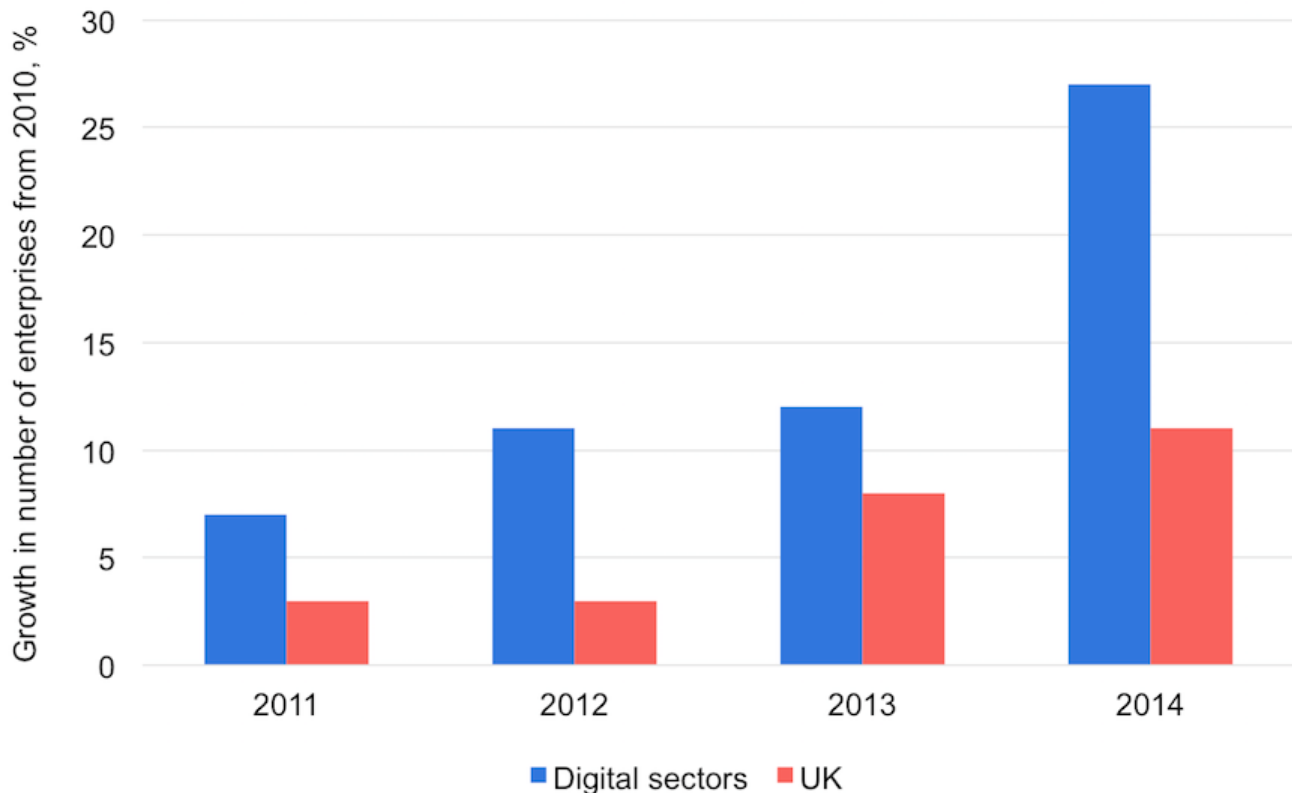
Our ambition is for the sector to continue growing so that by 2025 its contribution to the economy rises to £200 billion. To achieve this, we must create the right conditions for the digital sectors to continue to thrive and to ensure the benefits are spread throughout the UK. Although this will be led by the private sector, government has a key role to play in supporting innovation and the commercialisation of ideas, and helping all digital businesses take advantage of opportunities for growth.

Source: DCMS Sectors Economic Estimates (Cumulative growth, Index 2010=0)

From 2010 to 2015, the digital sectors' contribution to GVA grew by 21.7%, compared to the UK's total GVA which increased grew by 17.4%



The number of businesses in the digital sectors grew at a faster rate than the total number of businesses in UK between 2010 and 2014



Source: DCMS Sectors Economic Estimates (Cumulative growth, Index 2010=0)

Supporting innovation

The Industrial Strategy green paper set out the government's ambition to create the conditions for competitive, world-leading businesses to prosper and grow right across the UK. The following outlines the steps we are taking to create this environment for digital sectors.

An effective tax structure

We have already created one of the most innovation and entrepreneur-friendly tax systems in the world. The government has delivered highly competitive headline corporation tax rates and introduced a range of initiatives to further support innovative businesses. This includes the Patent Box, which enables companies to apply a reduced 10% rate of corporation tax to profits earned from patented inventions.

Support is also in place to help small, early stage companies raise equity finance through the Seed Enterprise Investment Scheme (SEIS), which offers tax reliefs to individual investors who purchase new shares in those companies. It complements the Enterprise Investment Scheme (EIS), which offers tax reliefs to investors in high risk and growing companies. SEIS is intended to recognise the particular difficulties which very early stage companies face in attracting investment, by offering tax relief at a higher rate.

We are currently undertaking a review of the tax environment for R&D to examine whether there is more we could do to stimulate private sector investment and make the UK an even more competitive place to innovate.

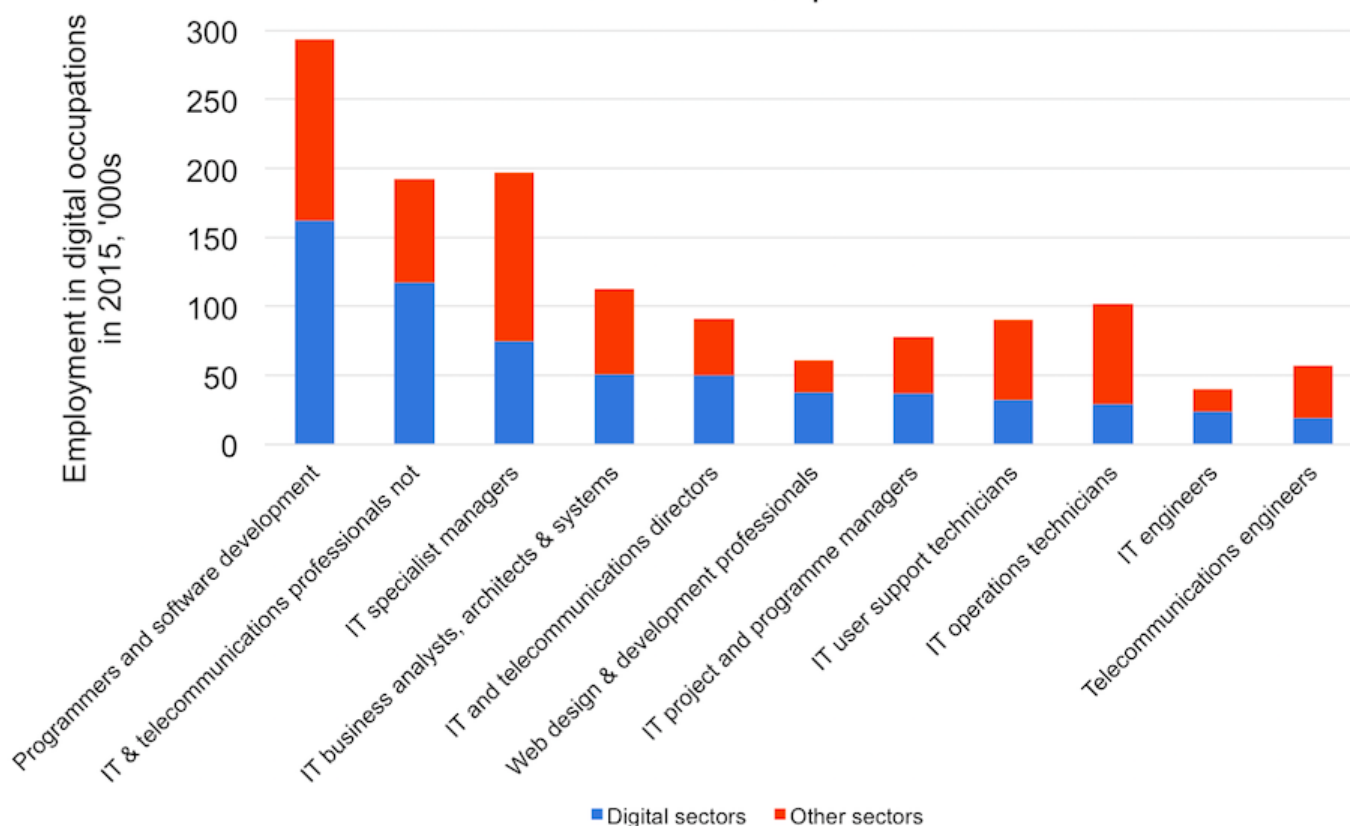
A strong supply of skilled workers

Digital businesses need a supply of employees with the right digital skills if they are to flourish. This means developing the skills we need domestically, and Chapter 2 covers how we will develop a strong pipeline of digital skills within the UK.

Digital sector companies employ around 80,000 people from other European Union countries, out of the total 1.4 million people working in our digital sectors. The government has been clear that it wants to continue to attract the brightest and best to study and work in Britain after we leave the EU. The Prime Minister has said that she wants the UK to be a magnet for international talent and a home to the pioneers and innovators who will shape the world ahead, and that openness to international talent must remain one of this country's most distinctive assets. We recognise the importance which the technology sector attaches to being able to recruit highly skilled staff from the EU and around the world. As one part of this, we have asked the **Migration Advisory Committee to consider whether the Tier 1 (Entrepreneur) route is appropriate to deliver significant economic benefits for the UK**, and will say more about our response to their recommendations soon. We also recognise that digital businesses are concerned about the future status of their current staff who are EU nationals. Securing the status of, and providing certainty to, EU nationals already in the UK and to UK nationals in the EU is one of this Government's early priorities for the forthcoming negotiations. We continue to support Tech City UK's key role in attracting world class talent into the UK's digital sectors through the Tech Nation Visa Scheme (<http://www.techcityuk.com/tech-nation-visa/>).

Source: DCMS Sectors Economic Estimates

The most common occupation in the digital economy is software developer



Regulation that keeps pace with technological change

An innovation-friendly regulatory environment is crucial to allowing university researchers and digital companies to develop, test and sell their ideas, goods and services. The quality and agility of regulation can often make or break disruptive innovation, which rarely fits neatly into existing regulation.

We will work with the independent regulators to ensure that regulation across sectors is open to realising the benefits of new and disruptive digital innovations, while continuing to protect the public. Companies developing new technology will be able to get a fair hearing from government on any regulatory or competition issues that they feel are impeding their businesses.

The Challenger Business Programme has also helped establish an environment in which innovative businesses can thrive, and is another channel for businesses to alert government to regulatory barriers to growth. It has helped 400 businesses since its launch in 2013 and will now be expanded as part of the government's Industrial Strategy. We want to undertake more deep dives into emerging sectors, and are keen to hear from industry about new areas the programme could look to explore. We also want to intensify our efforts on driving through the recommendations from previous Challenger Business reviews.

If innovation is to flourish, a **dynamic and flexible intellectual property (IP) regime** is also vital. We need to make sure that the IP rules keep up with technological change. We will, for example, conduct research to look at 3D printing technology and how IP rights apply to 3D files and products. We will legislate through the Digital Economy Bill to give designers a new way of giving the public notice of their IP rights with a web address. And the Intellectual Property Office will make sure that UK digital businesses can easily find the advice on IP they need.

Ultimately, businesses rather than the government are best placed to identify what companies need to enhance their competitiveness as a sector. That is why our Industrial Strategy green paper proposes to set an ‘open door’ challenge to industry to come to the government with proposals to transform and upgrade their sector through **sector deals**. As part of these deals, sectors will be able to identify how companies within a sector and government could take action to increase their prospects of success, and this could include addressing a regulatory issue or deregulating.

FinTech: a UK success story supporting access to financial services for all consumers

The UK is the global capital for financial technology, or ‘FinTech’, which generated £6.6 billion in revenue and raised over £500 million of investment in 2015 alone. It is disrupting established processes and changing the ways that consumers interact with financial services.

In doing so, it is radically reducing the cost of accessing financial services and broadening the range of services available. This is allowing those who may previously have struggled to access financial services to do so, and providing consumers with the tools they need to manage their finances well.

The government and regulators are taking a significant number of actions to support the UK FinTech industry:

- supporting the banks to deliver Open Banking through a fully open application programming interface (API), providing ongoing access to authorised third parties by Q1 2018. Third-parties will then be able to access consumers data in real-time, thereby allowing them to offer budgeting tools to support individuals in managing their finances
- supporting industry to design and deliver a pensions dashboard by 2019 – a digital interface where an individual can view all their pensions in one place, enabling consumers to make more well-informed decisions about their pensions
- working with Tech City UK on a FinTech delivery panel to set out a long-term strategy for UK FinTech, identify key industry initiatives to deliver this, and drive forward progress. This panel comprises key representatives from the FinTech sector, existing financial services sector, and the Financial Inclusion Commission, given the significant potential of FinTech in supporting financial inclusion
- appointing regional FinTech envoys to ensure the continued growth of FinTech across the UK. To date, regional FinTech envoys have been appointed for the Northern Powerhouse and Scotland
- launching a professional services information hub
- showcasing the best of British FinTech to investors at the annual International FinTech Conference, to take place on 12 April 2017

The Bank of England is also supporting the FinTech sector by:

- establishing the New Bank Start-up Unit in January 2016 (in partnership with the Financial Conduct Authority). Nine new UK banks have been authorised in this parliament
- expanding access to central bank money to non-bank payments service providers, allowing them to compete on a level playing field with banks
- being open to providing access to central bank money for new forms of wholesale securities settlement, such as those based on Distributed Ledger Technology
- proactively seeking contributions from a wide range of perspectives and disciplines to feed into its long-term research into the impact of a digital currency on monetary and financial stability and whether new technology has the potential to be used to provide wider access to central bank money, via a Central Bank Digital Currency
- partnering with FinTech companies through a Bank of England FinTech Accelerator to help harness FinTech innovations for central banking

Increasing the level of research and development

The UK supports on average £1.3 billion a year in digital R&D, through the private sector, public investment by the Research Councils and Innovate UK, and research carried out by the government itself. We have world-class universities and laboratories, whose excellence is one of the key guarantees of our global tech leadership. Business expenditure on digital R&D exceeded £3.2 billion in 2015 - 15% of all business R&D expenditure.⁵

Government provides approximately £600 million of support each year through Innovate UK's programmes and competitions. This support has been instrumental to the success of some of the UK's leading digital start-ups, including Swiftkey and Magic Pony. In 2015, we launched the Alan Turing Institute (<https://turing.ac.uk/>), a joint venture of leading UK universities to undertake research using advanced mathematics, computer science, algorithms and big data. With £42 million from the government, it has already secured £35 million from private and partner organisations. The Digital Catapult (<https://digital.catapult.org.uk/>) and the Hartree Centre (<http://www.hartree.stfc.ac.uk/hartree/>) also continue to help researchers and businesses develop technologies and bring them successfully to market.

We will also award **£17.3 million in Engineering and Physical Sciences Research Council (EPSRC) grants to support the development of new Robotics and Artificial Intelligence (RAI) technologies in UK Universities**. One project, led by the University of Manchester, will develop robotics technologies capable of operating autonomously and effectively within hazardous environments such as nuclear facilities, while researchers at Imperial College London will look to make major advances in the field of surgical micro-robotics.

