REFORM
RESILIENT STATE

aws

Digital public services: what's next?

Matthew Fetzer
Eleonora Harwich

January 2021

#reformdigital

Acknowledgements

Reviewers

The authors would like to thank Charlotte Pickles, Director, *Reform* and Paul Waller, Faculty of Management, Law and Social Sciences, University of Bradford for helpful comments on an earlier draft of this paper.

Interviewees

The authors would like to express their gratitude to the eight individuals and organisations who were interviewed as part of the research for this paper and kindly agreed to be acknowledged:

William Barker, Associate Director Society for Innovation, Technology and Modernisation, SOCITM and former Head of National Cyber Security Programme – Local, Ministry of Housing, Communities and Local Government (2015-19)

Rachel Dunscombe, Chief Executive Officer, NHS Digital Academy

Eliot Fineberg, Freelance Digital, Design, and Delivery; and Former Deputy Director, Ministry of Justice

Yvonne Gallagher, Director, Digital Value for Money, National Audit Office

James Johns, Senior Manager UK Public Policy, Amazon Web Services

Jocelyn Palmer, Programme Lead - Connecting Care, South, Central and West Commissioning Support Unit

Lara Sampson, Product Director, Universal Credit, Department for Work and Pensions

Paul Waller, Faculty of Management, Law and Social Sciences, University of Bradford

Research seminar

Reform also organised a research seminar to consider what lessons could be learnt from the pandemic in terms of the digital transformation of public services and is grateful to the 8 individuals and organisations who participated.

About

Reform is established as the leading Westminster think tank for public service reform. We are dedicated to achieving better and smarter public services. Our mission is to set out ideas that will improve public services for all and deliver value for money.

We are determinedly independent and strictly non-party in our approach.

About *Reform* Ideas

These are short research papers which enable a high-level exploration of a key public service challenge. The papers examine the policy context, identify key opportunities for reform and set a vision for the future.

About *Amazon Web Services*

For 14 years, Amazon Web Services has been the world's most comprehensive and broadly adopted cloud platform. AWS offers over 175 fully featured services for compute, storage, databases, networking, analytics, robotics, machine learning and artificial intelligence (AI), Internet of Things (IoT), mobile, security, hybrid, virtual and augmented reality (VR and AR), media, and application development, deployment, and management from 77 Availability Zones (AZs) within 24 geographic regions, with announced plans for 18 more Availability Zones and six more AWS Regions in Australia, India, Indonesia, Japan, Spain, and Switzerland. Millions of customers—including the fastest-growing start-ups, largest enterprises, and leading government agencies—trust AWS to power their infrastructure, become more agile, and lower costs. To learn more about AWS, visit aws.amazon.com.

Contents

Ideas

Idea 1: The Department of Digital Culture Media and Sport, in conjunction with the Cabinet Office, should lead a cross-Government digital skills strategy. This should include a focus on how to develop and retain digital leaders in the public sector, including reviewing the pay scales for those with high-level technical skills.

Idea 2: As part of its strategy to move away from legacy IT, the Cabinet Office should focus on identifying solutions to key blockers which have prevented public sector organisations acting on existing guidance. It could consider the creation of a cross-government legacy IT fund, to support departments to move away from legacy systems.

Idea 3: The Cabinet Office, alongside the Department for Digital, Culture, Media and Sport and the Treasury, should re-examine current spending strategies for technology. Specifically, it should review the limits on availability of resource spending for technology as a service.

Introduction

COVID-19 has served as a strong reminder of the importance of digitally enabled public sector organisations, and of how far the UK public sector still is from harnessing the full potential of technology. Despite key advances, for many public sector organisations the pandemic has exposed the patchy nature of public service digitisation – and in some cases, the absence of basic, but essential, capabilities.

Our research suggests, the UK's public sector data infrastructure lacks the coherence and investment which would enable government departments and public sector organisations to make best use of the data they hold.[1] At the start of the pandemic, for example, it became clear that the NHS did not have the infrastructure in place to access and use data for critical operational decisions.[2] This meant that even obtaining a simple count of the number of ventilators in the country became a complex exercise.[3]

In contrast, some government departments proved more resilient from the outset. During the first lockdown, the Department for Work and Pensions (DWP) faced a huge surge in benefit claims and managed to rapidly treble the payment capacity of Universal Credit and Employment and Support Allowance.[4] This highlights the importance of having the right tools and 'ways of working' in place in order to respond in a time of crisis.

Ministers and senior public sector leaders have long recognised the need to get public sector digital infrastructure right in order to harness the transformative potential of technology.[5] However, this has not always translated into an appropriate level of investment or action. The National Audit Office highlights that "data is not always seen as a priority"[6] despite successive governments' stressing the importance digital public services.

Prior to the pandemic, several witnesses to the House of Commons Science and Technology Select Committee suggested that the digital government agenda lost its momentum[7] because many of the big questions around legacy IT or data infrastructure remained unanswered – putting a clear brake on progress.

COVID-19 has "provided a catalyst for change"[8] and renewed impetus for digital public services. To drive the next phase of digital public services, it is crucial that government

