HM Government

# Pro-innovation Regulation of Technologies Review

## Digital Technologies

March 2023

HM Government

# Pro-innovation Regulation of Technologies Review

## Digital Technologies

This report was presented by Sir Patrick Vallance, the Government Chief Scientific Adviser, to the Chancellor of the Exchequer and to HM Government, as part of the Pro-innovation Regulation of Technologies Review.

March 2023

# Contents

# Context

Digital technologies are the engine driving the UK's economic growth. The UK digital sector contributed 7.4% of UK total GVA in 2022, growing three times faster than the rest of the economy. We are home to over 85,000 tech startups and scale ups providing over 3 million jobs and a strong innovation ecosystem.[1]

Advances in digital technologies, such as artificial intelligence (AI), are and will continue to be a significant contributor to the UK's future competitiveness, productivity, and sustainable growth. With our strong research base, we are in a favourable position to capture the economic prize presented by emerging digital technologies. However, the challenge for government is to keep pace with the speed of technological change: unlocking the enormous benefits of digital technologies, while minimising the risks they present both now and in the future.

Digital technologies are challenging existing regulatory structures, and governments around the world are taking steps to respond. Well-designed regulation and standards can have a powerful effect on driving growth and shaping a thriving digital economy. Ensuring a proportionate and agile regulatory approach can offer clarity and confidence to investors, businesses and the public.

The UK should seize this opportunity to champion a pro-innovation approach that facilitates widespread commercial S&T applications. We should be bold, taking a three-stage approach to the regulation of emerging technologies by allowing:

- regulatory flexibility and divergence at an early stage for emerging technologies, thereby defining regulations and standards in the global markets we want to lead;
- promoting and learning from experimentation to support the scaling of key technologies e.g., through regulatory sandboxes and testbeds; and
- seeking international regulatory harmonisation once technologies are becoming established, ensuring market access for our most innovative companies.

This three-stage approach should underpin our regulatory approach for innovation.

[1] Department for Digital, Culture, Media and Sport (DCMS) (2022) *UK tech sector retains #1 spot in Europe and #3 in world as sector resilience brings continued growth*: https://www.gov.uk/government/news/uk-tech-sector-retains-1-spot-in-europe-and-3-in-world-as-sector-resilience-brings-continued-growth

## Scope of the review

We have engaged extensively across government, with regulators, industry and academic experts and have identified digital technologies and applications which require a distinct regulatory approach. Our advice focuses on specific challenges for artificial intelligence and data, as well as short-term actions to address regulatory barriers for autonomous vehicles, drones, cyber security, and space and satellite technologies. A number of these proposals may require legislation to achieve. Given the cross-cutting nature of digital technologies, recommendations on regulatory changes in green industries and the life sciences will be addressed in subsequent reports.

In this review we offer recommendations in three broad areas:

a) supporting a step-change in the UK's regulatory approach to AI;

b) facilitating greater industry access to public data to help deliver the government's public services transformation programme and address pressing societal challenges; and

c) government signalling and leadership to focus regulator efforts on innovation in autonomous vehicles, drones, cyber security, and space and satellite technologies.

This advice complements recent reviews including the government's Plan for Digital Regulation, Digital Strategy and the report of the independent Taskforce on Innovation, Growth and Regulatory Reform. Recommendations will support forthcoming policy including through the AI White Paper and the Emerging Technologies Regulation Review.

## Key challenges

Existing regulatory rules and norms which have guided business activity were in many cases not designed for emerging digital technologies and business models. Many digital technologies require a different approach because they combine distinct features - such as powerful data processing capabilities, the use of advanced data analytics and algorithms, speed of innovation and growth, and horizontal integration.[2]

Regulation of the digital sector is changing, with new legislation being considered across online safety, data protection, financial services, cyber security, and competition in digital markets, among others. Navigating these different regulatory remits – and keeping track of evolving changes – can be challenging for businesses trying to introduce new products and processes. Regulator behaviour and culture is a major determinant of whether innovators can effectively navigate adapting regulatory frameworks. In this review we have identified regulatory challenges which significantly impact the digital sector:

[2] DCMS (2021) *Digital Regulation: Driving growth and unlocking innovation*: https://www.gov.uk/government/publications/digital-regulation-driving-growth-and-unlocking-innovation

1. Fragmentation: There are over 10 different regulators with digital technologies within their direct remit, whose mandates often overlap and can be contradictory. This can create a significant burden when companies, particularly SMEs, need to engage with multiple regulators or are unclear on which regulator(s) to approach (case study A). Initiatives on cross-regulator cooperation such as the Digital Regulation Co-operation Forum seek to create a more coherent regulatory landscape (case study B).