This funding also includes £6.5 million capital investment to support further collaboration within the UK Robotics and Autonomous Systems (UK-RAS) Network. This will enable the UK's robotics and artificial intelligence researchers to accelerate the translation of fundamental research into enabling technologies and promote cross-sector growth.

The Digital Catapult

The Digital Catapult Centre is a space for technologists, creatives from business and academia to collaborate and develop their new ideas and showcase their products to the UK and the rest of the world. It enables UK digital businesses to innovate at speed, and with less risk, so new products and services can be accelerated to market.

Its new strategy outlines the key technologies it will focus on moving forward:

- **data-driven:** new ways to work with personal data with more control and trust, applications of blockchain and smart contracts, cybersecurity particularly for emergent threats
- **connected:** the Internet of Things, and associated enabling networking technologies such as Low-Power Wide-Area Networks (LPWAN) and 5G
- **intelligent:** artificial intelligence and machine learning
- **immersive:** augmented, virtual and mixed reality, haptics and related new forms of human machine interface

It will initially apply these in three market sectors through large scale programmes:

- **Digital Manufacturing** - accelerating adoption of digital technologies to increase productivity and the creation of new value in UK manufacturing
- **Digital Health and Care** - enabling people to live longer, happier, healthier lives through digital technology

- **Creative Industries** - creating new markets for the UK's Creative Industries using emerging digital technologies; making the UK the best place in the world to create content for immersive systems
-

In the Chancellor's Autumn Statement the government announced a further £4.7 billion in R&D funding to enhance the UK's position as a world leader in science and innovation, and we need to make sure we are getting the most from this investment. As a key part of this, we are taking forward the recommendations of the **Nurse Review, and creating UK Research and Innovation (UKRI)**, in order to ensure that the UK continues to support world-leading research and innovation, investing public money in the best possible way.

Industrial Strategy Challenge Fund

We are creating an **Industrial Strategy Challenge Fund** to help the UK capitalise on its strengths in science and innovation. This new funding stream will enable UKRI to back technologies at all stages, from early research to commercialisation, where the UK has the potential to take an industrial lead.

The Industrial Strategy Challenge Fund will focus on challenges where:

- the global market is potentially large, or fast growing and sustainable
- the UK has capabilities to meet market needs in terms of research strength and business capacity
- there are significant social and economic benefits
- there is evidence that government support will make a difference

The Industrial Strategy green paper initiated a consultation (https://beisgovuk.citizenspace.com/strategy/industrial-strategy/?utm_campaign=gov&utm_source=gov.uk&utm_medium=referral&utm_content=cons-page) on the first set of technologies which the Fund could support, which included:

- smart, flexible and clean energy technologies (such as storage, including batteries, and demand response)
- robotics and artificial intelligence (including connected and autonomous vehicles and drones)
- satellites and space technologies
- leading edge healthcare and medicine
- manufacturing processes and materials of the future
- bioscience and biotechnology
- quantum technologies
- transformative digital technologies including supercomputing, advanced modelling, and 5G mobile network technology

These are early suggestions for potential challenge areas and there may be more opportunities - for example, in the creative industries.

Supporting early-stage digital companies and innovators in universities

The UK is home to many top academic and research institutions, which act as excellent ecosystems to cultivate the next generation of future founders and employees in the digital sectors. The government is committed to supporting institutions to have the right structures for students to pursue entrepreneurial activities.

There are examples around the world which demonstrate the importance of an educational institution acting as a pipeline for talent. For example, California's Stanford University runs 145 education courses on enterprise⁶ which feed into Silicon Valley employment opportunities.

There are fantastic examples in the UK too, for example the University College London Innovation and Enterprise creates a bridge between UCL's computer science departments and practical enterprise modules and training; Durham University combines their career services with an enterprise incubator to embed the idea of being a founder as a viable postgraduate career; and Cambridge Enterprise was formed by Cambridge University to specifically focus on spinning out start-ups from academics and students, including creating successful tech and data companies by providing seed funding.

We believe that every computer science student should have the space and support to explore building tech start-ups that will shape their digital employment prospects and to become tech founders. Building on the government's creation of over 200 enterprise societies and clubs through the National Association of College and University Entrepreneurs, we will work with partners to develop a more unified approach to encourage students to become digital entrepreneurs. This will include recognising computer science students who are spinning out promising start-ups and linking their companies to funders and other opportunities.

Supporting digital businesses

Commercialising ideas

Government can play an important role in helping entrepreneurs and early-stage digital companies turn ideas into viable businesses through interventions such as accelerators, mentoring, and export assistance. While the UK has a world-leading track record in research and innovation, we have a challenge in translating our leadership in global research into commercial outcomes. While the UK produces a similar number of spin-off companies as US universities, we register far fewer patents. From the development of medical imaging technologies to biotechnology, the UK has too often pioneered discovery but not realised the commercial benefits.

Our Industrial Strategy green paper outlined a number of actions to address this. As part of this we have commissioned independent research on approaches to commercialisation in different institutions, including how they approach licensing intellectual property and taking equity in spin-outs. BEIS's Chief Entrepreneurial Advisor, tech entrepreneur Tim Dafforn, will also lead a **review to take stock of the support currently available to entrepreneurs and consider international best practice**, with the aim of identifying any potential gaps in current policy. The review will examine the entire entrepreneurial journey, focusing on the motivations and opportunities for those embarking on business ventures, from education to business development and growth.

Supporting emerging technologies

From the Internet of Things and connected and autonomous vehicles, to artificial intelligence and virtual reality, the UK already has world-leading businesses developing and using new technologies.

Government can support the growth of these emerging technology sectors through strategic interventions. The following boxes look at two technologies where we are already playing an active role.

Connected and Autonomous Vehicles

Connected and autonomous vehicle technologies are set to transform our roads and could offer huge benefits including improved road safety, traffic flow, efficiency and mobility, together with significant opportunities for UK industry. We want to ensure the UK is at the forefront of these developments and we will work with industry and road network managers to understand the changes necessary to make this a reality, including improved connectivity on the road network.

Our regulatory framework already supports real-world testing of automated vehicle technologies, and our world-leading 'test anywhere' approach, which encourages co-operation between a variety of organisations, is helping to attract international companies to test their vehicles on our roads. We are keen to ensure that we are acting at speed to put in place the necessary regulatory framework to enable the safe sale and use of this technology, and will be taking forward a rolling programme of reform, engaging with industry and international partners to identify where to focus our efforts.

We have also provided over **£100 million of funding to support research, development and real-world demonstrations of connected and autonomous vehicles**, matched by industry. Our driverless car trials have commenced public demonstrations in Milton Keynes, and projects in Bristol, Greenwich and Coventry will go live soon. In February 2016 we awarded £20 million to 21 new collaborative research and development projects, and in August 2016 we launched a further £35 million research competition, one part of which involves a grand challenge demonstration of a highly autonomous vehicle operating in a variety of conditions on public roads.

We are consolidating this effort to assert a world leadership position in the demonstration and deployment of connected and autonomous vehicle technologies. In his 2016 Autumn Statement, the Chancellor announced **£100 million for new connected and autonomous vehicle testing infrastructure**. The funding will be used to develop a high impact programme (to be matched by industry up to £200 million) over four years to provide a globally competitive testing ecosystem for these technologies by strengthening and integrating our existing centres of excellence.

The Internet of Things and Smart Infrastructure

The Internet of Things enables connected objects and devices containing sensors to share data, information and insights - from industrial machines, infrastructure, buildings and vehicles, to consumer electronics and clothing. The benefits for industry, the public sector and citizens could be huge. For example: wearable monitors can improve personal health care; smart water pipes can warn of falls in pressure; street-level data can improve traffic flows and planning.

We want the UK to remain an international leader in R&D and adoption of IoT. We are funding research and innovation through **the three year, £30 million IoT UK (<https://iotuk.org.uk/>) Programme**, including:

- the large-scale **Cityverve** (<http://www.cityverve.org.uk/internet-of-things/>) **smart cities demonstrator in Manchester** to show how IoT technologies and services can improve the quality and efficiency of services in transport, energy, health and culture
- **NHS test beds, using IoT and health and care innovations** to help people with dementia in Surrey and people with diabetes in the West of England
- the **IoT Research Hub** led by University College London and partners, to develop UK interdisciplinary research excellence, focusing on privacy, ethics, trust, reliability, acceptability and security (PETRAS (<http://www.petrashub.org/>))
- help for IoT entrepreneurs and innovators from the Digital Catapult and Future Cities Catapult; and **specialist accelerator schemes** for IoT hardware businesses, R/GA and Startupbootcamp.

Increasingly, new infrastructure is also smart: connected, and operated with data to achieve maximum efficiency and effectiveness. To provide leadership in the roll out of smart infrastructure, the EPSRC has announced £138 million of funding for the **UK Collaboratorium for Research in Infrastructure and Cities (UKCRIC)** to create a coordinated and coherent national infrastructure research community, spanning at least 14 universities. UKCRIC stated aims are to:

- build on existing capabilities to establish a network of state-of-the-art large-scale experimental facilities supporting world-leading research in cities and infrastructure
- establish a unique, national network of local 'urban laboratories' to sense, capture, monitor and evaluate new and existing infrastructure in UK towns and cities
- establish world-leading computation and big data infrastructure for the modelling, simulation, and visualisation of cities and infrastructure
- we have also asked the National Infrastructure Commission to undertake a new study on how emerging technologies can improve infrastructure productivity

Sector deals offer another important channel to support specific industries. They offer an opportunity for important players to join together and address shared challenges and opportunities they face. We are therefore pleased to support reviews into the following important and rapidly growing sectors, which could inform potential sector deals.

Professor Dame Wendy Hall, Regius Professor of Computer Science at the University of Southampton, and Jerome Pesenti, Chief Executive of BenevolentTech, will conduct **a review of how industry and government can create the conditions for the artificial intelligence industry to continue to thrive and grow in the UK**. The review will consider the core challenges such as skills and access to talent, access to data, and access to finance and investment. This review will build on the work on machine learning by the Royal Society, and it will complement, but remain separate from, the ongoing work by the British Academy and Royal Society on data ethics and governance, which will also cover ethical issues around AI.

As outlined in the Industrial Strategy green paper, Sir Peter Bazalgette will conduct an independent **review into how the UK's creative industries, such as our world-leading music and video games industry, can help underpin our future prosperity** by utilising and developing new technology, capitalising on intellectual property rights, and growing talent pipelines.

In addition to these reviews, government will consider how it can further support the **virtual reality (VR) and augmented reality (AR) sectors in the UK, considering how these industries could seize opportunities for growth**. The UK is home to a number of innovative firms working in this sector, including Blippar, Improbable.IO, Ultrahaptics, and a host of world-leading production houses specialising in VR or AR content. As an international hub for the cultural and creative industries, and with our strengths in research and computer science, the UK is well placed to take advantage of global growth in these sectors.

The Digital Catapult is already helping advance next generation virtual and augmented reality businesses. Earlier this month, it launched **Augmentor**, an equity free 10-week programme to provide technical and business mentorship to start-ups in this space. Successful applicants will have access to the Digital Catapult Centre in London as a space to work and collaborate, as well as the state-of-the-art Immersive Lab at the centre.

Supporting new and growing businesses

Digital start-ups are a core part of the success of our digital sectors. In 2014, there were almost 200,000 digital enterprises in the UK, 90% with fewer than five employees. Central to our ambition for the growth of digital sectors is therefore to **make the UK the best country to start and scale a digital business**.

As with our support of new technologies, we will identify those where government can play an effective role in helping specific sectors to grow. For example, we will:

- continue to support the growth of the UK video games industry. In 2015 we launched our £4m four year UK Games Fund to accelerate the growth of games clusters around the UK by helping creative young businesses develop new games ideas and by supporting talent. The Fund is helping companies become more diverse and innovative, create IP and grow in strength and size and has helped over 50 companies to date to become investor-ready. Additionally, six graduate teams have formed new games business after taking part in the first round of the Fund's separate Tranzfuser talent programme
- increase support for new businesses in cyber security, where - with the support of the National Cyber Security Programme - we have launched a series of inter-locking initiatives including two innovation centres, a Cyber 20 programme of intensive business support, a GCHQ-sponsored accreditation programme for new technologies, and programmes to help universities to turn their research into businesses. We will then look at scaling up the elements of this programme that have proven most effective, and which might translate to the wider digital sectors, such as a Future 50 of the top UK scale-ups to receive intensive support and mentoring

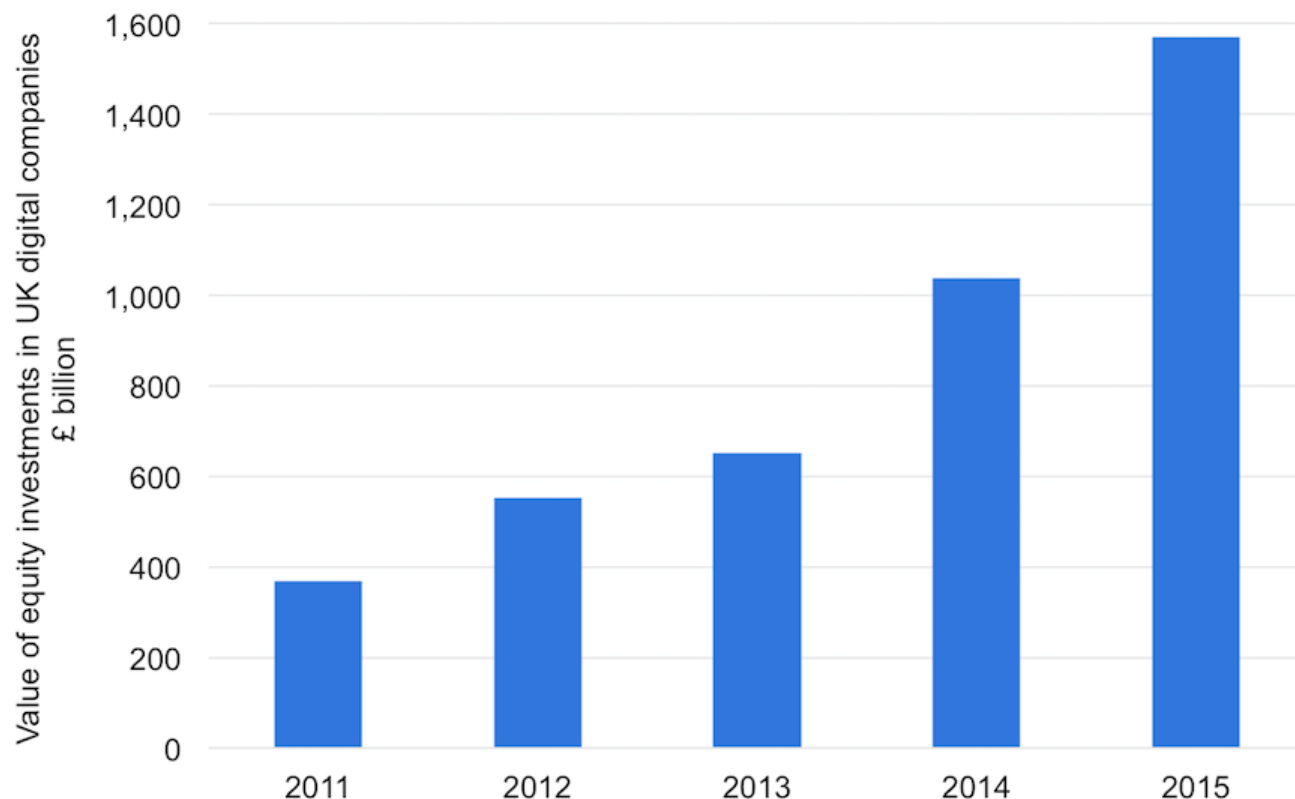
Those businesses that successfully establish themselves and begin to grow rapidly face a particular set of challenges. **The Minister for Small Businesses will take on an additional role as the Scale-up Champion**, working to coordinate support across the UK specifically aimed at these businesses, which are so crucial to our future prosperity. The government will also work with the ScaleUp Institute and other partners, including Local Enterprise Partnerships and Growth Hubs and their network of strategic partners to build peer-to-peer business networks specifically for fast-growing firms. And we will use data that only government has – such as VAT returns – to help identify fast-growing firms at an early stage. This will enable the efficient offer of advice and support to catalyse business growth and support scale-up businesses in cooperation with the Behavioural Insights Team and the ScaleUp Institute.