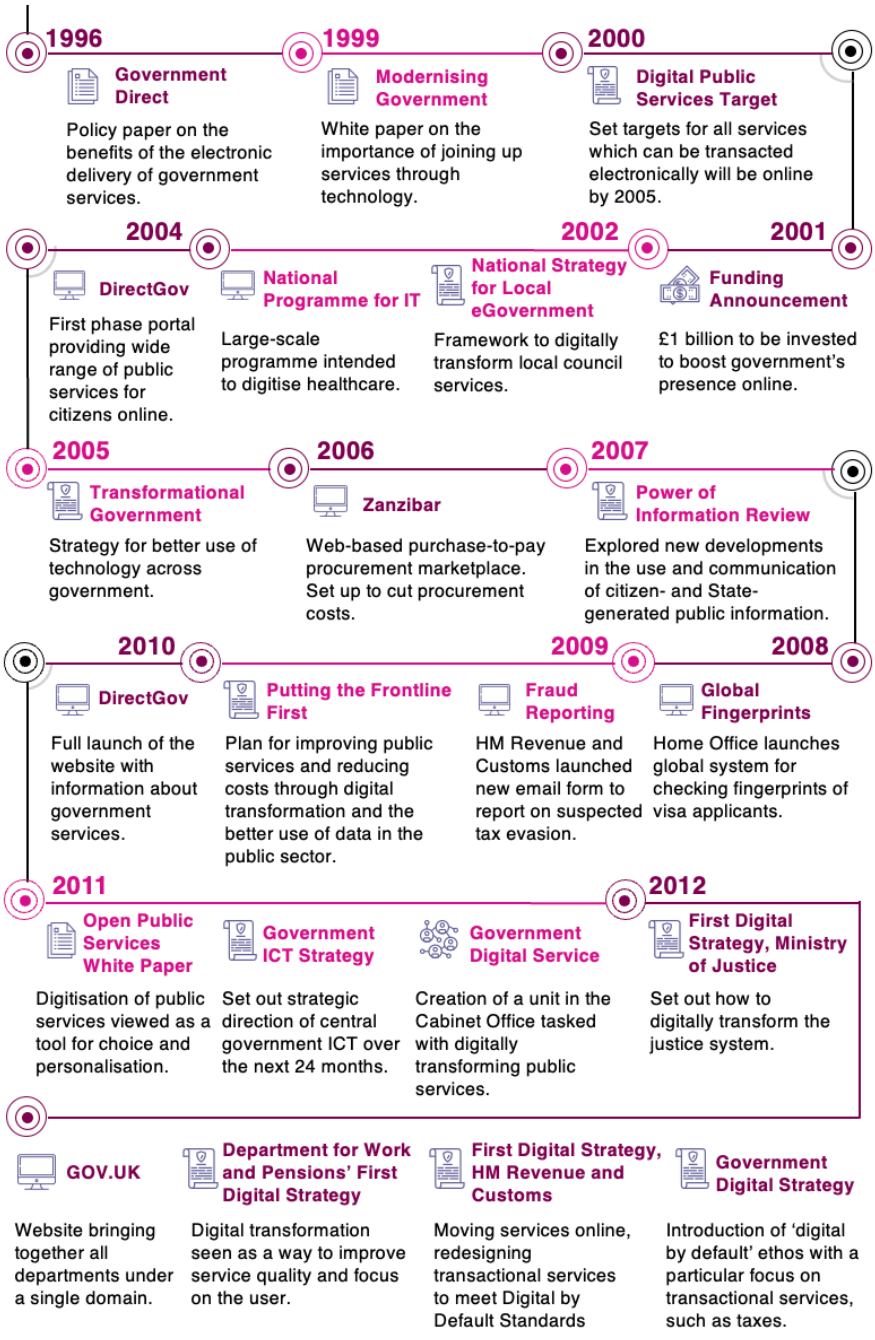
[1] Sarah Timmis, Luke Heselwood, and Eleonora Harwich, *Sharing the Benefits: How to Use Data Effectively in the Public Sector* (Reform, 2018); National Audit Office, *Challenges in Using Data across Government*, HC 2220 (London: The Stationery Office, 2019).
[2] Matthew Gould, Indra Joshi, and Ming Tang, 'The Power of Data in a Pandemic - Technology in the NHS', Web Page, Department of Health and Social Care, 28 March 2020.
[3] Axel Heitmueller, 'The Future NHS Is out There', Webpage, Royal Society of Arts and Manufacturing, 28 April 2020.
[4] Simon McKinnon, 'Supporting DWP's Critical Digital Services during the Coronavirus Outbreak', *DWP Digital*, 7 May 2020.
[5] Cabinet Office, *Transformational Government: Enabled by Technology*, 2005; Cabinet Office, *Government Transformation Strategy*, 2017; Matt Hancock, 'My Vision for a More Tech-Driven NHS', Speech at NHS Expo, Department of Health and Social Care, 6 September 2018; Department for Culture Media & Sport, *National Data Strategy*, 2020.
[6] National Audit Office, *Challenges in Using Data across Government*, 5.
[7] House of Commons Science and Technology Committee, *Digital Government, Eighteenth Report of Session 2017-19*, HC 1455 (London: The Stationery Office, 2019), 30.
[8] Ming Tang, 'Examining Data Use in Healthcare and Life Sciences - Collection and Trust, Innovation and Improving Patient Care, and the Contribution to Fighting COVID-19', Conference, Westminster Health Forum, 20 October 2020.

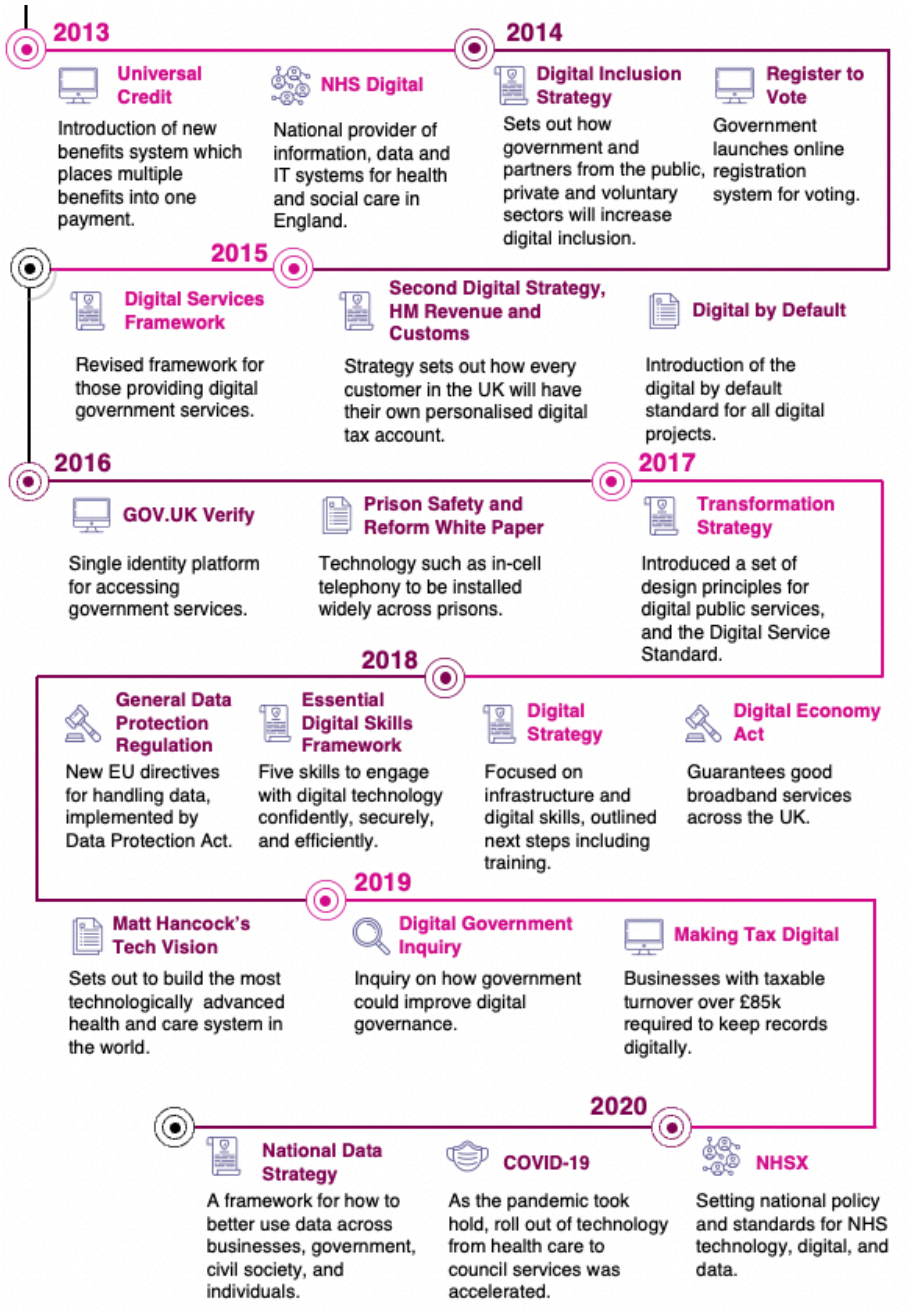
takes stock of the progress made so far and understands the challenges that still lie ahead in order to truly realise the benefits of digital transformation.

1. Digital public services in practice

Over the past 25 years, successive governments have attempted to change the way citizens interact with public services through the better use of public sector data and digital technologies. As highlighted by James Johns, Senior Manager UK Public Policy at Amazon Web Services, "governments have sought to make public services smarter, data-led and more efficient". This is reflected in the history of adopting digital in government, shown in Figure 1.

