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Policy paper

National Data Strategy

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Ministerial foreword

When I became Digital Secretary, I vowed to be unashamedly pro-tech. This has to begin with data. Data is now the driving force of the world's modern economies. It fuels innovation in businesses large and small, and has been a lifeline during the global coronavirus pandemic. The fact that governments, businesses, organisations and public services were able to share vital information quickly, efficiently and ethically during the pandemic has not only saved countless lives, but has enabled us to work from home, keep the economy running and stay connected with loved ones during a period of unprecedented disruption. As we enter into recovery, it is vital that we make the most of what we have learnt.

This National Data Strategy aims to do exactly that, building on our manifesto pledge to improve data use in government, and going further. It seeks to maintain the high watermark of data use set during the pandemic, and to free up businesses and organisations to keep using data to innovate, experiment and drive a new era of growth. It seeks to harness the power of data to boost productivity, create new businesses and jobs, improve public services and position the UK as the forerunner of the next wave of innovation.

Under this strategy, data and data use are seen as opportunities to be embraced, rather than threats against which to be guarded.

This means asking fundamental questions about what data should and should not be made available across the UK. It means maintaining a regulatory regime that is not overly burdensome for smaller businesses and that supports responsible innovation. It means driving a radical transformation of how the government understands and unlocks the value of its own data to improve a range of public services and inform decisions at scale, through a whole-government approach driven from the centre. It means taking the risks of increased data use seriously. And it means positioning the UK as a global champion of data use, and encouraging the international flow of information across borders.

The strategy is a central part of the government's wider ambition for a thriving, fast-growing digital sector in the UK, underpinned by public trust. We want the UK to be a nation of digital entrepreneurs, innovators and investors, the best place in the world to start and grow a digital business, as well as the safest place in the world to go online. We will set out more on how we propose to support a digital drive for growth in our Digital Strategy, which we will be publishing in the Autumn.

This document is a framework for the action this government will take on data. It is not the final answer, but part of a conversation about the way that we support the use of data in the UK. We lay out the opportunities that we want to realise, the pillars that we have identified as core to unlocking the power of data for the UK, and the missions that we must prioritise now.

Rt Hon. Oliver Dowden CBE MP (Secretary of State for Digital, Culture, Media and Sport

Executive summary

The opportunity

Better use of data can help organisations of every kind succeed – across the public, private and third sectors. It can support the delivery of existing services, from manufacturing to logistics, and it can be used to create entirely new products. It is a driver of scientific and technological innovation, and central to the delivery of a whole range of vital public services and societal goals, from tackling climate change to supporting the National Health Service. As businesses embrace technology, data creates jobs, opens up whole new markets and drives demand for a highly skilled workforce.

On an individual level, the use of data benefits us every day – from the lives saved due to data-driven medical discoveries, to personal budgeting, understanding how much we have exercised and identifying better transport routes.

The UK is already a leading digital nation. The data market in the UK (i.e. money made from products or services derived from digitised data) is the largest in Europe (http://datalandscape.eu/study-reports/final-study-report-european-data-market-monitoring-tool-key-facts-figures-first-policy). UK tech grew dramatically in 2019 (https://technation.io/news/2019-a-record-year-for-uk-tech/), with the UK securing 33% of European tech investment.[1] Globally, the UK now sits behind only the US and China (https://technation.io/report2020/#forewords) in terms of venture capital investment.

But the last five years have seen huge technological changes, and national governments need to respond accordingly. We need a data strategy that reflects the opportunities and challenges of our new hyper-digital world, one that ensures we weigh the priorities and potential trade-offs of data in a deliberate and evidence-based way, and, above all, one that drives growth in the UK economy and powers our recovery from the coronavirus pandemic.

This strategy looks at how we can leverage existing UK strengths to boost the better use of data across businesses, government, civil society and individuals. Having left the European Union, we will take advantage of being an independent, sovereign nation to maximise those strengths domestically, and position ourselves internationally to influence the global approach to data sharing and use. We will act ambitiously at home and on the international stage, aligning our history of problem-solving in science and technology with progressive values and the competence and pragmatism of our regulatory institutions.

The UK response to the global coronavirus pandemic has powerfully illustrated the potential benefits of data. Our understanding of this disease, our ability to support people and our cooperation across borders have all relied on the responsible and effective use and sharing of data.

But we have a duty to do more – especially with the data that the government itself holds, which can be used and shared for the benefit of society. Individual transactions, from applying for social security benefits to buying a house, are more resilient when personal information can be shared from trusted

sources – for example, in the form of a digital identity.

Data is a non-depletable resource in theory, but its use is limited by barriers to its access – such as when data is hoarded, when access rights are unclear or when organisations do not make good use of the data they already have. These barriers undermine the performance of public services and our economy, risking poorer outcomes for citizens. We will ensure that data can be leveraged to deliver new and innovative services, promote stronger competition, and better prices and choice for consumers and small businesses. We will drive an approach to data that holds that all can benefit when data is used responsibly, and that withholding data can negatively impact society.

This strategy

As part of this document, we are asking for your views. Consultation questions are included throughout the text and in an accompanying document (https://www.gov.uk/government/consultations/uk-national-data-strategy-nds-consultation). In future updates, we will lay out the steps that we will take to implement the strategy, and the way that your responses and the evidence you have provided have shaped our approach.
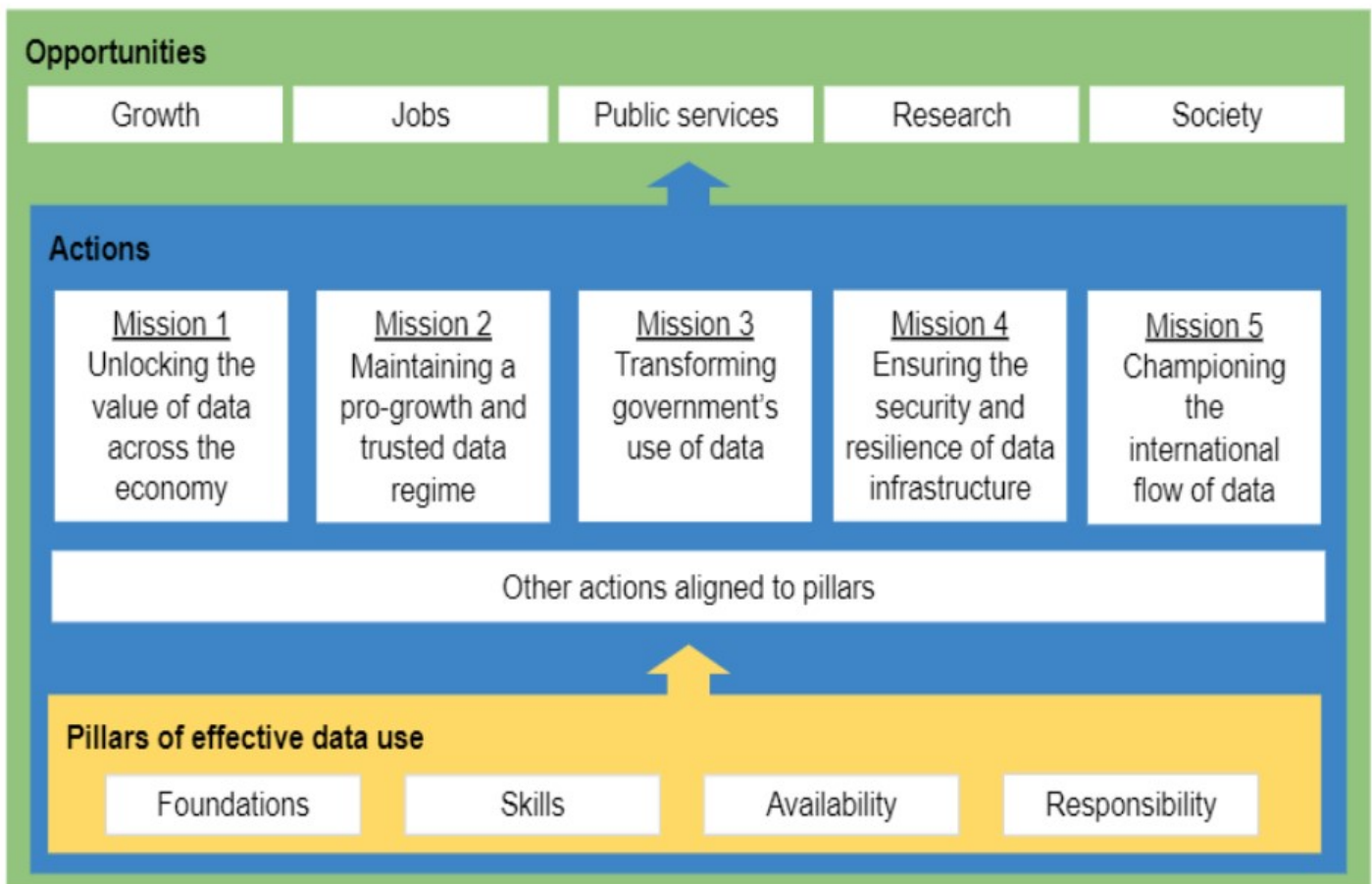
The pillars

A number of interconnected issues currently prevent the best use of data in the UK. These are reflected in the core pillars of this strategy:

1. **Data foundations**: The true value of data can only be fully realised when it is fit for purpose, recorded in standardised formats on modern, future-proof systems and held in a condition that means it is findable, accessible, interoperable and reusable. By improving the quality of the data, we can use it more effectively, and drive better insights and outcomes from its use.

2. **Data skills**: To make the best use of data, we must have a wealth of data skills to draw on. That means delivering the right skills through our education system, but also ensuring that people can continue to develop the data skills they need throughout their lives.

3. **Data availability**: For data to have the most effective impact, it needs to be appropriately accessible, mobile and re-usable. That means encouraging better coordination, access to and sharing of data of appropriate quality between organisations in the public, private and third sectors, and ensuring appropriate protections for the flow of data internationally.

4. **Responsible data**: As we drive increased use of data, we must ensure that it is used responsibly, in a way that is lawful, secure, fair, ethical, sustainable and accountable, while also supporting innovation and research.

The missions

From these pillars, we have identified five priority areas of action. These missions address key challenges that can prevent us from taking advantage of the opportunities that data offers.

1. **Unlocking the value of data across the economy.** Data is an incredibly valuable resource for businesses and other organisations. However, there is increasing evidence to suggest its full value is not being realised because vital information is not getting to where it needs to be. To ensure the UK is a world leader in data, our first mission will be to set the correct conditions to make data usable, accessible and available across the economy, while protecting people's data rights and private enterprises' intellectual property. Using a considered and evidence-based approach, we will develop a clear policy framework to determine what government interventions are needed to do so.

2. **Securing a pro-growth and trusted data regime.** We want the data revolution to benefit businesses large and small. That means maintaining a data regime in the UK that is not too burdensome for the average company; one that helps innovators and entrepreneurs to use data responsibly and securely, without undue regulatory uncertainty or risk, to drive growth across the economy. But we also want the public to be active agents in the thriving digital economy and to have confidence and trust in how data, including personal data, is used. The UK's data regime will support vibrant competition and innovation, building trust and maintaining high data protection standards without creating unnecessary barriers to data use.

3. **Transforming government's use of data to drive efficiency and improve public services.** The coronavirus pandemic showed that there is massive untapped potential in the way government and public services use and share data to help and protect people. To sustain the high watermark set by the pandemic, the government will undertake an ambitious and radical transformation of its own approach, driving major improvements in the way information is efficiently managed, used and shared across government. To succeed, we need a whole-government approach that ensures alignment around the best practice and standards needed to drive value and insights from data; and the creation of an appropriately safeguarded, joined-up and interoperable data infrastructure to support this. We also need the right skills and leadership within the public sector to understand and unlock the potential of data.

4. **Ensuring the security and resilience of the infrastructure on which data relies.** The use of data is now a central part of modern life, so we need to make sure that the infrastructure underpinning it is safe and secure. The infrastructure on which data relies is a vital national asset that needs to be protected from security risks and other concerns, such as service disruption. Interruption to data-driven services and activities can cause disruption to businesses, organisations and public services. While these are also commercial risks to

manage, the government has a responsibility to ensure that data and its supporting infrastructure is resilient in the face of established, new and emerging risks, protecting the economy as it grows.

5. **Championing the international flow of data.** The flow of information across borders fuels global business operations, supply chains and trade, powering growth across the world. It also plays a wider societal role. The transfer of personal data ensures people's salaries are paid, and helps them connect with loved ones from afar. And, as the coronavirus pandemic has demonstrated, sharing health data can aid vital scientific research into diseases while uniting countries in their response to global health emergencies. Having left the European Union, the UK will champion the benefits that data can deliver. We will promote domestic best practice and work with international partners to ensure data is not inappropriately constrained by national borders and fragmented regulatory regimes so that it can be used to its full potential.

Together, the steps identified in this strategy build on UK strengths to drive better use of data – data use that is more secure, more innovative and more widely recognised as a force for good. Better use of data will drive growth and productivity, improve our society and public services and position the UK as a leader of the next wave of data-driven innovation. We have an obligation to realise this ambition.

1. About the National Data Strategy

This strategy sets out how best to unlock the power of data for the UK. It builds upon initiatives such as the Industrial Strategy (https://www.gov.uk/government/topical-events/the-uks-industrial-strategy), the AI Review (https://www.gov.uk/government/publications/growing-the-artificial-intelligence-industry-in-the-uk), the AI Sector Deal (https://www.gov.uk/government/publications/artificial-intelligence-sector-deal/ai-sector-deal) and the Research and Development Roadmap (https://www.gov.uk/government/publications/uk-research-and-development-roadmap) – setting out a framework for how we approach and invest in data to strengthen our economy and create big opportunities for us in the future. The government believes that unlocking the value of data is key to driving growth both within the digital sector and across the economy. This will be part of our Digital Strategy, which will be published in the Autumn and will consider more broadly how we can support a digital drive for growth.

In this publication, we set out the framework for the approach this government will take, the improvements we seek to deliver and the priority missions we will focus on now to realise that change. The increasing importance of data raises novel and complex policy questions. Some of these need further consideration before the UK government confirms its direction. As such, we are also asking for your views in relation to our general framing, along with some of the actions we are considering. These questions are included throughout the document and also collated in an accompanying publication.

This consultation is on a UK-wide basis: we welcome responses from organisations and individuals across the UK. The strategy covers both reserved and devolved areas: where the strategy covers reserved areas (and, in respect of Northern Ireland, excepted areas), it does so for the whole of the UK, and where it covers devolved or transferred areas, it applies to England only. We will publish a response to this consultation in early 2021.

A National Data Strategy will require activity and focus beyond government. In this framework strategy we have focused on the government's role in harnessing data. Following this consultation period, and as we move to implementation, we will work with stakeholders to set out how we will work with business and actors across the wider data landscape to land a strategy for the whole of the UK.

What we mean by data

Data is notoriously hard to define – and it means different things to different people. For an application developer, data is what enables the creation of rich and complex digital services. For a scientist, it is what is collected as part of experiments or surveys. For a data protection practitioner, it is the names and addresses of staff organised in a spreadsheet. For a personal trainer, it is the information in an app recording our heart rate during a workout. And for every one of us, it is the tool that powers our online maps, helps us book supermarket delivery slots, and allows us to check tomorrow's weather forecast.

When we refer to data, we mean information about people, things and systems. While the legal definition of data covers paper and digital records, the focus of this strategy is on digital information. Data about people can include personal data, such as basic contact details, records generated through interaction with services or the web, or information about their physical characteristics (biometrics) – and it can also extend to population-level data, such as demographics. Data can also be about systems and infrastructure, such as administrative records about businesses and public services. Data is increasingly used to describe location, such as geospatial reference details, and the environment we live in, such as data about biodiversity or the weather. It can also refer to the information generated by the burgeoning web of sensors that make up the Internet of Things.

When thinking about the government's own data use, the strategy covers administrative, operational and transactional data – that is, data collected in the process of running services or businesses – as well as analytical and statistical data.

To ensure that data dependency risks are well managed, we are also interested in the infrastructure underpinning the storage of data, such as physical and virtualised data centres/the Cloud.

1.1 Evidence and working with stakeholders

This strategy, and the structure and substance of the pillars on which it is built, is drawn from a range of evidence sources, including desk research covering both case studies and published academic/sector research.

In June 2019, the government launched a call for evidence on the proposed framework of the strategy, receiving over 100 responses. Alongside this, a programme of stakeholder engagement was undertaken, including the hosting of 20 roundtables and workshops, with representatives from over 250 organisations across business, the third sector and local government. Through our call for evidence, roundtables and workshops held across the country in 2019, we consulted on our parameters and objectives, and gathered evidence that has underpinned this framework National Data Strategy.

We have analysed the call for evidence submissions and the discussions at the roundtables to make sure our evidence base is as wide and inclusive as possible. A summary of our call for evidence and of the stakeholder engagement can be found in the accompanying publication (https://www.gov.uk/government/publications/uk-national-data-strategy/call-for-evidence-and-roundtable-engagement-summaries).

Data policy is a rapidly evolving area globally, and for many of the issues highlighted in this strategy a number of questions remain unanswered, with further research and analysis required. As the government takes this strategy forward, we will continue to draw upon available evidence to inform our actions. We will develop a monitoring and evaluation process for the strategy to help ensure it is achieving its intended outcomes, as well as building the evidence base on which we develop and evaluate future policy decisions. As we move to implementation, we will further continue to work with stakeholders to set out how we will engage with business and the wider data economy to land a strategy for the whole of the UK.

2. The data opportunity

We are currently in the middle of a fourth industrial revolution. Technological innovation has transformed our lives, changing the way we live, work and play. At the same time, this innovation has brought with it an exponential growth in data: in its generation and use, and in the world's increasing reliance upon it.[2] By embracing data and the benefits its use brings, the UK now faces tangible opportunities to improve our society and grow our economy. If we get this right, data and data-driven technologies like AI could provide a significant boost to the entire economy. Data can improve productivity and provide better-quality jobs. But it can also transform our public services and dramatically improve health outcomes nationally. It can keep us safe and assist the reduction of crime, speed the journey to decarbonisation, and, used well, drive efforts to create a more inclusive, less biased society.

Importantly, data can also be used to harness the potential of regions right across the country,[3] ensuring that people and organisations from the whole of the UK can benefit from the full value of the digital revolution.

Like many things, the use of data also presents risks; those risks need to be fully understood and taken into account. Used badly, data could harm people or communities, or have its overwhelming benefits overshadowed by public mistrust. Equally, misplaced government reluctance to securely share and use data undermines the performance of public services and risks causing harm by missing opportunities to help those most in need. In the same way, unnecessary barriers to technological innovation could drive inefficiencies and slow down growth. So it is vital that we take decisive and evidence-led steps to make the most of data's potential.

We have identified five concrete and significant opportunities for data to positively transform the UK:

1. Boosting productivity and trade
2. Supporting new businesses and jobs
3. Increasing the speed, efficiency and scope of scientific research
4. Driving better delivery of policy and public services
5. Creating a fairer society for all

Achieving these opportunities will not be easy. While they are already being realised in some contexts, the means to do so are missing in many others. There is also a great deal of competition in the data space internationally, combined with differing global views on data and its use. As a digital leader, the UK is well placed to overcome this challenge.

In realising these opportunities, the UK can further enhance its world-class status in science and technology, and its reputation for finding pragmatic and innovative solutions to difficult problems. In the years to come, it can use these strengths as a springboard to become a global leader in data as well.

2.1 Boosting productivity and trade

Data is knowledge. By having access to more of it, combined with the ability to analyse it through modern techniques, we get greater insight into what works and what does not – both in terms of selling products and services, and in terms of making our own processes and practices more efficient. Data therefore has the potential to significantly enhance economic competitiveness and productivity across the UK economy, through new data-enabled business models, as well as through the adoption of data-driven processes by existing businesses.

