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_Longer_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. [footnote 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. [footnote 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.[footnote 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)](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,[footnote 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.[footnote 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/).[footnote 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 CMA's market study into online platforms and digital advertising (https://assets.publishing.service.gov.uk/media/5dfa0580ed915d0933009761/Interim _report.pdf) highlight data concentration and lack of interoperability as a critical factor to suboptimal competition and innovation in digital markets. Alongside this, research by the Bennett Institute and ODI (https://www.bennettinstitute.cam.ac.uk/media/uploads/files/Value_of_data_summar y_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 (https://assets.publishing.service.gov.uk/media/5dfa0580ed915d0933009761/Interim_report.pdf) 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
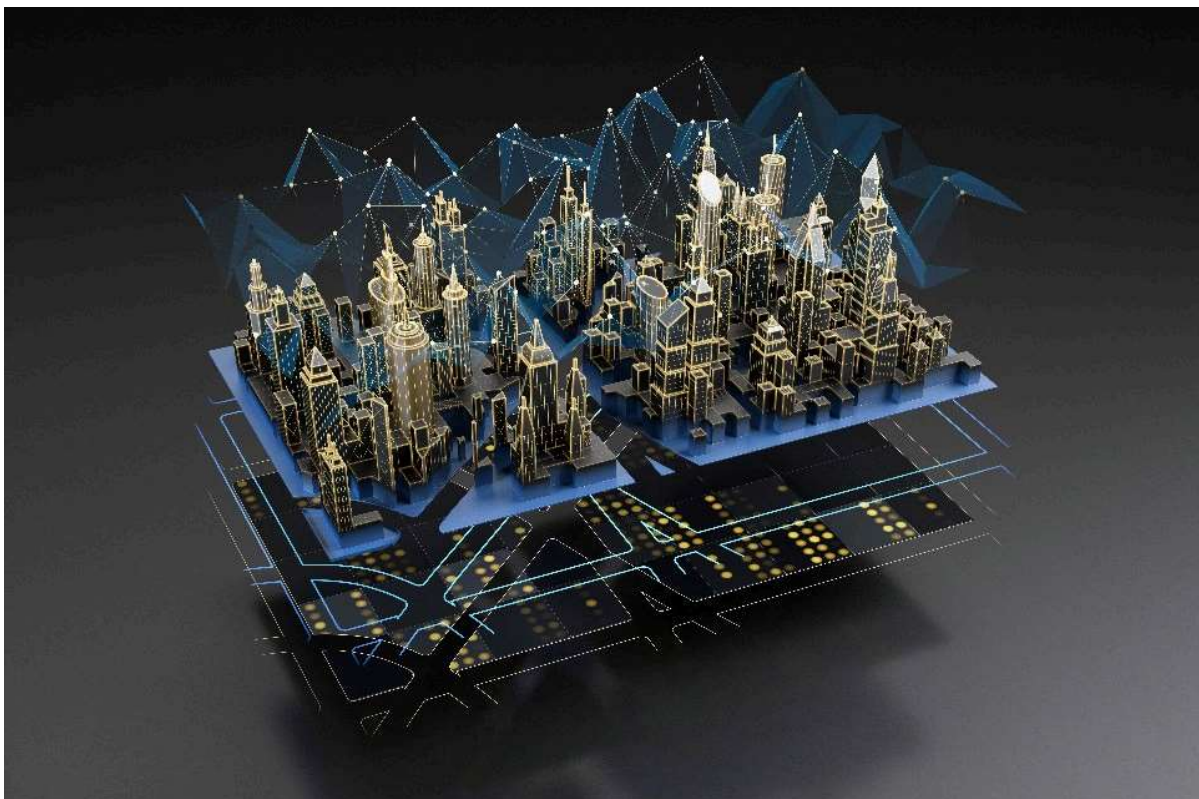
Case study: Data for the built environment