Figure 1: Twenty-five years of public sector of digital transformation





Source: *Reform* Research. The timeline presented is intended to show key policy developments over the last 25 years. It is not meant to be an exhaustive list.

As highlighted by Figure 1, there have been numerous government-wide and departmental digital strategies with similar rhetoric around the potential of technology to improve public services through greater personalisation and increased efficiency.

The first wave of digitisation during the Blair administration sought to change the way public sector organisations were designed and make them more citizen-centric.[9] The focus was on joining-up services and developing cross-government approaches to issues, with digital solutions supporting this.[10] During this period, the rhetoric around the personalisation of public services rose to prominence as a "way of thinking about services and those who use them".[11]

The greater personalisation of public services was also a key theme during the Coalition years,[12] along with a larger focus on efficiency and cost reduction through the use of technology.[13] This led to the creation of the Government Digital Service (GDS) which was set-up to drive this agenda across the public sector.[14]

However, while technology has improved citizens' experience of public sector processes, "in many cases it has not changed the way government organisations operate to deliver them".[15] The Science and Technology Select Committee has highlighted difficulties in systematically assessing the impact of digital transformation due to the absence of a single definition.[16] As William Barker, Associate Director at the Society for Innovation, Technology and Modernisation, put it: 'digital transformation' is used as a "catch-all term" with "everyone having their own spin".

This paper differentiates between the digitisation of public services, described as moving existing services or processes online; and digital transformation, defined as the process of changing the way a service is organised and delivered – both of which are essential.

1.1 Online shift: information and transactions

The Government has a successful track record of transforming the way citizens access information about public services as well as digitising 'straight forward' transactions.

Since the early 2000s, government has sought to simplify the way it disseminates information and communicates with citizens by standardising and centralising the information held on disparate departmental websites (see Figure 1). This work culminated in the creation of the GOV.UK website, which brought websites for all ministerial departments into one single domain – creating "a more consistent experience of Government for the citizen". It was a hugely successful achievement and placed the UK at the forefront of government digital transformation.[17]

The GOV.UK website became an extremely valuable communication tool for Government during the pandemic. According to the Institute for Government, digital technology and the existence of the GOV.UK website made managing the supply and

[9] Cabinet Office, *Modernising Government*, 1999.
[10] National Audit Office, *Government on the Web II*, HC 764 (London: The Stationery Office, 2002).
[11] Catherine Needham, 'Personalization: From Story-Line to Practice', *Social Policy & Administration* 45, no. 1 (February 2011): 55.
[12] HM Government, *Open Public Services*, 2011.
[13] Cabinet Office, *Government ICT Strategy*, 2011.
[14] House of Commons Science and Technology Committee, *Digital Government, Eighteenth Report of Session 2017-19*, 8.
[15] Cabinet Office, *Government Transformation Strategy*, 2017.
[16] House of Commons Science and Technology Committee, *Digital Government, Eighteenth Report of Session 2017-19*, 12.
[17] House of Commons Science and Technology Committee, *Digital Government, Eighteenth Report of Session 2017-19*.

demand for information "easier than at any time in history".[18] The Government Digital Service team rapidly created a "coronavirus hub page on GOV.UK" as traffic on the website surged.[19] It is thanks to this existing infrastructure and investment in the creation of the GOV.UK website that government had an effective medium through which to disseminate key information about the COVID-19 response and the support that people were entitled to during this period.

Governments have also sought to change the "relationship between citizens and the state by providing citizens and businesses with a more coherent experience"[20] of public services by moving transactions online. The ambition was not only to make services more responsive to the citizen's expectations and needs, but also to increase the efficiency of public services and reduce the cost of public service provision.[21]

Government departments and local public services have developed strategies and implemented a wide array of platforms to digitise transactions and access services online. As highlighted by Rachel Dunscombe, Chief Executive Officer, NHS Digital Academy, the public sector has actually been "quite successful in digitising straight forward transactions". This was supported by several other interviewees who highlighted that successive governments have been relatively successful at implementing changes in the modality of service delivery.

At a local government level this has translated in some innovative initiatives to change the way people interact with their local services. The case study highlighted in Figure 2 shows how the digitisation of an existing process like notifying a council about fly tipping can greatly improve resource allocation and reduce costs.

Figure 2 – LoveLewisham

In 2004, the London Borough of Lewisham commissioned a web application to allow residents to report issues such as fly tipping. It made it dramatically easier for residents, visitors, and councillors to report issues and monitor progress.[22] It costs the council £1.10 for each use of LoveLewisham compared to £5.10 by phone.[23] It was also more effective, and helped the council achieve a 73 per cent reduction in graffiti between 2006 to 2014, and a 22 per cent reduction of casework in related services.[24]

There is, however, great variation in terms of digitisation between public sector organisations.[25] Interviewees for this paper highlighted that this variation is particularly visible at a local level – meaning that local councils or NHS Trusts, for example, can have varying degrees of digital maturity. This also occurs at the departmental level, where "progress in terms of digital transformation varies greatly from department to

[18] Gavin Freeguard, Marcus Shepheard, and Oliver Davies, *Digital Government during the Coronavirus Crisis* (Institue for Government, 2020), 25.
[19] Ibid.
[20] HM Revenue and Customs, *Making Tax Digital: An Evaluation of the VAT Service and Update on the Income Tax Service*, 2020, 3.
[21] Cabinet Office, *Government ICT Strategy*; Cabinet Office, 'Government Digital Strategy: December 2013', 10 December 2013.
[22] Local Government Association, *Transforming Local Public Services Using Technology and Digital Tools and Approaches*, 2014.
[23] Nesta, 'Love Lewisham', Web Page, n.d., accessed 28 October 2020.
[24] Local Government Association, *Transforming Local Public Services Using Technology and Digital Tools and Approaches*.
[25] National Audit Office, *Digital Transformation in Government*, HC 1059 (London: The Stationery Office, 2017); Sally Howes and Tess Kidney Bishop, 'The Hidden Obstacles to Government Digital Transformation', October 2018.

department" according to Eliot Fineberg, a former Deputy Director at the Ministry of Justice.

HM Revenue and Customs (HMRC) has long been considered to be at the forefront of placing services online and of developing and implementing their own digital strategies.[26] In 2012, HMRC published its Digital Strategy which states an ambition "to deliver a transparent tax system that encourages voluntary compliance, enabled by customer-focused digital services which are so straightforward and convenient that all who can use them will choose to do so, whilst those that can't are not excluded".[27] The ambition was also to reduce fraud and error through digitisation.[28]

HMRC has heavily invested in building a sound digital and data infrastructure to support its various digital transformation strategies.[29] There has also been a strong focus on building capability internally to support the ambitions and delivery of HMRC's digital strategies.[30]

This investment has paid off, enabling departmental resilience during the pandemic. Within less than five weeks HMRC set up and launched the Coronavirus Job Retention Scheme which provided financial support to furloughed workers.[31] By mid-November the scheme had paid out £43 billion for 9.6 million furloughed employees.[32] As highlighted at a research roundtable convened by *Reform*, such a degree of adaptability was only possible because of prior investment and strong commitment to digital ways of working.