There are various ways of defining and measuring the data market and the data economy.[4] A range of estimates suggest that the data economy grew about twice as quickly as the rest of the economy during the 2010s, making up about 4% of UK GDP in 2020

(http://datalandscape.eu/sites/default/files/report/D2.9_EDM_Final_study_report_16.06.2020_IDC_pdf.pdf).
Beyond the impacts of data-driven products and services (i.e. the direct 'data economy'), the use of
data has a more general role in underpinning digitally delivered trade. ONS estimates show that in
2018 the UK exported £190 billion in digitally delivered services (67% of total UK services exports) and
imported £90 billion digitally delivered services (52% of UK services imports)
(https://www.ons.gov.uk/releases/modesofsupplyexploratoryestimatesfortheuk). Enabling and growing this
data-driven trade will be a priority in our approach to free-trade negotiations.

While research into the business impact of increasing and improved data use is in its infancy and
methodologically challenging, the existing evidence suggests wide-ranging economic benefits arising
from better data use, in particular an association between efficiency, productivity and data-driven
business practices.[5] There are also significant economic advantages from individual companies
increasing data access and sharing. For example, Transport for London (TfL)'s opening up of its data
sets to travellers and third-party providers contributed up to £130 million per year to the London
economy through time saved by travellers (http://content.tfl.gov.uk/deloitte-report-tfl-open-data.pdf).

In recent years, the UK government has taken significant and unprecedented steps to position the UK
as a world leader in data-driven innovation. This includes committing to raising investment in (often
data-heavy) research and development by 2.4% of GDP by 2027, establishing institutions such as the
Centre for Data Ethics and Innovation (CDEI) and the Alan Turing Institute, launching brand new
conversion courses in data science and AI, and conducting pioneering work on 'data trusts' – a novel
data-sharing framework.[6] The importance of continuing and furthering this work will be even more vital
in ensuring the UK's recovery from the coronavirus pandemic, and its economic success in the years
beyond.

Case study: Sharing data to drive open innovation

Open innovation allows companies to apply externally-developed data, ideas and technology to help address challenges. Sharing operational data provides the necessary insights into business challenges, allowing collaborators to analyse and use that data to deliver better insights and demonstrate the value of new technologies.

The Open Data Institute documented how an open innovation programme, Data Pitch, has allowed Greiner Packaging International GmbH, a company producing rigid plastic packaging, to share data with logistics intelligence company, Obuu, to help monitor the resilience and efficiency of its supply chain. To do this, Obuu used data to map out shipping, storage and manufacturing flows so they could investigate three key performance indicators for efficiency in the supply chain: whether spare parts were available when needed; the average time the system is down when a part is not available; and the overall investment in the accessible stock. From this, Obuu was able to identify reductions in fixed asset investment, resulting in a significant cost saving (https://datapitch.eu/wp-content/uploads/2020/01/London-Economics-Data-Pitch-evaluation-FINAL-PDF.pdf).

2.2 Supporting new businesses and jobs

Data skills – like many digital skills – are increasingly important for all aspects of life, but especially for the working environment. Increasing numbers of jobs require technical data skills. One estimate suggests there was over a 50% increase in data professionals between 2013 and 2020 – increasing from 1.1m to 1.7m employees. However, there are also over 100,000 unfilled data professional posts in 2020.[7]

But beyond these jobs requiring technical data skills, most jobs require some data and digital skills, and they are only set to increase in importance. Estimates from a DCMS-commissioned module of the February 2020 ONS 'Opinions and Lifestyle' survey found that nearly half (48%) of the working population use 'basic' data skills at work a lot, and just under a quarter (24%) use more advanced skills, such as data analysis and making graphs, a lot in their current job.[8]

We know that data is a basis for the creation of new jobs that use both general and more technical data skills. TfL's work on open data (below) is estimated to have created 500 jobs directly, and another 230 indirectly.[9] More widely, the European Data Portal predicts a baseline scenario of 1.12m open data employees and an optimistic scenario of 1.97m open data employees in the EU by 2025 (https://www.europeandataportal.eu/sites/default/files/the-economic-impact-of-open-data.pdf). And over 6% of new companies in the UK in 2019 were tech start-ups (https://centreforentrepreneurs.org/cfe-research/business-startup-index/#:~:text=Over%2045%2C000%20tech%20startups%20were,in%20Bournemouth%2C%20Poole%20and%20Christchurch.), with data and the aligned need for increasingly sophisticated data skills underpinning their business models.

By encouraging and supporting the use of data in the UK, we can ensure that the coming waves of technological innovation do not just drive new services but also foster the creation of new businesses and new jobs for the UK.

Case study: Using data in the transport sector

'Intelligent Mobility', the moving of people and goods in an easier and more efficient way, provides an intersection between traditional transport and exciting new products and services relating to mobile devices, open data, wireless communication or the Internet of Things. According to research commissioned by the Transport Systems Catapult, the international Intelligent Mobility market is estimated to grow to just over £900bn a year by 2025, with data comprising an estimated £32bn of this per year by 2025 (https://ts.catapult.org.uk/wp-content/uploads/2016/08/TSC-Intelligent-Mobility-Market-Update-2016-003.pdf).

TfL already uses technology and data to make journeys easier for their customers. By making live travel information available, developers can create software and services, such as online maps and journey planners. The data is provided via an API, which unifies the data for different modes of transport into a common format and structure, where historically they have differed and been hard to layer onto each other.

This data has been used to develop applications used by the public to plan journeys and check for disruptions and has helped create hundreds of jobs. Recent research by Tech City noted London's digital economy was worth £30bn in GVA supporting over 300,000 jobs (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/642813/15780_TSC_Market_Forecast_for_CAV_Report_FINAL.pdf), and the government's Future of Mobility strategy (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/846593/future-of-mobility-strategy.pdf) describes some of the actions being taken to maximise the benefits of data use in the UK's transport sector.

2.3 Increasing the efficiency and scope of scientific research

The UK is a leader in science and research, and data is at the heart of it. New scientific developments driven by data have potentially game-changing applications across the economy, such as tracking public health risks and aiding decarbonisation through smarter energy grids, predictive maintenance of infrastructure or better traffic management.

While data is critical in all research, some of the clearest examples of the benefits to society are in the life sciences. For example, data has been crucial in recognising and understanding the side effects of drugs, identifying the benefits of surgery for patients with Inflammatory Bowel Disease and demonstrating the impact of anti-smoking laws on the number of babies born prematurely in Scotland (https://mrc.ukri.org/research/initiatives/health-and-biomedical-informatics/value-of-using-data/). The UK has also published five principles which will underpin the government's policy framework to govern fair, ethical and appropriate use of health data, while also supporting innovation. More advanced applications of data-driven technology have also provided responses to the coronavirus pandemic, with AI-driven systems being used to predict the virus's protein structure (https://deepmind.com/blog/article/AlphaFold-Using-AI-for-scientific-discovery) and determine which drugs may be effective for treatment, helping prioritise promising candidates for real-world trials (https://www.benevolent.com/news/potential-treatment-for-covid-19-identified-by-benevolentai-using-artificial-intelligence-enters-randomised-clinical-trial).

However, barriers to accessing data represent a significant limitation on research; these range from legal barriers (real and perceived) through to cultural blockers and risk aversion. These barriers must be addressed if the UK is to remain at the forefront of science and research. For example, recent research into data use by the pharmaceutical and life sciences industry (https://s3-eu-west-1.amazonaws.com/media.newmd.catapult/wp-content/uploads/2019/10/22170649/health-data-report.pdf) identified a number of systemic barriers that limit access to data. Most companies surveyed noted having experienced delays and uncertainties. These include time taken to access data, access constraints for commercial users, the effort to identify and assess the quality of data sets and, most notably, the cost of the data itself.

When dealing with sensitive data, the way forward must be considered and appropriate. For example, NHSX (https://www.nhsx.nhs.uk/) is developing a Data Strategy for Health and Social Care in Autumn 2020, which will aim to build on the permissive approach to data sharing for care seen during the coronavirus response, while still protecting the absolute need for patient confidentiality. A similar balance is needed in other instances where risks must be managed while unlocking the significant opportunities from data use at the forefront of science, research and technological development.

Case study: Data-driven clinical trials to tackle coronavirus

Conducting clinical trials that are better, faster and more efficient is a UK priority.

Electronic Health Records (EHR) play a key role in identifying and enabling individuals from across the UK to take part in clinical trials. The UK is well-placed to take advantage of EHRs due to the unified nature of the NHS within the four nations and because a large portion of NHS records are electronic. Using securely stored data, we can find patients from across the UK that might benefit from a particular trial, rather than just a single NHS Trust or geographical location. All while protecting patients' data.

This approach was tested during the response to coronavirus and the RECOVERY trial (https://www.recoverytrial.net/) for potential treatments. These trials normally take months to set up but, designated as an Urgent Public Health Research study, RECOVERY was set up in a matter of days. 12,000 patients from 176 NHS hospital organisations were enrolled in the trial with data being tracked and analysed.

Within 100 days, the trial identified the world's first coronavirus treatment proven to save lives – Dexamethasone. The results were announced on 16 June 2020, adopted into UK practice later the same day and included in new US guidelines within 2 weeks.

RECOVERY was supported by NHS DigiTrials (https://digital.nhs.uk/services/nhs-digitrials), the Health Data Research UK (https://www.hdruk.ac.uk/) hub for clinical trials, which provided centrally collected and curated data on a weekly basis so that progress and outcomes of trial participants could be closely tracked. The data was drawn from extracts from routine EHR data, and supported rapid access to new data assets collected in response to the coronavirus pandemic, such as test data, intensive care data, and GP data. The approach not only removed the burden on the NHS 'front line' to field additional data requests, but enabled the RECOVERY trial team to make rapid decisions.

2.4 Driving better delivery of policy and public services

Data can revolutionise the public sector, creating better, cheaper and more responsive services. Public services are complex to deliver, with services such as the pensions system, the benefits system, the NHS, tax and the courts each engaging with millions of people across the UK every year. Likewise, keeping people safe requires access to the right information. These services and capabilities rely heavily on data, but the systems that handle this data have grown iteratively and independently, increasing in complexity over time. Many legacy systems are out of date, costly to operate and incapable of exchanging data with one another, presenting challenges in a world where public services are increasingly interconnected – be that between health and social care provision, tax and benefits or across policing, courts, prisons and probation.

Our experience responding to the coronavirus pandemic has demonstrated that when we treat data as a strategic asset and improve coordination between organisations, the delivery of services can be more agile, more innovative, more effective and more cost-effective. Indeed, it has underlined the need for the public sector to move away from a culture of risk aversion towards a joined-up approach, where the presumption is that, with appropriate safeguards, data should be shared to drive better outcomes. The rollout of the Coronavirus (COVID-19) Shielded Patients List (https://digital.nhs.uk/coronavirus/shielded-patient-list) showed how much can be achieved through appropriate data sharing across central and local government and the private sector, with over four million support packages distributed to some of the most vulnerable people in society.

For central government, better data also means better decision-making. It means policies that can be tailored and delivered more efficiently and significant savings for the public purse. Better evidence on whether policies are delivering their intended effects in different areas and for different groups means interventions can be far more effectively designed. This aligns with the public's new expectations in our increasingly digital context. As highlighted by the CDEI's public attitudes research (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/864167/CDEJ7 836-Review-of-Online-Targeting-05022020.pdf), for example, 'there is an expectation that the public sector should use online targeting to ensure that advice and services are delivered as effectively as possible.

The problem and the opportunity are not limited to central government. Some of the biggest benefits can be realised by better, more coordinated use of data across the wider public sector – in education, the justice system, health and within local government. As we move to implementation, we will work with partners to better understand the needs and barriers faced by local government in utilising data to its fullest potential. We will cut down on bureaucratic burdens, tackle risk aversion and strengthen the incentives to share data across the public sector. Non-standardisation and a lack of coordination on data mean that data collected by one organisation cannot easily be used by another. This results in duplication of effort and wasted resources. Treating data in the public sector as a strategic asset, with appropriate governance, will save time and money and drive better outcomes for us all.

Case study: Data First

Data First is an ambitious, pioneering data-linking programme led by the Ministry of Justice (MoJ) and funded by UK Research and Innovation through Administrative Data Research UK. The projects it supports will enable researchers in government, universities and other institutions to securely access anonymised extracts of linked administrative datasets held by MoJ and its executive agencies. This can then be linked with data held by other government departments, such as the Department for Education.

Data First will allow researchers to understand how people interact with courts over time and analyse which characteristics influence patterns of frequent use, all to build a much better understanding of what MoJ policies and services are most effective. Researchers will be able to explore how users of the justice system interact with other government services. This will enable a deeper understanding of how the economic, social and educational backgrounds of people who use the justice system influence their needs, the pathways they follow through the system (for example, between the civil and criminal courts) and the outcomes they experience. Such understanding will enable more evidence-informed, targeted support and lead to lower cost, higher-quality public services for everyone in the UK.

Data access will be facilitated by the controlled circumstances of the ONS Secure Research Server, an accredited processor under the Digital Economy Act 2017, which complies with the highest standards of data security and protection outlined by the principles of the Five Safes (https://www.ukdataservice.ac.uk/manage-data/legal-ethical/access-control/five-safes).

2.5 Creating a fairer society for all

Data holds great potential to empower people and civil society, delivering benefits that reach beyond the economy. Powered by better data, civil society organisations can be better equipped to reach the people most in need, at the time they most need it. Better data use could also significantly decrease operating costs, allowing charities to focus resources on protecting the most vulnerable parts of our society. Charities and other non-profits, and particularly smaller organisations, rarely have access to large enough datasets to be able to prove, to very high levels of certainty, the effectiveness of different interventions. Better coordination, re-use and sharing of data between civil society organisations can also lead to better understanding of societal issues, and of what interventions are effective in supporting those most at need. Data can drive applications that make our digital lives better. Artificial intelligence is increasingly being used to drive automated content moderation online, particularly in social media contexts, where it can help tackle misinformation (https://www.ofcom.org.uk/__data/assets/pdf_file/0028/157249/cambridge-consultants-ai-content-moderation.pdf). Data-driven online profiling technologies can help identify potentially vulnerable web users (such as people suffering from gambling addiction), and target support or prevent them from seeing potentially harmful content.

We can harness data as part of struggles to tackle bias and exclusion. Data can be used to hold a mirror up to society – to understand how different groups are faring, and to ensure that government and private sector actions treat people fairly, and are not unintentionally discriminating against protected groups.[10] We must further ensure that data-driven technologies and AI are a force for good. Biases arising from data or algorithm use will need to be addressed to ensure that data's potential is harnessed to drive a better, more inclusive and less biased society rather than entrenching existing problems. This is part of using data in an ethical and responsible way.

Case study: Domestic abuse statistics tool

The Office for National Statistics (ONS) domestic abuse publication brings together data from a range of sources, including the Crime Survey for England and Wales, police recorded crime, other government organisations and domestic abuse services. When taken in isolation, these data

sources may not provide the context required to understand the national and local picture of domestic abuse. However, bringing this data together enables appropriate action to be taken to improve victims' experiences and to help provide a clearer understanding of the criminal justice system's response to perpetrators of abuse.

Alongside the publication, there is also an interactive data tool (https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/datasets/domesticabuseinenglanda ndwalesdatatool) for domestic abuse statistics. This allows users to explore data for their police force area in more detail and compare this with data from other areas. The tool is intended to help shape the questions that need to be answered by police forces and other agencies working with victims and responding to perpetrators of domestic abuse.

The statistics are used to monitor the UK's progress toward the 17 Sustainable Development Goals adopted by all UN Member States in 2015, as part of the 2030 Agenda for Sustainable Development.

2.6 Realising the Data Opportunity

While the preceding examples show the significant promise of better data use, there are considerable challenges preventing us from realising this more broadly and consistently across our economy and society. Organisations do not always make the best use of the data they hold, whether due to a lack of skills, a lack of leadership or a lack of resources – government and the wider public sector provide examples of this. Many organisations are limited in their access to data, much of which is controlled by a small number of key players. When data is available, it may be in formats that are unhelpful or of undetermined accuracy. And while the UK does have a wealth of data skills, these are concentrated in areas of UK expertise like science and technology; we have identified an overall lack of data skills across the workforce as a whole.

To harness the opportunities and realise our vision, we need to drive improvement across the entire data landscape. Through thematic analysis of the responses to our call for evidence, stakeholder engagement and reviewing the wider evidence base, we have organised this into four highly interconnected pillars that describe the basis for better data use. These are:

These are:

Data foundations: The true value of data can only be fully realised when it is fit for purpose, recorded in standardised formats on modern, future-proof systems and held in a condition that means it is findable, accessible, interoperable and reusable. By improving the quality of the data, we can use it more effectively and drive better insights and outcomes from its use.

Data skills: To make the best use of data, we must have a wealth of data skills to draw on. That means delivering the right skills through our education system, but also ensuring that people can continue to develop the data skills they need throughout their lives.

Data availability: For data to have the most effective impact, it needs to be appropriately accessible, mobile and re-usable. That means encouraging better coordination, access to and sharing of data of appropriate quality between organisations in the public sector, private sector and third sector, and ensuring appropriate protections for the flow of data internationally.

Responsible data: As we drive increased use of data, we must ensure it is used responsibly, in a way that is lawful, secure, fair and ethical, sustainable and accountable, while supporting innovation and research.

To ensure that we drive focused change, we have identified five priority missions (outlined in the next section) where the government will emphasise activity across these pillars to begin realising the data opportunity set out above.

Questions on the framing of the strategy

We want to ensure that we produce a forward-looking strategy that takes into account public opinion and delivers real change. These questions will help to inform future work that the government will take in this space. It will provide evidence for the government to target areas for intervention in future policy.

Q1. To what extent do you agree with the following statement: Taken as a whole, the missions and pillars of the National Data Strategy focus on the right priorities. Please explain your answer here, including any areas you think the government should explore in further depth.

NB: For question 2, we are only looking for examples outside health and social care data. Health and social care data will be covered in the upcoming Data Strategy for Health and Social Care.

Q2. We are interested in examples of how data was or should have been used to deliver public benefits during the coronavirus (COVID-19) crisis, beyond its use directly in health and social care. Please give any examples that you can, including what, if anything, central government could do to build or develop them further.

Q3. If applicable, please provide any comments about the potential impact the proposals outlined in this consultation may have on individuals with a protected characteristic (https://www.equalityhumanrights.com/en/equality-act/protected-characteristics) under the Equality Act 2010?

Q4. We welcome any comments about the potential impact the proposals outlined in this consultation may have across the UK, and any steps the government should take to ensure that they take account of regional inequalities and support the whole of the UK.

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3. Missions

This strategy sets out five priority areas of action for the government. By delivering against these missions, we will create the optimal environment for data to drive growth and productivity in the UK for the benefit of all, while helping to solve a number of societal and global issues.

Mission one: Unlocking the value of data across the economy

Data is an incredibly valuable resource for businesses and other organisations, helping them to deliver better services and operations for their users and beneficiaries. However, there is increasing evidence to suggest the full value of data is not being realised because vital information is not getting to where it needs to be.

For example, the Digital Competition Expert Panel's review of competition in Digital Markets and the Competition Market Authority's report into Online Platforms and Digital Advertising highlighted that smaller companies often do not have the same access to data as tech giants, potentially limiting their participation and innovation in digital markets. Improved public sector access to data can also lead to better decision-making at scale. For example, if the government had better data about infrastructure, it could reduce the disruption caused when underground pipes and cables are struck by mistake, or drive more informed choices about where to build new housing.