Increasing the level of investment

The UK is already a world centre for finance, and home to a great deal of investment finance. Overall, investment in UK technology businesses is buoyant. Analysis by the British Business Bank using data from Beauhurst shows a record £1.57 billion of equity finance was invested in the digital sectors in 2015, more than four times the level of investment in 2011. Investment in the sector has remained high over the first three quarters of 2016.

Source: British Business Bank Analysis of Beauhurst

Investment in UK technology businesses is growing



We want to make sure that the UK remains the best place in the world to do business. As well as encouraging home-grown digital companies to start and grow, we need to attract innovative digital companies to come to the UK. This work will be led by the Department for International Trade, working closely with the National Technology Adviser and our network of embassies around the world.

Over four hundred inward investment projects were secured in the UK in 2014/15 with DIT/UKTI assistance - including both companies new to the UK, and expansions from companies already located here. Government works to encourage overseas technology companies to expand internationally into the UK to strengthen our technology clusters and enhance the UK's competitive edge. Both here in the UK and overseas, we strongly promote the message that the UK is not only the best place to internationalise, but that we have the clusters that make us the best place in the world to find innovative technology solutions, products and services.

International investment in the UK's digital sectors

The UK's digital sectors have had a number of investment success stories in the past year.

The UK Tech sector drew more investment than that of any other European country in 2016,⁷ with a number of major investments in UK digital businesses:

- **Deliveroo** - London-based food delivery company raised a further \$275 million round⁸
- **Farfetch** - London-based luxury fashion platform raised a further \$110 million funding round⁹
- **TV Squared** - Edinburgh-based TV ad campaign measurement platform raised a further \$6.5 million¹⁰
- **DarkTrace** - Cambridge-based cybersecurity company raised a further \$65 million¹¹
- **Onfido** - London-based online background check platform raised \$25 million¹²

There have been a number of substantial investments from leading international tech companies:

- **Apple** - announced that they will be developing a new London Headquarters at Battersea Power Station, with enough space for 3000 employees¹³
- **Facebook** - announced that they will be hiring 500 new UK staff in 2017 and opening a new London Headquarters¹⁴
- **Google** - announced that they will develop a new headquarters and create 3000 jobs in Kings Cross, London. An investment in excess of £1 billion¹⁵
- **Snap Inc** - the creators of the messaging app SnapChat chose the UK as the location for their first international headquarters¹⁶

There have been several acquisitions of world-leading companies that were founded in the UK:

- **ARM Holdings** - acquired by Softbank for £24.3 billion who have committed to doubling headcount in the UK¹⁷
- **Magic Pony** - acquired by Twitter for \$150 million¹⁸
- **Skyscanner** - acquired by Ctrip for \$1.7 billion¹⁹
- **SwiftKey** - acquired by Microsoft for \$250 million²⁰

Leading technology investors have chosen to locate in the UK or raised further investment funds, including:

- **Softbank Group** - chose London as the headquarters for their \$100 billion Vision Fund²¹
- **Atomico** - an international investment firm headquartered in the UK, closed their fourth tech fund at \$765M²²
- **Scottish Equity Partners** - Glasgow-based venture capital firm closed a £260 million technology fund, taking their total funds under management to £1 billion²³
- **Index Ventures** - multi-stage venture capital firm that opened its London Office in 2002, raised a further \$550 million to invest in technology businesses²⁴

There have been major investments in cloud data centres, which will help UK firms work smarter and faster:

- **Amazon** - announced its first data centre region in London, bringing faster cloud computing to the UK²⁵
- **IBM** - announced four new UK data centres, tripling the number of facilities in the region²⁶
- **Microsoft** - announced its first UK cloud computing data centres are up and running, in London, Durham and Cardiff²⁷

To boost our impact in emerging digital economies around the world, we are working to establish a network of **UK Tech Hubs in five developing countries to work alongside the key existing hub in Israel**. Tech Hubs are small, expert teams based inside the UK embassy tasked with driving UK economic growth by partnering British companies with innovative local start-ups. They enable local digital sectors to go global through British businesses, and help provide British businesses with a global competitive edge. They also drive collaboration on R&D, skills, innovation and technology between countries, leading to more trade and investment in the longer term, and forging a deeper, more strategic commercial and research relationship between the two countries.

This new network of Tech Hubs will be modelled on the successful UK Israel Tech Hub. Since its creation in 2011, it has enabled over 80 innovation partnerships between the UK and Israel²⁸ with a deal value of £62 million.

As part of our wider industrial strategy, we are taking a number of other actions which will support the availability of finance to all businesses, including start-ups and scale-ups in the digital sectors. These include:

- a Treasury-led **review of Patient Capital**, to understand better where there are barriers to the growth of long-term investment. The review will publish a consultation document in the Spring and make its final recommendations ahead of the Autumn Budget 2017
- increasing our investment in venture capital by the British Business Bank by £400 million – to unlock £1 billion of new finance. This will act as a catalyst for the creation of larger funds to support follow-on investments in promising scale-up companies across the UK. The BBB will invest in funds alongside private investors, helping more late-stage venture capital funds to be created

Widening procurement

The Industrial Strategy green paper sets out how we will take a more strategic approach to government procurement to drive innovation and value across public and private sector supply chains. This offers a significant opportunity to support digital sectors, particularly for start-ups and scale-ups. A contract from government can transform the prospects of a small business, giving it credibility, income and the crucial first customer.

We will continue to procure through the Digital Marketplace (<https://www.digitalmarketplace.service.gov.uk/>) - the platform that is helping the public sector buy what it needs to deliver great digital services. So far it has supported UK public sector organisations to spend over £1.7 billion with digital and technology suppliers. 56% of that (almost £1 billion) has been with small and medium-sized enterprises (SMEs). This has already significantly exceeded the government's ambitious target that £1 in every £3 spent will be with SMEs by 2020. Moving forward we will promote the use of the Digital Marketplace by local government and wider public sector bodies, to improve efficiency of procurement and lower barriers for digital and technology suppliers. **Our target is for the proportion of the total sales to SMEs in the Digital Marketplace to rise by 10% year-on-year reaching at least £750 million a year by 2020.**

Alongside this we will look at procurement across government, drawing in expertise from the digital sector itself, to see what changes can be made to help more British digital and technology suppliers benefit from government's own spending. Building on the Digital Marketplace's approach, we will embed user-centred, design-led, data-driven and open approaches in procurement and contracting across government by 2020.

The **Small Business Research Initiative** (SBRI), which connects public sector challenges with innovative ideas from industry through funding competitions, will continue to be a key route for this. Since its introduction in 2009, the SBRI has already had a number of notable successes in bringing innovative solutions from digital SMEs into government. For example, StepJockey Ltd developed its app for discouraging sedentary behaviour with a £200,000 SBRI contract from the Department of Health. StepJockey is now set to grow its business after securing £600,000 in private investment. In her speech to the CBI in November 2016, the Prime Minister announced that David Connell would lead a review to consider how to improve the UK SBRI in light of the equivalent US scheme, looking at how we can increase its impact and give more innovators their first break

Spreading the growth across the whole country

Supporting and growing digital clusters

London and the South East is now widely regarded as Europe's leading tech cluster, with incubators, accelerators and innovation centres creating an environment in which tech businesses can thrive. However, we will measure this Strategy's success not just by the national performance of the sector, but also by its strength

right across the UK. This supports the government's broader objective, set out in the Industrial Strategy green paper, of rebalancing the economy across the whole country to create stronger and more resilient cities and regions.

Tech City UK's Tech Nation 2016 report (<http://www.techcityuk.com/technation/>) shows that there are already a growing number of viable tech clusters across the UK. For example, Edinburgh has a thriving FinTech sector; Belfast's strengths include app and software development; and Manchester boasts a world-class digital media cluster.

Tech City UK's Tech North (<http://technorthhq.com/>) programme is helping to catalyse the development of the tech ecosystem around the seven northern cities of Hull, Leeds, Liverpool, Manchester, Newcastle, Sheffield and Sunderland. The Northern Powerhouse's tech businesses produce £9.9 billion GVA,²⁹ with Manchester identified as the biggest cluster outside of the South East.³⁰ Meanwhile there are similar programmes underway in other parts of the country, such as Tech East, and Croydon Tech City. Government will work with Tech City and other partners across the country to ensure the learning and best practice from these programmes are shared and reapplied to develop the tech ecosystem across the UK.

Tech City UK

Tech City UK, launched in 2010, has grown from supporting the East London tech cluster to accelerating the digital sectors across all regions of the UK through a number of different programmes:

- **FutureFifty** - a network to support 50 of the UK's most pioneering late stage tech companies. Its members have created over 23,000 jobs and raised over £2 billion since starting the programme; four companies, including FarFetch, are now valued at \$1 billion and others, such as Just Eat and Zoopla, have listed on the London Stock Exchange
- **Upscale** - a six month mentoring programme to help the most promising early stage start-ups to scale-up. Previous participants include Improbable, Kano and Administrate. In January 33 new companies from across the UK joined Upscale³¹
- **Digital Business Academy** - a free online platform providing training on how to start, grow or join a digital business. The Academy has so far attracted 17,000 active users since its launch and includes access to work and start-up opportunities

Tech City UK will be a crucial partner in delivering our ambition to grow the tech sector right across the country.

Encouraging innovation in digital for social good

The use of digital technologies to generate positive social impact ('social tech'), has emerged in a number of fields, from the provision of healthcare to addressing financial exclusion. The UK is a world leader for social tech. Programmes such as Bethnal Green Ventures in London and Dotforge Impact in Manchester are the first of their kind in the world and have now supported over a hundred new social tech businesses. The government has supported projects such as these through the £10 million Social Incubator Fund, and we will continue to support the UK's social tech ecosystem.

Some people in the UK struggle to access and engage with the financial system. This can make it difficult for them to manage their finances, access the best value goods and services, absorb financial shocks and plan and provide for the future. Digital solutions can play an important role in helping with some of these issues. For example, the government has supported a pilot of Affordable Loans, an online portal that makes it easier for consumers to access loans from responsible lenders.

In order to support digital innovation that helps people better manage their money, **we will launch a competition to encourage the development of digital approaches to support financial inclusion.** This will be run by Tech City UK, as part of its wider role on FinTech, with external support from both charitable and financial service providers.

Outside of financial inclusion, the Council for Science and Technology will undertake a number of studies considering the opportunities for society from emerging technologies, including how technology can help extend healthy and independent living for ageing populations.

Digital technology also offers opportunities to engage citizens in social action in new ways, from providing platforms to facilitating mass movements. That is why during the last Parliament we supported a range of innovative social action projects that use digital technology, helping them develop and grow, including as part of a £10 million Innovation in Giving Fund. We have provided support for tools and platforms that make it easier to find opportunities to volunteer and give, such as Do-it and Localgiving. We will continue to look for ways that digital technology can promote and support social action, providing government support where it can make a difference.

Maximising the impact of our specialist digital sectors

Many of the developments in digital technology and innovation are transforming our public services as well as the experiences we all have as users of those services. Some examples of these are set out in the sixth chapter of this strategy. The benefits of these developments are not just for the end users, but for the economic prospects of the sector creating them.

HealthTech

Across England, National Health Service clinicians are working to improve patient outcomes through innovation, with initiatives such as:

- the work of the National Information Board to deliver the Personalised Health and Care 2020 (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/384650/NIB_Report.pdf) agenda, including support for the Code4Health initiative (<https://code4health.org/>), which has delivered innovative apps such as Open Eyes (<http://www.openeyes.org.uk/>), an electronic medical record for eye care, and the DIADEM (<https://code4health.org/Dementia>) tool to improve diagnosis of advanced dementia in care homes
- the NHS Test Bed (<https://www.england.nhs.uk/ourwork/innovation/test-beds/>) programme, which explores the potential of technologies such as mobile and wearable health self-management tools and monitoring devices
- putting patients in the driving seat for managing their own care using telehealth, apps and digital tools, for example through the NHS.UK platform with increased online patient services and patient access to personal health records

We will facilitate improved access to the health and care services for the right products through:

- addressing the barriers that inhibit the delivery of innovative digital health products to NHS patients, by taking forward the recommendations from the Accelerated Access Review (AAR)
- accelerating the uptake of new innovation, including devices and apps to help patients with chronic health conditions, by guaranteeing reimbursement for the use of approved innovations
- NHS England will commission the approval of clinical apps by the appropriate regulator by March 2017, offering support to patients, including those with long-term conditions, in managing their health. They will create a developer ecosystem giving access to standards, sandbox, kite marking and technical assessment to allow patient led access to records and other data from trusted services

The NHS produces a wealth of data with huge potential to improve decision making, clinical pathways and efficiencies. Access to this will be improved for both patients and professionals, whilst ensuring security and privacy:

- through the implementation of the recommendations of the National Data Guardian's Review of data security and consent
- real-time digital information will be available to patients and clinicians by ensuring health and care records are digital by March 2020
- the MyNHS website will give better data on how NHS services are performing, developing to provide maps, graphs and tools so patients can see how the performance of their local services has changed over time

This work programme will have the dual benefit of helping innovators in the digital health sector, by clarifying and accelerating the access pathway and evidence requirements for digital health products through the AAR and app assessment process.

The UK is also home to a number of innovative digitally-focused health enterprises, including Babylon (who offer virtual consultations with doctors and are bringing AI to digital healthcare), Big White Wall (who have created a safe online community for people to share what's troubling them and support each other with the help of trained professionals), and many others.

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See more information about this Policy paper (<https://www.gov.uk/government/publications/uk-digital-strategy>)

Policy paper

4. The wider economy - helping every British business become a digital business

Published

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The challenge of digitisation

Support for business

The benefits of digital are not limited to the digital sectors: digital transformation can make every business in every sector more productive, wherever they are located. A recent survey of 1,000 UK-based businesses found digital capabilities helped boost revenues by 4.4% and reduce costs by 4.3%.¹ For example, small and medium sized enterprises (SMEs) with a strong web presence on average grow more than twice as quickly as those with minimal or no presence, export twice as much, and create twice as many jobs.