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.
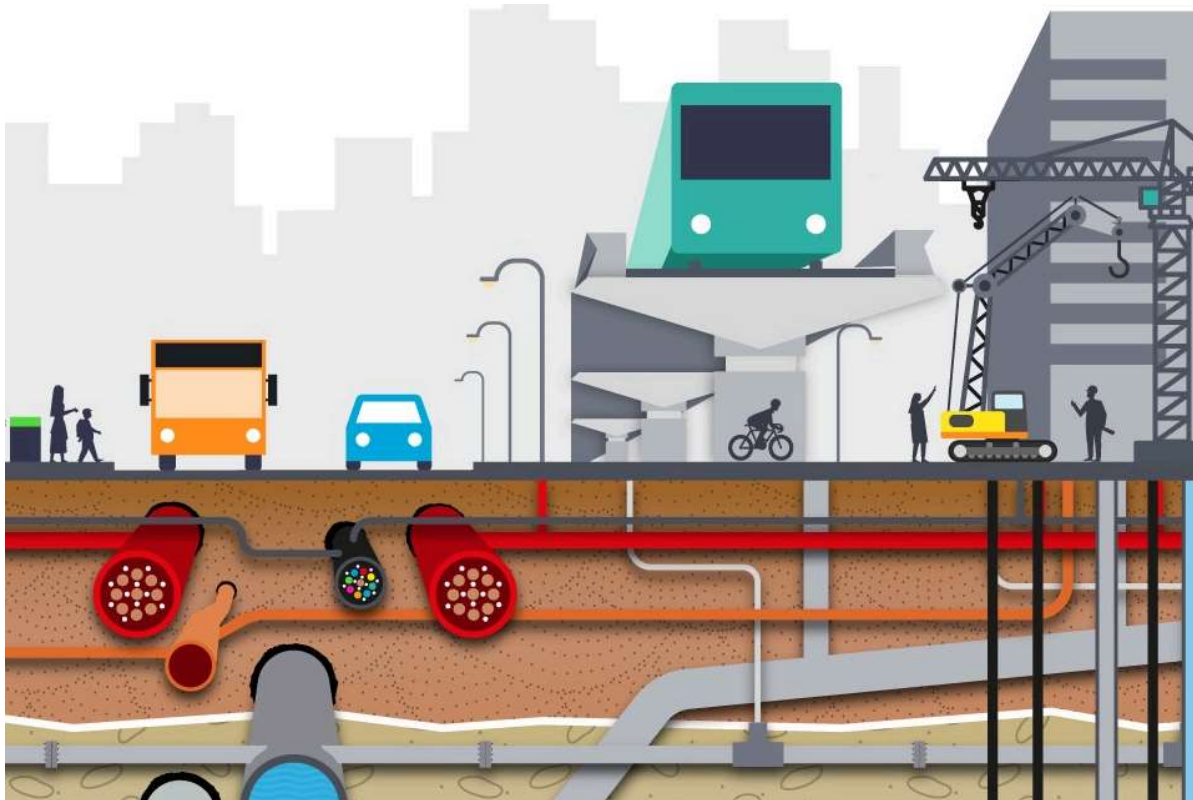
Image source: Project Iceberg, FutureCitiesCatapult © 2017

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/)](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:

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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[footnote 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.[footnote 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/)](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.
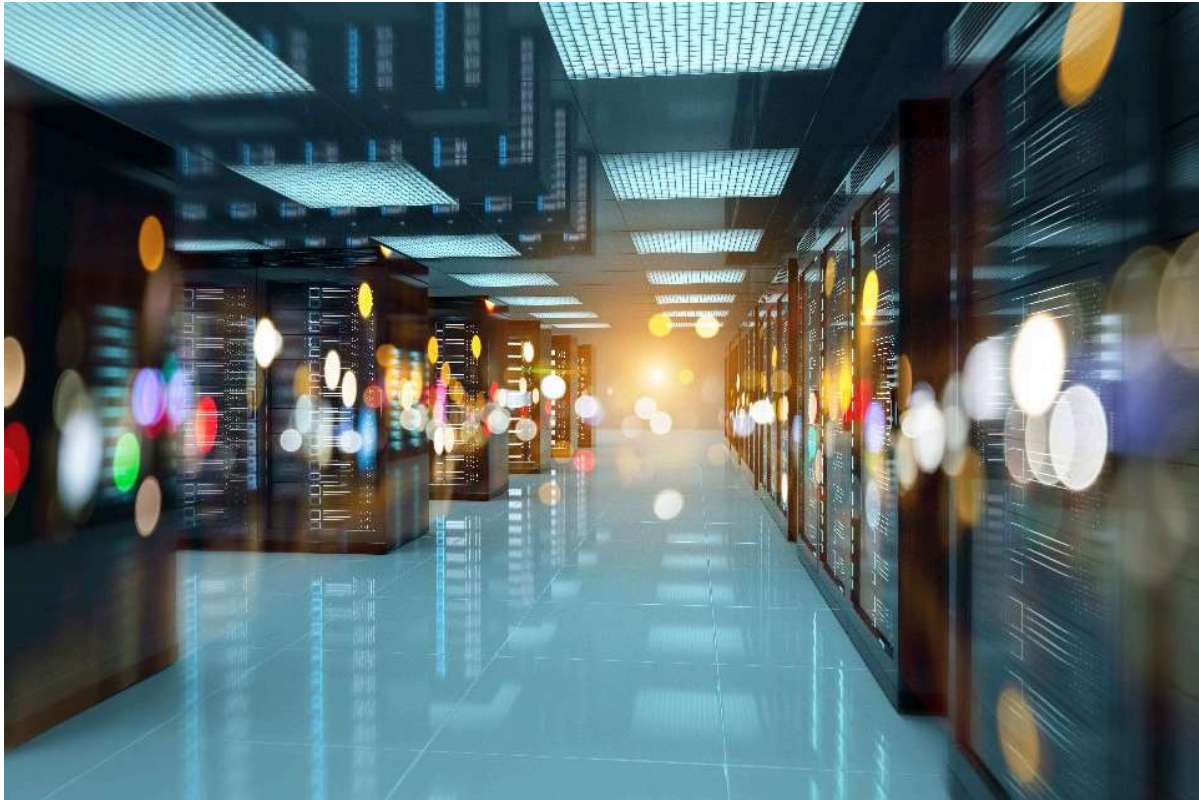
Case Study: The hidden impact of the legacy estate

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.

Consultation

A public consultation on this document was held in late 2020, and the government formally responded to the consultation in May 2021.

[Read the full government's response to the National Data Strategy consultation. (https://www.gov.uk/government/consultations/uk-national-data-strategy-nds-consultation)](https://www.gov.uk/government/consultations/uk-national-data-strategy-nds-consultation)

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.
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.

Term	Description
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.

Term	Description
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.
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.

Term	Description
	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.
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.

Term	Description
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:	Cabinet Office / ONS

Pillar	Action	Owner
	– 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)	
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

Pillar	Action	Owner
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
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	DCMS

Pillar	Action	Owner
	out clear distinctions between data skills, digital skills and AI skills, and consider the benefits of providing information on pathways into data related careers.	
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	DCMS

Pillar	Action	Owner
	training, helping signpost SMEs to good quality online training material matched to their technical data science capabilities and ambitions.	
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
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	BEIS

Pillar	Action	Owner
	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	
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
Data Availability	We will seek provisions with trade partners – including current negotiations with the EU, US, Japan, Australia and New Zealand – that remove unnecessary	DCMS

Pillar	Action	Owner
	barriers to cross border data flows, with specific commitments to prevent the use of unjustified data localisation measures.	
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

Pillar	Action	Owner
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
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	Cabinet Office

Pillar	Action	Owner
	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.	
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
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	DEFRA

Pillar	Action	Owner
	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.	

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)](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)](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)](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)](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)](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.

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