Our first mission is to create an environment where data is appropriately usable, accessible and available across the economy – fueling growth in organisations large and small.

Much of the transformative potential of data lies in the potential for linkage and re-use of datasets across organisations, domains and sectors. We must ensure that the right conditions and incentives are in place to encourage organisations to work together across the economy, ensuring appropriate and timely access to data that is of sufficient quality. This can aid innovation, ensure the benefits of data can be realised by the maximum possible people in society and aid scientific research.

This is not simply a case of opening up every dataset. We must take a considered, evidence-based approach: government interventions to increase or decrease access to data are likely to have myriad consequences, intended and not. There is a balance to be struck between maintaining incentives to collect and curate data, and ensuring that data access is broad enough to maximise its value across the economy. For personal data, we must also take account of the balance between individual rights and public benefit.

This is a new and complex issue for all digital economies, one that has come to the fore as data has become a significant modern, economic asset. The first step must therefore be the development of a clearer policy framework to identify where greater data access and availability across and with the economy can and should support growth and innovation, in what form, and what government's role should be, in the UK and globally. We will move quickly to build that framework in the coming months by:

- undertaking research to further develop our evidence base on the timely availability of appropriate quality data, set out the economic case and understand the opportunities and rationale for intervention
- drawing on that work, and our existing evidence base, to scope out government's potential role, both with respect to short-term quick wins and longer-term projects
- piloting the most promising interventions, working closely with industry and expert groups
- working closely with the CDEI, the Open Data Institute (ODI) and others to leverage their expertise and capability to support delivery of this agenda

We are proposing the creation of a framework to identify where we can and should make data available in the wider economy. There are a number of ways the government can intervene to achieve this goal – including as a collaborator, steward, customer, provider, funder, regulator and legislator. Using Policy Lab's Style of Government Action (https://openpolicy.blog.gov.uk/2020/03/06/introducing-a-government-as-a-system-toolkit/) could be helpful in thinking about the next few questions.

These questions will provide an opportunity for the government to scope out areas of focus for the data availability framework.

Data availability: For data to have the most effective impact, it needs to be appropriately collected, accessible, mobile and re-usable. That means encouraging better coordination, access to and sharing of data of appropriate quality between organisations in the public sector, private sector and third sector, and ensuring appropriate protections for the flow of data internationally.

Q5. Which sectors have the most to gain from better data availability? Please select all relevant options listed below, which are drawn from the Standardised Industry Classification (SIC) (https://onsdigital.github.io/dp-classification-tools/standard-industrial-classification/ONS_SIC_hierarchy_view.html) codes.

- Accommodation and Food Service Activities

- Administrative and Support Service Activities Agriculture, Forestry and Fishing
- Arts, Entertainment and Recreation
- Central/ Local Government inc. Defence
- Charity or Non Profit
- Construction
- Education
- Electricity, Gas, Steam and Air Conditioning Supply
- Financial and Insurance Activities
- Human Health and Social Work Activities
- Information and Communication
- Manufacturing
- Mining and Quarrying
- Transportation and Storage
- Water Supply; Sewerage, Waste Management and Remediation Activities
- Wholesale and Retail Trade; Repair Of Motor Vehicles and Motorcycles
- Professional, Scientific and Technical Activities
- Real Estate Activities
- Other

Q6. What role do you think central government should have in enabling better availability of data across the wider economy?

Q6a. If yes, what is it? If not, why not? How does this vary across sectors and applications?

Data foundations: The true value of data can only be fully realised when it is fit for purpose, recorded in standardised formats on modern, future-proof systems and held in a condition that means it is findable, accessible, interoperable and reusable. By improving the quality of the data we are using, we can use it more effectively, and drive better insights and outcomes from its use.

Q7. To what extent do you agree with the following statement: The government has a role in supporting data foundations in the wider economy. Please explain your answer. If applicable, please indicate what you think the government's enhanced role should be.

Q8. What could central government do beyond existing schemes to tackle the particular barriers that small and medium-sized enterprises (SMEs) face in using data effectively?

The Smart Data Review (https://www.gov.uk/government/consultations/smart-data-putting-consumers-in-control-of-their-data-and-enabling-innovation) in 2019 consulted on ways to make evolving schemes more coordinated across banking, finance, telecoms and energy. The focus of Smart Data is customers asking their providers to share information about them with third parties who then use this data to offer innovative services to consumers and SMEs.

Q9. Beyond existing Smart Data plans, what, if any, further work do you think should be done to ensure that consumers' data is put to work for them?

Mission two: Securing a pro-growth and trusted data regime

As the world becomes increasingly digitised, data has become a central driving force of the modern economy. So it is vital that the UK has a data regime that promotes growth and innovation for businesses of every size, while maintaining public trust.

The UK is already a world leader in technological innovation and robust data protection standards: two areas required to build and maintain privacy, security and public confidence.

We will build on these strengths to maintain a data regime that supports the future objectives of the UK outside of the EU. A pro-growth legal regime must include consideration of both regulation in the wider digital and technology landscape, which will be addressed in the government's forthcoming Digital Strategy, as well as our data protection laws.

As with all policy areas, the UK will control its own data protection laws and regulations in line with its interests after the end of the transition period. We want our data protection laws to remain fit for purpose amid rapid technological change. Far from being a barrier to innovation or trade, we know that regulatory certainty and high data protection standards allow businesses and consumers to thrive. We will seek EU 'data adequacy' to maintain the free flow of personal data from the EEA, and we will pursue UK 'data adequacy' with global partners to promote the free flow of data to and from the UK and ensure that it will be properly protected.

But data is now a far more influential force in our economy than ever before – with the potential to affect the structure and competitiveness of entire markets. This has serious implications for innovators, not least in the way our approach to data affects the ease, costs and risks of developing new technologies and services. The government needs to create the conditions to support vibrant competition and innovation, which will in turn drive future growth.

To build a world-leading data economy, we must maintain and bolster a data regime that is not too burdensome for the average company – one that helps innovators and entrepreneurs to use data legitimately to build and expand their businesses, without undue regulatory uncertainty or risk in the UK and globally.

Given the rapid innovation of data-intensive technologies, we also need a data regime that is neither unnecessarily complex nor vague. Businesses need certainty to thrive, and the government will work with regulators to prioritise timely, simple and practical guidance, especially for emerging technologies, and create more opportunities to experiment safely.

We want to encourage the widespread uptake of digital technologies more broadly – both for the benefit of the economy and wider society. We will work with regulators to provide more support and advice to small and medium-sized businesses to help them expand online, lifting compliance burdens where possible. We will also prioritise the development of sector-specific guidance and co-regulatory tools to accelerate digitisation across the UK economy.

Amid all this technological change, we want people to be active agents in the digital revolution. This is a shared responsibility of both businesses and individuals.

- **Businesses** and other data-using organisations should be clear and transparent about how they collect and use data responsibly. Working with the CDEI, the government will partner with industry to identify and incentivise best-practice.
- **People** should be empowered to choose whether and how to share data in both the public and private sectors, including where the use of their data can help others. In turn, the government will remain committed to high data protection standards so that data processing is fair and does not result in discriminatory outcomes.

People, businesses and other data-using organisations need the right data skills to participate actively. Individuals should have the basic data skills to be able to engage with and understand what is happening to their data. UK organisations will need access to top talent in data science, data engineering and related fields, as well as data-literate workforce.

Q10. How can the UK's data protection framework remain fit for purpose in an increasingly digital and data driven age?

In section 7.1.2 we lay out the functions of the Centre for Data Ethics and Innovation (CDEI), set up in 2018 to advise the Government on the use of data-driven technologies and AI.

Q11. To what extent do you agree with the functions set out for the CDEI – AI monitoring, partnership working and piloting and testing potential interventions in the tech landscape? Please explain your answer.

Q11a. How would a change to statutory status support the CDEI to deliver its remit?

Mission three: Transforming government's use of data to drive efficiency and improve public services

There is massive untapped potential in the way the government uses data. The coronavirus pandemic showed how much can be achieved when government departments and the wider public sector share vital information to solve problems quickly. We have a duty to maintain that high watermark after the pandemic, and will implement major and radical changes in the way the government uses data to drive innovation and productivity across the UK. In doing so, we will improve the delivery of public services, as well as our ability to measure the impact of policies and programmes, and to ensure resources are used effectively.

There is already consensus amongst experts both inside and outside government – including academics, civil society and parliamentarians – on the need to address this challenge and to capitalise on the opportunities.

However, there are numerous obstacles to achieving our ambitions, many of which are long-term and systemic. These include: real and perceived legal and security risks of sharing data; a lack of incentives, skills or investment to drive effective governance and overhaul data infrastructure; and a lack of consistency in the standards and systems used across the government, making it hard to share data efficiently.

These obstacles are not insurmountable, and we have both the ambition and the commitment to tackle them.

To succeed, we need a whole-government approach led by a Government Chief Data Officer from the centre in strong partnership with organisations. We need to transform the way data is collected, managed, used and shared across government, including with the wider public sector, and create joined-up and interoperable data infrastructure. We need the right skills and leadership to understand and unlock the potential of data – and we need to do so in a way that both incentivises organisations to do the right thing, as well as build in the right controls to drive standardisation, consistency and appropriate data use.

To achieve this objective, we will need to drive change across five key areas:

1. **Quality, availability and access**: striving towards improved data quality that is consistent, a clear understanding of what data is held and where, better data collection, and efficient data-sharing between organisations. All should be the norm, rather than the exception.
2. **Standards and assurance**: setting and driving the adoption of standards for data, leading to greater consistency, integrity and interoperability, and enabling data to be used widely and effectively across government.

3. **Capability, leadership and culture**: developing world-leading capability in data and data science across central and local government, so that leaders understand its role, expert resource is widely available, staff at all levels have the skills they need, and a 'data-sharing by default' approach across government tackles the culture of risk aversion around data use and sharing.

4. **Accountability and productivity**: opening government up to greater scrutiny and increasing accountability, ensuring that this drives improvements in productivity, policy and services for people, while also ensuring data security; and using procurement to drive innovation and better outcomes.

5. **Ethics and public trust**: this transformation will only be possible and sustainable if it is developed within a robust ethical framework of transparency, safeguards and assurance which builds and maintains public trust in the government's use of data.

The government is going to set an ambitious package of work in this space and wants to understand where we can have the biggest impact.

Q12. We have identified five broad areas of work as part of our mission for enabling better use of data across government:

- Quality, availability and access
- Standards and assurance
- Capability, leadership and culture
- Accountability and productivity
- Ethics and public trust

We want to hear your views on which of these actions will have the biggest impact for transforming government's use of data.

Q13. The Data Standards Authority is working with a range of public sector and external organisations to coordinate or create data standards and standard practices.

We welcome your views on which if any should be prioritised.

Mission four: Ensuring the security and resilience of the infrastructure on which data relies

With data now a critical part of modern life, we need to ensure the infrastructure underpinning it is safe, secure and resilient. The infrastructure on which data relies is a vital national asset – one that supports our economy, delivers public services and drives growth – and we need to protect it appropriately from security risks and other potential service disruption.

In the UK, the government already imposes safeguards and enforcement regimes to ensure that our data is handled responsibly. But we will also take a greater responsibility in ensuring that data is sufficiently protected when in transit, or when stored in external data centres.

The government will determine the scale and nature of risks and the appropriate response, accounting for emerging trends.

We will tackle the cyber threats that arise from those seeking to harm the UK head on. We will shape a more secure technology environment, and improve cyber risk management in the economy to make the UK resilient to cyber threats. The increasingly international nature of data collection, storage and

transfer can present data security risks. We will determine whether current arrangements for managing data security risks are sufficient to protect the UK from threats that counter our missions for data to be a force for good.

Data use creates other risks. Better use of data has the potential to help solve wider climate change problems and help the UK meet its net zero 2050 target, but we will also consider government's and businesses' responsibility for the environmental impact of increased data use. We will look to understand inefficiencies in stored and processed data, and other carbon-inefficient processes.

The infrastructure on which data relies is the virtualised or physical data infrastructure, systems and services that store, process and transfer data. This includes data centres (that provide the physical space to store data), peering and transit infrastructure (that enable the exchange of data), and cloud computing that provides virtualised computing resources (for example servers, software, databases, data analytics) that are accessed remotely.

Q14. What responsibilities and requirements should be placed on virtualised or physical data infrastructure service providers to provide data security, continuity and resilience of service supply?

Q14a. How do clients assess the robustness of security protocols when choosing data infrastructure services? How do they ensure that providers are keeping up with those protocols during their contract?

Q15. Demand for external data storage and processing services is growing. In order to maintain high standards of security and resilience for the infrastructure on which data use relies, what should be the respective roles of government, data service providers, their supply chain and their clients of such services?

Q16. What are the most important risk factors in managing the security and resilience of the infrastructure on which data relies? For example, the physical security of sites, the geographic location where data is stored, the diversity and actors in the market and supply chains, or other factors.

Q17. Do you agree that the government should play a greater role in ensuring that data does not negatively contribute to carbon usage? Please explain your answer. If applicable, please indicate how the government can effectively ensure that data does not negatively contribute to carbon usage.

Mission five: Championing the international flow of data

In our hyper-connected world, the ability to exchange data securely across borders is essential. Economically, it drives global business, supply chains, trade and development; it will also be critical in enabling the global recovery after coronavirus. On a personal level, people rely on the flow of personal data to ensure their salaries are paid and to connect with loved ones from afar; this data in particular needs to be suitably protected. Finally, it has a huge impact on international cooperation between countries, including for law enforcement and national security, keeping the public safe.

Having left the European Union, the UK now has a unique opportunity – as a world leader in digital and as a champion of free trade and the rules-based international system – to be a force for good in the world, shaping global thinking and promoting the benefits that data can deliver while managing malign influences.

Using our international engagement and influence, we will:

1. **Build trust in the use of data**: We will create the regimes, approaches and tools to ensure personal data is appropriately safeguarded as it moves across borders. This will include looking to secure positive adequacy decisions from the EU to allow personal data to continue to flow freely from the EU/EEA to the UK, implementing an independent UK Government capability to conduct data adequacy assessments for transfers of personal data from the UK, and working with the Information Commissioner's Office (ICO) to build cooperation between national data authorities. The importance of data to our daily lives has made it a geostrategic tool. We will establish clear expectations of accountability when processing data – to protect personal data when it moves across the globe. These criteria will align with the UK's stance on promoting its wider values, ethics and national interests.

2. **Facilitate cross-border data flows**: We will work globally to remove unnecessary barriers to international data flows. We will agree ambitious data provisions in our trade negotiations and use our newly independent seat in the World Trade Organisation to influence trade rules for data for the better. We will remove obstacles to international data transfers which support growth and innovation, including by developing a new UK capability that delivers new and innovative mechanisms for international data transfers. We will also work with partners in the G20 to create interoperability between national data regimes to minimise friction when transferring data between different countries.

3. **Drive data standards and interoperability internationally**: We will cooperate with nations to develop shared standards that align with the UK's national interests and objectives. In a global arena, technical standards are increasingly expressions of ethical and societal values, as well as industry best practice. Recognising this, the UK will support global work on interoperability, which will facilitate the combination and cross-referencing of different data sources. This will include support to the collaborative on interoperability, an outcome of the UN World Data Forum in January 2017. The UK Government will also work with like-minded states to seek to ensure our values are considered and incorporated into the standards for new technologies which substantially impact data and their data trail.

4. **Drive UK values internationally**: The UK will be a champion of good-quality, available data across the globe. We want to ensure that UK values of openness, transparency and innovation are adopted worldwide. Now the UK has left the EU, we have an opportunity to set the UK apart and take an independent, individual approach that extols UK values. National competitiveness and the balance of power internationally are increasingly based on technology and the data that drives it. We want to ensure that UK values of openness, transparency and innovation, as well as the protection of security and ethical values, are adopted and observed globally. The UK will continue to play a leadership role to meet the urgent need for open, inclusive data, and its commitments under the International Aid Transparency Initiative. And we will continue to support the work of the Open Government Partnership to open up governments across the globe.

As the UK leaves the EU, we have the opportunity to develop a new UK capability that delivers new and innovative mechanisms for international data transfers.

Q18. How can the UK improve on current international transfer mechanisms, while ensuring that the personal data of UK citizens is appropriately safeguarded?

We will seek EU 'data adequacy' to maintain free flow of personal data from the EEA and we will pursue UK 'data adequacy' with global partners to promote the free flow of data to and from the UK and ensure it will be properly protected.

Q19. What are your views on future UK data adequacy arrangements (e.g. which countries are priorities) and how can the UK work with stakeholders to ensure the best possible outcome for the UK?

4. Data foundations: ensuring data is fit for purpose

In this section:

- 4.1 Data foundations in the wider economy and society
- 4.2 Data foundations across government and the wider public sector
- 4.3 Supporting data foundation internationally

If the UK is to fully realise the benefits of our ongoing technological transformation, we must start by getting the basics right. This means being more effective in how we collect, curate, store, manage and delete data. Left alone, data does not sort itself out. If it is to become a powerful tool that can transform organisations and society, data requires effective governance, management and stewardship. It also requires modern infrastructure, allowing data to be shared across systems that can interact with one another.

Data Foundations

In this strategy we are using the term 'data foundations' to mean data that is fit for purpose, recorded in standardised formats on modern, future-proof systems and held in a condition that means it is findable, accessible, interoperable and reusable.

The case for change in public sector data use is clear. Presently, data is not consistently managed, used or shared in a way that facilitates informed decision-making or joint working across government and the wider public sector (https://www.nao.org.uk/wp-content/uploads/2019/06/Challenges-in-using-data-across-government.pdf). Data remains undervalued and underexploited (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/752003/Getting_smart_about_intellectual_property_and_other_intangibles_in_the_public_sector_-_Budget_2018.pdf).

Modernising the way we manage and share data across government will generate significant efficiency savings and improve services. To succeed, we must expand work to treat data as a strategic asset, and create a whole-government, collectively responsible approach to investing in data foundations, so that everyone can benefit from the improved outcomes data can offer.

The picture is more varied across the private and third sectors. While the UK is home to many world-leaders in data use, driving innovation and better services for consumers, this is not universally the case. Responses to our call for evidence and the wider existing evidence base suggest that across all sectors of the economy – perhaps particularly for SMEs and the third sector – issues include a lack of understanding about how data can be used, and used well; these issues are felt at most levels of organisations.[11]

The lack of basic coordination and interoperability both within and between organisations can drive inefficiency, a lack of accountability and an inability to thoroughly evaluate or plan. Data that is not usable, linkable or comparable between organisations means that, nationally, we lose out on the 'positive externalities of data' (https://www.bennettinstitute.cam.ac.uk/media/uploads/files/Value_of_data_summary_report_26_Feb.pdf) – on the ability to pool data from multiple sources and sectors to create new economic opportunities, or to save lives.

Indeed, even those working on advanced technologies report that poor data foundations can be a real blocker for driving the transformative power of data. For example, when the source data needed to power AI or machine learning is not fit for purpose, it leads to poor or inaccurate results, and to delays in realising the benefits of innovation (https://www.gov.uk/government/publications/cdei-ai-barometer).

With better data, we can unlock new opportunities for businesses to grow and innovate. We can vastly improve and streamline public service delivery and offer consumers greater power and choice in the market.