While UK companies have similar levels of internet access and web presence as those in other European countries, they are less likely to digitise their back-office functions than their peers in other countries. Fewer than 20% of UK enterprises use software to share information across the organisation, compared to 40% in France and more than 55% in Germany² and only 22% of SMEs in the UK use any form of e-commerce.³

From marginal changes like a restaurant adopting online bookings, to wholesale business transformation, our ambition is for all UK companies to be able to realise the efficiency gains offered by adopting digital ways of working. If successful, this could play a crucial role in closing the UK's productivity gap with the G7 average.⁴

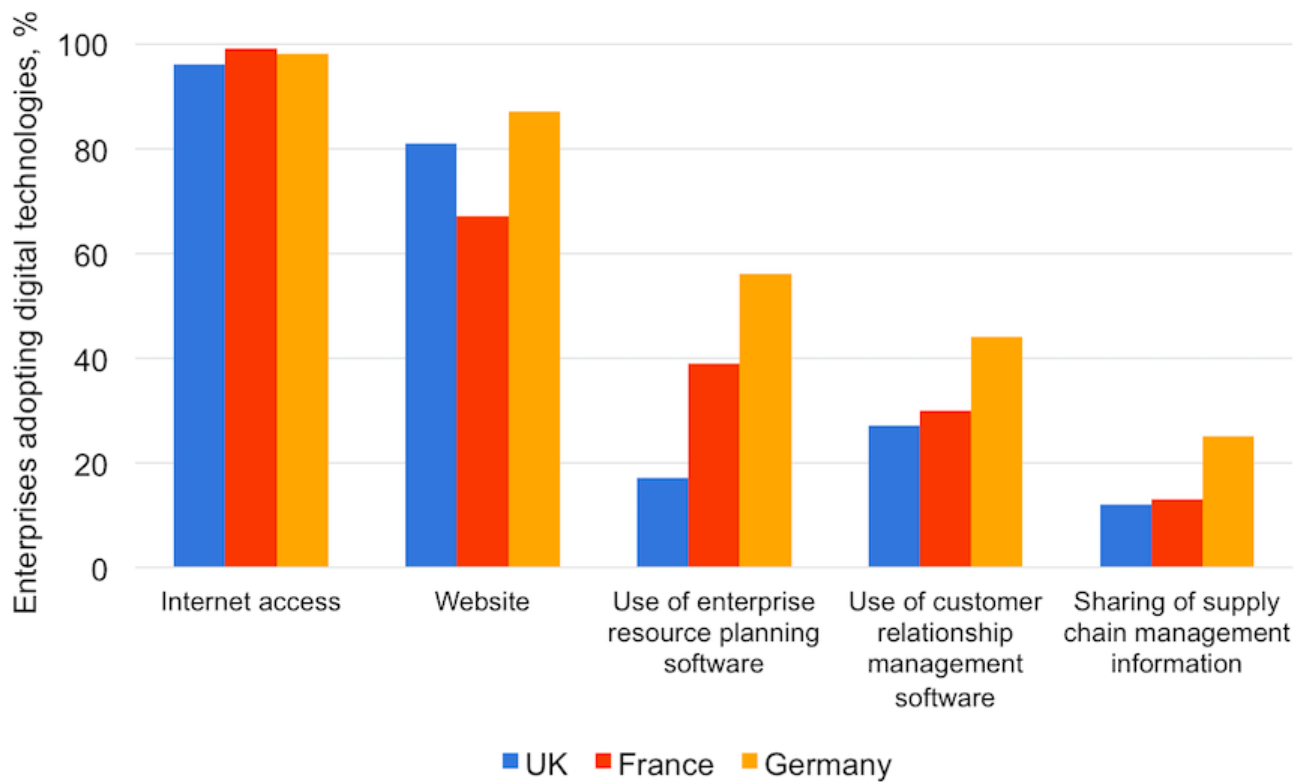
The challenge of digitisation

Each business has its own specific digital needs, but there are four core digital activities that we believe most businesses need to do to remain competitive:

- maintain a web presence
- sell online
- use the cloud
- digitise back-office functions such as payroll

Many businesses are still a long way off adopting these digital processes as a core part of their operations and, as the chart below shows, we are lagging behind our competitors.⁵

UK businesses are lagging behind our competitors in adopting some digital technologies

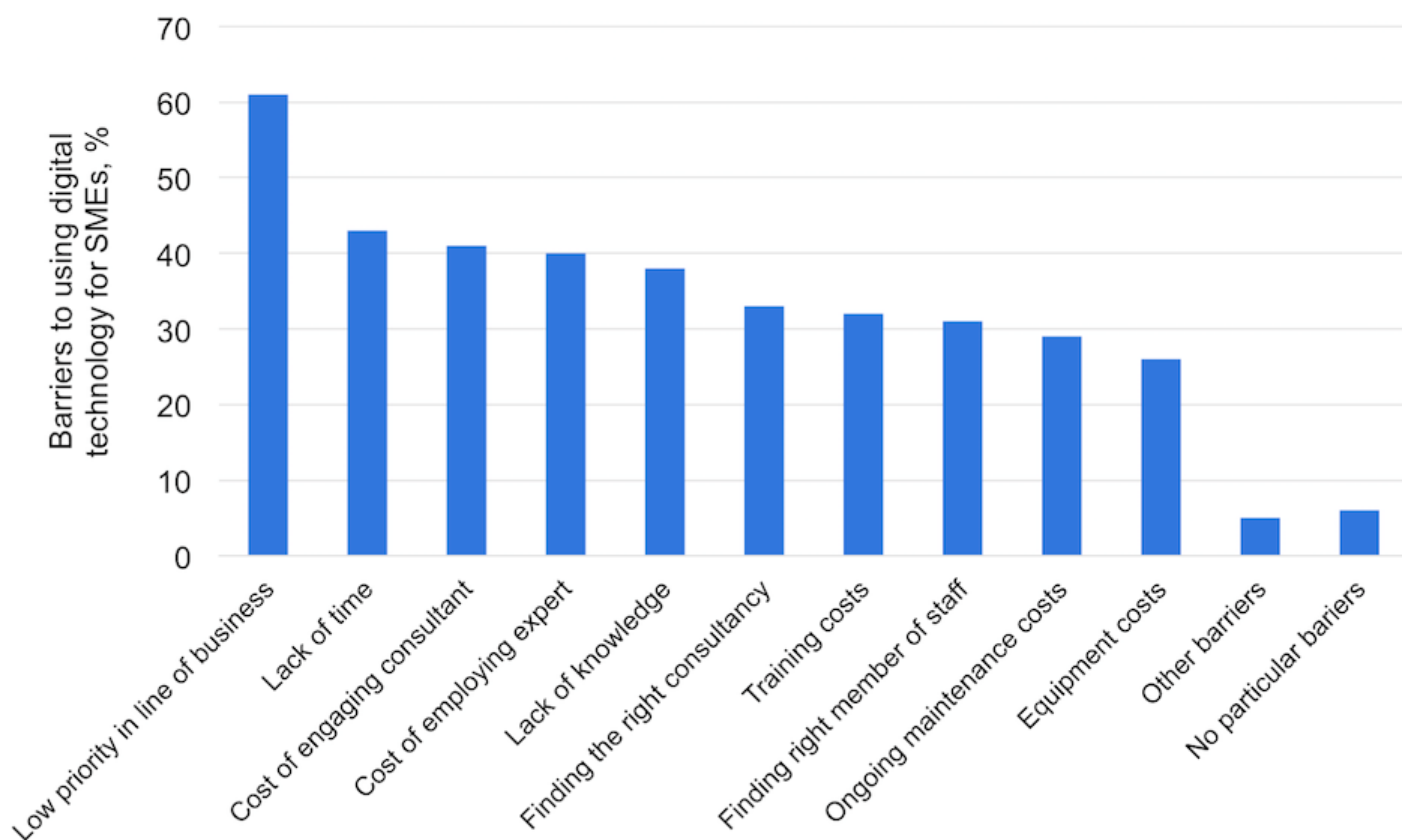


The Productivity Leadership Group, a business-led initiative addressing the UK's productivity challenge, has recently published a report (<https://howgoodisyourbusinessreally.co.uk/downloads/business-leadership-groups/digital/accelerating-the-impact-of-digitisation.pdf>)⁶ identifying some of the barriers that may be stopping businesses adopting digital technologies. These include:

- knowledge by managers of what technologies are available and how they could be deployed within businesses
- the low priority afforded to digital transformation
- the cost of bringing in outside expertise
- the cost of buying new software and equipment
- lack of skills among the workforce
- connectivity

These echo the findings of a 2015 SME self-assessment survey⁷ on the barriers they face in adopting digital technologies, shown in the chart below.

Many SMEs don't prioritise adopting digital technologies



The Productivity Council

In the Autumn Statement 2016, government confirmed £13 million funding to support the creation of a Productivity Council.

It will be established to drive engagement with business and improve productivity across the economy, including through appropriate use of digital technologies. It will connect, encourage and amplify the impact of existing initiatives to improve productivity, acting as the UK's productivity 'centre of excellence'. It will also:

- promote the message that businesses are at the heart of productivity growth and engage, encourage and inspire every business in the UK to improve
- act as a conduit to connect and share best practice, drawing on the firm-level local expertise and networks of the Local Enterprise Partnerships (LEPs) and Growth Hubs to maximise impact
- achieve impact at scale by capturing the existing initiatives and guidance that currently sits across other professional bodies, organisations and universities – giving business a single first point of contact for business improvement and helping them navigate the available help

Specifically, the Council will:

- create **open-source user-rated 'productivity hubs'** to capture this guidance, so businesses are able to see in a transparent manner which resources have been most valuable to other companies
- connect businesses, in-person, to share what 'good' looks like - in their local region, sector or supply chain - driven through engagement with LEPs, high-performing businesses in their area, and local industry bodies
- use data and analysis to better inform legislation to promote and support productivity

Support for business

Co-ordination of provision

There are a range of tools and training programmes that are already available to businesses to help understand and deliver the efficiencies offered by adopting digital ways of working, and a number of these are outlined in the box below.

If businesses are unaware of the support that is on offer to them or do not know how to take advantage of it, then government can help. Initiatives such as the **Digital Skills Partnership** (described in Chapter 2), and the **Productivity Council** (described above) have been designed to make the process of finding the right support as simple as possible.

The Industrial Strategy green paper set out how we will support the development of **business-to-business ratings and feedback platforms**. This could make it easier for SMEs to determine the quality of business advice and support services provided to them by other firms.

Support for wider digital adoption

There is already a range of free support available to businesses across different sectors, and of different sizes to help them become more digital and improve their access to skills. Below is a non-exhaustive list of the types of initiative currently available to demonstrate the breadth of support available and organisations providing support.

The **Google Garage** initiative has delivered training in 80 towns across the UK to over 250,000 businesses and individuals. Garages have operated in Newcastle, Manchester, Birmingham, Leeds, and Glasgow. Throughout 2017, the programme will offer face-to-face training in 100 cities and towns across the UK as well as free online courses, providing face-to-face training and mentoring in digital skills for all local businesses. Google has pledged to provide five hours of digital training to every person and every small business in the UK.

Microsoft is providing support to charity NACUE (National Association of College and University Entrepreneurs) to help young entrepreneurs get digital and business skills training. It has also opened up five Regional Skills Academies in partnership with Risual (a IT services company) and a select group of colleges. The colleges will provide industry relevant IT apprenticeships and youth employment as well as provide access to Microsoft certified qualifications. Colleges are already open in Derby and Wales.

Digital Business Academy is a free online platform created by Tech City UK to provide the skills needed to start, grow or join a digital business. There are over 14,000 active learners. Currently there are 11 courses available created by University College London, Cambridge University Judge Business School, Founder Centric and Valuable Content.

Do it Digital is an independent, not-for-profit campaign that looks to highlight resources around the UK - online and off - that can help small businesses get the most out of digital. The campaign has set an ambition to help one million small businesses during 2017 and is currently running its second 100 Days Of Digital, during which it shares and champions a different digital opportunity every day. A range of organisations have committed to supporting this goal, including the British Library, which is running a programme to train 10,000 small businesses through its Business & IP Centres network.

Targeted interventions

Where there is a specific geographical, sectoral or economic need that is not being met by existing provision, we will ensure that action is taken to address such gaps.

We have already introduced a number of programmes aimed specifically at closing the gap in digitisation between different sectors and we will build on this work to tackle the specific issues certain industries face.

Juergen Maier, CEO of Siemens UK, will lead a review of **industrial digitalisation**, that will report its findings in the summer. This will consider how UK manufacturing can become more productive and competitive by increasing its use of digital technology and automation. A key focus will be identifying where policy interventions and support mechanisms can encourage industry investment in technology and innovation and drive forward the automation of industrial processes. This will include considering which sectors can benefit most from these advances, and looking at the experience of our international competitors. Two further examples of work with specific sectors is outlined in the box below.

To ensure support is more effectively deployed to the regions and businesses that need it we will ensure interventions are based on quality data and business analytics. For example, we will explore how data – such as that held by HMRC and Companies House – can be used to identify scale-up businesses. This could then be made available to local public and private sector organisations so they can better identify, target and evaluate their support. We will also be examining how we can best exploit synergies in other government datasets to more effectively identify and target advice and support, and improve our communication with the UK's fast growing businesses.

Construction

Over the last two decades construction has had the lowest productivity and R&D investment rates of any industrial sector in the UK. Following a government initiative in 2011, construction clients and their industrial supply-chain are starting to adopt a digital approach through the use of Building Information Modelling (BIM); we now lead the world in its implementation. Last year, digital construction made a major contribution to savings of £1.2 billion in government construction programmes.

In February 2015 government set out the next phase of digital construction with the launch of **Digital Built Britain** (DBB). This strategy introduces more sophisticated digital and data tools, incorporating performance measurement of assets and service through the Internet of Things, sensors and telemetry. This is further supported by the coordination of government policy of Smart Cities with DBB to provide asset owners, service providers and the construction sector with an integrated, safe and secure data-infrastructure to ensure the future provision of social infrastructure and services.

Ultimately, DBB will create a direct data chain between the design, construction, commissioning and operation of assets to enhance social outcomes and, through data feedback mechanisms, provide a basis for continued improvement in asset design and performance.

Retail

Globally, retail is increasingly moving online and the UK leads the way in online sales. In 2014 almost £600 billion in online sales were made by non-financial UK businesses. Over 86 million online shoppers bought from the UK in 2015. But while many of the world's leading online retailers are British, many British traditional retail businesses are not yet making best use of digital technology. Retail companies that are not taking advantage of e-commerce are impeding themselves when online channels are often the first port of call for shoppers. We will encourage businesses and Local Enterprise Partnerships to build on the **Digital High Streets initiative**, to help retail businesses become more digitally capable.

A changing workforce

The adoption of digital technologies such as connected and autonomous vehicles, connected devices, robots, and AI present attractive new business opportunities, and a means to unlock productivity gains. But they will also bring significant changes to the future of work, employment and society, as well as increased threats from cyber attack. Preparing for and responding to these developments will require collective action across government and society, and for our business leaders to have the necessary digital acumen to lead the digital transformations within their companies.

To meet this challenge we are already undertaking a review of modern employment (<https://www.gov.uk/government/news/taylor-review-on-modern-employment-practices-launches>), including the impact of new ways of working such as on-demand platforms, led by Matthew Taylor, the Chief Executive of the Royal Society of Arts. This will ensure that employment practices keep pace with modern business models. Additionally, given the paramount need for workers to continue retraining and upskilling to ensure they are not lost from the workforce, we are taking forward a range of measures (set out in Chapter 2) to incentivise digital skills training.

