Future technology in government [1]

The world is currently experiencing a period of rapid technological change that has been called 'the fourth industrial revolution [2]'. New technologies are being developed which will fundamentally reshape government workforces and change how government makes policy and delivers public services.

The breadth and complexity of new technologies has created uncertainty about how they will be used, with many, often contradictory claims being made about their benefits and harms, such as the threats to privacy and the potential for governments to be more efficient.

What are future technologies? [3]

Future technologies can be physical devices such as drones, wearable technology and robots. These may be used as tools directed by humans to collect data, access information, or perform useful tasks, sometimes in the place of a person.

Other future technologies take the form of advanced computer software that can handle data in new and powerful ways – for example, artificial intelligence. Some of these methods can identify patterns from data and take actions in response to them, or they may offer new ways to securely store and share information.

In some instances, these technologies will provide insights or perform tasks that were previously impossible. In other cases, they will do things that were possible in principle, but impractical in reality – due to the time or cost of using humans to perform these tasks. These technologies may also do things that people currently do, just with greater precision or speed.

The list of technologies is long, and the names can be confusing. For a more extensive list, visit our future technology glossary [4].

How could technology change government? [5]

Government has always been shaped by advances in technology. For example, advances in communication – from the printing press to email – have changed how governments organise themselves and interact with the public they serve. New future technologies have the potential to drive another fundamental shift in how the whole of government works.

In 2017 the Government Digital Service (GDS) conducted a survey of technological innovation in government [6]. It identified five types of public sector innovation. These also broadly describe the types of change that new technology could bring within government.

Services	Future technologies may offer substantial improvements to how existing services are operated and delivered. Some existing services have already incorporated elements of future technology on a trial basis – for example, the use of advanced types of computer-based learning to predict the weather. They may also make entirely new types of service possible.
Processes	Within government, future technology has the potential to transform entire processes – such as welfare benefits payments or construction planning – in ways that significantly improve productivity and efficiency. This will include changes to the government workforce, which will see some tasks taken out of human hands, and the creation of other new tasks that require specific human action or oversight.
Regulations	As new technologies emerge and mature, they will create new regulatory needs and may also offer novel ways to regulate activities in a faster, more reactive, and more precise way. For example, algorithms using real-time traffic data could make on-the-go adjustments to speed limits to improve the flow of vehicles in towns and cities.
Policies	The unprecedented ability of future technologies to assemble, interrogate and interpret large amounts of data will transform how policies are made and implemented. This may make it possible to target policies with increasing precision, or to design policies which adapt smartly to changing circumstances.
Technology	The adoption of technologies by government, and its own internal process of innovation, may give rise to new forms of technology that have applications and benefits for government, the wider public sector and the private sector.

Definitions adapted from Government Digital Service, Technology innovation in government survey, 2017.

Where are these technologies currently being used in government? [7]

The GDS review of the technology landscape identified well over a hundred projects across government which have

experimented with or are actively trialling future technologies to various ends. Other examples are documented in news articles and other releases on GOV.UK, or the blogs of departmental digital and innovation units.

Current areas include:

Artificial intelligence (AI), machine learning and algorithms

These are technologies which can learn from data to perform tasks that normally require human intelligence. For example:

- Project NELSON [8] is a Ministry of Defence project which uses AI to provide a rapid decision-making capacity built into all warships. This system gathers information collected by Navy vessels, such as radar and sonar data. NELSON then incorporates this data into a single, secure platform that is shared between all the ships in a fleet. The AI system can automatically analyse this data and offer information on potential threats and hazards, ranging from hostile entities to adverse weather.
- Machine learning is being trialled to improve education in the UK. In 2018 Ofsted began using new automated methods to analyse historical school inspection data [9]. Insights from this are used to help determine when a school needs to be inspected. Similarly the Department for Education is using computerised learning methods to analyse patterns of underinvestment in schools [10].

Blockchain, cryptocurrencies and distributed ledgers

These are technologies which offer new ways to securely store and share information. They can also form the basis for systems of information exchange, mediating new types of transaction. For example:

- The Department for Work and Pensions (DWP) has trialled a bespoke cryptocurrency, a type of digital money, called Govcoin [11] to make benefits payments [12] to individuals. This system aimed to make payments easier and more secure. Benefit claimants could access their funds instantly, and with the help of a new phone app they could apportion money to different needs – such as rent, utilities, or savings.
- Blockchain, a novel form of database technology, is being trialled by the Food Standards Agency to track the movement of cattle [13] as part of the ongoing development of the Livestock Information Service [14]. Information about cattle, such as their age and veterinary history has previously been spread over a mixture of paper records and digital databases. The new system brings this information together in a single place. Using blockchain adds transparency to the system of records and makes it easier for farmers and vets to add new information and share it instantly.