4.1 Data foundations in the wider economy and society

Poor data quality and, relatedly, a lack of agreed standards are clear barriers to the effective use of data, from basic record-keeping to cutting-edge applications of data-driven technology. Responses to our call for evidence and stakeholder engagements highlighted common issues around:

- a lack of (central) ownership of data standards/ metadata/ APIs
- a lack of skills in managing data
- the pace of change leading to a fragmentation in the systems used to manage data, with ongoing resourcing issues linked to set up and maintenance costs

Some respondents suggested these costs could be especially burdensome for smaller organisations, or for organisations who make data as a bi-product of their operations rather than as a discrete business product. There was anecdotal evidence from our call for evidence that in general SMEs find it more difficult than large companies to invest in and maintain high quality data. There are pockets of stronger evidence for particular types of business. For example, the construction industry has well recognised Business Information Management (BIM) standards.[12] However, a range of academic studies find SMEs in construction generally do not use BIM. The issues identified by SMEs include:

- perception that BIM is only of benefit for larger construction projects
- high set-up costs of software
- licensing of software
- lack of in-house skills and/or cost of training.
- information retention across platforms (interoperability) – despite the industrial strategy supporting BIM
- lack of demand from clients (so no push to adopt the greater functionality)[13]

Pulling together the pockets of evidence with the wider anecdotal points, it is likely these issues do act beyond just the construction industry. The wider evidence base on the impacts of improving data 'foundations', and conversely the effect of not investing in them, is not especially strong. There appears to be little robust and independent research into the case for – and means of – implementing data quality, standards and management-improvement measures. This could be for a number of reasons:

- definitions vary, with a lack of consensus on how to measure the constituent elements of 'data foundations'
- most organisations would not want independent analysts studying their proprietary data, because of the risks to reputation or intellectual property

This is an apparent evidence gap that the government intends to address. Taking the limited research that does exist, there appears to be widespread concerns for 'data foundations' in the private and third sectors, with some consensus that small businesses, charities and SMEs are particularly affected. These problems are seen to result in loss of time and risk lower quality business decisions and operation.

Any way forward must be carefully considered, and one size will not fit all. Some barriers to better data use, even when substantiated by evidence, will not necessarily warrant government intervention. Poor data quality within organisations, for instance, is unlikely to warrant government intervention, unless it stops them carrying out a legal or statutory requirement. Even then, it is more likely to be a question for

enforcers or regulators (for example, if poor records lead to poor or negligent care, or if an organisation's poor data management procedures lead to a data breach that warrants ICO involvement).

What could warrant intervention is the need to drive better quality, more standardised and interoperable data to help drive economic growth or enable a public good outcome, especially where the value of the data sits beyond its immediate use. The government has taken decisive action to unlock the power of location data and data about the built environment – as exemplified by the Geospatial Commission and through our world-leading National Digital Twin programme (https://www.cdbb.cam.ac.uk/what-we-do/national-digital-twin-programme). The government has acted to further ADR-UK's work to transform the way researchers are able to access public sector administrative data by using the Research Powers of the Digital Economy Act (2017). There may be a case for extending this approach to other areas of the economy. In the first instance, we will take the actions outlined in the section below, and are seeking your views where stakeholder input and debate might push the agenda forward.

4.1.1 Consolidating a clear framework for government action in the wider economy

The government is committed to tackling market failures that mean the foundations of data use in the wider economy are missing or misaligned. Interoperable and consistent data can bring wide economic benefits. However, data of sufficient quality comes with a cost, and businesses can lack the information they need to make resourcing choices. Organisations report being tied into contracts on legacy systems that make collecting and maintaining data in interoperable formats harder. We know that a lack of coordination can act as a barrier to interoperability. And where businesses require data in certain formats for their business practices, such data may be undersupplied by the current market.

This is a new and complex issue that has come to the fore as data has become a more significant modern, economic asset. We are committed to addressing these issues, as highlighted in Mission 1 (Unlocking the value of data across the economy). This is a complex area, with many actors and the potential for unintended consequences. Before moving to consolidate this framework, we are keen to work in partnership with stakeholders as highlighted by our consultation questions and plans for future engagement. We are further working to build on the evidence base by commissioning research that deepens how we understand the government's role in driving data availability in the economy.

The steps we will take to consolidate the framework and approach, working with regulators and the Better Regulation Executive where appropriate, will include the coordination and alignment of existing work to build on data foundations across the economy, such as:

- working across the physical environment, including the standardisation of data about location, the built and natural environment, and transport and other infrastructures. This will include further developing the Information Management Framework (https://www.cdbb.cam.ac.uk/news/pathway-towards-IMF), which will seek to establish a common language by which digital twins can communicate securely and effectively, part of the Centre for Digital Built Britain's work towards developing a National Digital Twin.
- maximising the use of trusted data in innovation at the national and local level through supporting the new UK R&D roadmap (https://www.gov.uk/government/publications/uk-research-and-development-roadmap). This will include taking decisive action to drive the standardisation and interoperability of data for research, science and innovation, and improving the access to trusted data resources at local and regional levels, with further actions to be confirmed as joint work on R&D progresses.
- bolstering efforts to ensure that consumers' data is put to work for them

Case study: the Food Hygiene Ratings Scheme

The Food Hygiene Rating Scheme (FHRS) is an established, government-led open data service. Diners across the UK will recognise the scheme from the green stickers on restaurant windows. The scheme was set up in 2010, with a web service and an associated API created in 2012. The scheme serves in the region of 120 million API calls a year and covers over 400 local authorities in the UK.

The Food Standards Agency makes these ratings available as open data to platforms such as Just Eat, Uber Eats and Deliveroo. This data can then be combined with other data sources to support consumers and platforms in making more informed choices about where to eat and which businesses to feature.

Behind the FHRS is a complete and rigorous method of food safety and hygiene assurance based on best practice developed over many years. Due to the open availability of its data, the scheme has also been used for purposes beyond its original intention. For example, the FHRS was used by the Department for the Economy in Northern Ireland to help close the business rates gap (https://www.odcamp.uk/open-data-case-study-how-belfast-found-350000-in-rates-revenues-using-open-fhrs-data/).

The usual method of targeting missing rates is to conduct manual inspection on high value properties, but the Department for Economy used FHRS data, along with other datasets, to work out which properties were likely to be occupied. This targeted approach increased the success rate of inspections in a two-week period and enabled the pilot to identify £350,000 in business rates that were not being collected. In another example, FHRS data was correlated with other datasets allowing it to be used to help identify risks as diverse as the location of fatbergs in the sewers. The power of the FHRS as a tool for consumers lies in its simplicity, which is achieved without compromising its underlying fidelity.

4.2 Data foundations across government and the wider public sector

In our call for evidence, issues related to 'data foundations' were particularly highlighted across government and the public sector. Key issues included:

- data quality issues, and different standards for data used at all stages of the data lifecycle from collection to publicly available datasets, and the (in)consistent use of metadata – where it was provided at all
- issues with legacy systems and different, often incompatible systems for inputting and recording data at different stages of the data journey
- a lack of resources for local authorities to deal with data issues
- a lack of senior buy-in and leadership on data
- a lack of alignment across government

The case for change for government and the wider public sector's use of data is well established. The Chancellor of the Duchy of Lancaster stressed the importance of using data more effectively (https://www.gov.uk/government/speeches/the-privilege-of-public-service-given-as-the-ditchley-annual-lecture) to measure the impact of policies and make the best value-for-money decisions, for the greatest benefit, while increasing accountability. As highlighted by the National Audit Office (NAO) report – Challenges in using data across government (https://www.nao.org.uk/wp-content/uploads/2019/06/Challenges-in-using-data-across-government.pdf) – too often data is not seen as a key priority, the quality of data is not well understood and there is a culture of tolerating and working around poor-quality data. Inefficiency and cost can arise not just from poor-quality data, but also from a lack of coordination in data systems.

The NAO report referenced above also found that a lack of standards across government has led to inconsistencies in the way data is recorded between departments, including identifying numerous methods of capturing and storing data on individuals and businesses. This makes it extremely challenging for the government to get a holistic view of problems and limits the ability of departments to benefit from new technologies and tools.

These problems extend into the wider public sector. For example, effective electronic health recording systems play an important role in direct care, service delivery and research. While many of these systems are likely working to the same data standards and many neighbouring Trusts have interoperable systems, a recent study (https://spiral.imperial.ac.uk/bitstream/10044/1/75302/9/ImprovingDataSharingBetweenAcuteHospitals.pdf) indicated that, of the 117 NHS trusts using electronic health recording systems, 92 of them were using at least 21 different medical records systems, making it harder to coordinate and effectively share information. Ensuring these systems are fully functional and interoperable is vital if we want to continue to realise their benefits. The government took decisive steps at the March 2020 Budget, announcing the establishment of the Data Standards Authority, the Government Data Quality Hub and the development of an integrated platform for data across government. In July 2020, the Cabinet Office also assumed responsibility for government use of data to drive coordinated improvements in the use of data in policy making and service delivery. More remains to be done.

4.2.1 Data quality and technical barriers to data use and re-use across government

We will improve data quality across the public sector, ensuring that this data is not fragmented, siloed or duplicated across different organisations, and is deleted appropriately. Even the best-quality data cannot be maximised if it is placed on ageing, non-interoperable systems. The government is committed to removing the barriers to data interoperability presented by variations in the hardware and software used across government,[14] including by using processing techniques that make data 'independent' of the infrastructure that contains it.

We will:

- launch a programme of work to tackle the cultural and coordination barriers to good quality data, including:

  - creating a central team of experts able to ensure a consistent interpretation of the legal regime around data sharing
  - launching the Data Quality Framework
  - creating a Data Maturity Model for government
  - building a data management community of good practice
  - learning and setting best practice and guidance through a series of flagship demonstration – or 'lighthouse' – projects

- implement the recommendations of the 'Joined-up data in government: the future of data linking methods' (https://www.gov.uk/government/publications/joined-up-data-in-government-the-future-of-data-linking-methods) report to improve data linkage methods, application and skill sets across government
- commit to resolving the long-running problems of legacy IT and broader data infrastructure
- drive data discoverability across government through:

  - developing an Integrated Data Platform for government, which will be a safe, secure and trusted infrastructure for government's own data. It will be a digital collaborative environment that will support government in unlocking the potential of linked data, building up data standards, tools and approaches that enable policymakers to draw on the most up-to-date evidence and analysis to support policy development, improving public services and improving people's lives.
  - creating an audit of data inventories

- work to better support local government in maximising the benefits of data

4.2.2. Standards and assurance

To ensure that data is reusable and interoperable across government,[15] we have established a Data Standards Authority, with ongoing work to identify and agree a prioritised list of data standards to adopt across government. In the past, standards around data have been seen as voluntary. The result has been inconsistent adoption and a failure to realise the benefits – we will tackle this through a prioritised approach to mandating certain standards and using spend controls to drive others.

We will:

- develop and validate a set of data principles to be applied across government
- set out a strategy for standards, to include:

  - clarity on where the Data Standards Authority will mandate some standards
  - use of the DDaT spend controls process
  - a parallel controls process for APIs and Technology Code of Practice to ensure consistent adoption of data standards across government

4.2.3. Productivity and accountability

To ensure that these changes are effective, we will tackle data governance across government, challenging risk aversion and data-hoarding, driving consistent levels of data maturity and ensuring a joined-up approach to establishing appropriate safeguards. A whole-government approach on data requires oversight and accountability from the top and centre of government, and through each department; we will ensure aligned accountability mechanisms, as well as a set of senior data leaders with the relevant expertise and backing and support from across government.

We will:

- recruit senior cross-government data leadership, including a Chief Data Officer for government
- establish a cross-departmental governance mechanism with the authority to enforce standards across government
- drive aligned governance structures across government by:

    - undertaking a review of governance structures for data within departments
    - ensuring central government departments include data management plans in their Single Departmental Plans

Case Study: Harnessing the power of administrative data to transform statistical systems for the public good

Timely population, migration, social and economic statistics reflecting regional variations better enable the government to proactively respond to trends, and to react more effectively to crises.

ONS is using administrative data to transform its statistical systems, efficiently providing more timely, flexible statistics and analysis to decision-makers. These transformed systems will, in turn, provide greater insight across key aspects of our society and the economy, ultimately leading to better outcomes for the public.

4.3 Supporting data foundations internationally

Beyond our borders, and as brought to the fore most recently, a lack of basic data maturity, standardisation and interoperability on the international stage can mean that it is difficult to thoroughly understand issues that affect us globally, such as the difficulty in comparing transmission or mortality figures in the early stages of the coronavirus pandemic.

In the global arena, technical standards are increasingly expressions of ethical and societal values, as well as industry best practice. As we set in place our domestic data strategy, we must engage our global partners to adopt complementary measures so they can fully embrace and harness the innovations that data can bring. We must also work with like-minded states to ensure our values are considered and incorporated into the standards of new technologies which substantially impact data and their data trail.

We want to be a data champion across the world.

We will:

- support the global effort on data interoperability, which will facilitate the combination and cross-referencing of different data sources
- collaborate with our international partners to build strong national statistical systems to drive economic growth and help to deliver inclusive, effective services

Case study: Ordnance Survey and Singapore's exploration of a 3D geospatial data model

In 2016-19, following prior joint research programmes, Singapore turned to the UK's Ordnance Survey (OS) for expertise in geospatial data standards and interoperability to help pave the way and enable enhancements to their 3D 'digital twin' of Singapore.

OS carried out two projects involving a variety of stakeholders and discovered data requirements. An efficient data-capture process for a variety of city 'themes' (e.g. buildings, vegetation, street furniture and transport) was identified and set up. A key part of the challenge was to select relevant information 'locked away' in building information management (BIM) models, and to make it accessible through an open standards data model to wider stakeholders, such as city planners or regulatory bodies, who would benefit from the data to test new developments or city planning initiatives.

Based on these findings, joint collaboration between OS and the National University of Singapore led to the development of an 'IFC2CityGML transformation engine' – a software tool capable of automating the transfer of detailed building model information for different geospatial use cases. The project also helped to improve engagement, understanding and collaboration across the BIM and geographic information systems communities in Singapore, creating a new building theme with enhanced semantic representations for mobility, energy and urban planning. In the UK, OS is continuing to innovate with spatial-visualisation and data-integration techniques, combining them with other technologies such as Artificial Intelligence and machine learning. By applying common standards to practical solutions, OS is ensuring that the right information can get to the right people at the right time – and, crucially, in the right format.

5. Skills: Data skills for a data-driven economy and data-rich lives

In this section:

- 5.1 Driving clarity and coordination
- 5.2 Ensuring formal and vocational education rises to the challenge
- 5.3 Driving data skills across the public sector: capability, leadership and culture

Data skills deliver benefits across the board. Businesses are more likely to be competitive in today's digital-driven economy if they can use data effectively. Likewise, data-literate individuals are more likely to benefit from and contribute to the increasingly data-rich environments they live and work in, while data-driven companies can deliver significant productivity benefits to their own business and the wider economy.

The need for data skills continues to grow across the economy. The Royal Society reports that demand for specialist data skills has more than tripled since 2013, while DCMS-commissioned analysis of 9.4 million online job adverts predicts that data analysis skills will be the fastest growing digital skills cluster over the next five years. This characterises the exponential growth in the demand for advanced applications of data science and machine learning across all sectors of the economy, from cyber to construction. The growth in AI and cyber specialisms also drives the demand for broader supply of data skills at foundational level, to feed the pipeline of advanced skills and to provide business with the foundational skills they need to work with data. Notably, these scarce skills have been critical in the deployment of research capabilities to the coronavirus response. The portion of UK R&D that they support is significant and growing rapidly.

Data skills

There is no widely agreed definition of data skills. In this document we use the term broadly to cover the full range of basic, technical, governance and other skills – including project management, governance and problem solving – needed by practitioners to maximise the usefulness of data.

The required technical skills range from programming, data visualisation, analysis and database management, to core skills such as problem solving, project management and communication.

Planning for and delivering data at the right quality requires a wide range of skills that are sometimes underappreciated. Assurance of data requires people familiar with data laws and ethical oversight. Data processing and analysis skills, used to turn data into useful information, span a wide range of capabilities comprising both technical and soft skills.

Basic data literacy requires some knowledge of data uses, some ability to assess the quality of data and its application, and the skills to conduct basic analysis.

Consultation with data experts, the responses to the call for evidence and a review of existing research identifies a number of challenges involved in helping both individuals and companies develop the data skills they need. These include:

- **Lack of coordinated vision and leadership across multiple industry interests**. Many of the issues with data skills lie parallel to the issues with AI and Cyber skills needs. For example, almost half of UK businesses are facing a cyber skills gap (https://www.gov.uk/government/publications/cyber-security-skills-in-the-uk-labour-market-2020/cyber-security-skills-in-the-uk-labour-market-2020). A coherent approach across all skills stakeholders and landscapes will be required, as will enhanced efforts to drive diversity in skills provision.

- **Greater clarity needed in describing data skills required by industry**, which will help assessment of individual skill sets and will ensure a better match of new recruits to company requirements.

- The need for the formal and vocational education system to **better prepare those leaving school, further education and university for increasingly data-rich lives and careers** (https://royalsociety.org/-/media/policy/projects/dynamics-of-data-science/dynamics-of-data-science-skills-report.pdf?la=en-GB&hash=212DAE7D599B0A48687B372C90DC3FEA). Foundational data literacy will be required by all. Working with industry will be necessary to help ensure that the supply of specialist data skills meets and responds to companies' changing requirements.

- **Industries needing to develop their understanding of their own data skills needs**, including how to define and source these requirements, and how to develop or source employees with the right mix of sector and specialist knowledge. Companies that are able to meet these challenges, particularly through senior buy in and advocacy, will likely thrive in a data-driven economy (https://www.splunk.com/pdfs/dark-data/the-state-of-dark-data-report.pdf).

- **A limited pool of data-skilled individuals nationally**, with the cost of hiring and retaining such staff preventing the government from accessing the data skills it needs. The NAO's 'Challenges in using data across government' (https://www.nao.org.uk/wp-content/uploads/2019/06/Challenges-in-using-data-across-government.pdf) report also highlights the current gap in skill sets "at several levels": legal and ethical data use; data storage, management and architecture; and planning and data governance. These points were reiterated in responses to the NDS call for evidence and roundtable discussions.

The government is committed to working with the devolved administrations to align activity on advanced data, digital and R&D skills to support vibrant career pathways and to attract talent. Further actions will be laid out through the government's upcoming Digital Strategy and through the next steps of the R&D Roadmap.

5.1 Driving clarity and coordination

5.1.1 Definition of data skills and role descriptors

Research commissioned by DCMS (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/807830/No_Lo nger_Optional_Employer_Demand_for_Digital_Skills.pdf) and the Royal Society (https://royalsociety.org/-/media/policy/projects/dynamics-of-data-science/dynamics-of-data-science-skills-report.pdf?la=en-GB&hash=212DAE7D599B0A48687B372C90DC3FEA), and responses to our call for evidence, all indicate that there is an inconsistent use of data role descriptors – an employee in a data scientist role at one company may have a distinctly different skill profile than a data scientist at another firm. There is often a lack of clear distinction between data skills, digital skills, AI skills and similar terms. This inconsistent use of role descriptors and the lack of clear distinctions between skills complicates skills assessment and makes it difficult to recruit staff with the specific skills required.

As highlighted in responses to our call for evidence, there is a need to develop and promote clearer career pathways for individuals looking to work in data roles. This is also true of related roles in AI and cyber security.[16] Importantly, many of these roles are underpinned by common skills, whether that be specific technical skills or more general aptitude.

We will:

- publish a working definition of data skills for the wider economy, set out a clear distinction between data skills, digital skills and AI skills, and consider the benefits of providing information on pathways into data related careers

This will build on industry initiatives, such as the Royal Statistical Society-led project (https://rss.org.uk/news-publication/news-publications/2020/general-news/professional-standards-to-be-set-for-data-science/) to establish industry-wide professional standards for data science, and existing government initiatives to fully describe data skills within the existing DDaT framework.