1.2 Smarter services

Digitisation can also foster the delivery of smarter public services through allowing organisations to make better use of the data they hold. This can translate into improvements in the way information is displayed – allowing public sector practitioners to make evidence-based decisions – and into improvements in the detection and prediction of issues. Here, too, there is great variation between public sector organisations.

The NHS went into the COVID-19 pandemic handling "information in spreadsheets held by disparate organisations", which, as senior NHS leaders wrote in a blog in late March, hugely increases the risk of having inaccurate data as it "will be duplicated and rapidly become outdated, leading to inaccurate or incomplete understanding of the situation".[33] As they go on to say: "in a crisis response, inconsistencies in this data could cost lives".[34]

[26] HM Revenue and Customs, *HMRC Digital Strategy*, 2012.
[27] Ibid., 2.
[28] HM Revenue and Customs, *HMRC Digital Strategy*, 2012.
[29] National Audit Office, *Tackling the Tax Gap*, HC 372 (London: The Stationery Office, 2020).
[30] HM Revenue and Customs, *HMRC Digital Strategy*, 2012; HM Revenue and Customs, *HMRC Digital Strategy*, 2014.
[31] Freeguard, Shepheard, and Davies, *Digital Government during the Coronavirus Crisis*, 9.
[32] HM Revenue and Customs, 'HMRC Coronavirus (COVID-19) Statistics', Webpage, GOV.UK, 1 December 2020.
[33] Gould, Joshi, and Tang, 'The Power of Data in a Pandemic - Technology in the NHS', 28 March 2020.
[34] Ibid.

Almost two weeks after the start of the first lockdown, the NHS still did not have a single place to collect and analyse multiple data sources to understand the spread of the virus and enable key operational decision making.[35] The lack of a pre-existing infrastructure meant that the NHS was slower than it could have otherwise been. Nevertheless, it quite rapidly managed to partner with several private sector organisations to create a COVID-19 data store (see Chapter 3 Figure 6) which linked key datasets together and allowed decision-makers to have access to essential real-time and up-to-date information.

Yet in other aspects the NHS boasts some of the most advanced uses of technology in the public sector – with an increasing number of applications of artificial intelligence.[36] This technology can, for example, be used to improve the detection of certain health conditions and allow for earlier intervention. The field of medical imaging, for example, is an area where artificial intelligence has produced promising results. Algorithms can be used to improve the early detection of certain types of cancer,[37] or to improve detection of certain eye conditions, helping to prevent blindness.[38]

The potential benefits of this type of application are so great that NHSX, a unit within NHS England and Improvement with a mission to drive digital transformation in healthcare, has an entire work programme dedicated to 'AI in imaging'.[39] One of the programme's core components is the curation of datasets in order to enable the research and develop this technology.[40]

Technology can also be used to help public services analyse huge amounts of data. In policing for example, the ever-increasing volume of data in areas such as forensics is becoming difficult to handle (see Figure 3).[41] In 2015, Metropolitan Police Service forensic staff were examining about 40,000 devices in investigations, by 2018 it was about 200,000.[42] Each device contains tens of thousands of data items to be analysed.[43] The use of tools like machine learning enables the police to rapidly analyse copious amounts of data and start drawing connections between cases.

[35] Ibid.
[36] Eleonora Harwich and Kate Laycock, *Thinking on Its Own: AI in the NHS* (Reform, 2018); NHSX, *Artificial Intelligence: How to Get It Right*, 2019; The AHSN Network, Department of Health and Social Care, and NHS England, *Accelerating Artificial Intelligence in Health and Care: Results from a State of the Nation Survey*, 2018.
[37] Karin Dembrower et al., 'Effect of Artificial Intelligence-Based Triaging of Breast Cancer Screening Mammograms on Cancer Detection and Radiologist Workload: A Retrospective Simulation Study', *The Lancet Digital Health* 2, no. 9 (1 September 2020); National Institute for Health Research, 'Artificial Intelligence Could Help to Detect Breast Cancer', Webpage, NIHR, 1 February 2020; Harwich and Laycock, *Thinking on Its Own: AI in the NHS*.
[38] Jason Yim et al., 'Predicting Conversion to Wet Age-Related Macular Degeneration Using Deep Learning', *Nature Medicine 26*, 18 May 2020.
[39] NHSX, 'AI in Imaging', Webpage, NHSX, n.d., accessed 17 November 2020.
[40] Ibid.
[41] Ian Kearns and Rick Muir, *Data-Driven Policing and Public Value* (The Police Foundation, 2019).
[42] National Crime Agency, Metropolitan Police Service, and National Police Chiefs' Council, *Policing for the Future: Written Evidence*, 2018.
[43] Kearns and Muir, *Data-Driven Policing and Public Value*.

Figure 3 – West Midlands Police and Valcri

When a crime is committed, analysts have to spend large amounts of time consulting police databases in order to identify connections. In 2017, West Midlands Police trialled 'Valcri', a semi-automated analysis technology to help understand a crime scene. The technology works by scanning "millions of police records, interviews, pictures, videos and more, to identify connections that it thinks are relevant".[44] Whilst for the most part this is a time-saving tool, it can also open up new lines of enquiry that may have been missed.[45] Further, as it uses machine learning, the technology constantly evolves to become better at carrying out these tasks, with analysts raising or lowering the importance of the connections it makes through swiping on the device.[46]

The better use of data and digital has the potential to improve the prediction of demand or areas of need, and to allow resources to be better targeted through earlier intervention. Newcastle City Council, for example, combined and analysed several key datasets from sources such as housing and social care in order to identify young people at risk of becoming NEET (not in education, employment of training).[47] Young people who are NEET are more likely as adults to be dependent on welfare, experience negative health outcomes, or become tangled up in the criminal justice system.[48] By identifying which children are at risk, local authorities can target support more effectively.[49]

1.3 The challenge of complex human services

Despite the success exhibited by Newcastle City Council, complex human services can often face challenges around digital transformation or the increased use of data-driven technologies. As explained by a couple of interviewees for this paper, policy makers can often imbue technology with an aura of impartiality which prevents them from focusing on the policy design and the ethical challenges that arise from digital public services. This then translates into inappropriate uses of technology or implementation issues. Technology cannot substitute a well-designed policy and designing a digital service must take into account the myriad of ways in which people interact with public services.

The use of predictive models in children's social care, for example, is not always appropriate as highlighted by the *What Works Centre for Children's Social Care* in a recent report on the uses of machine learning in the sector.[50] It warns that they "do not find evidence that the models we created using machine learning techniques 'work' well in children's social care."[51] This is in part due to the paucity of data in this area of the public sector.[52] In addition, there is a multitude of ethical challenges when applying

[44] Timothy Revell, 'AI Detective Analyses Police Data to Learn How to Crack Cases', *New Scientist*, 10 May 2017.
[45] Valcri, 'About Valcri', Web Page, Valcri, n.d., accessed 29 October 2020.
[46] Revell, 'AI Detective Analyses Police Data to Learn How to Crack Cases'.
[47] Social Finance, Newcastle City Council, and Impetus, *New Insights into Improving Outcomes for At-Risk Youth: The Newcastle Experience* (Social Finance, 2016).
[48] Ibid.
[49] Ibid.
[50] Vicky Clayton et al., *Machine Learning in Children's Services: Does It Work?* (What Works For Children's Social Care, 2020).
[51] Ibid., 5.
[52] D Leslie et al., *Ethics Review of Machine Learning in Children's Social Care*, 2020, 9–10.

this type of approach to children's social services, including bias or issues around individual agency.[53] This serves as a strong reminder of the importance of thinking about the ethical implications of technology and its unintended consequences.