Supporting exporters

Adopting digital technology and ways of working can help businesses gain access to markets in other countries. The government recently launched GREAT.gov.uk (<https://www.great.gov.uk/>), a new digital trade hub to help businesses export, which provides advice and support to current and potential exporters. This includes access to a smart database to connect them with global online marketplaces such as Amazon and Alibaba. We have also negotiated preferential rates with key e-marketplaces, making the UK one of the easiest and best places from which to sell goods online around the world. We are delivering promotions in key overseas markets to promote UK companies on these marketplaces.

We are developing a new, more flexible Customs Declaration Service (CDS), which will replace the current service, CHIEF. We expect all customers to have moved onto CDS by January 2019. CDS will support increased volumes of transactions and any future changes to legislation, and will ensure that the UK has a robust and flexible customs declarations service in the years ahead.

A common identity framework

If we are to have a genuinely **digital economy**, a critical component will be a trusted framework for sharing and validating information related to identity. The approach must be secure, reliable and convenient for individuals and businesses.

The cost of identity assurance processes in the UK has been estimated at over £3.3 billion (£1.65 billion inside organisations and another £1.65 billion of consumers' time costs). This figure excludes fraud to the UK economy, which the National Fraud Office estimates at £52 billion, of which an increasing proportion is perpetrated online.

There is a tremendous opportunity to reduce fraud in our current system. In the immediate future, transaction costs for both businesses and individuals could reduce, as trust increases and transactions that have traditionally been manual become digital. There will be positive economic impact not only in creating markets for new products and services, such as allowing the easy export of digital content produced in the UK, but also through realising the value that these products and services will deliver to the wider UK economy.

We will work with industry and the relevant stakeholders and interest groups to **adopt and promote open standards for validating information**, especially as it relates to identity. If we get this right, it will create a safe, reliable, cost-efficient way for individuals and businesses to transact with each other and the government digitally.

GOV.UK.Verify (see chapter 6), the government's online identity verification service, went live in May 2016. It enables individuals to prove their identity online and to access government services securely. Verify is being piloted with a number of local authority services to establish where it can meet identity needs in local government. We are working towards 25 million people having a GOV.UK Verify account by 2020.

GDS will work with the private sector so that people can use the same account to prove their identity online for private sector services. We have already begun work on some early pilots to explore opportunities for private sector applications, for example allowing people to open a bank account without having to go into a branch.

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 4. Ibid ↩
 5. Adoption of e-business technologies in enterprises, EU-28, 2010 and 2015 (% enterprises). Source: Eurostat (isoc_ci_in_en2 (http://ec.europa.eu/eurostat/product?code=isoc_ci_in_en2&language=en&mode=view)) and (isoc_ci_cd_en2 (http://ec.europa.eu/eurostat/product?code=isoc_ci_cd_en2&language=en&mode=view)) and (isoc_bde15dip (http://ec.europa.eu/eurostat/product?code=isoc_bde15dip&language=en&mode=view)) ↩
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- Department for Culture Media & Sport (<https://www.gov.uk/government/organisations/department-for-culture-media-sport>)

See more information about this Policy paper (<https://www.gov.uk/government/publications/uk-digital-strategy>)

Policy paper

5. A safe and secure cyberspace - making the UK the safest place in the world to live and work online

Published

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Cyber security

Child internet safety

An open internet

The internet has been an unquestionable force for economic and social progress. Its open and global character makes it an extraordinarily powerful tool for freedom, innovation, growth and knowledge. The increasing uptake of internet-based technologies worldwide has brought, or will bring, significant advantages to connected societies such as ours.

But as our reliance on technology grows, so do the opportunities for those who would seek to compromise our systems and data. Responding to this threat and ensuring the safety and security of cyberspace is an essential requirement for the entire digital economy. The benefits of digital will only continue if people and businesses feel safe and confident whilst online.

We therefore need to secure our technology, data and networks in order to keep our businesses, citizens and public services protected. We will continue to work with international partners to protect a free, open and secure internet that supports our economic prosperity and social well-being. And we must also do all we can to make sure that children and young people are protected from exposure to dangerous, inappropriate or harmful content online.

Cyber security

The new **National Cyber Security Strategy** (<https://www.gov.uk/government/publications/national-cyber-security-strategy-2016-to-2021>) published on 1 November 2016 sets our vision for the UK in 2021 as **secure and resilient to cyber threats, prosperous and confident in the digital world**. To realise this vision we will work to achieve the following objectives:

- **Defend:** we have the means to defend the UK against evolving cyber threats. We are equipped to respond effectively to incidents. UK networks, data and systems are protected and resilient. Citizens, businesses and the public sector have the knowledge and ability to defend themselves
- **Deter:** the UK will be a target for all forms of aggression in cyberspace. We detect, understand, investigate and disrupt hostile action taken against us, pursuing and prosecuting offenders. We have the means to take offensive action in cyberspace, should we choose to do so
- **Develop:** we have an innovative, growing cyber security industry, underpinned by world-leading scientific research and development. We have a self-sustaining pipeline of talent providing the skills to meet our national requirements across the public and private sectors. Our cutting-edge analysis and expertise will

enable the UK to meet and overcome future threats and challenges

These objectives are underpinned by our actions across the world, including by investing in partnerships that shape the global evolution of cyberspace.

The key elements of the government's strategy for achieving these objectives include:

- **levers and incentives.** We will support start-ups and invest in innovation. We will also explore all regulatory levers, including the forthcoming General Data Protection Regulation (GDPR), to drive improvements in cyber risk management across the economy
- **expanded intelligence and law enforcement.** The intelligence agencies, the Ministry of Defence, the police and the National Crime Agency, in coordination with international partner agencies, will expand their efforts to identify, anticipate and disrupt hostile cyber activities by foreign actors, cyber criminals and terrorists
- **development and deployment of technology** in partnership with industry, including Active Cyber Defence measures, to deepen our understanding of the threat, strengthen the security of the UK public and private sector systems and networks and disrupt malicious activity. These measures, once implemented, will automatically counter the most common forms of malicious activity in cyberspace – highly prolific, damaging but often low-sophistication cyber attacks
- **National Cyber Security Centre (NCSC)**, a single new central body for cyber security at a national level. Its role is to manage national cyber security incidents, provide an authoritative voice and centre of expertise on cyber security, and deliver tailored support and advice to government departments, the devolved administrations, regulators and businesses. The NCSC will analyse, detect and understand cyber threats, and will also provide its cyber security expertise to support the government's efforts to foster innovation, support a thriving cyber security industry and to develop cyber security skills

In the Strategic Defence and Security Review 2015 (<https://www.gov.uk/government/publications/national-security-strategy-and-strategic-defence-and-security-review-2015>), the government set aside £1.9 billion over the five years of the strategy to deliver on these commitments and objectives.

We will also provide the pipeline of **cyber skills** that the country needs to actively secure and defend against potential and established threats. These measures will underpin the digital skills agenda and ensure that the UK economy has the skills and capacity to protect businesses and individuals from cyber threat. We will do this through a series of ambitious initiatives, including:

- a national extracurricular school programme to identify the most promising students with intensive training and mentoring, starting in 2017/18 with 600 pupils in secondary schools
- establishing a range of higher and degree-level cyber apprenticeships, with tailored programmes in key sectors
- a re-training programme for people changing to cyber security mid-career

We will also:

- ensure that anyone who would do the country harm knows that we can and will fight back using the most appropriate response at our disposal, including through the use of our National Offensive Cyber Programme
- make cyberspace '**secure by default**' by working in partnership with industry to build security into the development of the next generation of internet-connected products and services. We are establishing a project team in DCMS to take this forward
- develop **international and multi-stakeholder responses** to this cross-border problem, strengthening frameworks for international cooperation and developing the capacity of our partners to improve their own cyber security

- retain the trust of citizens in online **public sector services and systems**, ensuring that appropriate levels of security are implemented across the public sector and supporting law enforcement action to protect the public and bring cyber criminals to justice

Support for businesses and individuals

It is essential that help individuals and businesses stay safe online.

One of the UK's best guarantees of future security is a flourishing, **indigenous cyber security sector** - UK companies innovating in cyber defence, keeping the UK at the sharpest edge of cyber innovation, and creating jobs and wealth in a booming market at the same time. The government has announced an interlocking series of initiatives to help grow the UK's cyber security sector including:

- establishing two **Innovation Centres** in London and Cheltenham to support start-ups in the crucial first months of their development and to provide a platform for them to have access to the highest quality support
- funding **HutZero** (<http://www.hutzero.co.uk/>), an **early stage accelerator** programme that provides innovators with business advice to help them take their ideas forward to commercialisation
- supporting innovators in UK universities to commercialise their ideas, through an **Academic Start-Up** programme
- helping UK early-stage cyber security businesses grow by sharing best practice and delivering business training 'bootcamps' alongside the Digital Catapult

However, we are a long way from achieving this - one in four businesses say they experienced a cyber breach in the last 12 months, yet only 22% of small businesses have provided any cyber security training to their staff.¹ So we will develop and promote guidance and schemes to help firms protect themselves against cyber threats. We will actively encourage the adoption of **Cyber Essentials**, our flagship, GCHQ-backed scheme which sets out the basic technical controls that all organisations, regardless of size or sector, should have in place to protect themselves against the most prevalent forms of cyber attack. We will also support public awareness initiatives, like the **Cyber Aware campaign**, to help raise the level of protection against cyber crime across the UK.

Finally, we will make sure that the right regulatory framework is in place in the UK, which incentivises better cyber security but avoids unnecessary business burdens. Many of our industry sectors are already regulated for cyber security, while for the wider economy the forthcoming General Data Protection Regulation is expected to drive improvements in cyber risk management due to the introduction of compulsory breach reporting and significantly increased maximum fines. We will continue to ensure the right steps are taken, particularly regarding critical national infrastructure which was recognised as a priority in the Industrial Strategy green paper, to manage cyber security risks.

Child internet safety

As well as ensuring that organisations and individuals can operate securely in cyberspace, it is also essential that children and young people are protected from inappropriate or harmful material such as extremist or age-inappropriate content.

The UK is a world leader in **child internet safety**, with legal protections against abuse and illegal content, and tools for parents to restrict content they do not wish their children to see. We have a strong track record in working with the internet industries to drive progress. For example, the UK Council for Child Internet Safety (<https://www.gov.uk/government/groups/uk-council-for-child-internet-safety-ukccis>) (UKCCIS), set up in 2008, brings the government together with key stakeholders to help keep children and young people safe online.

Recent UKCCIS achievements include:

- the roll-out of family-friendly filters for the vast majority of broadband customers, with prompts to encourage parents to activate them, and automatic family-friendly public Wi-Fi in places where children are likely to be
- guidance for providers of social media and interactive services (including gaming) to help make their platforms safer for children and young people under 18

We are always looking to do more to protect children from harm online. As a next step, the government will require **age verification** controls for access to online pornographic material provided on a commercial basis in the UK, which is currently easily accessible with little or no protections, to ensure that those accessing it are of an appropriate age. These measures will be backed up by a robust regulatory regime that protects children from content that can harm them.

We will continue to work in collaboration with industry, seeking to eradicate the opportunities presented by developing technology to facilitate **online child sexual exploitation**. The world-leading Internet Watch Foundation (<https://www.iwf.org.uk/>) (IWF) was established in the UK to prevent access to images of child sexual abuse. The government has worked with the IWF to share with major technology companies almost 35,000 digital fingerprints or 'hashes' of indecent images of children known to law enforcement agencies, so that they can remove the images from their platforms and services.

We will also continue to lead the global effort to end online child sexual exploitation. In 2014, we set up the WePROTECT initiative, which brought together countries and international organisations, as well as major companies, in a coordinated response to the threat from online child sexual exploitation. In 2016, the WePROTECT initiative merged with the Global Alliance against Child Sexual Abuse Online to create, for the first time, a single global organisation (<http://www.weprotect.org/>) with the influence, expertise and resources to tackle online child sexual exploitation and abuse worldwide. We have also committed £40 million to the Fund to End Violence against Children (<http://www.unicef.org/endviolence/>), hosted by UNICEF to further support the international effort.

And we will continue to lead the world in addressing the challenges posed by **online radicalisation and extremism**. Since the Counter Terrorism Internet Referral Unit was set up in 2010, it has led to the removal by companies of over 250,000 pieces of harmful terrorist and extremist content and the model is being replicated internationally.

An open internet

We will continue to work closely with international partners to ensure the continuation of a free, open and secure internet that supports our economic prosperity and social well-being.

The UK and our allies have been successful in building a broad consensus that the multi-stakeholder approach is the best way to manage the complexities of internet governance. However, there remain those who promote an alternative vision of an internet that is controlled by governments and where national borders are recreated in cyberspace. We reject such an approach and will continue to play an active role in the United Nations and other international organisations to strengthen the multi-stakeholder model and ensure that the internet remains open for technical innovation and for economic and social development around the world.

1. Cyber Security Breaches Survey 2016

(https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/521465/Cyber_Security_Breaches_Survey_2016_main_report_FINAL.pdf) ↩



- Department for Culture Media & Sport (<https://www.gov.uk/government/organisations/department-for-culture-media-sport>)

See more information about this Policy paper (<https://www.gov.uk/government/publications/uk-digital-strategy>)

Policy paper

6. Digital government - maintaining the UK government as a world leader in serving its citizens online

Published

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Our approach
Digital Civil Service
Government digital products

From personalised services in health and safer care for the elderly at home, to tailored learning in education and access to culture – the tools, techniques, technology and approaches of the internet age give us greater opportunities than ever before to improve services. They will give us all more choice, control and information on how and when public services are accessed.

The UK has already made good progress and the UN has recognised the UK as the world leader in digital government.¹ In the annex to this strategy we give examples from right across government of how we are using digital to improve services. But we want to go further and faster. We want to serve the citizens and businesses of the UK with a better, more coherent experience when using government services online – one that meets the raised expectations set by the many other digital services and tools they use every day.

Central to this is building the capability of government to not only design, develop and operate modern digital public services but also to transform old government infrastructure. Through this we will make government a digital organisation that is more responsive to our users' needs. The Government Transformation Strategy (<https://www.gov.uk/government/publications/government-transformation-strategy-2017-to-2020>), published on 9 February 2017, sets out in detail how we will do this.