5.1.2 National leadership in data skills

There are a number of national institutions that are involved in data skills related work. These include the Alan Turing Institute (National Institute for Data Science and Artificial Intelligence), the National Innovation Centre for Data, and the ODI. However, their respective roles in addressing the UK's data skills challenges are not clearly understood by all, which can lead to coordination issues, confusion among industry and the need for a more unified voice.

The Data Skills Taskforce was set up – partly in response to a recommendation in Nesta's Analytic Britain report – to act as a knowledge and best practice-sharing forum across key participants from industry and higher education, and to promote data skills and analytics. It has a wide range of members from industry, academia, Royal Societies and government.[17]

In related areas, the government has created the AI Council and UK Cyber Security Council. As independent bodies capable of providing authoritative advice and representing their communities, these are intended to serve as national leadership in AI and cyber security, respectively. The Data Lab, partly funded by the Scottish government, aims to help Scotland maximise value from data and plays a key role in helping to develop data skills in Scotland.

We will:

- consider the roles of the Alan Turing Institute, the National Innovation Centre for Data, the ODI, the Data Skills Taskforce, the AI Council, the UK Cyber Security Council and others in the data skills ecosystem in order to improve the leadership and facilitation of new and better collaborations between industry, the public sector, universities and institutes

5.2 Ensuring formal and vocational education rises to the challenge

5.2.1 Schools

This data revolution has implications not only for experts with advanced analytical skills, but for the entire UK workforce. While we do not all need to become data scientists, everyone needs some level of data literacy in order to operate successfully in increasingly data–rich environments.[18]

To prepare the workforce of tomorrow to contribute to – and benefit from – a data-rich environment, it is important for everyone leaving our schools and universities to be better prepared for data-rich lives and careers. This has been emphasised by Royal Society (https://royalsociety.org/-/media/policy/projects/dynamics-of-data-science/dynamics-of-data-science-skills-report.pdf?la=en-GB&hash=212DAE7D599B0A48687B372C90DC3FEA) and Nesta (https://media.nesta.org.uk/documents/analytic_britain.pdf) publications, which call for data science to be integrated across a wider range of subjects. It is similarly important that data science is accessible as an education pathway and to ensure that information about relevant qualifications and skills is widely available, as well as about career opportunities.

Post 16 T Levels (https://www.gov.uk/government/publications/introduction-of-t-levels/introduction-of-t-levels) are being developed to give young people a high quality technical option that delivers on the skills needs of employers. All T Levels technical qualifications will include the digital skills, and the Digital Production T Level will include content on data, digital analysis and software development.

Outside the formal curriculum, the education system offers opportunities to capitalise on students' interest in technical fields, enabling them to develop their technical skills and learn about options for further study and future careers.

Further measures will be announced as part of the digital strategy and through the National Skills Fund.

5.2.2 Universities and vocational education

The government's Higher Technical Education reforms (https://www.gov.uk/government/publications/higher-technical-education-reforms) will establish prestigious qualifications that meet employer needs, promote high quality courses and provision, and encourage HTE to be a more popular choice for learners and employers, starting with the Digital route from September 2022. The Department for Education is also working across government and with the organisations driving innovation, providers and industry on the adoption of emerging skills, and considering how links between universities and regional businesses could be more effectively coordinated.

In June 2020, DCMS and the Office for AI announced £13m for the Office for Students to support degree conversion courses in data science and AI (https://www.gov.uk/government/news/2500-new-places-on-artificial-intelligence-and-data-science-conversion-courses-now-open-to-applicants), including £10m for up to 1,000 scholarships for people from diverse backgrounds, matched by an additional £11m from universities and industry partners. At least 2,500 graduate places will be created through the programme, with the first courses starting in Autumn 2020. This programme builds on a highly

successful pilot (https://www.officeforstudents.org.uk/media/f537c003-c851-43a2-b560-fbc1a2bee23d/evaluation-of-a-scheme-to-develop-pilot-engineering-and-computing-conversion-masters-courses.pdf) of degree conversion courses in data science.

The Royal Statistical Society has highlighted the opportunity for UK Research and Innovation (UKRI) to further develop and strengthen data skills across the research landscape. There is interest from Research England, Economic and Social Research Council (ESRC) and others to address these gaps across the UK through the potential establishment of Data and Public Policy Centres for Doctoral Training (CDTs).

We will:

- work with the appropriate bodies to understand how data science is integrated into relevant technical qualifications, ensure that good quality data science courses are offered and that data related skills are given due consideration in their work to support emerging skills
- test the most effective ways to teach foundational data skills to undergraduates in two ways – through offering modules including wider subjects such as AI, cyber and digital skills, and by integrating data skills in other subject areas. Universities will take part in the pilot on a voluntary basis.
- examine ways of expanding the supply of advanced data skills across research engineers and professionals to help maximise R&D investments and to increase mobility across business and academia and to foster the links between industry and universities at the regional level; this work will build on the interim observations of the UKRI AI Review, which highlights the critical shortage of data capabilities in research professionals across all disciplines.

5.2.3 Labour market and industry

It is important for the UK to have data skills capabilities in companies, from basic data literacy to advanced technical skills. Those with both advanced data skills and sector knowledge will be in particular demand throughout the UK and internationally, meaning that companies – especially SMEs – will need to have access to viable training options. We will also need to build on the diversity and mobility initiatives in the workplace, and integrate the provision of data skills with the development of business skills at all levels to help develop data-driven companies. We will look to build on the recent government announcement (https://www.gov.uk/government/news/government-fires-up-rd-across-the-country-to-cement-the-uk-as-science-superpower) about the establishment of a new Office for Talent that will make it easier for top science, research, digital and technology talent to come to the UK.

The Data Lab's engagement with industry over the past five years points to a need for an improved understanding of:

- how specific roles and skills are best suited to deliver company requirements. This will help ensure first hires are more successful.
- the opportunities for data to drive productivity improvements and innovation at leadership and board level
- the need for all workers at board level to have basic data skills

With further measures to be announced as part of the Digital Strategy and through the National Skills Fund, we will:

- launch an online portal to support businesses' access to data skills training, helping signpost SMEs to good-quality online training material matched to their technical data science capabilities and ambitions

Case Study: Airbus Internal Training Programme – data culture as data capabilities for all

Airbus has developed an internal training programme to help equip itself with the data capabilities needed to become a data-driven company. The programme was open to all employees subject to passing an entry test to identify the basic skills required to complete the course. Trainees from all core Airbus countries, including the UK, took part, including subsidiary SMEs.

The 9-month part-time programme paired existing business knowledge and analytics skills (acquired during the programme) and was part of the Airbus digital transformation. The learning framework relied on both digital and social/community learning, allowing enough flexibility for each participant to learn and leverage knowledge and experience from other trainees.

5.3 Driving data skills across the public sector: capability, leadership and culture

Despite the many benefits that can be derived from data, institutionalised data culture – where data is seen as everyone's job and where data is seen to support outcomes at all levels – is lacking in many organisations across government and the wider public sector. There is not yet a consistent and mature approach to working with data based on knowledge, experience and best practice: we must strive to change this in the same way that the government has worked to instill a culture that emphasises value for money. In the future, the use of data in our work must become the norm, rather than the exclusive domain of specialists.

The lack of a mature data culture across government and the wider public sector stems from a fragmentation of leadership and a lack of depth in data skills at all levels. The resulting overemphasis on the challenges and risks of misusing data has driven a chronic underuse of data and a woeful lack of understanding of its value.

Senior leadership and effective governance will be key to establishing a data culture across government, but everyone, regardless of seniority or profession, should see data as a priority in their role – with data supporting each step of policy and delivery, from scoping to ongoing performance tracking, evaluation and improvement.

Work is underway to drive the importance of improving data culture across government and the wider public sector. At more senior levels, an innovation fellowship scheme, sponsored by No.10, will bring top data skills from the digital and tech sector into government. Fellows will support senior leaders on transformation projects of national importance.

With further measures to be announced as part of the Digital Strategy and through the National Skills Fund, we will:

- prioritise bringing in and building the right skills across government
- recruit leaders with data and digital skills across government to build a strong cadre of technical, policy, legal and analytical data experts in the centre of government
- train 500 analysts across the public sector in data science by 2021, through the Data Science Campus at the ONS, the Government Analysis Function and the Government Digital Service. This will be reviewed in 2021 with a new capacity building strategy meeting the emerging needs of government up to 2025.
- deliver the range of actions to be outlined in the Public Sector Data Science Capability Audit
- review data training available to all civil servants and develop proposals to enhance and extend this offering
- design a career pathway for data expertise in government
- agree a shared definition of data expertise across central government
- review the needs of local government in having the capabilities to manage, use and disseminate data

Case Study: The ONS Data Science Campus

In 2017, the Office for National Statistics (ONS) established the Data Science Campus (https://www.ons.gov.uk/aboutus/whatwedo/datasciencecampus) in 2017 with a core of qualified data professionals. The Data Science Campus was established to build skills across the UK and internationally. It accomplished this by building public sector capacity and capability, strengthening the evidence base around data skills, investigating new sources of data and enhancing analytical methods and approaches to data policy.

The campus has set up a series of data projects to provide insight into key policy themes, creating new learning and development pathways in data science at a range of different levels from Level 4 Apprenticeships to providing support for PhDs and post-doctoral projects. Courses on offer include:

- The Data Science Accelerator: A 12-week mentoring programme for public sector analysts delivered up to 3 times a year by the ONS and Government Digital Service on behalf of the Government Data Science Partnership
- Direct Training: The Data Science Campus and the Government Statistical Service deliver a range of training courses in data science and advanced analytical techniques to individuals and organisations across the public sector
- MSc in Data Analytics for Government: This part-time MSc programme is aimed at existing public sector analysts seeking to upskill in data science, and is delivered by Cardiff, Glasgow, Oxford Brookes, Southampton, and UCL on behalf of the Data Science Campus

6. Availability: ensuring data is appropriately accessible

In this section:

- 6.1 Data availability for the economy and society
- 6.2 Data availability within government and the public sector
- 6.3 International data availability

With the increasing ascendance of data,[19] it has become ever-more important that the government removes the unnecessary barriers that prevent businesses and organisations from accessing such information.

Data availability

The terms data sharing, data discoverability, data access, data availability, data portability and data mobility are often used in combination and interchangeably.

In this strategy we use 'data availability' to mean an environment which facilitates appropriate data access, mobility and re-use both across and between the private, third and public sectors in order to generate maximal economic and/or societal benefit for the UK.

The advent of new technologies models (e.g. Cloud, edge, secure) are making it increasingly feasible to allow multi-party access to data in secure and privacy-enhancing ways, for example through secure research environments, or through attribute exchange models. As we move to implementation, we will consider the government's role in supporting technologies that allow for this access, as well as governance and organisational models for data sharing or stewardship.

The importance of data sharing was demonstrated during the first few months of the coronavirus pandemic, when government departments, local authorities, charities and the private sector came together to provide essential services. One notable example is the Vulnerable Person Service, which in a very short space of time enabled secure data-sharing across the public and private sectors to provide millions of food deliveries and access to priority supermarket delivery slots for clinically extremely vulnerable people.

Aggregation of data from different sources can also lead to new insights that otherwise would not have been possible. For example, the Connected Health Cities project (https://www.connectedhealthcities.org/) anonymises and links data from different health and social care services, providing new insights into the way services are used.

Vitally, data sharing can also fuel growth and innovation.[20] For new and innovating organisations, increasing data availability will mean that they, too, will be able to gain better insights from their work and access new markets – from charities able to pool beneficiary data to better evaluate the effectiveness of interventions, to new entrants able to access new markets. Often this happens as part of commercial arrangements; in other instances government has sought to intervene where there are clear consumer benefits, such as in relation to Open Banking and Smart Data. Government has also invested in the research and development of new mechanisms for better data sharing, such as the Office for AI and Innovate UK's partnership with the Open Data Institute to explore data trusts (https://theodi.org/article/odi-data-trusts-report/).[21]

However, our call for evidence, along with engagement with stakeholders, has identified a range of barriers to data availability, including:

- a culture of risk aversion
- issues with current licensing regulations
- market barriers to greater re-use, including data hoarding and differential market power
- inconsistent formatting of public sector data
- issues pertaining to the discoverability of data
- privacy and security concerns
- the benefits relating to increased data sharing not always being felt by the organisation incurring the cost of collection and maintenance

This is a complex environment, and heavy-handed intervention may have the unwanted effect of reducing incentives to collect, maintain and share data for the benefit of the UK. It is clear that any way forward must be carefully considered to avoid unintended negative consequences. There is a balance to be struck between maintaining appropriate commercial incentives to collect data, while ensuring that data can be used widely for the benefit of the UK. For personal data, we must also take account of the balance between individual rights and public benefit.

This is a new issue for all digital economies that has come to the fore as data has become a significant modern, economic asset. Our approach will take account of those incentives, and consider how innovation can overcome perceived barriers to availability. For example, it can be limited to users with specific characteristics, by licence or regulator accreditation; it can be shared within a collaborating group of organisations; there may also be value in creating and sharing synthetic data to support research and innovation, as well as other privacy-enhancing technologies and techniques.

6.1 Data availability for the economy and society

There is increasing evidence suggesting that the full value of data is not being realised in the economy, and that government intervention is necessary to address specific market failures in this area. The report of the Digital Competition Expert Panel and the Competition Market Authority's market study into online platforms and digital advertising highlight data concentration and lack of interoperability as a critical factor to suboptimal competition and innovation in digital markets. Alongside this, evidence from the ODI & Nuffield Trust

(https://www.bennettinstitute.cam.ac.uk/media/uploads/files/Value_of_data_summary_report_26_Feb.pdf) argues that government intervention is necessary to realise the full value of data in the UK. Economic analysis by Ctrl-Shift (https://www.ctrl-shift.co.uk/reports/DCMS_Ctrl-Shift_Data_mobility_report_full.pdf) uses the observed productivity and efficiency increases seen following the introduction of Open Banking to the financial sector, and looks at how equivalent changes would impact a variety of other sectors given differing levels of data use across them. This analysis suggests an average 1.4% increase to UK GDP, which in 2017 would have constituted a £27.8bn increase. The contribution to the economy that digital innovation represents is likely to be significantly greater, given multiplier effects.

Given this evidence, we anticipate that in certain circumstances increasing data availability across the wider economy and society has the potential to support greater innovation and drive economic growth. This would ensure that the benefits of data are realised by the maximum possible number of people in society and further aid scientific research.

These issues are addressed in Mission 1 (Unlocking the value of data across the economy). In addition to this, the government will continue to take action in a number of more specific areas, set out below.

6.1.1 Ensuring consumer's data works for them: Smart Data

Smart Data enables consumers and SMEs to simply and securely share data that firms hold about them with authorised third parties. The first and most advanced Smart Data initiative, Open Banking, has over one million users and an estimated gross annual benefit of £12bn for consumers and £6bn for SMEs (https://www.openbanking.org.uk/wp-content/uploads/Consumer-Priorities-for-Open-Banking-report-June-

2019.pdf). Following the issuing of the Retail Banking Market Investigation Order 2017 by the CMA, the advent of interoperable formats and new data flows have enabled new, innovative services to develop while increasing competition in the banking market and beyond, as different providers are able to offer services built on this newly available data.

For too long it has been unnecessarily difficult and time consuming for consumers to access and use the data that suppliers hold about them, or to access innovative new services that use this data. The government is committed to an economy where consumers' data works for them, and innovative businesses thrive. We expect that, in time, the extension of Smart Data will deliver new and innovative services, stronger competition in the affected markets, and better prices and choice for consumers and small businesses, including through reduced bureaucracy. Competitive data-driven markets can reduce friction for business and drive start-ups, investment and job creation.

In the 2019 Smart Data Review, the government committed to supporting existing initiatives in other regulated sectors such as finance, energy, telecoms and pensions. We believe that such measures will allow us to solve this problem, and that government intervention is needed to coordinate and incentivise action across sectors.

We are committed to an economy where consumers' data works for them, and innovative businesses thrive. As announced in the parallel Smart Data Review response, we continue to advance the Smart Data agenda. The extension of Smart Data will deliver new innovative services, stronger competition in markets and better prices and choice for consumers and small businesses.

We will:

- establish a cross-sector Smart Data working group, which will coordinate and accelerate existing Smart Data initiatives in communications, finance, energy and pensions, while providing recommendations to support the development of high-quality standards and systems across sectors
- introduce primary legislation, when parliamentary time allows, to improve our ability to mandate participation in Smart Data initiatives and provide a legislative footing for all initiatives

6.1.2 Ensuring digital markets work effectively

Data lies at the heart of dynamic and competitive digital markets; it is central to the future of the UK's economy. We need the right incentives and structures to create, share and use data safely, and with consumer confidence, to drive the provision of new, improved and innovative digital products and services.

However, the economic characteristics of data may mean that it is not always allocated efficiently. The value of large, aggregated datasets set against the high costs required to build them leads to economies of scale, with the potential to inhibit market entry, undermine effective competition, reduce data sharing and result in unequal access to consumer data. A poorly designed regulatory regime can also reduce access to data. A pro-growth data regime must not drive concentration of data or limit data sharing at the expense of those individuals it seeks to empower.

The government has accepted in principle all six of the strategic recommendations made by the Digital Competition Expert Panel (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/785547/unlocking_digital_competition_furman_review_web.pdf). The government has also established a cross-regulator Digital Markets Taskforce (https://www.gov.uk/cma-cases/digital-markets-taskforce) to consider the functions, processes and powers which may be needed to promote competition. The Taskforce is based in the Competition and Markets Authority (CMA), and draws on the expertise of ICO and Ofcom. The government is committed to ensuring that our overall approach to digital regulation is proportionate and supportive of innovation.

We will:

- ensure that the findings of the CMA's 'Online platforms and digital advertising' report inform our development of a clear policy framework; the framework will identify where greater data access and availability across and with the economy can and should support growth and innovation, in what form, and what government's role should be in supporting the market

6.1.3 Open data

Since its introduction in the 2012 White Paper, 'Unleashing the Potential' (https://www.gov.uk/government/publications/open-data-white-paper-unleashing-the-potential), the government has adopted the policy of 'Open by Default' for public sector data across all departments. This approach promotes the concept of open data release for a number of desired outcomes:

- accountability (by openly publishing data and the evidence base behind policy, government will drive trust in decision making)
- efficiency (publishing data to identify duplication,waste and other systemic issues that can be reviewed and remedied)
- economic outcomes (catalysing the growth of innovative companies using data as the basis of new products and services)

By improving access to government-owned datasets – for example, by making them open – we unlock an abundance of value that can create and improve marketplaces to better meet people's needs. By moving away from document-based processes and systems, to one that is based on standardised data, we better support burgeoning industries like 'PropTech' (Property Technology). These industries are then equipped to drive innovation and improve people's engagement and experience with different services.

For open data to flourish, a number of underlying policies and mechanisms have been created. These include the technical frameworks for data use, governance forums and international commitments to transparency. Over time, the data landscape has evolved, and issues of impact measurement, effective governance and awareness for public officials have been raised. The government seeks to address these issues, and to drive the agenda to ensure that public sector open data is the backbone of innovation, efficiency and growth.

We will:

- review open data publication and decision-making processes to ensure their consistency; and support development of interoperable metrics to measure the impact of published data
- continue work to implement the recommendations of the Energy Data Taskforce and drive forward the Modernising Energy Data Access (https://innovateuk.blog.gov.uk/2020/05/29/modernising-energy-data-access-and-the-winners-are/) programme

Case Study: modernising the energy sector and regulatory frameworks

The Energy Data Taskforce, commissioned by government, Ofgem and Innovate UK, outlined a series of recommendations with the goal of digitalising the energy sector (https://es.catapult.org.uk/reports/energy-data-taskforce-report/). Broadly, these recommendations advocated a 'presumed open' data triaging model, centred around the sector making its data more visible and accessible through better data management and cataloguing. This mission is already essential, but will become even more critical when the energy system includes large amounts of low carbon energy demand, such as electric vehicles and heat pumps, and distributed generation such as solar panels. System planners and operators will need this data to make optimal decisions. Government is working closely with the Ofgem, Innovate UK and other industry stakeholders to implement this vision through the Modernising Energy Data (https://www.gov.uk/government/groups/modernising-energy-data) work.