2. Pacing: Often technological developments outpace the speed at which established regulatory systems can respond to its applications. However, for emerging digital technologies, the industry view is clear: there is a greater risk from regulating too early. It will be important that the regulatory system strikes the right balance between providing clarity and building public trust, while also enabling development, experimentation, and deployment.

3. Skills: Many regulators, including the CAA and ICO, report challenges in attracting and retaining individuals with relevant skills and talent in a competitive environment with the private sector, especially those with expertise in AI, data analytics, and responsible data governance.

4. Incentives: The rewards for regulators to take risks and authorise new and innovative products and applications are not clear-cut, and regulators report that they can struggle to trade off the different objectives covered by their mandates. This can include delivery against safety, competition objectives, or consumer and environmental protection, and can lead to regulator behaviour and decisions that prioritise further minimising risk over supporting innovation and investment. There needs to be an appropriate balance between the assessment of risk and benefit.

**Case Study A: Satellite launches: a complex regulatory pathway**

The launch of space missions in the UK is an example of where regulatory fragmentation is impacting the development of a high-growth potential sector. Space missions require an Orbital Operators Licence from the Civil Aviation Authority (CAA) under the Space Industry Act 2018, a Permanent Earth Station (PES) licence from Ofcom (and the International Telecommunication Union (ITU)) and possibly an export licence depending on where they are launching from.

This fragmentation can be a substantial burden on time and resources, first requiring identification of the right regulators, and then separate application processes for each. In some instances, this has resulted in delays to launches and the allocation of resources and labour away from the development of the technology.

# Headline recommendations

## Artificial intelligence

In the National AI Strategy, the government set out an ambitious ten-year plan for the UK to remain a global AI superpower and encourage AI companies to start and grow in the UK. We note from our engagement with industry that there is a 12-to-24-month window to make the UK one of the top places in the world to build foundational AI companies, with other countries moving faster to provide clarity and a friendly regulatory environment for innovators in this space. Our regulatory approach will be critical in reaching this ambition and action needs to be taken urgently.

AI technology covers a broad spectrum of technologies, tools and applications, with transformative implications across a number of sectors. There are currently differences between the powers of regulators to address the use of AI within their remit as well as the extent to which they have started to do so. The levels of acceptable risk in innovation in AI are sector and context dependent. AI technologies used in different sectors are therefore subject to different controls. While in some instances there will be a clear rationale for this, it can further compound an overall lack of regulatory clarity.

The extremely fast pace of development of AI technology also creates difficulties for regulators in keeping up with the emerging applications of AI and the need for continuous refinement of their regulatory approach. More needs to be done to improve business confidence, boost public trust, and ensure the public benefit from safe innovation, particularly where public services are concerned. Regulators should ensure that while they rightly safeguard against the risks of AI, they balance the opportunity cost of a lack of innovation, and the social benefits its deployment might bring.

## Sandboxing

**Recommendation 1: Government should work with regulators to develop a multi-regulator sandbox for AI to be in operation within the next six months**

A regulatory sandbox is a live testing environment, with a well-defined relaxation of rules, to allow innovators and entrepreneurs to experiment with new products or services under enhanced regulatory supervision without the risk of fines or liability. They are typically operated by a regulator for a limited time period and seek to inform rule making.

Effective and proportionate regulation of AI requires a new approach from government and regulators: one which is agile, expert led, and able to give clear and quick guidance to industry. From our engagement with industry there is clear appetite for the UK to rapidly launch an AI sandbox to enable experimentation and encourage greater co-operation between regulators. An approvals process that brings together multiple regulators would reduce inconsistencies in regulatory responses and provide a more coherent approach.