Implementation can also be a challenge for the use of technology when dealing with complex human services, and the Department of Work and Pensions', Universal Credit (UC) flagship programme is a case and point (see Figure 4). The platform that was built to deliver UC allows for the integration of several benefits, oversight of the claimant activity, and a work coach to support the claimant.

Figure 4: Universal credit

Government started working on UC in 2010, with the aim of replacing six separate benefits with a new single payment for those out of work, unable to work or on low income.[54] The goal of UC was to simplify the system, improve incentives to move into work,[55] reduce fraud and error, and reduce the costs of administering benefits through the use of a digital platform.[56] It was the first major government service to become digital by default, with the vast majority of transactions to take place online.[57]

There were several implementation challenges with UC which led to successive delays to the rollout timeline.[58] As highlighted by the National Audit Office, whilst some elements of UC have worked well, a "significant minority of claimants…have suffered difficulties and hardship during the rollout of the full service".[59] Yet, many of the issues with UC highlight flaws in the policy design rather than the technology – although there have also been persistent issues around digital exclusion.[60] As a response to these criticisms DWP has changed the way it provides supports to claimants.[61]

1.4 The challenge of identity

Prior to the creation of GDS, government had started initiatives to create common tools that could be used by various departments to change the way in which they communicate with citizens, foster the digital transformation of public services and move transactions online (see Figure 1). These have delivered mixed results in large part due to the challenges surrounding digital identity.

When GDS set out its "Government As a Platform Initiative" and created the GOV.UK Notify, Pay and Verify services – which would allow government departments to send messages to people, enable online payment and verify people's identity – success was

[53] Clayton et al., *Machine Learning in Children's Services: Does It Work?*
[54] These included the Jobseeker's Allowance, Income Support, Housing Benefit, Employment and Support Allowance, Working Tax Credit and Child Tax Credit. Department for Work and Pensions, '2010 to 2015 Government Policy: Welfare Reform', Webpage, 2015.
[55] House of Commons Work and Pensions Committee, *Universal Credit: The Six Week Wait, First Report of Session 2017 - 19*, HC 336 (London: The Stationery Office, 2017).
[56] National Audit Office, *Rolling out Universal Credit*, HC 1123 (London: The Stationery Office, 2018), 5.
[57] Gill Hitchcock, 'Universal Credit to Be First Service "Digital by Default"', *The Guardian*, 3 February 2012.
[58] National Audit Office, *Rolling out Universal Credit*, 5.
[59] Ibid., 6.
[60] National Audit Office, *Universal Credit: Getting to First Payment*, HC 376 (London: The Stationery Office, 2020), 12.
[61] Ibid.

not straight forward.[62] Whereas GOV.UK Notify and Pay, "continue to grow" and are being adopted by more organisations,[63] Verify – a common identity assurance program designed to be used by all government departments – has struggled with take up.[64]

Major government departments such as HMRC developed their own identity verification schemes as Verify did not meet their needs.[65] In 2019, the Public Accounts Committee published a highly critical report of Verify stating it had "not delivered value for money and members of the public using the system have been hampered by a catalogue of problems".[66]

The pandemic has also proved challenging for Verify and has confirmed that an alternative solution for identity verification is needed. The Institute for Government highlights that "some departments have resorted to older solutions or built new ones of their own to avoid using Verify".[67]

Verify's failure exemplifies common mistakes made across digital transformation programmes: an underestimation of complexity and over-optimistic ambitions.[68] Digital transformation is not only about having a sleek platform 'front-end'. The backend processes that power the platform need to reflect with the ways in which departments work. Interviewees for this paper unanimously argued that digital transformation is mostly about people and ways of working, with technology underpinning that.

The pandemic has acted as a catalyst for the further digitisation of the public sector. However, those organisations that managed to demonstrate greatest resilience and adaptability during this crisis where those that already had a certain degree of digital maturity. Greater efforts need to be placed on building the right environment which enables organisations to use the data they hold to make key operational decisions.

Ministers and public sector officials need a step change in their approach to technology in the public sector. Policymakers need to pay greater focus on how specific types of technology will aid addressing specific policy challenges. Technology is therefore not a universal solution to issues, but a key tool in achieving a policy outcome.

[62] The Institute for Government, 'Whitehall Monitor 2020 - Digital Services', Webpage, The Institute for Government, n.d.
[63] Ibid.
[64] National Audit Office, *Investigation into Verify*, HC 1926 (London: The Stationery Office, 2019).
[65] Rebecca Hill, 'HMRC Confirms It Will Use Alternative to Flagship GOV.UK Verify Identify Service', Webpage, Civil Service World, 14 February 2017.
[66] House of Commons Committee of Public Accounts, *Accessing Public Services through the Government's Verify Digital System, Ninety-Fifth Report of Session 2017 - 19*, HC 1748 (London: Stationary Office, 2019), 3.
[67] Freeguard, Shepheard, and Davies, *Digital Government during the Coronavirus Crisis*, 6.
[68] House of Commons Committee of Public Accounts, *Accessing Public Services through the Government's Verify Digital System, Ninety-Fifth Report of Session 2017 - 19*, 3.

2. People-enabled tech

To build on progress to date, and overcome barriers to further transformation, the public sector must renew its focus on the 'people aspects' of digital transformation, which have often been underestimated. Rachel Dunscombe from the NHS Digital Academy argues that many of the mistakes made in the history of digital transformation have come down to having overlooked people and design; and focused too much on the technology. Key to the success of public sector digital transformation is strong leadership, skills and an understanding of how to implement new ways of working to drive culture change.

2.1 Leadership skills

Promoting leadership at all levels is critical to the success of digital transformation as noted by Jocelyn Palmer, Programme Lead at Connecting Care, South, Central and West Commissioning Support Unit. It is not only about ministers, but also about senior civil servants and frontline practitioners.[69]

Leadership in central government can ensure that departments are not falling behind in their digital transformation journeys. The Alan Turing Institute has highlighted that the current lack of leadership in fostering the development and use of technology in the public sector means that a "a two-tier system is emerging" where some departments are much more advanced than others in harnessing the benefits of technology.[70]

The NAO also noted a lack of leadership across government in terms of data policy, and some government departments "expressed concern about a lack of overarching leadership" around data.[71] They were unsure that the Department for Digital Culture Media and Sport – which has the main responsibility for data policy – would have the "authority or mandate" to drive change.[72]

Despite these criticisms, the National Data Strategy, recently published for consultation, makes several mentions of the importance of leadership. It highlights the need to clarify leadership around data by recruiting a "Government Chief Data Officer".[73] This idea was first enshrined in the 2017 Government Transformation Strategy.[74] However, recent changes are encouraging. On 12 January 2021, the Cabinet Office established the Central Digital and Data Office, along with new senior staff members.[75] This office will be responsible for shaping "strategy and assure delivery for Digital, Data, and Technology across government".