Regulators, such as Ofgem, need to keep pace with technological change to enable better outcomes for society and the environment, at least cost to business. When regulators adopt agile regulatory approaches, the outputs are often decisive and impactful. The Better Regulation Executive is exploring how the Taskforce's recommendations might be adopted by other regulators and sectors to ensure best use of data in supporting the economy, enabling innovation and increasing transparency as part of the UK having a world-class regulatory system.

6.1.4 Shared models for deriving value from public and private data assets

Beyond the commitment to open data, the government has long recognised that new models and approaches are needed to drive value from data and data systems that span the private and public sector – this is particularly important in cases where the data itself is not appropriate to be shared as open data, be it for privacy, national security or commercial reasons.

This is well illustrated by the work of the National Infrastructure Commission and the Geospatial Commission, as further explored in the case studies below. To ensure that our focus on data availability supports both growth and the public good, the government will ensure an aligned approach to deriving value from these assets, supporting the future infrastructure required for emerging technologies such as driverless cars and smart cities.

This shared approach will be increasingly needed across the economy and society. For example, to improve systems for detecting and addressing online harms, the government is launching a £2.6m programme that will help companies to develop AI-based solutions to tackle these issues ever more effectively.

We will:

- review and upgrade the data infrastructure that underpins the monitoring and reporting of online harms such as child sexual abuse, hate speech and self harm and suicide ideation

Case study: Data for the built environment

The National Infrastructure Commission (NIC)'s 'Data for the Public Good' (https://www.nic.org.uk/wp-content/uploads/Data-for-the-Public-Good-NIC-Report.pdf) report made the compelling case that the structured use of data originating from emergent digital twin technology of individual or connected assets would bring significant operational efficiencies, improve public services and significantly contribute to the UK's net zero carbon commitments. In infrastructure alone, the NIC estimates that a saving of £7bn could be achieved through better use of data. The report also highlighted that the value and usefulness of this data would significantly increase if aggregated and shared effectively between organisations for both business and public good.

In response to the recommendations from the report, the 'Centre for Digital Built Britain' (a partnership between the government and the University of Cambridge) established the 'National Digital Twin Programme' (NDTP) to provide a national focus to efforts to deliver this vision. The NDTP has already produced the 'Gemini Principles' (https://www.cdbb.cam.ac.uk/system/files/documents/TheGeminiPrinciples.pdf) which provide the values to guide the development of individual and connected digital twins, to ensure these deliver public benefit in perpetuity.

The NDTP has also established an expert technical group drawn from government, industry and academia, who are now laying down the foundation for the 'Information Management Framework' (IMF). The IMF will create and enable the adoption of the common information management components to enable the integration of data in a consistent, resilient and secure manner across organisations and sectors. As the IMF is developed and approved, its parts will be made available nationally to progressively enable a UK system of trusted, decentralised and interoperable information exchange. This will create a data infrastructure for the built environment, and pave the way for the National Digital Twin.
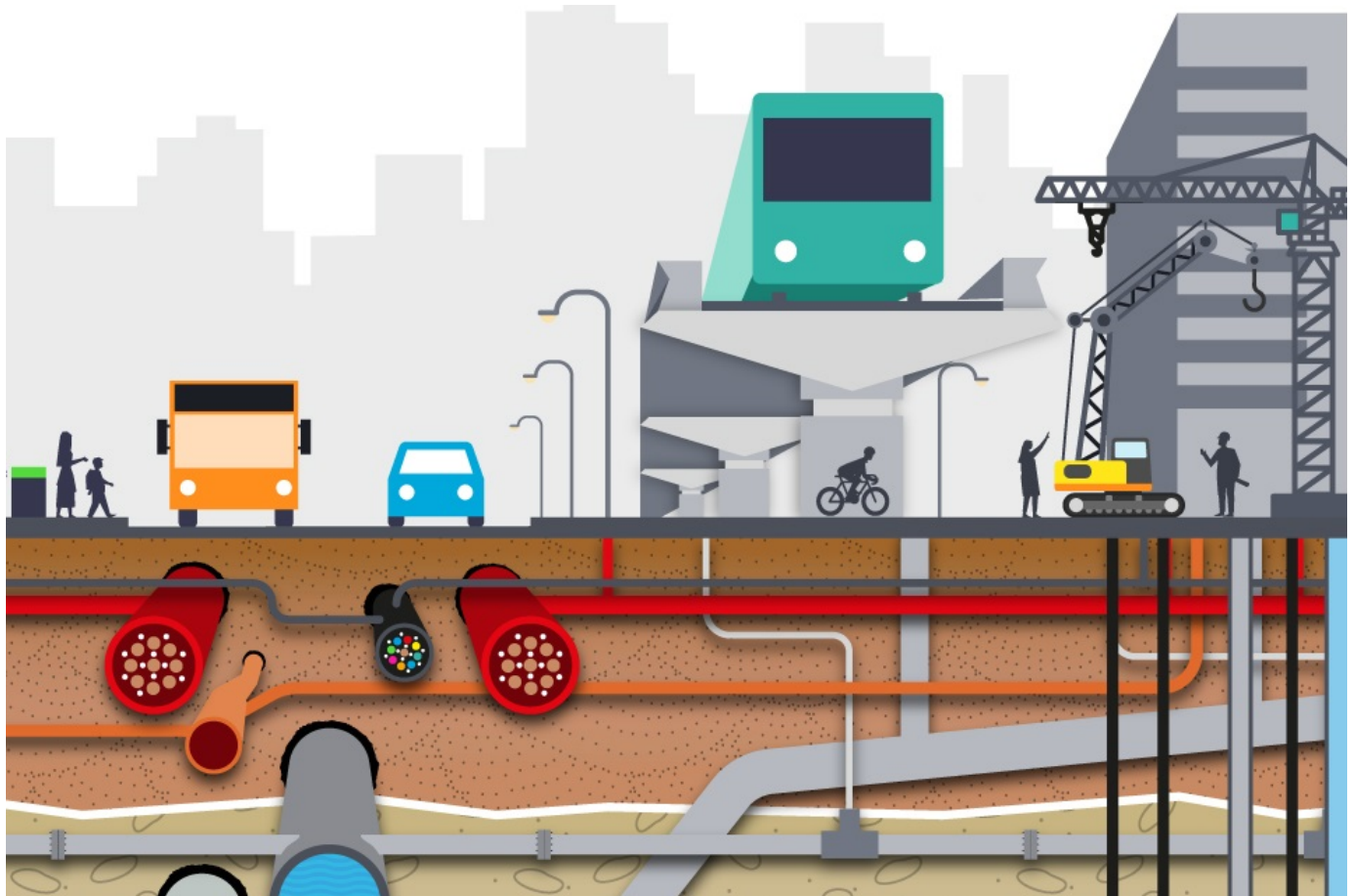

Image source: Project Iceberg, FutureCitiesCatapult © 2017

Case Study: National Underground Assets Register

In 2019-20, the Geospatial Commission launched two pilots in London and the North East of England to test the feasibility of creating a national underground asset register (NUAR), validate assumptions about the value of such a register, and seek feedback from planners and excavators. Findings from these pilots indicate significant economic and social value would be unlocked by creating a national register and ensuring field operatives have accessible data to carry out their work safely and effectively.

Given the significant economic value a national register will have to the UK economy (estimated at at least £245m per annum) and the pressing need to improve worker safety, the Geospatial Commission is preparing for a national rollout of NUAR which will be used by all asset owners to share data for the purposes of safe digging. To make this possible, they are addressing common barriers related to infrastructure data sharing. However, it is possible that an asset owner may still refuse to participate, even after reasonable requirements have been accommodated. Were this to happen, the asset owner would be limiting the value of NUAR to other participating organisations and the effectiveness of the platform in improving worker safety, especially in emergency situations where immediate data access is essential.

To maximise the benefit for the National Platform to all end users, the Geospatial Commission has been asked by asset owners and other stakeholders to mandate the sharing of data through the platform and are considering options, including the need to legislate.

6.2 Data availability within government and the public sector

6.2.1 Frameworks to enable public sector data sharing

Barriers to the sharing, linking and reuse of data across government and the wider public sector are well understood. As outlined in Mission 3: Transforming government's use of data and the Data Foundations pillar, there is work underway to ensure that data is reusable across government, and that systems are in place to allow for that re-use.

Legislative barriers – perceived and genuine – have also historically prevented greater data sharing in the public sector. Historically, a proliferation of powers to share data for specific purposes has made it difficult for public authorities to understand what data can be shared, and, where powers did not exist, it could take years to establish legislation to introduce new data sharing powers.

The government has already taken measures to address these issues and simplify public sector data sharing. The Digital Economy Act 2017 sought to reduce these legal barriers, with the introduction of legal powers for the sharing of publicly held information for a specific purpose.

Research into the use of the public service delivery power (https://troubledfamilies.blog.gov.uk/2019/02/21/promoting-the-public-service-delivery-information-sharing-power/) within the Digital Economy Act (2017) identified additional barriers, ranging from resource constraints and a lack of awareness of the powers, to cultural barriers centred around a nervousness around data sharing.

These issues are addressed in Mission 3: Transforming government's use of data).

In addition, we will:

- drive use of the Digital Economy Act (2017) powers, as well as addressing barriers to data sharing more widely

Case study: Better data sharing to improve the lives of children and families

The Troubled Families Programme (https://troubledfamilies.blog.gov.uk/), administered by the Ministry of Housing, Communities and Local Government (MHCLG), is designed to help local services improve the way they support families experiencing problems such as poor health, domestic abuse, addiction, poor school attendance and unemployment.

Since 2015, the second round of the programme has helped 350,105 families, including supporting 30,000 adults into sustained employment. The programme encourages services to: identify family problems early; work together to understand the needs of the whole family instead of responding separately to individual problems; coordinate support; track whether the support has improved outcomes or not; and re-design and transform services through digital tools to support better outcomes. None of this is possible without effective data sharing.

Dorset County Council and Bristol City Council have both set up needs analysis systems to identify vulnerable children and families at an early stage. Using legal gateways like the Digital Economy Act's power to reduce multiple disadvantages, these systems bring together relevant data from local public service partners such as attendance, employment, anti-social behaviour and crime, to identify which families are experiencing multiple problems and should be prioritised for targeted and tailored support from family support workers, schools, health or another local service to stop problems escalating further.

The benefits of this approach for families and the public purse have been shown in the programme's national evaluation of impact (https://www.gov.uk/government/publications/national-evaluation-of-the-troubled-families-programme-2015-to-2020-findings), which is itself one of the biggest data-linking exercises in government, bringing together administrative data on over one million individuals and around three hundred and fifty thousand families, from local government and four central government departments. MHCLG worked with the Office for National Statistics (ONS), acting as a trusted third party, to match the data together from the local authorities and

government departments to create an individual and family level dataset for analysis. The results showed positive impacts on a number of outcome measures and a good fiscal and economic case for the programme. The evaluation won the 2019 Civil Service Award for Innovation and Science, beating over 1200 other nominations. It was described as 'one of the most complex ever attempted in social policy' and a 'landmark study in terms of its methodological sophistication'.

6.3 International data availability

It is hard to overstate the importance of flows of data across borders to support economic development and global cooperation. Accurate, available data of appropriate quality can help to improve transparency, accountability and economic activity, which are all critical in creating more stable and prosperous countries across the globe. International data flows drive global business operations, e-commerce, supply chains and trade in goods and services. They also support cooperation between policymakers, law enforcement, regulators and academics – the need for this cooperation has been clearly demonstrated by the coronavirus pandemic.

The proposition to our international partners is that data can be used to drive innovation, the economy, governmental cooperation and trade without compromising safety, security or privacy. We will take a holistic approach to enabling global data, through the removal of unjustified barriers, the development of frameworks for the transfer of personal data, and, where appropriate, by helping our international partners to increase data availability in their own countries.

6.3.1 Removing barriers to data flows

Unjustified barriers to cross border data flows, such as measures that require the use of local computing facilities as a condition for conducting business in that country, can be a barrier to innovation, market access, and trade. The UK will take a leading role in encouraging the removal of such barriers to unlock the growth potential of global digital trade.

We will:

- seek provisions with trade partners – including current negotiations with the EU, US, Japan, Australia and New Zealand – that remove unnecessary barriers to cross border data flows, with specific commitments to prevent the use of unjustified data localisation measures
- advocate for the importance of global data flows in the World Trade Organisation (WTO), G7, G20 and Organisation for Economic Co-operation and Development (OECD)
- draw upon the expertise of the UK co-chaired Data Governance Working Group under the Global Partnership on AI to work with international partners and explore approaches to international data access and sharing

6.3.2 Personal data transfers

Digitally-delivered trade, which requires and generates data flows, has expanded rapidly in recent years, creating great opportunities for businesses and consumers. However, such trade faces significant challenges, such as fragmented transfer mechanisms and rising restrictions on cross-border data flows (https://ecipe.org/publications/restrictions-to-cross-border-data-flows-a-taxonomy/).

The importance of data to the daily lives of modern citizens has made it a geostrategic tool. The government is committed to supporting international data flows while ensuring that transfers of personal data from the UK uphold high data protection standards. The UK must take responsibility for the different means by which personal data may be lawfully transferred to countries outside of the UK. In doing this we will ensure that UK businesses, charities and public sector organisations have effective

and efficient mechanisms to transfer personal data from the UK, while safeguarding people's data. We will establish clear expectations of accountability to protect personal data when it moves across the globe. These criteria will align with the UK's stance on promoting its wider values, ethics and national interests.

We will:

- establish an independent HMG capability to conduct the UK's own data adequacy assessments for transfers of personal data from the UK
- review the transitional arrangements for international data transfers
- review the use of alternative transfer mechanisms which ensure that transfers of personal data outside the UK are appropriately protected
- seek positive adequacy decisions from the EU, under both the General Data Protection Regulation (GDPR) and the Law Enforcement Directive (LED), before the end of the transition period

6.3.3 Supporting availability in other countries

Available data is essential to understand and tackle global issues. The fight against climate change, international crime and the coronavirus pandemic are not confined to the borders of one country. Addressing them head on is made easier if data is available.

The UK has a strong track record here. For example, in 2019 cyclone Idai caused catastrophic damage over 17 days in Mozambique. The UK's response included collating evidence from a range of science and data providers. Using available and standardised data, we developed flood forecast and population exposure maps allowing response teams on the ground to prioritise where immediate action was needed. The UK has also helped to strengthen the capacity of the UK's international partner's National Statistics Systems to make data available, including setting up an Open Sustainable Development Goals platform.

We will:

- support countries to take a more open approach to their data and will continue to play a leadership role on the open data agenda internationally
- develop methods to use big data and modelling analyses to support a greater resilience of vulnerable countries to extreme weather events and disease outbreaks, as part of our Official Development Assistance
- support the implementation of standards such as the International Aid Transparency Initiative open data standard, Extractive Industries Transparency Initiative and Infrastructure Transparency Initiative
- work with international agencies such as the Red Cross and the UN to ensure data on crisis affected areas is handled safely, legally and ethically

7. Responsibility: driving safe and trusted use of data

In this section:

- 7.1 A pro-growth data rights regime
- 7.2 Data use that is secure and sustainable

The UK is already a major data user. This strategy sets out our ambition to make even greater use of data, recognising the benefits this will bring to all.

In order to reap the benefits of greater data use, we must maintain a fit-for-purpose legal and regulatory regime capable of keeping pace with, and responding to, the increasing importance of data in our economy, society and lives. A regime that reflects what people really care about and preserves their trust, while also enabling the opportunity that responsible data use creates.

The ever-growing importance of data will also increase our dependence on the infrastructure on which data relies, as well as on the systems and services that keep data both secure and accessible.

Responsible data

In this strategy, we use 'responsible data' to mean data that is handled in a way that is lawful, secure, fair, ethical, sustainable and accountable, while also supporting innovation and research.

Getting safe and trusted use of data right requires action at all levels of society:

- **Government** has a responsibility to ensure that there is a clear and predictable legal framework for data use that can both spur the innovative use of data, especially for purposes in the public interest, and earn people's trust. A pro-growth legal regime requires the consideration of regulation in the wider digital and technology landscape, which will be addressed in the government's forthcoming Digital Strategy, as well as in our data rights regime, explored in chapter 7.1. The government has a further responsibility to ensure that the infrastructure on which data relies is secure, sustainable and resilient enough to support ongoing digitalisation, economic growth and changes to the way that we live and work. The government must also be transparent and prepared to open itself up to scrutiny over its own use of data.

- **Organisations** have responsibilities to upskill themselves so that they can both manage and use data efficiently as a strategic resource, and ensure such use is lawful, secure, unbiased and explainable. We want businesses and other organisations to place a greater value on ensuring that they have the right skills to collect, organise and manage data. This will bring collective benefits to the wider economy and to society. There is also a growing need to ensure that security is incorporated as part of product and system design. Currently, almost half of UK businesses have identified a cyber security breach or attack in the previous 12 months (https://www.gov.uk/government/publications/cyber-security-breaches-survey-2020/cyber-security-breaches-survey-2020). To be effective, organisations must also ensure that they account for biases arising from data or algorithm use, as identified in the CDEI's interim report (https://www.gov.uk/government/publications/interim-reports-from-the-centre-for-data-ethics-and-innovation/interim-report-review-into-bias-in-algorithmic-decision-making).

- **Individuals** should be empowered to control how their data is used, and supported to have the necessary skills and confidence to take active decisions around the use of their data, in order to contribute to the wider societal benefit data can offer. Recent Ofcom research (https://www.ofcom.org.uk/__data/assets/pdf_file/0024/196413/concerns-and-experiences-online-harms-2020-chart-pack.pdf) into consumer experiences online found that over 80% of those surveyed had

concerns about using the internet, with 37% having specific concerns relating to data or privacy. Nonetheless, there is public benefit in the collective use of data that may derive from the activity of individuals. For example, our individual medical data has been critical in tracking the coronavirus pandemic and in making collective decisions about how quickly and in what areas it is safe for the UK to ease restrictions. Data about individuals is also critical to understanding threats to our collective security. We want people to recognise their responsibility to consider how their data – used responsibly and fairly – can create a better society for all. In particular, we want to strengthen the existing understanding that aggregated data about people – used responsibly and fairly – can have public benefits for all. Where people understand why data about them might be required, they tend to support it being used for the broader good. For example, a recent government survey (https://www.gov.uk/government/statistical-data-sets/ad-hoc-statistical-analysis-202021-quarter-2) revealed that 79% of british adults said that they would share some of their medical data if it helped develop new medicines or treatments. Enhancing individual awareness about the public benefits of data use requires transparency about such benefits, as well as a commitment to ensuring that people have trust and confidence in the use of their data and that it is adequately safeguarded.

7.1 A pro-growth data rights regime

As highlighted in Mission 2: Maintaining a pro-growth and trusted data regime, we will work to maintain a pro-growth data regime that the public trusts. We will focus on the key areas set out below.

7.1.1 Helping organisations to comply with the law

Responses to the NDS call for evidence highlighted a lack of clarity about certain aspects of data protection rules and regulations, which cause particular difficulty for SMEs. Businesses should not be driven to costly over-compliance or high risk aversion with respect to data sharing by unnecessary complexity or vagueness in the regulatory environment. This limits the societal benefits of responsible data sharing.