The Digital Regulatory Cooperation Forum, which brings together four key regulators (Ofcom, ICO, CMA, and FCA) would be well placed to support the sandbox with its convening role, bringing in other relevant regulators to encourage join up.

The following principles should guide the development of the AI sandbox:

- **Time-bound**: Provide a time-limited opportunity for firms to test innovative propositions in the market with real consumers.
- **Technology stage**: Focus on areas where the underpinning science or technology is at a stage to make a major breakthrough feasible.
- **Societal challenges**: Set out bold, ambitious ways to help solve a societal challenge and/or take advantage of areas where the UK is poised to be a world leader.

The following features should be considered in the design of the AI sandbox:

- **Targeted signposting**: Nationally and internationally to encourage uptake from companies with clear eligibility criteria.
- **Timelines**: Clear application deadlines, and a consistent feedback loop throughout for successful and unsuccessful companies. Timelines for outcomes should be clear and ambitious.
- **Accountability and transparency**: Consideration of ethics, privacy and protections of consumers, involving respected advisors and bodies early, and iterative engagement with companies.
- **Impact**: Defined clearly and early to inform the selection of businesses and stakeholders to work with and to minimise risks in the delivery phase. Pro-innovation objectives and outcomes should be monitored regularly. Ministers should consider how to agree targets for innovation and monitor progress.
- **Guaranteed output**: A commitment from the participant regulators to make joined-up decisions on regulations or licences at the end of each sandbox process and a clear feedback loop to inform the design or reform of regulatory frameworks based on the insights gathered. Regulators should also collaborate with standards bodies to consider where standards could act as an alternative or underpin outcome-focused regulation.
- **Synergy**: Consideration of other approaches that can complement the sandbox, including dedicated advice services for innovators (‘innovation hubs’), setting regulatory challenges to incentivise innovation, ‘scaleboxes’, and cross-regulator one-stop-shops.
- **Lessons learnt**: Ensure the advice and lessons learnt from regulatory experimentation are shared with the wider market to benefit the industry as a whole and mainstream innovation. This could also inform the expansion of this capability to cover multiple industry sectors over time for example, quantum and semiconductors.

A sandbox could initially focus on areas where regulatory uncertainty exists, such as generative AI, medical devices based on AI, and could link closely with the ICO sandbox on personal data applications.

Funding should be provided to support the creation of the sandbox and facilitate the rapid recruitment of specialist talent and skills. Forthcoming cross-cutting recommendations to future-proof our regulatory system will explore challenges around funding, capacity and skills in greater detail. Establishing a high profile, multi-regulator sandbox for AI staffed with content experts would support the scale-up of companies; increase investment opportunities; provide new products and services for consumers; and increased regulatory compliance by design.

Case Study B: Digital Regulation Cooperation Forum

The Information Commissioner's Office (ICO), Office of Communications (Ofcom), the Competition and Markets Authority (CMA) and the Financial Conduct Authority (FCA) have together formed the Digital Regulation Cooperation Forum (DRCF), which seeks to deliver greater co-operation and a coherent approach to regulation between the four regulators of the digital sector, which contributed nearly £151bn to the economy in 2019, with 1.7 million filled jobs in the sector in 2020.

The DRCF is helping to create a more supportive environment for innovation in the UK by making it easier for firms that operate across digital regulatory boundaries to do business.

The DRCF is undertaking exploratory research and piloting a multi-agency advice service for digital innovators who require joined up advice from multiple regulators. The service is being designed around the views, needs and working practices of innovators across the digital economy. Success will be measured by the accessibility of the pilot service and the impact of the advice on the businesses who use it.

## Generative AI

Generative AI creates text, images, music, speech, code or video based on learning from existing available content. In light of rapid technological advancements in this space, generative AI is of growing interest to technologists, investors, policymakers, and society at large.