Good leadership in the context of digital transformation is about understanding the importance of change management and stakeholder engagement. One of the key

[69] House of Commons Science and Technology Committee, *Digital Government, Eighteenth Report of Session 2017-19*, 31.
[70] House of Commons Committee of Public Accounts, *Accessing Public Services through the Government's Verify Digital System, Ninety-Fifth Report of Session 2017 - 19*, 26.
[71] National Audit Office, *Challenges in Using Data across Government*, 24.
[72] Ibid.
[73] Department for Culture Media & Sport, *National Data Strategy*.
[74] Cabinet Office, *Government Transformation Strategy*, 2017.
[75] Alex Chisholm, 'Government Strengthens Digital Leadership', Press Release, GOV.UK, 12 January 2021.

lessons from the failure of the National Programme for Information Technology in the NHS, which sought to create a fully digital and interoperable NHS, was the lack of these key elements.[76] Ensuring strong leadership at all levels is crucial as those leading change on the ground need to be "promoting the adaptive changes that are needed when an organisation switches from one way of doing work to another."[77]

Rachel Dunscombe argues that government needs to "invest in creating good digital leaders to drive change". There have been attempts to create this across the public sector, with the GDS Academy running a one-day "digital leadership course" for senior civil servants outside of purely digital roles or new to government.[78] Digital leadership in healthcare specifically has been aided by the Digital Academy launched in 2018 and the appointment of the first NHS Chief Clinical Information Officer in 2016.[79]

Public sector leaders need to understand that "real digital transformation can only be reached through real policy design", as highlighted by Paul Waller. As demonstrated in the first chapter, technology is not a panacea and cannot absolve policy makers from the complexities of policy design – in fact technology will only deliver if the context within which it is being deployed is right.

Digital transformation is about changing the ways in which people work – meaning a culture shift as well as a focus on ensuring that organisations have the right skills.

2.2 Ways of working

Interviewees for this paper highlighted the importance of bridging the gap between the technology professionals and the policy makers. The successful delivery of public services requires that the two work hand-in-hand. Those in charge of technology need to understand the complexities faced by policy makers and policy makers need the skills to understand how technology might be used to deliver policy outcomes. William Barker argues that "there isn't sufficient dialogue between those who administer the statutory function and those making the technologies." In this regard, the introduction of the Digital Data and Technology profession (DDAT), is to be welcomed.[80] It has helped to introduce greater mutual understanding of how the different skills come together to deliver good outcomes.

Key to the success of digital transformation is an understanding of how to work within an agile framework, which pushes individuals and teams to "test, iterate and test again".[81] It is a way of working in which teams are encouraged to "build quickly […] and iterate their work based on regular feedback."[82] Several interviewees argued that this

[76] Oliver Campion-Awwad et al., 'The National Programme for IT in the NHS', *MPhil Thesis Cambridge*, 2014.
[77] Robert M Wachter, *Making IT Work: Harnessing the Power of Health Information Technology to Improve Care in England* (National Advisory Group on Health Information Technology in England, 2016), 36.
[78] Digital, Data and Technology Profession, 'Digital Leadership Course', Web Page, GOV.UK, 31 March 2020.
[79] Eric Topol, *The Topol Review: Preparing the Healthcare Workforce to Deliver the Digital Future. An Independent Report on Behalf of the Secretary of State for Health and Social Care* (Health Education England, 2019).
[80] Digital, Data and Technology Profession, 'About Us', Webpage, n.d.
[81] Local Government Association, *Benefits of an Agile Approach*, 2019.
[82] Agile delivery community, 'Agile and Government Services: An Introduction', Webpage, GOV.UK, 23 May 2016.

iterative approach to digital public services is key to "learn as we go" and improve services.

Lara Sampson, Product Director for Universal Credit at DWP, reflected that one of the reasons why DWP managed to respond so rapidly to the huge surge in demand it faced during the pandemic was the existing ways of working and culture around digital. She highlighted that the digital teams at DWP had been used to working in an agile fashion and argued that "empowered teams that know immediately what to do" (see Figure 5).

Figure 5: Coping with a surge in demand

During the first lockdown new Universal Credit claims hit 2.9 million, almost double the number of total claims before the pandemic.[83] As well as increased demand, DWP had to move almost all services online, as Jobcentres were closed.[84] The Department successfully managed to deal with new claims, by trebling the future payments capacity. This allowed them to "make up to 180,000 one-off or repeating payments to customers a day".[85] As of May 2020, 90 per cent of payments due were paid in full and on time.[86] A key reason for success, according to Lara Sampson, was that they "had already been on that transformation journey pre-COVID". DWP benefited from a sound, cloud-based digital infrastructure which allowed them to easily ramp up the service. In addition to the technical infrastructure the Universal Credit team benefited from good working practices with empowered teams used to working in an agile way.

Addressing the digital skills gap is key to delivering further public service transformation. This gap deeply affects the public sector's ability to make the most of available technologies. One survey of industry professionals found that 40 per cent of public sector organisations did not have the right skills in order to carry out digital transformation.[87] This is partly an issue of pay. The "level of pay required to attract digital people" is one of the biggest barriers.[88] There is a compelling case to be made that securing the right technical skills warrants hiring outside of the current pay structures.

GDS was recently hiring for a Head of Technology and Architecture boasting a maximum salary of £70,887 per annum.[89] According to Google Jobs typical pay for this type of work ranges from £65,000-£180,000 in the private sector. This clearly shows a wide pay gap between the public and the private sectors and helps explain why it is hard to attract and retain those types of skills in the public sector.

Simon Mckinnon, Chief Digital and Information Officer at the Department for Work and Pensions has noted that "the competitiveness of the packages offered" in the private sector have, in the past, made it harder to recruit individuals with the right digital skills.[90]

[83] House of Commons Work and Pensions Committee, *DWP's Response to the Coronavirus Outbreak: First Report of Session 2019 - 21*, HC 178 (London: The Stationery Office, 2020).
[84] The Rt Hon Therese Coffey MP, *Oral Statement to Parliament: DWP's Response to Coronavirus (COVID-19)*, 2020.
[85] McKinnon, 'Supporting DWP's Critical Digital Services during the Coronavirus Outbreak'.
[86] Mike Brewer and Karl Handscomb, *This Time Is Different - Universal Credit's First Recession* (The Resolution Foundation, 2020).
[87] Cloud Industry Forum, 'Public Sector IR Skills Shortages Puts Brakes on Digital Transformation of Government Services', n.d.
[88] Emily Andrews et al., *Making a Success of Digital Government* (Institute for Government, 2016), 23.
[89] Government Digital Service, 'GDS Hiring for a Head of Technology', Webpage, GOV.UK, n.d.
[90] Simon McKinnon, *Digital Government: Oral Evidence*, HC 1455 (London: The Stationery Office, 2019).

In addition to reviewing pay, the public sector therefore also needs to focus on developing digital skills in-house. It has put in place various schemes through the digital academy which has been successful at training over 10,000 people as of 2019.[91] Still, retention of those workers for an extended period of time, according to Simon McKinnon is difficult due to public sector pay scales.[92]

Idea 1: The Department of Culture Media and Sport, in conjunction with the Cabinet Office, should lead a cross-Government digital skills strategy. This should include a focus on how to develop and retain digital leaders in the public sector, including reviewing the pay scales for those with high-level technical skills.

[91] Kevin Cunnington, *Digital Government: Oral Evidence*, HC 1455 (London: The Stationery Office, 2019).
[92] McKinnon, *Digital Government: Oral Evidence*.