We will:

- work in partnership with the ICO and other bodies to clarify aspects of the UK's existing data regime that generate confusion or inertia, including by fast-tracking guidance and the use of co-regulatory tools
- work in partnership with the ICO to lift compliance burdens wherever possible on businesses, especially SMEs
- boost proactive advice and support for innovators, including via world-leading interventions such as the ICO's regulatory sandbox

7.1.2 Fairness, transparency and trust

Our data regime should empower individuals and groups to control and understand how their data is used. It should also instil confidence in individuals, increasing their comfort with the use of data, including their personal data, to deliver benefits for the whole of society. Principles of fairness and transparency are central to the UK's data regime, which also safeguards people's access to their data and to information about how their data is collected, shared, analysed and stored. These principles require active interpretation and application to new and emerging technologies, such as big data

techniques and machine learning. The use of algorithms has the potential to improve the quality and speed of decision-making, but there are also risks of human-introduced bias, discriminatory outcomes or unsafe applications, which must be mitigated if we are to harness their benefits.

In particular, the transformation of government data, and the data-driven transformation of government, will only be possible and sustainable if it is built upon a sound ethical and legal framework which engenders public trust. People need to have confidence that the government is collecting, storing and using their data safely and securely, in accordance with the highest standards of ethics, privacy and security.

A wide range of research suggests transparency around how data is used is important for building public trust (https://livingwithdata.org/project/wp-content/uploads/2020/05/living-with-data-2020-review-of-existing-research.pdf), and the importance of trust as an enabler for public sector data sharing (https://www.gov.uk/government/publications/cdei-publishes-its-first-report-on-public-sector-data-sharing/addressing-trust-in-public-sector-data-use). Evidence on existing levels of public trust in government data use is mixed; estimates from a DCMS commissioned module of the February 2020 ONS 'Opinions and Lifestyle' survey found that nearly half of adults (49%) trust central government with data about them[22] (comparable to the estimate of those who would trust families and friends at 50%). In contrast, a 2019 study by the ODI (https://theodi.org/article/nearly-9-in-10-people-think-its-important-that-organisations-use-personal-data-ethically/) found that only 30% of people trust central government to use their personal data ethically. These differences may stem from different methodologies.

Initiatives such as Project ExplAIn, a collaboration between the ICO and the Alan Turing Institute, are creating practical guidance to assist organisations with explaining artificial intelligence (AI) decisions to the individuals affected. The ICO has also recently published an AI Auditing Framework (https://ico.org.uk/about-the-ico/news-and-events/ai-auditing-framework/), focusing on best practices for data protection compliance. Nonetheless, a number of expert institutions – including the Alan Turing Institute, the Ada Lovelace Institute, the Oxford Internet Institute and AI Now – have emphasised the need for greater algorithmic transparency, particularly within the public sector.

We recognise and commit to addressing the need to develop appropriate mechanisms for increasing transparency and accountability in decisions made or supported by algorithmic systems, and for monitoring their impact. We will therefore collaborate with the leading organisations and academic bodies in the field to scope and pilot methods to enhance algorithmic transparency.

We will:

- run a national engagement campaign on the societal benefits of the use of government data
- explore appropriate and effective mechanisms to deliver more transparency on the use of algorithmic assisted decision making within the public sector
- work in partnership with the Centre for Data Ethics and Innovation (CDEI) and other leading organisations in the field of data and AI ethics to pilot approaches to algorithmic transparency this year, and consider what would be needed to roll them out across the public sector
- explore the role of privacy enhancing technologies to enhance consumer control and confidence
- explore further measures to ensure appropriate fairness, transparency and trustworthiness in private and third sector data use
- leverage our position as a founding member of the newly established Global Partnership on AI, collaborating with our international partners and drawing upon the expertise and, in particular, recommendations on this agenda from the Responsible AI and the (UK co-chaired) Data Governance Working Group

Finally, new technologies may help to create safe and secure environments for sharing data, including personal data. Privacy-enhancing technologies facilitate data sharing in ways that can improve privacy and in so doing build trust, while personal data stores could help people to exercise more control over their data. Nevertheless, ethical and legal questions remain (https://royalsociety.org/-/media/policy/projects/privacy-enhancing-technologies/privacy-enhancing-technologies-report.pdf?la=en-GB&hash=862C5DE7C8421CD36C105CAE8F812BD0).

The government will only be able to build and maintain public trust by ensuring and clearly demonstrating that its approach to data is rooted in appropriate levels of transparency, robust safeguards and credible assurances. To support this, the government must be willing to open itself up to scrutiny, increase public engagement and improve the publishing of data by which progress can be measured. The recently refreshed Data Ethics Framework (https://www.gov.uk/government/publications/data-ethics-framework/data-ethics-framework) guides appropriate and responsible data use in government and the wider public sector.[23] In the research and statistics community, the UK Statistics Authority has established the National Statistician's Data Ethics Advisory Committee (https://uksa.statisticsauthority.gov.uk/about-the-authority/committees/national-statisticians-data-ethics-advisory-committee/) and developed a self-assessment tool (https://uksa.statisticsauthority.gov.uk/about-the-authority/committees/national-statisticians-data-ethics-advisory-committee/ethics-self-assessment-tool/) to help researchers and statisticians consider the ethics of their use of data.

We will:

- promote the use of the government's Data Ethics Framework across the wider public sector; support data scientists and data policymakers to build lasting capability for ethical data use; and disseminate knowledge, resources and case studies through the data ethics community
- work with the CDEI to understand how to ensure public sector use of data is trustworthy, by exploring the potential for technical innovations, such as privacy enhancing technologies, and through research into public attitudes

Case Study: Establishing the National Data Guardian

In 2014, the National Data Guardian (NDG) for Health and Social Care
(https://www.gov.uk/government/organisations/national-data-guardian) was created to help build trust in
the use of data across the sector. Given the sensitivities around this type of data, its purpose is to
ensure that people's information is kept safe and confidential, and that it is only shared when
appropriate to achieve better outcomes for patients. The NDG also acts as an independent
champion for the public when it comes to matters of their confidential health and care information.

Since 2019, the NDG has had the power to issue official guidance about the processing of health
and adult social care data in England. All public bodies – including hospitals, general practices,
care homes, planners and commissioners of services – must take note of guidance that is relevant
to them. The guidance also extends to any organisation, public or private, delivering services for
the NHS or publicly funded adult social care.

The NDG's work has involved the examination of data sharing in line with people's reasonable
expectations (https://www.gov.uk/government/publications/sharing-data-in-line-with-patients-reasonable-
expectations), in addition to a review of data security, consent and opt-outs
(https://www.gov.uk/government/publications/review-of-data-security-consent-and-opt-outs). The
recommendations of the latter resulted in the national data opt-out
(https://digital.nhs.uk/services/national-data-opt-out), a service providing individuals with the choice to
opt-out of their confidential information being used for research and planning, and the redesign of
the Data Security and Protection Toolkit (https://www.dsptoolkit.nhs.uk/).

The Centre for Data Ethics and Innovation (CDEI), founded in 2018 to advise on the use of data-driven technologies and AI, is the world's first body of its kind. In its first year, the government commissioned the CDEI to conduct two policy reviews on online targeting and algorithmic bias. The CDEI also set up an 'Analyse and Anticipate' function providing expert-horizon scanning to identify the barriers to ethical innovation and to monitor public attitudes. It has produced the AI Barometer Report, as well as a series of thematic 'snapshot' reports on high profile technologies such as facial recognition, and reviewed data sharing in the public sector.

The CDEI has developed a partnership working approach, working with a range of public and private sector organisations to address specific barriers to responsible innovation at an operational level, and to scale these tools and methodologies to other organisations. In addition, we will ask the CDEI to build on its existing independent status to provide more practical support for the technical development of potential interventions in the tech space. The government will consider whether putting the CDEI on a statutory footing would enhance these functions.

7.2 Data use that is secure and sustainable

7.2.1 Security and resilience of UK infrastructure on which data relies

As our economy and public services become increasingly dependent on data, the security and resilience of the infrastructure on which data relies will also become more important.

The need to store and process data externally – for example, in data centres – will also become even more of a critical operating function. OECD figures show that the number of businesses in the UK purchasing cloud computing systems nearly doubled from 2014 to 2018. As data centres underpin an increasing amount of business and societal activity, having confidence in the security and resilience of the UK's infrastructure on which data relies is a key aspect of protecting individuals' rights, service delivery across private and public sector organisations and national interests.

Significant progress has already been achieved in managing the risks from threats and hazards to the infrastructure on which data relies, with the establishment of the National Cyber Security Centre (NCSC), as well as the GDPR and the Network and Information Systems Regulations. However, due to our dependence on the infrastructure on which data relies, the government must provide constant risk assurance in this area, taking into account the global and dynamic nature of the data storage and processing market.. Accordingly, as outlined in Mission 4: Ensuring the security and resilience of the infrastructure on which data relies, we will keep apace with the risks that come with increasing reliance on data, taking steps as needed to build confidence in the security and resilience of the infrastructure on which data relies. We will also determine whether current arrangements for managing data security risks are suitable for protecting the UK from threats that counter our mission for data to be a force for good.

7.2.2 Sustainable data use

The trajectory for global warming is well documented, with a recent special report by the Intergovernmental Panel on Climate Change (IPCC) projecting a stark increase in climate-related risks to health, livelihoods, food security, water supply, human security and economic growth. Given such projections, business as usual is no longer an option.

Data and its supporting infrastructure are increasingly championed as key components of any solution to the global climate crisis and associated targets and goals. However, the true impact of data and digital on sustainability is not yet fully understood. Recent research has shown that while demand for data centre services increased by more than 500% between 2010 and 2018, the amount of energy

consumed by data centers only increased by 6% over the same period. This can be attributed to improvements in energy efficiency. But issues remain around a lack of transparency from providers, in particular sustainability reporting related to specific services. Procurement teams and service designers could benefit from improved knowledge of the use of sustainability criteria in commissioning. End users are largely unaware of the impacts of digital consumption on energy use and wider sustainability issues. Poor data management and culture can also lead to a vast amount of data duplication, unnecessary data retention, migration and processing that contributes to carbon use.

We will:

- publish the Greening Government: ICT & Digital Services Strategy 2020-2025, that will look to address transparency, accountability, responsibility and resilience to reduce carbon and cost related to government procurement. Alongside this we will commit to producing a Data Sustainability Charter that will inform how government works with its suppliers to manage and use data sustainably.

Case Study: The hidden impact of the legacy estate

The Ministry of Defence (MoD) had traditionally reported the energy use by its corporate IT systems and associated large data centres. In 2019, additional resources were expended in approaching programme teams and departmental bodies across Defence for a more complete view of their assets. Not only did this expose a considerably larger estate than had been previously identified, but energy-intensive elements of the estate were incorporated for the first time. This may have been because they were previously considered 'enabling' rather than 'delivery' components, as was the case with a large number of network components whose energy consumption represented a significant increase over previous years. This 'hidden' infrastructure has not yet been fully documented, so there may be further additions in future years.

The work has been extremely positive: it presents a clearer picture of MoD's true estate and energy consumption figures. MoD's data centres represented about 12% of Defence's ICT energy consumption against 40% from end user devices and 48% from networks. While the review is ongoing – to better understand the true consumption figures of the estate – this is a good step in indicating how we can measure consumption and work to reduce it.

8. Next steps

This strategy proposes five priority missions where we can take action now to have the biggest impact. This document also captures further actions that will support the delivery of the National Data Strategy. A key area of focus will be to ensure that we put the right structures and mechanisms in place to monitor and assess progress against each of these actions.

It is equally important to recognise that the government cannot – and must not – deliver these actions alone. Given the cross-cutting nature of data, collaboration across a wide range of sectors and organisations will be essential. We are therefore seeking to consult further with stakeholders to sense-check our proposed actions, and make use of their expertise on how we can best deliver them and ensure that the strategy meets its overarching objective of unlocking the power of data across the UK.

Monitoring and evaluation

Each proposed priority mission and action will be delivered by an accountable owner across government (set out in Annex A). Annex A groups these actions by pillar to show alignment with the Strategy's framework.

In order to drive successful implementation, we will develop a monitoring and evaluation process for the strategy. This will monitor the Strategy's delivery and help ensure that it is achieving its intended outcomes, in line with the vision and opportunities set out in Chapter 2. We will provide further details of this monitoring and evaluation process in a future publication.

Why we are consulting

Given the significant technological changes of the last five years, and the more significant changes we expect to see throughout the 2020s, we need a data strategy that reflects the opportunities and challenges of our new hyper-digital world, and ensures that the decisions, priorities and potential trade-offs that we face are considered in a deliberate and evidence-driven way.

To ensure that our overall direction and approach is sensible, we are keen to further consult stakeholders about the framing and core principles of the strategy, as outlined in consultation questions 1-4.

Our decisions will have an impact beyond government, extending into the wider economy and society. As such, we need to ensure that our missions, associated areas of focus and policy proposals have received proper scrutiny and input from a diverse range of stakeholders (as set out in questions 5-19). We also want to ensure that these decisions do not have any negative impacts on specific groups within our society, including, but not limited to, individuals with a protected characteristic under the Equality Act 2010 (as set out in question 4). Given the importance of data to the economy, we are taking a considered and evidence-based approach to developing the strategy. While the evidence base in this rapidly changing environment is still emerging, the responses to this consultation will help expand this, as well as supporting the further development of the strategy.

Who we are seeking to consult with?

We are keen to hear from a representative cross-section of society, ensuring diversity and inclusion. The consultation has been designed in line with the government Consultation Principles (https://www.gov.uk/government/publications/consultation-principles-guidance) and with due consideration to the Public Sector Equality Duty (https://www.gov.uk/government/publications/public-sector-equality-duty).

Given its focus, we believe that the consultation has particular relevance to:

- start-ups, charities and small businesses; especially those currently struggling to use data effectively
- technology and data-driven, or data-rich companies
- investors in technology and data companies
- civil society organisations focused on vulnerable people, consumer rights, digital rights, privacy and data protection
- local authorities and other public bodies
- academics and research and policy organisations with a particular interest in the role of data in the economy and society
- international data standards, regulation and governance bodies
- law firms and other professional business services

It is also likely that there will be wider public interest in the social aspects of the strategy.

Summary of next steps

The government's response to this consultation will be published following the closure of the consultation period. All consultation submissions will be carefully considered as part of the formulation of this response.

9. Glossary

Term	Description
Adequacy (EU)	Adequacy decisions are how the EU determines if a non-EU country has an adequate level of data protection. They are unilateral decisions taken by the European Commission after an assessment of a country's data protection framework. 'Data adequacy' is the status granted by the European Commission to countries outside the EEA whose level of personal data protection is judged to be essentially equivalent to the EU's. Once a third country has received a positive adequacy decision, personal data can flow from the EEA to that country without any further safeguards.
Adequacy (UK)	Data adequacy is a status granted by the Secretary of State to countries outside the UK that provide high standards of personal data protection. When a country has been designated 'adequate', personal data can be transferred from the UK without further safeguards being required. In addition to countries, specified territories within countries or sectors of an economy or international organisations can be 'adequate'.
Data Availability	The terms data sharing, data discoverability, data access, data availability, data portability and data mobility are often used in combination and interchangeably. In this strategy we use 'data availability' to mean an environment which facilitates appropriate data access, mobility and re-use both across and between the private, third and public sectors in order to generate maximal economic and/or societal benefit for the UK.

Term	Description
Data Economy	See Digital Economy, below.
Data Foundations	In this strategy we are using the term 'data foundations' to mean data that is fit for purpose, recorded in standardised formats on modern, future-proof systems and held in a condition that means it is findable, accessible, interoperable and reusable.
Data Infrastructure	See Infrastructure below
Data Mobility	Data mobility refers to the efficient and safe flow of data between individuals and organisations, including but not limited to personal data.
Data Portability	The right to allow individuals to obtain and reuse their personal data for their own purposes across different services, as defined in the GDPR (see below).
Data Protection Act 2018	Act supplementing the General Data Protection Regulation (GDPR). The Data Protection Act is a complete data protection system, so as well as governing the processing of personal data covered by the GDPR, it also covers all other processing of personal data for UK law enforcement and national security. It makes a number of agreed modifications to the GDPR to make it work for the benefit of the UK, in areas like academic research, financial services and child protection.
Digital Economy	Economic activity featuring digital technologies, and changes to market activities based on the influence and changes digitalisation brings. The term Data Economy, while more specific, is often used interchangeably, and covers the direct, indirect, and induced effects that the use and selling of data has on the economy as a whole. It involves the generation, collection, storage, processing, distribution, analysis elaboration, delivery, and exploitation of data enabled by digital technologies.
Digital Economy Act	References to this act in the National Data Strategy refer to part 5 of the Digital Economy Act 2017, which gives government powers to share information across organisational boundaries for a number of purposes including improving public service delivery, reducing fraud against the public sector and improving the production of national and official statistics.
Five Safes	A framework for helping to make decisions about effective use, regulation and access to potentially disclosive information, developed by the ONS in 2003 and widely used across the public and private sectors. The 'five safes' are: Safe people; Safe projects; Safe settings; Safe outputs; Safe data.
General Data Protection Regulation (GDPR)	The GDPR is an EU regulation that applies directly across all EU Member States, including the UK, until Exit Day. It regulates the processing of personal data by organisations established in the EU/UK and those outside the EU who are processing the personal data of individuals in the EU/UK to provide them with goods and services or to monitor their behaviour.

Term	Description
Geospatial Data	Often used interchangeably with 'location data' or 'geographical information'. Geographic data is an umbrella term for any type of data with a location element. Fundamentally related to what we do, and where we do it. It tells us where people and objects are in relation to a particular geographic location.
Infrastructure	**Data infrastructure** – Data infrastructure is a broad concept that indicates the data assets and processes that are significant to acquire knowledge and take action about a specific context. This consists of data assets, such as datasets, identifiers and registers, the processes to acquire these assets, and the support process, including the people, standards, and technologies used, which can be both digital and non-digital. This also includes the policies that guide curation, access, management, and use of the data infrastructure. **The infrastructure on which data relies** – The virtualised or physical data infrastructure, software, systems and services that store, process and transfer data. This includes data centres (that provide the physical space to store data), peering and transit infrastructure (that enable the exchange of data), and cloud computing that provides virtualised computing resources (for example servers, software, databases, data analytics) that are accessed remotely.
Interoperability	**Data Interoperability** – The ability of data services and products to interact and share data. The term tends to cover two main aspects: the digital protocols that allow for data exchange, and the data standards used to preserve compatibility while processing data. It is enabled through open or common technical standards, which create a shared protocol for the exchange of information. **In the context of data protection regimes** – Increasing interoperability between data protection regimes usually indicates a willingness to remove barriers to data flows by, for example: increased alignment of rules, negotiated codes of conduct or similar schemes.
Open Banking	Open Banking is a banking technology that enables people and businesses to benefit from a range of new payment solutions and data-based products and services from regulated third-party providers, through secure connections to their customers' payment accounts. Following an investigation into the retail banking market, the Competition & Markets Authority (CMA) issued an Order requiring the nine largest banks in the UK to provide these third parties with API access to payment account data and payments initiation, in order to stimulate innovation and competition. The UK's Open Banking Standard guarantees interoperability between banks and third party providers, making it easier for new third parties to come to market and offer services to people and businesses.
Linked Data	Structured data that uses common standards and identifiers to allow multiple datasets to be used in conjunction with each other. It requires a common data model, and a technological and data standards that enable the use and interoperability of the data model. Z
Metadata	A set of data that describes contextual information on another set of data. It helps to organise, find, understand and manage data.