**Recommendation 2: Government should announce a clear policy position on the relationship between intellectual property law and generative AI to provide confidence to innovators and investors.**

We note from our stakeholder engagement that the relationship between intellectual property law and generative AI is unclear. The Intellectual Property Office (IPO) has consulted on changes to Text and Data Mining (TDM) rules in the UK but there remains a lack of regulatory clarity as to the direction of those reforms, particularly for AI firms deploying TDM techniques to generate new content. Creating an environment in which TDM is enabled in the UK would

attract investment, support company formation and growth, and show international leadership.

If the government's aim is to promote an innovative AI industry in the UK, it should enable mining of available data, text, and images (the input) and utilise existing protections of copyright and IP law on the output of AI. There is an urgent need to prioritise practical solutions to the barriers faced by AI firms in accessing copyright and database materials. The government should work with the AI and creative industries to develop ways to enable TDM for any purpose, and to include the use of publicly available content including that covered by intellectual property as an input to TDM (including databases). The opportunity here is to focus on clarifying a simple process concerning the input to AI models; IP rights and their enforcement would apply to the output of any product. We also recommend a code of practice and a requirement for altered images to be labelled as generated or assisted by AI.

In parallel, technological solutions for ensuring attribution and recognition, such as watermarking, should be encouraged, and could be linked to the development of new international standards in due course. The government should prioritise reaching a policy position rapidly, building on the external engagement conducted over the last 12 months. The government should recognise that the advent of generative AI globally represents both an opportunity and a challenge to the creative industries and education sectors but that the restriction of data access for training sets would be likely to put the UK at a disadvantage and impede domestic development of the technology.

The content produced by the UK's world-leading creative industries, including for generative AI, is fundamental to the success of the tech sector. These sectors are the UK's strengths and their success is central to realising our growth ambitions and they should continue to grow in partnership.

To increase confidence and accessibility of protection to copyright holders of their content as permitted by law, we recommend that the government requires the IPO to provide clearer guidance to AI firms as to their legal responsibilities, to coordinate intelligence on systematic copyright infringement by AI, and to encourage development of AI tools to help enforce IP rights.

## Data

Both the development of new technology and service improvement relies heavily on access to good data. The government and broader public sector bodies hold significant data, which if made available to industry in a consistent way, could facilitate research and innovation and improve public services. However, the ability of the private sector to access public data is inconsistent and fragmented. Concerns over privacy, perceptions of a restrictive regulatory regime, and a lack of investment in skills and the time needed to make public data available, are significant constraints.

Data sharing and linkage across the public sector is also limited, which hinders the ability of government to develop innovative methods to improve public services. Improved integration of government datasets not only has the potential to improve policy making, but also could make it easier for private sector firms to access this information safely, including by ensuring consistency across data and privacy standards. While the government has set out a number of recommendations to address this, including the '2020 National Data Strategy' and the

'2022 to 2025 Roadmap for Digital and Data', feedback from stakeholders suggests that many practical barriers to implementation remain.

**Recommendation 3: Facilitate greater industry access to public data, and prioritise wider data sharing and linkage across the public sector, to help deliver the government's public services transformation programme.**

The AI industry can play a key part in helping to deliver the transformations to the top 75 public services as set out in the 2022-25 Roadmap – and access to the necessary data will be an essential part of that process. The government should identify the most pressing of these challenges and run a competitive process to seek innovative, data driven ideas from industry to deliver the Roadmap. As part of this competition, the government should establish a process to allow the rapid provision of data in selected areas, in the form of reusable verifiable credentials and ensure appropriate access to data sets that can realise commercial value opportunities. Ongoing public engagement and involvement on the use of data will be key.

The Government should also consider the potential use of other privacy enhancing technologies or data intermediaries to provide efficient, lower risk options for data exchange. The lessons learnt from this process around the type and detail of public data that industry finds most valuable should inform further work on the government's open data strategy. In parallel, government departments should prioritise further data sharing and linkage across departmental boundaries to support policy development and public services transformation, using platforms such as the ONS' Integrated Data Service to make data available to a wider number of analysts and researchers on a consistent and repeatable basis.