3. Overcoming technical barriers

An effective and secure digital infrastructure means getting several key technical elements right. As Eliot Fineberg, former Deputy Director at the Ministry of Justice, put it: there is "no innovation before the basics are sorted." The public sector needs to focus on getting its data right, which means collecting the right type of good quality data in a consistent format. It also needs to be transparent in the way that it uses data about citizens as this affects levels of trust and confidence.[93]

The public sector must also focus on moving away from outdated IT systems which make it more vulnerable to cyber-attacks and prevents organisations from making the most of the data they hold. This can be incentivised through better procurement policies.

3.1 Getting data right

The NAO has found that departments do not have a consistent approach to data and do not always view or treat data as "a strategic asset".[94] Data projects can often be put on the back burner when funding is under pressure – a false economy. [95] This lack of prioritisation for creating a sound public sector data infrastructure has hampered the public sector's ability to harness the power of digital.

Previous *Reform* research has highlighted multiple issues concerning the state of public sector data, including quality, standards and interoperability.[96] Issues of data quality are pervasive across the public sector[97] and have huge implications for the application of tools like machine learning, not least as poor data quality can perpetrate bias.[98]

Designing and adopting data standards within a public sector organisation can be a daunting task, but it is a vital one. Yvonne Gallagher from the NAO highlights that because of the diverse set of policy goals or legal instruments used to collect information in order to deliver a service, there are multiple ways of collecting the same information. She went on to explain that HMRC, for example, holds multiple databases, such as stamp duty and PAYE. These can hold similar pieces of information about an individual, like name or address, yet are likely held in a completely different manner (e.g. first name and surname versus first name, middle name and surname). This means that even within a single government department having a single version of a specific individual's record or single 'customer view' can be challenging.

[93] Timmis, Heselwood, and Harwich, *Sharing the Benefits: How to Use Data Effectively in the Public Sector*, 2018, 26.
[94] National Audit Office, *Challenges in Using Data across Government*, 9.
[95] Ibid.
[96] Timmis, Heselwood, and Harwich, *Sharing the Benefits: How to Use Data Effectively in the Public Sector*, 2018.
[97] National Audit Office, *Challenges in Using Data across Government*, 29.
[98] Eleonora Harwich, 'Garbage in Garbage out: The Dangers of Training Algorithms on Biased Data', Webpage, THINK Digital Partners, 22 June 2017; Madeleine Waller and Paul Waller, 'Why Predictive Algorithms Are So Risky for Public Sector Bodies', SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, 21 October 2020).

This problem is then replicated across public sector organisations and government departments. It is extremely difficult to have a 'single version of the truth' across the datasets held by public sector organisations, which hampers government's ability both to provide a better citizen experience and to identify efficiencies through smarter working. The recently published National Data Strategy acknowledges that the public sector needs to become more effective in how it collects, curates, stores and manages data.[99]

The current pandemic has shown just how important robust data infrastructure is to enabling key operational decisions – and just how far the public sector is from having the right infrastructure (see Figure 6).

Figure 6: COVID-19 data store

At the start of the COVID-19 pandemic, the NHS did not have the right type of data infrastructure to enable critical operational decision-making.[100] As highlighted in an early blog by the Department of Health and Social Care, the NHS lacked "a single place to gather and analyse [this] data" and decision-makers struggled to move swiftly.[101] The usual processes of having "spreadsheets held by disparate organisations" were no longer seen as acceptable because they would be "duplicated and rapidly become outdated, leading to inaccurate or incomplete understanding of the situation." [102]

The NHS COVID-19 data store was created and provided "national organisations responsible for coordinating the response with secure, reliable and timely data"[103] to enable critical decision to be made. The NHS enlisted the help of several private companies including AWS, Faculty and Palantir to create the data store. Several datasets were linked from disparate sources such as call centres and COVID-19 tests. This information went through a process of reconciliation to improve the accuracy of the information and was then presented in the dashboard.[104]

The current pandemic has shone a light on the patchy nature of the public sector's digital and data infrastructure. However, as highlighted by our research roundtable attendees, it has given a new impetus to less digitally mature public sector organisations to focus on building the infrastructure that will allow them to be more responsive in a time of crisis.

The recently published National Data Strategy also reflects this by highlighting that "when we treat data as a strategic asset and improve coordination between organisations, the delivery of services can be more agile, more innovative, more effective and more cost-effective".[105] It is essential that this renewed impetus and

[99] Department for Culture Media & Sport, *National Data Strategy*.
[100] Heitmueller, 'The Future NHS Is out There'.
[101] Gould, Joshi, and Tang, 'The Power of Data in a Pandemic - Technology in the NHS', 28 March 2020.
[102] Ibid.
[103] Ibid.
[104] Ibid.
[105] Department for Culture Media & Sport, *National Data Strategy*.

commitment to treat data as a strategic asset met with an adequate level of funding and investment in getting the public sector's data infrastructure right.

3.2 Moving away from legacy

Legacy IT – defined as old computer systems, programming languages, or application software that are still being used even though more up-to-date ways of operating are available[106] – is another key barrier to government digital transformation.[107] Historically public services were tied into long-term inflexible contracts with IT providers,[108] however, many of these are coming to an end, and there is now an opportunity to phase out old systems.

In addition, legacy infrastructure has long been recognised by government and the NAO as a hindrance to improving public services and cyber security.[109] Public sector data can still be trapped within legacy IT which lacks interoperability with other systems and therefore makes it very hard to extract and use to deliver smart services.[110] There is still a lot work to be done to modernise the public sector's digital infrastructure.

Despite existing guidance and documents published on the GOV.UK website trying to help public services move away from legacy IT, the problem persists and there is therefore is a gap between guidance and action taking on the ground. As one interviewee put it: there has not been the political focus by organisations to address legacy because "legacy is not sexy". This was corroborated by several other interviews carried out for this paper.

However, the impact of legacy IT on the public sector is huge. It thwarts efforts to achieve value for money[111] and heightens security risks due to reliance on "on older, unpatched versions" of software.[112]

There needs to be a greater commitment from within government, especially the Cabinet Office, to truly understand the impact of legacy IT and the reasons why, despite guidance from GDS on how to manage and move away from legacy public services, many departments have struggled to do so.[113]

Jacky Wright, former Chief Digital Officer at HMRC, offered an interesting insight into one of the main blockers to this transition. Speaking to the House of Commons Science and Technology Committee in 2019, she highlights that "it was difficult to make a

[106] Timmis, Heselwood, and Harwich, *Sharing the Benefits: How to Use Data Effectively in the Public Sector*, (Reform 2018, 20).
[107] National Audit Office, *Managing the Risks of Legacy ICT to Public Service Delivery*, HC 539 (London: Stationary Office, 2013); House of Commons Science and Technology Committee, *Digital Government, Eighteenth Report of Session 2017-19*; Lucy Carey and Claire Ashworth, 'Understanding Legacy Technology in Government', *Technology in Government Blog*, 24 May 2018; Matt Baker, 'Legacy Applications Pose Serious Cybersecurity Risks to Hospitals - UK Tech News', *UK Tech News* (blog), 19 February 2019.
[108] National Audit Office, *Information and Communications Technology in Government - Landscape Review*, HC 757 (London: The Stationery Office, 2011), 17.
[109] National Audit Office, *Managing the Risks of Legacy ICT to Public Service Delivery*; Cabinet Office, *Government ICT Strategy*; Cabinet Office, *Government Transformation Strategy*, 2017.
[110] Timmis, Heselwood, and Harwich, *Sharing the Benefits: How to Use Data Effectively in the Public Sector*, 2018, 19–20.
[111] National Audit Office, *Managing the Risks of Legacy ICT to Public Service Delivery*.
[112] HM Government, *National Cyber Security Strategy 2016-2021*, 2016, 23.
[113] Government Digital Service, 'Managing Legacy Technology', Webpage, GOV.UK, 21 February 2019; Government Digital Service, 'Moving to Modern Network Solutions', Webpage, GOV.UK, 23 January 2020.

convincing case to the Treasury to replace legacy systems, due to the cost."[114] Yvonne Gallagher from the NAO added that solving legacy IT implies focusing on the hard question of getting data right. Moving away from legacy opens up questions around how to save information into a new system, what standards should be used or how to reconcile conflicting records.