Drones, mechanical robots, wearables and the internet of things

These are physical devices which may have some autonomy; they can perform tasks in place of humans. These devices are particularly suited for tasks which take place in inaccessible or hazardous environments, or require speed, strength or precision beyond human abilities. They can also enable people to interact with intelligent systems and the internet in new and more direct ways.

- The Defence Science Technology Laboratory's Project Minerva [15] seeks to develop an autonomous robot which can investigate sites with chemical or biological hazards [16]. This greatly reduces the risks that individual human investigators face when examining these types of site.
- The NHS has been developing a system called Technology Integrated Health Management [17] as part of its larger NHS Test Beds programme. This system aims to improve the care of individuals with dementia and help them to live more independently in their own home. Networks of sensors, monitors and other devices, some worn by the patient, some placed in their home, gather information about the patient and provide insights and alerts which help to support their wellbeing.

Data visualisation, simulation and big data

Building on the potential of methods such as deep learning to interrogate data, these technologies offer new ways for people to interact with and immerse themselves in virtual worlds and other environments that derive from massive datasets.

- Sky View 360 [18] is a virtual reality training system developed by the Met Office to enhance how it trains its meteorologists. Part of the training program involves familiarising trainees with features of the weather, such as different cloud types or the intensity of rain. Previously this involved spending time outside, so depended on the right conditions. Using virtual reality, relevant weather features can be simulated to help trainees develop the understanding they need.
- DWP has developed Churchill, a novel data visualisation system [19]. This "allows policy makers to safely explore [ONS] data by geography, time and characteristics to develop and deliver data-driven and evidence-based policy". Previously officials would get these data releases in large document packs [20] which did not always have the exact statistics they needed. Churchill provides instant access to the exact data they need when they are developing policy.

These are just some of the projects that have been trialled by government organisations in the UK. In addition to the four main areas of technology outlined above, there have been advances in the infrastructure that underpins them – such as 5G, cloud services and advanced forms of computer hardware.

These kinds of innovation are not limited to the UK – new technologies are being trialled and used in governments all over the world:

- Estonia has developed a form of distributed ledger, a secure type of shared database, called Keyless Signature Infrastructure (KSI) [21]. This provides a secure system to store government information. Estonians can use KSI to verify the authenticity of official documents and electronically sign them if needed.
- South Korea has published a government-wide strategy [22] for future technology that emphasises the applications of what they call 'intelligent IT' to government services. This includes military and law-enforcement applications, as well as customising administrative and welfare services. The South Korean Government is developing a system called MeGov which will "automatically recognise the needs and circumstances of individual citizens".

Further information

The Institute for Government is currently undertaking a research project investigating how these future technologies will change the way government works. In particular, the implications for the government workforce, how it makes policy, and how it delivers public services. Fnd out more from our project page [23], or follow our weeknote [24] and the updates to our future technology glossary [4].

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Links
[1] https://www.instituteforgovernment.org.uk/explainers/future-technology-government
[2] https://www.gov.uk/government/speeches/the-4th-industrial-revolution
[3] http://twitter.com/intent/tweet?text=What%20are%20future%20technologies%3F
[4] https://docs.google.com/document/d/1eBcVVuvUKLLReziK-EAV9aqQKixbEsVrKXB43NEILfQ/edit
[5] http://twitter.com/intent/tweet?text=How%20could%20technology%20change%20government%3F
[6] https://www.gov.uk/government/publications/technology-innovation-in-government-survey/technology-innovation-in-government-survey
[7] http://twitter.com/intent/tweet?text=Where%20are%20future%20technologies%20currently%20being%20used%20in%20government%3F
[8] https://www.gov.uk/government/speeches/dsei-2017-naval-technology-zone
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[12] https://www.publictechnology.net/articles/news/dwp-minister-government-%E2%80%98carefully-considering%E2%80%99-wider-blockchain-benefits-trial
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