Our approach

Since the publication of the 2012 Government Digital Strategy (<https://www.gov.uk/government/publications/government-digital-strategy>), we have made significant progress in building online services (<https://www.gov.uk/transformation/exemplars>). However, we can still do more to build 'online services so good people prefer to use them' – the ambition of that strategy. Based on what we have learned, there is a cross-government consensus on how the scope of service transformation must expand. It must:

- recognise that government delivers services through a variety of channels (including online, telephone and face-to-face)
- broaden the definition of users, for example to reflect that some users will interact with government through third-party services that use government APIs (application programming interfaces)
- cover the internal workings of departments as well as the services they offer to users

The government has the following areas of priority for citizen-facing digital transformation this Parliament:

- design and deliver joined-up, end-to-end services
- deliver the major transformation programmes (<https://www.gov.uk/government/collections/major-projects-data>)
- establish a whole-government approach to transformation, laying the ground for broader transformation across the public sector

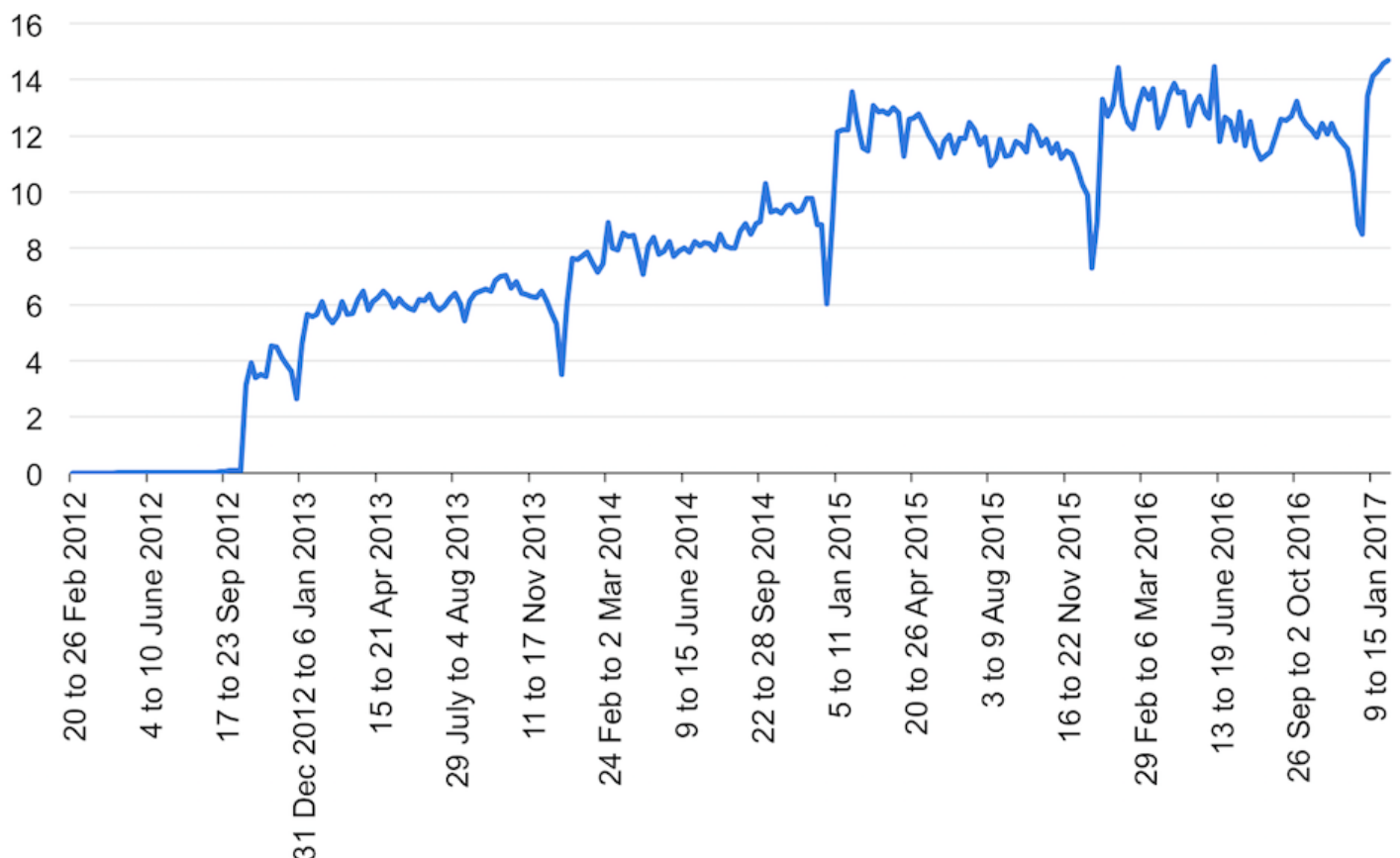
Departments and agencies will keep working to radically improve the user experience of government services by building digital services that meet the Digital Service Standard. The Government Digital Service (GDS) will lead three major areas of work to help departments meet the priorities for this Parliament.

First, we will accelerate the pace and scale of transformation by avoiding duplicated development of solutions, developing new digitally native business processes and focusing on the specific challenges of legacy contract exit and transformation. We will do this in a way that is secure, with privacy and security considerations throughout the design and deployment of every component and platform.

Second, we will build on the Government as a Platform concept, ensuring we make greater reuse of platforms and components across government. We will also continue to move towards common technology, ensuring that where it is right we are consuming commodity hardware or cloud-based software instead of building something that is needlessly government specific. Common components and platforms will cover both citizen-facing services and internal public sector technology.

And third, we will work towards having a range of reusable components to make it quick, cheap and easy to assemble digital services. These will be a mixture of government-built components, both from departments and the Government Digital Service, and common components that government can procure based on open standards.

Unique visitors to GOV.UK, 2012-present (millions)



Digital Civil Service

The right culture

Since 2012, many more digital, data and technology specialists have been recruited across government, improving government's technical capability significantly. The challenge now is to continue to attract, recruit and retain specialists in a very competitive marketplace.

In particular, we want to evolve our culture by:

- embedding digital skills throughout government, including by taking advantage of Microsoft's commitment to provide digital skills training for 30,000 public servants
- making sure digital experts understand government
- making sure that civil servants of other professions understand digital
- strengthening our leaders' skills in agile project and programme management
- establishing better ways to develop policy and deliver services in tandem – using an agile approach to iterate rapidly

Our ambition is to have one of the most digitally skilled populations of civil servants in the world, delivering the Civil Service vision (<https://www.gov.uk/government/publications/a-brilliant-civil-service-vision-statement>) to be 'A Brilliant Civil Service' (<https://civilservice.blog.gov.uk/2016/06/16/our-vision-for-a-brilliant-civil-service-and-what-it-means-for-you/>).

We will do this by:

- growing the digital, data and technology (DDaT) profession in government, including developing consistent career paths and reward structures
- building the best possible learning and development opportunities for DDaT professionals through the Digital Academy
- building government's data science capability through the Data Science Campus and Data Science Accelerator training programme
- making government a leader in attracting a diverse workforce for digital, data and technology roles

We also want to collaborate with business, academia and the social sector to accelerate digital innovation in government. To do this we will establish a new **Digital Government Partnership** that deepens collaboration with external partners, including by inviting outside experts into government as Technology Fellows to help policy-makers:

- think about how government should respond to the rapidly evolving digital landscape
- generate analysis and ideas to inform current policy
- experiment with emerging technologies, such as distributed ledgers and machine learning

The Partnership is being overseen by Cabinet Office's new Open Innovation Team, who aim to launch it by summer 2017.

The right workplace

A digital government does not just deliver excellent public services for its users. It creates the right environment for world-class public service by having the right digital tools, technology, governance and processes. Today there is wide diversity across government organisations in both the daily technology used by civil servants and its sourcing (both commercial and procurement).

We will create an empowering workplace by:

- making sure government buildings have common, interoperable technology and that the design and use of space helps to create a culture of open, digitally enabled policy-making and service delivery
- giving public servants the right, location-independent tools to do their jobs

Building on the Digital Marketplace's approach, we will embed user-centred, design-led, data-driven and open approaches in procurement and contracting across government by 2020.

Government digital products

GOV.UK Verify

One of the most important and challenging aspects of delivering transformed online services is identity assurance – establishing that the user is who they say they are and not someone pretending to be them. GOV.UK Verify, the government's online identity verification service, went live in May 2016 and delivers a federated, market-based approach to identity assurance for central government that can be reused in the wider public and private sectors.

We will continue to enable individuals to prove their identity online and to access government services securely and safely. We will help protect against the growing threat of online identity fraud.

To achieve this, we will:

- work towards 25 million people having a GOV.UK Verify account by the end of 2020
- continue a series of pilots for local authority and private sector services during 2017 to understand the user need and the commercial and legal basis for allowing people to use their GOV.UK Verify accounts to access services in those sectors
- continue to work with industry and GOV.UK Verify certified companies to expand the range of ways people can prove their identity online
- work with the Open Identity Exchange (<http://www.openidentityexchange.org/>) to further explore the role of secure, trustworthy digital identities and benefit from market innovation in that field

GDS will help departments use the identity assurance capabilities provided by GOV.UK Verify along with other cyber security techniques to make sure that government transactions can be completed wholly electronically.

We will also work across government to determine the best next steps for other forms of identity (such as verification of intermediaries and businesses) and which parts of government would be best placed to lead on this.

GOV.UK Pay

The government receives millions of online payments every day. We want people to have the option to pay digitally for public services. We are committed to offering users who pay for public services online an experience as good as any they might expect from leading online businesses.

GOV.UK Pay took its first payment (<https://governmentasaplatform.blog.gov.uk/2016/09/16/ready-for-business/>) on 2 September 2016. GOV.UK Pay makes it easy for people to pay government securely online, reducing the time and hassle of doing business with government and removing the need for the government to buy or build payment systems multiple times. We aim to increase its scope over time, so that citizens can pay for services using a wide range of payment types (such as cards, Direct Debit and e-wallets).

GOV.UK Notify

The government receives millions of calls every year from people anxious to find out the progress of an application, or to check if a payment has been received. We want to avoid people needing to call government and to reduce the amount that government spends on contact centres. We want to transform the way citizens communicate with government.

GOV.UK Notify sent its first messages on 18 July 2016

(<https://governmentasaplatform.blog.gov.uk/2016/07/26/notify-sends-first-messages/>), making it easier for service teams across government to keep people updated through text messages, emails or letters.

1. UN E-Government Survey 2016 (<https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2016>) ↩



- Department for Culture Media & Sport (<https://www.gov.uk/government/organisations/department-for-culture-media-sport>)

See more information about this Policy paper (<https://www.gov.uk/government/publications/uk-digital-strategy>)

Policy paper

7. Data - unlocking the power of data in the UK economy and improving public confidence in its use

Published

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- Supporting the data economy
- Building public trust
- Using government data effectively

Developments such as the rising use of social media and the increasing adoption of new technologies like the Internet of Things mean more data is being produced than ever before. At the same time, lower costs of collection, storage and processing - coupled with rising computing power - are making this data a rich raw material. This is creating new opportunities for business growth across all industry sectors, changing how we innovate, market, sell and consume services.

The UK is at the forefront of data innovation. The Data Protection Act 1998, which provides the legal framework for the use of personal data, is often cited as a global gold standard; we are a global leader at opening up public datasets to drive public services transformation, business growth and democratic engagement;¹ our research community has world-class data scientists and high-performance computing facilities; and we have created an innovation environment that has fostered many successful data-driven companies many of whom use open data provided by the public sector as their raw material.

Data analytics is a fast moving area and we are committed to keeping the UK at the leading edge of new developments, whilst putting in place the necessary protections to ensure data is kept safe and used appropriately. To achieve this, we will:

- encourage innovative uses of data by making it easier where possible to access and use data held by both government and businesses
- work with business and education providers to strengthen data skills provision
- create legal frameworks that keep pace with new data technologies, support the innovative use of data by business, and provide robust protection for people's privacy rights
- ensure data is used to its maximum potential within government to provide more efficient and responsive public services

Supporting the data economy

Our data economy will be integral to the UK's growth and future prosperity. Analysis predicts that data will benefit the UK economy by up to £241 billion between 2015 and 2020.² We therefore must ensure businesses and government are able to use data in innovative and effective ways. This includes creating a strong data infrastructure, having a high level of regulatory compliance, developing a data-literate workforce, and increasing the number of people with advanced data skills.

Data infrastructure

Data infrastructure refers to the assets, technology, processes, and organisations that not only create data, but open it up and allow it to be shared. It includes storage facilities, software tools, networks, cyber-security systems, and data-management platforms.

By strengthening our infrastructure we will create new opportunities for organisations to use data to produce market-changing new products and better public services. From easing travel congestion to enabling cheaper insurance, and from speeding up the development of new medicines to helping prevent crime, data has the potential to significantly improve people's lives. This infrastructure is also integral to the successful development of technologies such as connected and autonomous vehicles, smart cities, and the Internet of Things.

Citymapper: Creating Value from Data

Citymapper is a smartphone app that provides journey planning information in a way that is comprehensive and intuitive.

Developed in London and launched in 2012, the app uses transport data released by the UK government and Greater London Authority public data platforms. By integrating multiple sources of data on London transport, Citymapper provides its users with a sophisticated view of how to travel to their destination.

The app combines information on different transport modes (bus, tube, taxi, walking, cycling) and factors (prices, journey duration, real-time delays, weather, and calorie burn) – understanding that people make travel decisions based on the whole journey environment. Citymapper displays this information through a clearly designed user interface. Compared to historical one-dimensional public transport maps, the app provides a modern real-time view of urban mobility.

Citymapper is part of a new generation of data-driven start-ups, and its success is partly due to the UK being one of the first countries to release open, real-time public transport data in 2010. This enabled the company to be an early mover in the transport app market.

It's estimated that the app is now installed on half of the iPhones in London. The app is also used by millions of people in cities such as New York, Paris and Berlin.

Data held by business

Many businesses could make better use of the data they hold. Not only will this boost the data economy, but it will deliver significant benefits to the businesses themselves. For example, a 2014 study of the global financial services market found that firms in the sector that use predictive data analytics were able to achieve an 11% increase in customers and a 10% increase in new opportunities.³

Effective use of data can create £66 billion of new business and innovation opportunities in the UK,⁴ yet international studies show that the vast majority of existing datasets are nowhere near fully exploited, with most companies surveyed estimating that they are analysing just 12% of their data.⁵

To support industry in unlocking value from data, we will work with organisations such as the Open Data Institute to **create an environment to open up customers' data across more sectors through the use of APIs** (Application Programming Interfaces). This will help the development of innovative new applications, such as dashboards that bring together household bills, or tools that could automatically switch consumers to

the cheapest energy deal based on their preferences and actual usage. The UK is the first country to start work on developing an Open Banking API that uses data to provide helpful information to consumers when using banking services.

We will continue to support organisations that are helping businesses to realise the potential of the data they hold. This includes working with organisations like the Catapult Centres to develop initiatives such as the Digital Catapult and Knowledge Transfer Network Personal Data and Trust Network.

It is also important that customers are given improved access to their data. The **midata programme**, launched in 2011, brought together business, consumer and privacy groups in a scheme to give consumers access to portable and electronic formats of data held about them by companies. Giving consumers access to their personal data in this safe and secure way enables them to make more informed choices on the products and services they buy and gives companies opportunities to innovate, creating further growth in the digital economy.

Sharing data across countries

The stability of data transfer is important for many sectors – from financial services, to tech, to energy companies. EU rules support data flows amongst Member States. For example, the EU data protection framework outlines the rights of EU citizens, as well as the obligations to which companies must adhere when processing and transferring data.

The referendum result therefore raises important questions for companies in the UK that want to share data across international boundaries, in particular with the 27 other countries of the EU. We recognise the importance of the UK maintaining strong data protection laws and safeguards to ensure that businesses and services can continue to operate across international borders.

The UK will therefore implement the General Data Protection Regulation by May 2018. This will ensure a shared and higher standard of protection for consumers and their data across Europe and beyond.

As part of our plans for the UK's exit from the EU, we will be seeking to ensure that data flows remain uninterrupted, and will be considering all the available options that will provide legal certainty for businesses and individuals alike.

Improving data skills

As the global digital economy grows, all leading economies are seeing a major increase in the demand not just for digital skills, but for a wide range of specialist data skills. Four out of five companies are struggling to find the talent they need⁶ and two thirds of data-driven companies have experienced difficulty in filling at least one vacancy when they have tried to recruit data analysts.⁷ This shortage of data talent has direct and serious economic implications, and addressing this shortfall should therefore be a strategic priority.