## Transport

The transport sector globally is undergoing substantial technological transformation. UK regulatory frameworks must keep pace to enable real world testing and deployment of various automated transport applications - including self-driving cars, autonomous shipping, and drones. The Department for Transport's proposed package of reforms to address some of this, developed through extensive consultation with industry, is set out in the Future of Transport Bill.

**Recommendation 4: The government should bring forward the Future of Transport Bill to unlock innovation across automated transport applications.**

We recommend allocating Parliamentary time for the passage of the Future of Transport Bill in the Fourth Session, starting in the Autumn, which would send a strong signal of intent and pave the way for regulatory clarity.

The government should continue to prioritise efforts to deliver effective regulation for commercialisation and scale-up. A good example of the progress the government has made in this area includes the new Future Mobility testbed project in the West Midlands, which will provide over 180 miles of roads, the largest area in the UK, for developing the next generation of connected autonomous road vehicles. By deploying concepts in a living environment, and using advanced facilities and services, organisations can understand how their technology is perceived and how it tackles real world challenges, speeding up research and development processes and demonstrating commercial viability.

# Further recommendations

In addition to the above headline recommendations, the review has identified a series of specific, short-term actions the government can take to improve the regulatory landscape across a range of emerging technologies that can deliver significant economic growth, including drones, cyber security, and space and satellite technologies.

## Drones

The drone sector alone is predicted to save UK businesses an estimated £22bn a year by 2030, and contribute £45bn to the UK economy (1.6% of projected GDP). Regulatory risk aversion constrains the use of drones, despite their potential to reduce costs, deliver new services and reduce risk to human life. Further recommendations to unlock the innovation potential of the drone sector include:

- The government should work with the CAA to establish an operating standard for drones, moving away from relying on operators to prove they are safe.
- The government should empower the CAA to better regulate the use of remotely piloted air systems (including drones and unmanned aerial vehicles) beyond visual line of sight. This should include the establishment of publicly owned test sites, developed in partnership with industry and other bodies to meet specific industry needs.
- Ofcom/CAA regulation on radio communications should be amended to allow the use of UAVs/Drones/High-altitude platform station (HAPS) systems to act as radio repeaters. This would allow novel applications to provide temporary or permanent radio coverage and ubiquity of service in rural locations, and would benefit consumers in terms of access to high-speed broadband by communication service providers (CSPs).

Case Study C: Managing Risk with Drones – the Swiss Model

In the UK, the Civil Aviation Authority (CAA)'s overriding objective is aviation safety, which is built around certified aircraft and human contact with pilots. There is currently underdeveloped drone operating standards in the UK, despite their potential to reduce costs and deliver new services.

Switzerland has been a world leader in shaping regulatory frameworks for drones authorisations. Through the Joint Authorities for Rulemaking on Unmanned Systems (JARUS) Working Group on Safety and Risk Management, the Swiss Federal Office of Civil Aviation (FOCA) has been leading the development of the Specific Operations Risk Assessment (SORA). SORA is a 10-step methodology to identify the risk of drone operations which require a permit, classifying the risk posed by a drone flight in the specific category of operations and for the identification of mitigations and safety objectives. This approval method for drone operations is allowing repeatable and scalable drone technology deployments globally and has allowed many startups to enter the market at low cost while meeting high safety standards[3].

In December 2022, the CAA announced its intention to adopt an amended version of the SORA as the mechanism for assessing risk when authorising more complex unmanned aircraft systems at scale. [4]

## Data

In addition to our headline recommendation on public sector data access, the ICO should update its guidance to clarify when an organisation is a controller, joint controller or processor for processing activities relating to AI as a service (AIaaS). This should include guidance on when providers can reuse personal information for improving their models. The current regime is burdensome for consumers and creates disincentives to providing data.

## Space and satellite technologies

The global space market is expected to more than double in size over the next 10 years, with an estimated value of £490 billion by 2030[5]. A 2022 study found that the UK space industry contributed £6.9 billion of direct gross value added (GVA) - equivalent to 0.31% of UK GDP – and £15.8 billion total GVA across the supply chain[6]. The UK is well positioned globally in the small satellite market, with the government's ambition for the UK to become the leading provider of commercial small satellite launches in Europe by 2030[7].