Term	Description
Open Data	Data that can be freely used, re-used and redistributed by anyone, subject only, at most, to the requirement to attribute and sharealike.
Personal Data Store	A means to manage and share personal information in a structured and secure manner with trusted parties.
Privacy Enhancing Technologies	A range of technical solutions to support the protection of personal data. This is done through either reducing personal data, or preventing undesired personal data processing, without losing the functionality of the information system.
Smart Data	A BEIS-led initiative that involves the secure and consented sharing of customer data with authorised third-party providers. These providers then use this data to provide innovative services for the customer, such as automatic switching and account management. This aims to save time, money and effort for consumers and SMEs, and increase competition in the sectors involved.
Responsible Data	In this strategy, we use 'responsible data' to mean data that is handled in a way that is lawful, secure, fair, ethical, sustainable and accountable, while also supporting innovation and research.

Annex A - List of actions and owners

This table reflects UK Government owners for each respective action:

Pillar	Action	Owner
Missions	Mission 1: Unlocking the value of data across the economy	DCMS
Missions	Mission 2: Securing a pro-growth and trusted data regime	DCMS
Missions	Mission 3: Transforming government's use of data to drive efficiency and improve public services	Cabinet Office
Missions	Mission 4: Ensuring the security and resilience of the infrastructure on which data relies	DCMS
Missions	Mission 5: Championing the international flow of data	DCMS
Data Foundations	We will launch a programme of work to tackle the cultural and coordination barriers to good quality data, including: – creating a central team of experts able to ensure a consistent interpretation of the legal regime around data sharing (Cabinet Office) – launching the Data Quality Framework (ONS) – creating a Data Maturity Model for government (ONS/Cabinet Office) – building a data management community of good practice – learning and setting best practice and guidance through a series of demonstration – or 'lighthouse' – projects (Cabinet Office/ONS)	Cabinet Office / ONS

Pillar	Action	Owner
Data Foundations	We will implement the recommendations of the 'Joined-up data in government' report to improve data linkage methods, application and skill sets across government.	Cabinet Office / ONS
Data Foundations	We will commit to resolving the long-running problems of legacy IT and broader data infrastructure.	Cabinet Office
Data Foundations	We will drive data discoverability across government through: – developing an Integrated Data Platform for government, which will be a safe, secure and trusted infrastructure for government's own data. It will be a digital collaborative environment that will support government to unlock the potential of linked data and build up data standards, tools and approaches enabling policy makers to draw on the most up to date evidence and analysis to support policy development, improving public services and improving people's lives. – creating an audit of data inventories	ONS / Cabinet Office (audit of data inventories)
Data Foundations	We will work to better support local government in maximising the benefits of data	MHCLG
Data Foundations	We will develop and validate a set of data principles to be applied across government.	Cabinet Office / ONS
Data Foundations	We will set out a strategy for data standards across government to include: – clarity on where the DSA will mandate some standards – use of the DDaT spend controls process –a parallel controls process for APIs and Technology Code of Practice to ensure consistent adoption of data standards across government	Cabinet Office
Data Foundations	We will recruit senior cross-government data leadership, including a Chief Data Officer for government.	Cabinet Office
Data Foundations	We will establish a cross-departmental governance mechanism with the authority to enforce standards across government.	Cabinet Office
Data Foundations	We will drive aligned governance structures across government through: – undertaking a review of governance structures for data within departments – ensuring central government departments include data management plans in their Single Departmental Plans	Cabinet Office
Data Foundations	We will support the global effort on interoperability, which will facilitate the combination and cross-referencing of different data sources.	FCDO / ONS

Pillar	Action	Owner
Data Foundations	We will collaborate with our international partners to build strong national statistical systems to drive economic growth and help to deliver inclusive, effective services.	FCDO
Skills	We will publish a working definition of data skills in the wider economy that sets out clear distinctions between data skills, digital skills and AI skills, and consider the benefits of providing information on pathways into data related careers.	DCMS
Skills	We will consider the roles of the Alan Turing Institute, the National Innovation Centre for Data, the Open Data Institute, the Data Skills Taskforce, the AI Council, the UK Cyber Security Council, the Data Lab, and others in the data skills ecosystem for ways to improve the leadership and facilitation of new and better collaborations between industry, the public sector, universities and institutes.	DCMS
Skills	We will work with the appropriate bodies to understand how data science is integrated into relevant technical qualifications, ensure that good quality data science courses are offered and that data related skills are given due consideration in their work to support emerging skills.	DfE
Skills	We will test the most effective ways to teach foundational data skills to undergraduates in two ways – through offering modules including wider subjects such as AI, cyber and digital skills, and by integrating data skills in other subject areas. Universities will take part in the pilot on a voluntary basis.	DCMS
Skills	We will examine ways of expanding the supply of advanced data skills across research engineers and professionals to help maximise R&D investments and to increase mobility across business and academia, and to foster the links between industry and universities at the regional level.	UKRI
Skills	We will launch an online portal that will support businesses' access to data skills training, helping signpost SMEs to good quality online training material matched to their technical data science capabilities and ambitions.	DCMS
Skills	We will recruit leaders with data and digital skills across government to build a strong cadre of technical, policy, legal and analytical data experts in the centre of government.	Cabinet Office
Skills	We will train 500 analysts across the public sector in data science by 2021, through the Data Science Campus at the ONS, the Government Analysis Function, and GDS. This will be reviewed in 2021 with a new capacity building strategy meeting the emerging needs of government up to 2025.	Cabinet Office/ONS
Skills	We will deliver the range of actions to be outlined in the Public Sector Data Science Capability Audit.	Cabinet Office/ONS

Pillar	Action	Owner
Skills	We will review the data training available to all civil servants and develop proposals to enhance and extend this offering.	Cabinet Office
Skills	We will design a career pathway for data expertise in government.	Cabinet Office
Skills	We will agree a shared definition of data expertise across central government.	Cabinet Office
Skills	We will review the needs of local government in having the capabilities to manage, use and disseminate data.	MHCLG
Data Availability	We will: – establish a cross-sector Smart Data working group, which will coordinate and accelerate existing Smart Data initiatives in communications, finance, energy and pensions, while providing recommendations to support the development of high-quality standards and systems across sectors –introduce primary legislation, when parliamentary time allows, to improve our ability to mandate participation in Smart Data initiatives and provide a legislative footing for all initiatives	BEIS
Data Availability	We will respond to the Competition and Market Authority's online platforms and digital advertising report, and consider how its findings inform the establishment of a pro-competition digital markets unit.	DCMS / BEIS
Data Availability	We will continue work to implement the recommendations of the Energy Data Taskforce and drive forward the Modernising Energy Data Access programme.	BEIS
Data Availability	We will develop a clearer policy framework to identify where greater data access and availability across and with the economy can and should support growth and innovation, in what form, and what government's role should be in supporting the market.	DCMS
Data Availability	We will review open data publication and decision making processes to ensure their consistency; and support development of interoperable metrics to measure the impact of published data.	Cabinet Office
Data Availability	We will review and upgrade the data standards and systems that underpin the monitoring and reporting of online harms such as child sexual abuse, hate speech and self harm and suicide ideation.	DCMS
Data Availability	We will drive use of the Digital Economy Act (2017) powers, as well as addressing barriers to data sharing more widely.	Cabinet Office

Pillar	Action	Owner
Data Availability	We will seek provisions with trade partners – including current negotiations with the EU, US, Japan, Australia and New Zealand – that remove unnecessary barriers to cross border data flows, with specific commitments to prevent the use of unjustified data localisation measures.	DCMS
Data Availability	We will advocate for the importance of global data flows in the World Trade Organisation (WTO), G7, G20 and OECD.	DCMS
Data Availability	We will draw upon the expertise of the UK Co-Chaired Data Governance Working Group under the Global Partnership on AI, work with international partners and explore approaches to international data access and sharing.	DCMS / BEIS
Data Availability	We will establish an independent HMG capability to conduct the UK's own data adequacy assessments for transfers of personal data from the UK.	DCMS
Data Availability	We will review the transitional arrangements for international data transfers.	DCMS
Data Availability	We will review the use of alternative transfer mechanisms which ensure that transfers of personal data outside the UK are appropriately protected.	DCMS
Data Availability	We will seek positive adequacy decisions from the EU, under both the General Data Protection Regulation (GDPR) and the Law Enforcement Directive (LED), before the end of the transition period.	DCMS (GDPR) / HO (LED)
Data Availability	We will support countries to take a more open approach to their data and will continue to play a leadership role on the open data agenda internationally.	FCDO / Cabinet Office
Data Availability	We will develop methods to use big data and modelling analyses to support a greater resilience of vulnerable countries to extreme weather events and disease outbreaks, as part of our Official Development Assistance.	FCDO
Data Availability	We will support the implementation of standards such as the International Aid Transparency Initiative open data standard, Extractive Industries Transparency Initiative and Infrastructure Transparency initiative.	FCDO / Cabinet Office
Data Availability	We will work with international agencies such as the Red Cross and the UN to ensure data on crisis affected areas is handled safely, legally and ethically.	FCDO

Pillar	Action	Owner
Responsibility	We will: – work in partnership with the ICO and other bodies to clarify aspects of the UK's existing data regime that generate confusion or inertia, including by fast-tracking guidance and the use of co-regulatory tools – work in partnership with the ICO to lift compliance burdens wherever possible on businesses, especially SMEs – boost proactive advice and support for innovators, including via world-leading interventions such as the ICO's regulatory sandbox	DCMS
Responsibility	We will run a national engagement campaign on the societal benefits of the use of government data.	Cabinet Office
Responsibility	We will explore appropriate and effective mechanisms to deliver more transparency on the use of algorithmic assisted decision making within the public sector.	Cabinet Office
Responsibility	We will work in partnership with the CDEI and other leading organisations in the field of data and AI ethics to pilot the proposed approach to algorithmic transparency this year, and consider what would be needed to roll it out across the public sector.	Cabinet Office
Responsibility	We will explore the role of privacy enhancing technologies to enhance consumer control and confidence.	DCMS
Responsibility	We will explore further measures to ensure appropriate fairness, transparency and trustworthiness in private and third sector data use.	DCMS
Responsibility	We will leverage our position as a founding member of the newly established Global Partnership on AI, collaborating with our international partners and drawing upon the expertise and recommendations on this agenda from the Responsible AI and (the UK Co-Chaired) Data Governance Working Group in particular.	DCMS / BEIS
Responsibility	We will promote the use of the government's Data Ethics Framework across the wider public sector, support data scientists and data policymakers to build lasting capability for ethical data use; and disseminate knowledge, resources and case studies through the data ethics community.	Cabinet Office
Responsibility	We will work with the CDEI to understand how to ensure public sector use of data is trustworthy, by exploring the potential for technical innovations, such as privacy enhancing technologies, and through research into public attitudes.	Cabinet Office

Pillar	Action	Owner
Responsibility	We will publish the Greening Government: ICT & Digital Services Strategy 2020-2025, that will look to address transparency, accountability, responsibility and resilience to reduce carbon and cost related to government procurement. Alongside this we will commit to producing a Data Sustainability Charter that will inform how government works with its suppliers to manage and use data sustainably.	DEFRA

1. DCMS analysis using the UNCTAD definition of digitally deliverable services. Services that are principally or largely enabled by information and communication technologies (ICT) are defined as digitally deliverable services, which are used within the data-enabled estimations. ↩

2. Several sector estimates suggest exponential growth in data use – for example, The Digitization of the World from Edge to Core, IDC (2018) (https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf) ↩

3. As highlighted in the 2019 Tech Nation report (https://technation.io/report2019/) ↩

4. For example, the European Data Market Monitoring Tool (EDMMT) defines Data Markets as 'the marketplace where digital data is exchanged as "products" or "services" as a result of the elaboration of raw data.' In contrast, the Data Economy is defined as 'the overall impacts of the Data Market on the economy as a whole. It involves the generation, collection, storage, processing, distribution, analysis elaboration, delivery, and exploitation of data enabled by digital technologies. The Data Economy includes the direct, indirect, and induced effects of the Data Market on the economy.' European Data Market Monitoring Tool, IDC (2020) (http://datalandscape.eu/sites/default/files/report/D2.9_EDM_Final_study_report_16.06.2020_IDC_pdf.pdf) ↩

5. For example, The Rapid Adoption of Data-Driven Decision-Making, Enterprise Research Centre. In construction, data sharing as part of Building Information Modelling (BIM) was associated with cost savings of up to a third in some areas – Building Information Modelling (BIM) Task Group (http://www.bimtaskgroup.org/bim-faqs). A 2019 McKinsey report found that internationally, a larger proportion of fast-growing companies use data-driven practices compared to slower-growing companies – Catch them if you can: How leaders in data and analytics have pulled ahead, McKinsey & Co (2019) (https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Analytics/Our%20Insights/Catch%20them%20if%20you%20can%20How%20leaders%20in%20data%20and%20analytics%20have%20pulled%20ahead/Catch-them-if-you-can-How-leaders-in-data-and-analytics-have-pulled-ahead.pdf) ↩

6. The AI Review recognised that to grow the AI industry in the UK, organisations required better access to data, with its key recommendation being the development of data trusts for data sharing. ↩

7. EDMMT, EU (2020) (http://datalandscape.eu/sites/default/files/report/D2.9_EDM_Final_study_report_16.06.2020_IDC_pdf.pdf). This is also an increasing share of total employment, from 3.9% of the workforce in 2013 to 5.4% of the workforce in 2020. Varying definitions and methodologies are likely the main reason for discrepancies between different sources in how many are employed in data professional roles. For example, Royal Society research (https://royalsociety.org/-/media/policy/projects/dynamics-of-data-science/dynamics-of-data-science-skills-report.pdf) found demand (based on internet listed job adverts) for data professionals was in line with increasing demand for all jobs between the years to December 2013 and July 2018, but demand for data scientists and advanced analysts rose much faster. Also see UK Consumer Digital Index, Lloyds Bank (2019) (https://www.lloydsbank.com/assets/media/pdfs/banking_with_us/whats-happening/LB-Consumer-Digital-Index-2019-Report.pdf) and No Longer Optional, DCMS (2018) (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/807830/No_Longer_Optional_Employer_Demand_for_Digital_Skills.pdf). ↩

8. Opinions and lifestyle survey data module, ONS (2020) (https://www.gov.uk/government/statistical-data-sets/ad-hoc-statistical-analysis-202021-quarter-2). This survey used specific definitions of data skills (see survey for details). The question was asked to respondents currently in employment or who had undertaken casual or unpaid voluntary work in the last week in February 2020. ↵

9. Assessing the value of TfL's open data and digital partnerships, Deloitte (2017). (http://content.tfl.gov.uk/deloitte-report-tfl-open-data.pdf) The international trend is also likely to see increasing demand and job creation for both high-skilled jobs, and also basic data skills for the entire workforce. For example, the growth in AI could create 58 million new (high-skilled) jobs internationally over the coming years, improving the quality of work by replacing manually laborious professions with more creative and analytical roles – World Economic Forum: The Future of Jobs, WEF (2018) (http://reports.weforum.org/future-of-jobs-2018/) ↵

10. Existing work in the space includes the Race Disparity Unit (https://www.gov.uk/government/organisations/race-disparity-unit). who collect, analyse and publish government data on the experiences of people from different ethnic backgrounds, supporting government departments in driving change where disparities are found. ↵

11. For a summary of findings from our call for evidence, see the accompanying publication (https://www.gov.uk/government/publications/uk-national-data-strategy/call-for-evidence-and-roundtable-engagement-summaries). Evidence on the scope and scale of data skills in the third sector can be found in the Skills Platform, Charity Digital Skills Report, (2019) (https://www.skillsplatform.org/charity_digital_skills_report_2019.pdf) ↵

12. These standards involve common file formats, integrated time and budget management, and can facilitate sharing of information, off-site construction, automation of supply chains, and a range of other benefits. HM Government, 2013. Construction 2025 (https://www.gov.uk/government/publications/construction-2025-strategy), Industrial Strategy: Government and Industry in Partnership (https://www.gov.uk/government/collections/industrial-strategy-government-and-industry-in-partnership) ↵

13. This paragraph summarises points from the following sources: A BIM Readiness & Implementation Strategy for SME Construction Companies in the UK (Ghaffarianhoseini, et al., 2016); BIM adoption and implementation: Focusing on SMEs (Vidalakis, et al., 2019); An overview of benefits and challenges of Building Information Modelling (BIM) adoption in UK residential projects (Georgiadou, 2019); Critical Success Competencies for the BIM Implementation Process: UK Construction Clients (Dakhil, et al., 2019) ↵

14. Some work has been done in parts of government to attempt to improve data quality. The Government Statistical Service 2019-21 Quality Strategy (https://gss.civilservice.gov.uk/policy-store/government-statistical-service-gss-quality-strategy/) aims to 'improve statistical quality across the Government Statistical Service (GSS). The forthcoming Data Quality Framework for government will set out key principles and provide guidance and tools for organisations to identify and take action to ensure data is fit for its intended purpose. ↵

15. Some work has taken place to try to implement a consistent approach to standards across government. In June 2019, the Office for National Statistics developed the GSS Harmonisation Strategy (https://gss.civilservice.gov.uk/policy-store/government-statistical-service-gss-harmonisation-strategy/), which sets out realistic actions to improve comparability and coherence across official statistics. In August 2019, the Government Digital Service developed a set of API technical and data standards (https://www.gov.uk/guidance/gds-api-technical-and-data-standards). The INSPIRE Regulations 2009 and INSPIRE Regulations (Scotland) 2009 established a UK Spatial Data Infrastructure with common standards for spatial data and spatial data services. ↵

16. To address the lack of career pathways in cyber security, DCMS is working with the Institute of Engineering and Technology to establish the UK Cyber Security Council – UK Cyber Security Council Formation Project, The IET (https://www.theiet.org/impact-society/uk-cyber-security-council-formation-project/) ↵

17. Members include companies such as Accenture, GSK and Nationwide, organisations such as the CBI, FSB, ONS, the Turing Institute, The National Innovation Centre for Data, the Data Lab several Royal Societies, academia, the Nuffield Foundation and DCMS. ↵

18. Opinions and Lifestyle survey data module, ONS (2020) (https://www.gov.uk/government/statistical-data-sets/ad-hoc-statistical-analysis-202021-quarter-2). Of respondents working in the UK in February 2020, 72% use some data skills occasionally or a lot. ↵

19. By one estimate, there was a five-fold increase in the amount of new data created and used internationally per year between 2018 and 2025 (The Digitization of the World from Edge to Core, IDC (2018) (https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf)). Beyond just volume, the UK data economy more than doubled from 2013 to 2020 (The European data market monitoring tool, EU (2020) (http://datalandscape.eu/european-data-market-monitoring-tool-2018)). The size of the UK data economy increased from €43.8bn in 2013 to €89.7bn in 2020. ↵

20. For example, a sample of larger businesses that used Companies House data directly attributed £23m/year of revenue to it, although this is an average and may not reflect changes over time. Companies House data: valuing the user benefits, BEIS (https://www.gov.uk/government/publications/companies-house-data-valuing-the-user-benefits) ↵

21. See also: The Value of Data, ODI (2020) (https://www.bennettinstitute.cam.ac.uk/media/uploads/files/Value_of_data_summary_report_26_Feb.pdf) ↵

22. Opinions and lifestyle survey data module, ONS (2020). (https://www.gov.uk/government/statistical-data-sets/ad-hoc-statistical-analysis-202021-quarter-2) Of the organisation types asked about, the least trusted were marketing and advertising companies (3%) and the highest were NHS and healthcare providers (73%). ↵

23. This guidance is aimed at anyone working directly or indirectly with data in the public sector, including data practitioners (such as statisticians, analysts and data scientists), policymakers and operational staff. The Framework teams and departments a template for the development of their own guidelines, such as the Office for AI's Procurement Guidelines and the Department for Health and Social Care's Code of Conduct for Data-Driven Health and Care Technology. ↵