In recognition of the importance of data handling and data analytical skills to the digital economy, **the government will work with the industry-led Data Skills Taskforce to help implement key elements of the Analytic Britain (https://www.nesta.org.uk/sites/default/files/analytic_britain.pdf) report produced by Nesta and Universities UK**, which provides a number of proposals to raise levels of data analysis education and skills provision in the UK.

Building public trust

Recent studies by the Information Commissioner's Office (ICO) show that only one in four UK adults currently trusts businesses with their personal information.⁸ If the UK is to benefit fully from the economic and social gains of data, the public needs to know that their personal data is safe and used responsibly.

Government and business must maintain the confidence and trust of those who provide us with their data: that it will be kept safe and secure; that it be handled legally, responsibly, and ethically; that we will be open and transparent about what data we are using and why; and that strict penalties will apply for misuse.

Supporting people's data rights and responsibilities

The Information Commissioner's Office (ICO), government, and consumer protection groups have worked hard to encourage people to take responsibility for their own data, particularly in the online environment.

Whilst we must have robust legal frameworks to ensure organisations use data appropriately, we also need people to play their part in keeping their information secure.

The ICO website contains a range of clear advice and information for individuals on their privacy rights and on actions they can take to keep their information safe.

The government will continue to support the work of the ICO and others who help people make informed decisions about how, when, and with whom they share their data.

Ethical frameworks for the use of data

Several businesses have already established their own ethics boards or advisory councils on the use of data, and there is a developing body of academic work in this field. In May 2016, the Cabinet Office published the Ethical Framework for Data Science, highlighting relevant principles and best practice guidance for civil servants.

The Royal Society and British Academy are leading a review of existing data governance frameworks in the UK that will produce its report later this year. This report will provide valuable analysis as we take forward our work looking at how businesses and new technologies can maximise the potential of data, while ensuring appropriate safeguards for citizens. We look forward to the findings of the review, and will consider them carefully.

Emerging issues

As technology evolves and the amount of personal data that is collected increases, there will inevitably be new issues with the way it is being used. The government is committed to ensuring that our laws on data protection respond to the dramatic pace of change in the digital field, and that innovation with personal data is ethical and responsible.

Data which had been legitimately collected and stored with all personal identifiers removed might be knowingly or deliberately de-anonymised, risking individuals' confidentiality. The impact of this is particularly acute in a health and care context, where personal data can be very sensitive. That is why **we will review the data protection offences, and introduce stronger sanctions for deliberate and negligent re-identification of anonymised data**. It is essential that the regulator has effective powers and that sanctions are a deterrent to the misuse of data.

Artificial Intelligence

Artificial Intelligence (AI) is an evolving technology that can be broadly described as “a set of statistical tools and algorithms that combine to form, in part, intelligent software that specialises in a single area or task. This type of software is an evolving assemblage of technologies that enable computers to simulate elements of human behaviour such as learning, reasoning and classification”.⁹

AI is particularly useful for sorting data, finding patterns and making predictions. Current examples of its use include translation and speech recognition services that learn from language online, search engines that rank websites on their relevance to the user, and filters for email spam that recognise junk mail based on previous examples.

This creative capacity gives AI enormous potential, but it also challenges some of our assumptions about the role of computers and our relationship with them. As the use of AI increases, we need to carefully consider how to ensure that the technology is not producing outcomes that discriminate unfairly or make judgmental, prejudicial or dangerous decisions. We must ensure citizens and businesses can trust the outcomes of processes that use AI technology.

In November 2016, the Government Office for Science published its ‘Artificial Intelligence: opportunities and implications for the future of decision making’ report which sets out where this technology is heading and describes some of the implications for society and government. The Royal Society and British Academy are also currently looking at how the UK can effectively manage the use of AI. The Government will consider carefully the findings of these two studies which will complement, but remain separate from, the review into how we can create the conditions for the artificial intelligence industry to thrive and grow in the UK.

Using government data effectively

Government is one of the biggest data businesses in the UK. Data is fundamental to what we do and vast quantities of data are collected, analysed and used every day. Advances in digital technology, cloud-based computing and data science open up huge opportunities to improve the effectiveness and precision of government policy interventions by using data more effectively. Furthermore, improving the way we collect, manage and share government data has the potential to deliver significant efficiency gains right across the economy.

Managing government data

Government data is generated and stored across departments, agencies, teams and areas of expertise. If government is to make services work smoothly and seamlessly for citizens, we need to put in place the infrastructure to enable the right information to be available to the right part of government at the right time.

We will create a linked ecosystem of trusted, resilient and accessible canonical datastores (known as registers) of core reference data. These registers will make government data easier to create, maintain, and put to use. To encourage their use in the public sector and beyond we will introduce a range of products and tools to make their application as straight-forward as possible. We will appoint a new Chief Data Officer for government to lead on use of data.

We must also earn and retain the trust of citizens and provide reassurance that personal and sensitive data is treated safely, securely and ethically within appropriate governance frameworks and with appropriate respect for privacy.

The government will therefore lead by example on using data responsibly and in extracting maximum value from data to create better services for citizens and better policy making. In May 2016 we published a Data Science Ethical Framework to provide guidance to civil servants on the ethical use of data within government. To build on this we will:

- aim to collect data once and use it many times - reducing the respondent burden for citizens and businesses
- make it clear and transparent why we are sharing data, how and what the benefits of this sharing are
- make data open where this is possible
- share anonymised data for research purposes for the public good

Opening up government data

The true potential of data can only be harnessed if it is open for use by others. The UK leads the world in open data, and the government is committed to building on this and being open by default. All official statistics are now published under the open government licence and we have made over 40,000 government datasets available through our data.gov.uk web-portal.

We also lead the world in the quality of our openly available geospatial data and we will **continue to support innovators and businesses to use this data**. This includes through the Ordnance Survey's GeoVation programme which runs competitions to help entrepreneurs use geospatial data and technology to develop their ideas, and provides a Hub where new start-ups can access desk-space, mentoring, and legal and professional support.

But government still holds data that could be opened up for researchers, campaigners, established companies and entrepreneurs to use. It is our ambition to ensure data is shared wherever appropriate. This will help businesses and government to innovate, generate maximum economic value and help create new digital products and services that enhance citizens' lives.

We will ensure that, where appropriate, data can be shared across organisational boundaries within the public sector. **Through the Digital Economy Bill, we will modernise legislation to enable data access for defined public interest purposes within government.** This will allow government to improve the lives of citizens who are in need of support through better targeted services. It will also improve the operation of government by enabling us to tackle fraud and debt more effectively, and by facilitating the production of timely and accurate national statistics.

Where this is already taking place, significant benefits are being realised. For example, HM Passport Office and DVLA have helped to ease the process for driving licence and passport applications by reusing, with user consent, data such as signatures and photo images that citizens have already provided to either organisation.

We will also work with key stakeholders, such as the Open Data Institute (<http://theodi.org/>), to open up more government data to external organisations than ever before. **We will deliver better services and drive innovation by ensuring the use of high quality, authoritative data across the economy.**

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4. Digital Catapult and productivity report (http://www.rand.org/pubs/research_reports/RR1284.html), 2015, RAND Corporation ↩

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9. Robotics and Artificial Intelligence report (<https://www.publications.parliament.uk/pa/cm201617/cmselect/cmsctech/145/14502.htm>), October 2016, House of Commons Science and Technology Committee ↩



- Department for Culture Media & Sport (<https://www.gov.uk/government/organisations/department-for-culture-media-sport>)

See more information about this Policy paper (<https://www.gov.uk/government/publications/uk-digital-strategy>)

Policy paper

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Next steps

This strategy has set out how we will build on our success to date to develop a world leading digital economy that works for everyone. We are committed to implementing the strategy and have established mechanisms to ensure this happens effectively.

But our strategy is a framework, and an ongoing commitment to progress, not a single document. We will therefore continue the engagement with industry that has played such an important role in the development of this strategy. In order to maximise the impact of this engagement, we will create a **forum led by the Secretary of State for Culture, Media and Sport** for government and the tech community to work together to support the growth of the UK digital economy. This will bring together representatives of some of the leading tech companies, tech industry bodies and innovative SME tech and digital-enabled firms from across the UK. The forum will focus on supporting tech sectors and innovation, as well as the adoption of digital in the wider economy.

So, while this strategy represents this government's first word on the UK's digital future, it is not its last. Through both our Industrial Strategy consultation, the forum above and our wider engagement we will continue to work side by side with all organisations involved in making our digital economy both stronger and fairer.

Annex: Embedding digital in public service delivery

Digital technology has the potential to provide more information on, and choice and control over how and when public services are accessed. It can also help radically improve the efficiency of our public services - enabling us to provide a better service to citizens and service users at a lower cost. From our schools to our hospitals to our police services, the following sets out how we are investing in new technology and new ways of working

Health and care

We have set out our vision for a seven day a week NHS (<https://www.gov.uk/government/news/prime-minister-pledges-to-deliver-7-day-gp-services-by-2020>), with accessible services wherever people live in the country, whenever you need them. We want to put patients at the centre of their care and to provide health professionals with the best information to treat them. All this will take place within a wider health ecosystem where HealthTech researchers and innovators develop new products and treatments to better meet patient needs.

Digital technologies and data are already helping to achieve these ambitions¹ and we will invest £4.2 billion over the next five years in areas such as electronic patient records, apps and wearable devices, telehealth and assistive technologies. The success of Public Health England's (<https://www.gov.uk/government/organisations/public-health-england>) (PHE) Sugar Smart app (downloaded by over 2 million people in the UK), and "How are You?" (<https://www.nhs.uk/oneyou/hay#BGCbMemVp6E8lq8h.97>) digital health quiz show how accessible apps can engage people and signpost them to support and advice. And, since March 2016, most patients have had the ability to request access to their GP record online, making it easier for them to access up-to-date information about their care; we are now supporting the development of apps to allow access and portability of personal health records.

Technology will be particularly important in providing the solutions to challenges faced by the ageing population, and help to realise the benefits of longer lives. It is already giving people the opportunity to remain independently in the home, but it's there to support people and act as an enabler and won't replace the important human dimension of care.

Data will be the key to the modern health and care system – but it must be used appropriately and lawfully, held safely and securely and in ways that maintain public trust and confidence. So we have:

- commissioned independent reviews of data security, led by Dame Fiona Caldicott and the Care Quality Commission (CQC), which reported in July 2016
- launched a public consultation on how best to take forward Dame Fiona's proposed data security standards and national consent/opt-out model that describes clearly when information is used, and when patients have a choice to opt out of personal confidential data being used

- developed a portal (<http://www.hdf.nihr.ac.uk/>) to help researchers and developers to find information about the UK healthcare data sets which are available for research

We will look at ways to deliver services in innovative ways. We will make sure that by 2020 patients will have access to digital consultations with healthcare professionals. In addition to the greater use of phone consultations through the GP Access Fund (<https://www.england.nhs.uk/ourwork/futurenhs/pm-ext-access/>), NHS England will:

- invest an extra £45 million over the next five years, as part of the General Practice Forward View (<https://www.england.nhs.uk/wp-content/uploads/2016/04/gp-fv.pdf>), to stimulate the use of online consultations
- develop a new “digital interaction” specification for general practice services
- support the adoption of email, phone and digital consultations as part of the £30 million national development programme

We will be introducing new online services giving patients more control and enable better choice:

- expanding the existing NHS 111 non-emergency phone line service to include a new online ‘triage’ service for less serious health problems
- creating a new suite of NHS-approved health apps to guide patient choice
- refresh of the current NHS website to improve the range of services available
- providing instant, downloadable access to personal health records online
- introducing interactive, local information about the performance of local health services

We want a health and care system that is paper-free at the point of care by 2020. To achieve this we will:

- encourage patients to make greater use of online transactional services, starting with at least 10% of patients in every general practice booking appointments and ordering repeat prescriptions online by March 2018.
- make GP, urgent and emergency services paper-free at the point of care in 2018
- make health and care records digital, real time and interoperable, with patients also able to add data from health consumer products such as wearables

We will also deliver a development plan focused on building the digital skills and digital capability of the NHS and social care workforce at all levels (from leadership to front line) so staff have the knowledge and motivation to act as digital champions, supporting and encouraging take-up of digital services.

Tax

We will make fundamental changes to the way the tax system works to make it easier and more efficient for individuals and most businesses across the UK to administer their tax affairs, including where tax rates are devolved.

As part of our ‘Making Tax Digital’ (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/484668/making-tax-digital.pdf) programme, we will continue to invest £1.3 billion in order to transform HM Revenue and Customs (HMRC) into one of the most digitally-advanced tax administrations in the world. Every business and UK based individual now has access to a secure digital tax account and, by 2020, we will enable taxpayers to:

- register for HMRC services, update their information digitally and make payments at any time, doing away with annual tax returns
- reduce their tax administration by not needing to provide HMRC with information it already has received from employers, banks and building societies
- see an up-to-date, complete picture of their information and tax affairs via their digital tax accounts and check at any time that their details are complete and correct, helping them to plan their financial affairs with more certainty throughout the year
- receive prompts, web-chat advice, and secure messaging to help them manage their tax affairs

Education

Education technology (EdTech) is one of the fastest growing sectors in the UK, accounting for 4% of all digital companies, and UK businesses have become world leaders in developing innovative new technologies for schools.² The potential benefits when implemented correctly are considerable, both in teaching and in school administration. We want to make sure our pupils, their parents and teachers are able to make use of these opportunities.

We will do this by helping schools to access, buy and use the right technology in the right way for their needs. We will help develop the evidence base on what works in EdTech, we will improve the use of data across the education system and we will help those schools without basic broadband to get a connection.

UK schools currently spend £900 million annually on EdTech³ and we want remove the hurdles and challenges leaders face in making effective and well informed decisions when purchasing technology. To support schools we will:

- investigate how we can better test technology to identify what works through faster, more agile, evaluation methods. The Education Endowment Foundation (<https://educationendowmentfoundation.org.uk/>) is well placed to build on their gold standard randomised control trials in this area, and we will be supporting them in this work
- better support schools to make informed decisions by building on the existing cloud guidance
- support schools to be more cost effective purchasers of technology through a series of aggregated procurement opportunities for tablet, desktop and laptop devices

To realise the potential benefits of the use of technology in education, schools may require help connecting to modern digital infrastructure and a suitable broadband connection. We will work to understand the needs of schools and address the barriers they face getting access to modern digital infrastructure.

Access to technology and infrastructure however will not solve this challenge by itself, and as mentioned earlier in this Digital Strategy, digital skills will play a key role in supporting educators to realise the benefits of technology whilst ensuring that the next generation have the digital skills they need for work.

Technology also offers opportunities to make efficiency savings, we have recently prototyped a new ‘Data Exchange’ system to simplify how we collect data from the sector into the department and this is built upon a common and open set of standards. This will:

- enable interoperability across the sector, by which we mean that EdTech products will be able to “talk to each other”, reducing the need for data administrators to enter data manually multiple times across their internal systems

- provide a single service for all data collections based upon APIs and user-friendly portal access which will simplify current processes and reduce the administrative burden across the sector

Over the next 12 months we will continue to work with schools and software suppliers to further develop this prototype with the intent to expand this to all schools during 2018.