However, industry reports that specific regulatory constraints – in particular the Space Act 2018's liability and indemnity requirements around the granting of licences to launch

[3] Switzerland Global Enterprise (2022) *Switzerland – at the forefront of drone technology*: https://www.s-ge.com/sites/default/files/publication/free/factsheet-drones-switzerland-s-ge-en-2022.pdf

[4] Civil Aviation Authority (2022) *Scalable beyond visual line of sight operations: Our plan to enable scalable beyond visual line of sight operations*: https://www.caa.co.uk/drones/rules-and-categories-of-drone-flying/scalable-beyond-visual-line-of-sight-operations/

[5] Department for Business, Energy & Industrial Strategy (BEIS), Ministry of Defence (MoD), UK Space Agency (2022) *National space strategy:* https://www.gov.uk/government/publications/national-space-strategy/national-space-strategy

[6] UK Space Agency (2022) *Size and Health of the UK Space Industry 2021*: https://www.gov.uk/government/publications/the-size-and-health-of-the-uk-space-industry-2021/size-and-health-of-the-uk-space-industry-2021

[7] BEIS, MoD, UK Space Agency (2022) *National Space Strategy*: https://www.gov.uk/government/publications/national-space-strategy

satellites commercially in the UK – are viewed as disincentivising investment, with the potential to make the UK uncompetitive[8].

In line with the Commons Science and Technology Select Committee's recommendation in their report on the UK space strategy and UK satellite infrastructure[9], government should implement a variable liability approach to granting licences by June 2023. This would reduce cost and time delays for companies seeking launch licences for small spacecraft in particular, making the UK space sector a more attractive location for investment.

## Cyber security

We recommend amending the Computer Misuse Act 1990 to include a statutory public interest defence that would provide stronger legal protections for cyber security researchers and professionals, and would have a catalytic effect on innovation in a sector with considerable growth potential. The Home Office is launching a consultation on how to deliver this change. A July 2022 DCMS data breaches survey found that in the preceding year, 39% of businesses reported a cybersecurity breach or attack[10]. This figure illustrates the gravity of the threat such attacks pose to our economic and national security. However, under the Act, professionals conducting legitimate cybersecurity research in the public interest currently face the risk of prosecution if they attempt to access a computer or computer material without obtaining the necessary authorisation. Countries such as France, Israel, and the United States have already updated their regulations to provide this defence. For the UK's cyber industry to compete on a level playing field, the UK government should do the same.

## Looking ahead to newly emerging technologies

In compiling this report we have engaged extensively across the digital economy. One message that comes across clearly from industry is that the government should avoid regulating emerging digital technologies too early, to avoid the risk of stifling innovation. We therefore recommend that the government and regulators should continue to engage with industry on issues around safety, risk and benefits of innovation, and that the government and regulators should rapidly build capability and know-how to enable them to positively shape regulatory frameworks at the right time. Upcoming government strategies, including the Quantum Strategy, Semiconductor Strategy, and the Emerging Technologies Review provide an opportunity for the government to signal its commitment to a strategic, long-term vision to support emerging digital technologies.

---

[8] Taskforce on Innovation, Growth and Regulatory Reform (2021) *Report*: https://www.gov.uk/government/publications/taskforce-on-innovation-growth-and-regulatory-reform-independent-report

[9] Science and Technology Select Committee, *UK space strategy and UK satellite infrastructure* (HC 2022-23 100) paras 76-78: https://publications.parliament.uk/pa/cm5803/cmselect/cmsctech/100/summary.html

[10] DCMS (2022) *Cyber security breaches survey 2022*: https://www.gov.uk/government/statistics/cyber-security-breaches-survey-2022

**© Crown copyright 2023**

This publication is licensed under the terms of the Open Government Licence v3.0 except where otherwise stated. To view this licence, visit nationalarchives.gov.uk/doc/open-government-licence/version/3

This publication is also available on our website at www.gov.uk/government/publications

Any enquiries regarding this publication should be sent to us at XWHRegulationSprint@go-science.gov.uk