We also want to allow better use of the data we hold for academic research. At all times, the need to preserve appropriate privacy and security will remain paramount and will be non-negotiable. We will:

- work with the Office for National Statistics (<https://www.ons.gov.uk/>) to make research samples of the National Pupil Database available through the Virtual Microdata Laboratory (VML) service, and provide secure access to the service from multiple sites
- work with the Open Data Institute (<http://theodi.org/>) to develop a secure way of allowing users to make use of the data we hold, whilst preventing sensitive information being seen by the user. This will facilitate the development of high quality evidence and research, contributing to our understanding of what works to improve outcomes in education

Transport

We have already committed to increasing investment in transport by 50% by 2020 (<https://www.gov.uk/government/news/department-for-transport-settlement-at-the-spending-review-2015>). A key part of this will be creating a genuinely digital transport system, making infrastructure smarter, more accessible and convenient. We will focus our efforts on three key areas:

Digital Signalling

At the 2016 Autumn Statement, the government committed an additional £450m in this Parliament to roll out digital signalling technologies on key routes on the UK rail network. The introduction of digital technologies, such as in-cab signalling and intelligent traffic management systems, will become increasingly important to deliver much needed capacity and improve connectivity to ports and terminals. For the rail passenger, real-time management of traffic will reduce disruptions and enable services to respond to peak times of demand.

Public and private investment in digital signalling over the next 10 years will aim to cement UK leadership in a growing market, worth over £30 billion globally by 2020. By 2019, nearly 200 trains with this technology will run on Thameslink and Crossrail. To support the adoption of digital signalling across the rail network, we are:

- developing a plan to introduce in-cab signalling on some of the UK's busiest rail routes, sponsored by government but in conjunction with the private sector
- bringing in industry leaders to advise the Secretary of State for Transport and introduce best practices from other industries that have successfully delivered digital transformation
- working closely with industry to maximise the opportunity Digital Railways presents to jobs, growth and exports

Smart ticketing

We want every passenger to have the choice of travelling on trains with a smart ticket by the end of 2018, providing them with more convenience and choice.

Digital tickets and payment through smartcards, mobile phones and contactless are offering customers more convenience and flexibility in how they buy and use tickets. Smart ticketing can also help to provide better passenger information, for example during disruption, and automatic passenger compensation when trains do not run on time (such as is happening for some customers on c2c). Prior to the further roll out of smart ticketing, we want digital technology to help make passengers aware of their right to claim compensation.

We are encouraging the rail industry to develop and deliver a modernised ticketing offer by setting challenging requirements for bidders in future franchising competitions. At the Autumn Statement a further £80m was allocated to accelerate the rollout of smart ticketing including season tickets for commuters in the UK's major cities.

As a result of investments made through the South East Flexible Ticketing programme, from December last year rail commuters on Abellio Greater Anglia, South West Trains, c2c, Govia Thameslink Railway and Southeastern have the option of buying season tickets on smartcards. And the investment has built one of the most comprehensive smart ticketing technologies currently available on the rail network, which now has the capability to be rolled out across the UK.

We have committed £150 million for multi-modal smart ticketing to be rolled out across the North of England.

Rail Data

Better real-time information will help passengers make better decisions about their journeys. Opening up data will spur innovation and help create apps, products and services.

We will build on this momentum by setting out recommendations later this year to improve data in the rail industry by making it more open and better quality in areas including reservations, reliability, planned disruptions, routing guides, and GPS train locations. This will enable the development of apps and services that will improve the customer experience, increase accountability and produce innovative solutions to problems the rail industry faces.

Energy

There are significant economic and environmental benefits to developing a smart energy sector, with estimated benefits to consumers of £17-40 billion over coming decades.⁴ Smart meter technology puts consumers in control of their bills: smart meters can tell customers how much energy they are using, what it's costing in near real-time and send meter readings directly to their energy supplier. Customers can also use actual consumption data when seeking energy efficiency advice or quotes on switching supplier; and, with the consumers' consent, Internet of Things technology can connect to the smart metering system and enable devices to be used when energy prices are cheapest.

The government is committed to ensuring that every home and small business is offered a smart meter by the end of 2020, delivered as cost effectively as possible. BEIS analysis shows the roll out of smart meters is expected to deliver net benefits of £5.7 billion. We will also:

- launch a smart systems plan with Ofgem on how to deliver a more resilient energy system which uses smart technologies and processes effectively, and helps keep consumer bills as low as possible
- work with Ofgem to enable half-hourly settlement, so that homes and small businesses can save money by using electricity when it is cheapest to do so
- use at least £50 million of funding, as announced in Budget 2016, to help new technologies and business models access the market⁵
- work on standards so that appropriate appliances have smart functionality that consumers can use, and all smart appliances are interoperable, e.g. so a dishwasher can be programmed to run when energy is cheapest and be finished by the consumer's chosen time, thus saving them money

Policing and justice

The policing and justice system needs to be able to operate effectively in a digital age. In the Spending Review, the government committed to funding Digital Policing work through a new transformation fund, making money available for a police-led programme that will work to equip forces with the tools to effectively police a digital age and protect victims of crime. To create a faster, simpler, better joined-up justice service, we will improve how data is shared across the system by developing a set of common data principles to encourage all organisations to collaborate in a more effective way.

Policing

The National Police Chiefs' Council (<http://www.npcc.police.uk/>) and the Association of Police and Crime Commissioners (<http://www.apccs.police.uk/>) have identified three areas of focus: to improve the links with the criminal justice system; transform the police's ability to recover and analyse digital material and the capability of officers to handle it; and ensure citizens can access police services, from reporting crimes, paying fines or submitting evidence, digitally. Together with policing, we will:

- make storage and subsequent sharing of digital evidence a seamless part of the judicial process, by implementing the Police Digital First and the Common Platform Programmes
- speed up officers' access to information and intelligence from a much wider range of national data sets including criminal records, intelligence and Automatic Number Plate Recognition through the National Law Enforcement Data Programme, so they can spend more time tackling crime

A new Emergency Services Network (ESN) (<https://www.gov.uk/government/publications/the-emergency-services-mobile-communications-programme/emergency-services-network>) will allow the development of apps over a secure platform to support real-time resolution of crimes. This will:

- allow police officers to use biometric applications to match marks, fingerprint and DNA from scenes of crime and return results to officers over mobile devices at the crime scene, reducing time spent going to and from the police station
- support video recording of interviews and statements at the scene, saving the public's time and improving the quality of evidence while it is still fresh in witnesses' minds
- provide a fast and more efficient platform through which to circulate real time information including photos and video clips on missing persons and suspects

We will continue to invest in our law enforcement capabilities so that we have the capacity to deal with the increasing volume and sophistication of **cyber crime**, including by strengthening the National Crime Agency, Regional Organised Crime Units and Action Fraud.

Justice

We will support fundamental reforms to the courts and tribunals service to radically and permanently improve the way we deliver justice.

In the modern world, services need to take advantage of technology, and be designed around the people who use them. We want to make the justice system easier to use and more efficient for everyone.

To create a more just, proportionate and accessible service we will:

- build a digital system for criminal justice - linking police, prosecutors and courts - putting an end to slow paper processes
- bring digital technology to civil and family courts and tribunals, including developing a new online court for fast resolution of simple matters
- train and develop people, including in digital skills and excellent customer service

Online, people will be able to:

- find information and guidance about the justice system
- start and progress their case
- access information about their case
- resolve disputes through the online court

As part of our Assisted Digital strategy, we will be working to ensure those that are digitally excluded or not fully able to engage with these new platforms are not disadvantaged and receive the support they require to conduct their case.

Prisons

We will use digital technology to reform the prison estate and the way prisons are run in England and Wales. We are replacing ageing and inefficient prisons with modern buildings with a digital infrastructure that will improve prison safety and security, as well as supporting delivery of services that will help reduce reoffending. This will include:

- secure networking facilities to enable digital solutions, like court video links, to be provided directly to prisoners and prison staff
- better access to offender data and advanced analytics to help identify and manage offender risks more effectively
- better online information to help when moving prisoners
- body worn cameras for prison officers
- pilots on new types of electronic tagging, including Global Positioning System and sobriety tags

Welfare

We are creating a welfare system that ensures that people who can work do so, while providing a safety net for the most vulnerable. Technology can make welfare services more efficient and easier for claimants to navigate.

We are using the latest secure digital technology and real-time data to deliver a single, seamless support system for people out of work and in low paid work. Universal Credit represents the biggest change in the welfare state since its inception. Once fully implemented, it will achieve around £7 billion economic benefits by eliminating complexity and removing poor work incentives. Universal Credit will create a more flexible labour market, where households can take advantage of employment opportunities, and it will support claimants in taking more responsibility for finding work.

Universal Credit aims to boost employment by up to 250,000 and the evidence shows that it is working; providing the incentives and flexibility for people to move into work and to work more.

To make it easier for claimants to make and maintain their claim, Universal Credit:

- creates a single, online account where claimants can make and manage their claim
- offers support for claimants needing help with an on-line claim
- encourages personal responsibility by allowing claimants to check payments, report changes and keep in touch with their work coach online
- notifies claimants about actions, tasks, or reminders via text or email, and allow claimants to document work search activity via an online journal
- uses data from across and beyond government to tailor the service to claimants' circumstances

We are transforming other aspects of our welfare system, including wider working age benefits, health and disability, and pensions, using the same key principles and transformative technology. For example we are introducing digital services to apply for budgeting loans, to check your state pension and to get your state pension. Technology is also evolving rapidly and we are exploring new ideas to take advantage of this, with a structured innovation methodology for testing that preserves the quality, security and user experience of our public services.

Diplomacy

The UK is at the centre of innovation in public service delivery. Our technology and cyber security capability is delivered by working with the UK's diverse, world-beating market of technology companies.

Our expertise and experience are recognised internationally. We are No 1 in the UN e-government survey 2016 and a recent EY study ranked us as the top G20 country for the ease of starting a digital business and for a digital business environment. We will use our international influence to:

- attract global trade and investment
- support UK-based tech companies to succeed in overseas markets
- share code, standards, training courses, methodology and implementation techniques with other governments. This will help other governments start their digital programmes with less risk
- embed our approach to technology in other countries. This will not only enable UK suppliers to operate in overseas markets, helping other governments in their government reform improves diplomatic relations
- collaborate and share knowledge with trusted partners as part of our common efforts in cyber security towards ensuring that cyber

Next steps include:

- work with our D5 (Digital 5) colleagues⁶ to create a 'Digital Government in a Box' solution, providing countries with assistance in developing an advanced digital government through making the components of our approach openly available and easily accessible. This will include sharing code, designs, methodologies, and lessons learned in the Open Source manner that enables continuous improvement of these solutions - so that we can benefit from others' experience and implementation.
- champion UK tech companies and support them to access overseas markets, working with other government departments to drive trade and investment

Culture

The Culture White Paper (<https://www.gov.uk/government/publications/culture-white-paper>) set out our ambitions for culture. We expect culture to be accessible to all with the wide benefits it brings, and digital technology has a key role to play in this aim.

Technology has the potential to bring arts and culture to new audiences; to inspire children and young people; and to support teaching and learning through interactive and online experiences. Many of our national and local cultural institutions are digitising their collections and screening content online, opening up access, especially for those who find it difficult or are unable to visit.

Improving access to culture

The National Theatre's NT Live programme (<http://ntlive.nationaltheatre.org.uk/>) of cinema broadcasts reached a global audience of 1.45 million people in 2015-16. Currently 45% of UK state secondary schools stream productions to classrooms for free using NT On Demand In Schools (<https://schools.nationaltheatre.org.uk/app/os>), and it has been rolled out to primary schools, giving more students the opportunity to access National Theatre's productions in the classroom.

The Royal Opera House relays live performances to thousands of viewers across the country, and for the first time, the global public can tour the British Museum's cultural treasures as part of a partnership with the Google Cultural Institute. The British Library is leading the way in curating and preserving a huge array of digital content.

Digitisation can support heritage conservation and protection. We have launched a new £30 million Cultural Protection Fund (<https://www.britishcouncil.org/arts/about/cultural-protection-fund-2016-2020>) to support the protection and recovery of cultural heritage from acts of damage or destruction. We expect new technologies such as 3D imaging and video recording to be a key element of this work.

To accelerate the digitisation of culture, and make culture accessible for all, we will:

- undertake a Digital Culture project to look at how arts and cultural organisations can make the most of the opportunities offered by digital technologies and how to make the UK one of the world's leading countries for public collections content
- Within the context of the DCMS Museums Review, consider how museums in England can use digital technology to improve audience engagement with collections
- undertake a major enhancement and rationalisation of heritage records nationally and locally, including an update and improvement of Historic England's customer-facing IT. This project will improve the presentation of heritage records and their links to other publicly accessible data sets, such as Google Earth and StreetView to ensure records function as educational and community assets as well as efficient technical planning tools.

We will explore the development of a shared national digital platform for public libraries in England to provide a seamless transition between physical and digital collections, including ebooks and digital magazines. We will work with libraries, authors, publishers and other interested groups so the public can access more ebooks through libraries, whilst ensuring that authors and other rights holders are appropriately remunerated for the loans of their works.

Local government

Digital technology can help deliver local services more efficiently, tailor services better to user needs and generate economic growth by creating opportunities for innovative local service providers. Sharing and repeating best practice across the UK can spread success, improve services and cut costs. We want public services - central, local, health and education - that make sense to our citizens and a local public sector that works together to make this happen.

The local digital opportunity goes beyond digitising service delivery. Data helps cities and regions get smarter by understanding challenges, using their assets more effectively, develop integrated solutions and plan future developments based on better information. Local government across the whole country can benefit from better use of data.

We set out in chapter 7 our commitment to opening up further central government data sets, to support further innovation at both national and local levels. This will be integral to the digital transformation of places and local public services, and we will also:

- encourage local authorities to release more of the data that they hold to drive local innovation and economic growth
- encourage collaborative efforts by sector-organisations to develop, and implement, common digital services and standards - for example, by supporting open data standards for election results, and advising LocalGov Digital on the Local Government Digital Service Standard
- develop our digital platforms so that they can be of more use for local public services, for example, through piloting the use of GOV.UK Verify in local government, providing support for procurement of digital services and skills through the Digital Marketplace

Digitisation of the planning system

As part of the government's drive to accelerate the level of housing development, we are considering how the planning system can be made both more efficient and give the public greater involvement through better use of data and digital tools.

To accelerate data and digital transformation in planning, we are therefore undertaking a R&D pilot which seeks to identify and develop the highest value data and digital opportunities to improve the planning system for land and housing in England.

The group works together to explore and share new and better ways of providing excellent digital government services. The founding members of the group, Estonia, Israel, New Zealand, South Korea and the United Kingdom, all have a record of excellence in digital government, including designing services around users' needs and sharing open source solutions.

1. The National Information Board published Personalised Health and Care 2020: a Framework for Action in November 2014 ↩
2. Tech Nation 2015 (<http://www.techcityuk.com/wp-content/uploads/2015/02/Tech%20Nation%202015.pdf>), Tech City UK (<http://www.techcityuk.com/>) ↩
3. Tech Nation 2016 (http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf), Tech City UK (<http://www.techcityuk.com/>) ↩
4. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/554485/An_analysis_of_electricity_system_flexibility_for_Great_Britain.pdf ↩
5. Budget 2016 (<https://www.gov.uk/government/publications/budget-2016-documents>), HM Treasury ↩
6. The inaugural Digital 5 (D5) summit was held in London (<https://www.gov.uk/government/news/uk-hosts-d5-the-first-digital-leaders-summit>) in 2014. The purpose of the group is to create a sustainable network of countries that promote international co-operation on digital government and work together to build solutions to common issues we face in driving digital reform. ↩