Idea 2: As part of its strategy to move away from legacy IT, the Cabinet Office should focus on identifying solutions to key blockers which have prevented public sector organisations acting on existing guidance. It could consider the creation of a cross-government legacy IT fund, to support departments to move away from legacy systems.

3.3 Improving IT spend and procurement

The public sector has struggled with technology procurement. Rachel Dunscombe, from the NHS Digital Academy, has highlighted that "IT procurement frameworks can reflect quite an outdated vision of technology". IT spend has historically been associated with buying physical equipment or software, and therefore the money allocated is capital spending. This can result in purchasing technology for a "predefined allocation of money over a fixed term" often meaning multi-million-pound contracts over multiple years.[115]

Pay-per-use technologies, such as the cloud, can be more flexible, however due to the spending structures can be difficult to make a business case for. These technologies remove the need to invest in hardware, servers and computer storage. Instead, organisations pay a subscription for only the functionalities and services "they consume and can change or terminate their usage at any time."[116]

However, given its pay-per-use structure it will often be categorised as resource spend – and therefore the business case to move to cloud can be challenging. Current spending controls, and the need to make a business case to the Treasury, incentivise public sector organisations to limit resource spend, and commit the same amount of capital in order for the department to maintain the same budget.[117] Further, accounting officers are limited in being able to move money out of capital budgets into resource expenditure.[118] This structure can encourage Departments to pursue capital intensive technology investment rather than pay-per-use technology.

Idea 3: The Cabinet Office, alongside the Department for Digital, Culture, Media and Sport and the Treasury, should re-examine current spending strategies for technology. Specifically, it should review the limits on availability of resource spending for technology as a service.

---

[114] House of Commons Science and Technology Committee, *Digital Government, Eighteenth Report of Session 2017-19*, 41.
[115] James Stewart and Manj Kalar, *Budgeting for Change: Four Ways the UK Government Can Spend Smarter and Deliver Better* (Amazon Web Services Institute, 2018).
[116] James Stewart and Manj Kalar, 'Smarter Spending: Unblocking the Increased Adoption of Cloud Computing by the UK Public Sector' (Amazon Web Services Institute, 14 June 2018).
[117] Stewart and Kalar, *Budgeting for Change: Four Ways the UK Government Can Spend Smarter and Deliver Better*.
[118] Ibid.

Conclusion

The COVID-19 pandemic has served as a crucial reminder that, while notable progress has been made over the past decade, the public sector's digital infrastructure is not consistently 'fit for purpose'. Whilst some departments and public sector organisations managed to respond almost immediately to a huge surge in demand such as DWP, or to set-up an entirely new payment system like HMRC, others were not as quick to respond to due to the lack of an existing infrastructure.

The NHS went into the pandemic by handling "information in spreadsheets" and did not have the infrastructure to allow decision-makers to make key operational decisions.[119] Due to the lack of this key infrastructure it had to rapidly partner with several private sector stakeholders to link datasets and build the infrastructure it needed.

The pandemic has given new impetus to digital transformation and has made a clear case for why getting the infrastructure right is key.[120] As highlighted by Oliver Dowden, Secretary of State for Digital, Culture, Media and Sport, "coronavirus has fundamentally altered our lives and the role that tech plays within it" and has "turbocharged the digital transformation of almost every part of our days".[121]

However, it is crucial that the Government capitalises on this impetus and focuses on investing in the basics – data infrastructure; leadership, skills, and ways of working; and moving away from legacy – so that it can truly harness the power of data and technology in the public sector. If not, as Yvonne Gallagher from the NAO put it, "applications of AI or any other type of advanced technology in the public will remain peripheral".

[119] Matthew Gould, Dr Indra Joshi, and Ming Tang, 'The Power of Data in a Pandemic - Technology in the NHS', Webpage, Department of Health and Social Care, 28 March 2020.
[120] Sarah Wilkinson, *Digital Transformation in the NHS: Oral Evidence*, HC 680, 2020.
[121] The Rt Hon Oliver Dowden CBE MP, 'Digital Secretary's Closing Speech to the UK Tech Cluster Group', Speech, Department for Digital, Culture, Media & Sport, 23 June 2020.

Appendix

Reform organised a research roundtable on 26th October 2020, attendees examined lessons from the history of digital transformation in the public sector, and in particular those learned from the COVID-19 pandemic. The authors are grateful to the eight individuals and organisations who participated:

- William Barker, Associate Director Society for Innovation, Technology and Modernisation (SOCITM) and former Head of National Cyber Security Programme – Local, Ministry of Housing, Communities and Local Government (2015-19)
- Sam Cannicott, Senior Advisor, Centre for Data Ethics and Innovation
- Yvonne Gallagher, Director, Digital Value for Money, National Audit Office
- James Johns, Senior Manager – UK Public Policy, Amazon Web Services
- Georgina Maratheftis, Head of Programme, Local Public Services, TechUK
- Ramraj Puvinathan, Research Associate, PUBLIC
- Tom Walker, Researcher, Ada Lovelace Institute
- Paul Waller, Faculty of Management, Law and Social Sciences, University of Bradford

Bibliography

Agile delivery community. 'Agile and Government Services: An Introduction'. Webpage. GOV.UK, 23 May 2016.

Andrews, Emily, Daniel Thornton, Joseph Owen, Alex Bleasdale, Gavin Freeguard, and Ines Stelk. *Making a Success of Digital Government*. Institute for Government, 2016.

Baker, Matt. 'Legacy Applications Pose Serious Cybersecurity Risks to Hospitals - UK Tech News'. *UK Tech News* (blog), 19 February 2019.

Brewer, Mike, and Karl Handscomb. *This Time Is Different - Universal Credit's First Recession*. The Resolution Foundation, 2020.

Cabinet Office. 'Government Digital Strategy: December 2013', 10 December 2013.

———. *Government ICT Strategy*, 2011.

———. *Government Transformation Strategy*, 2017.

———. *Government Transformation Strategy*, 2017.

———. *Modernising Government*, 1999.

———. *Transformational Government: Enabled by Technology*, 2005.

Campion-Awwad, Oliver, Alexander Hayton, Leila Smith, and Mark Vuaran. 'The National Programme for IT in the NHS'. *MPhil Thesis Cambridge*, 2014.

Carey, Lucy, and Claire Ashworth. 'Understanding Legacy Technology in Government'. *Technology in Government Blog*, 24 May 2018.

Chisholm, Alex. 'Government Strengthens Digital Leadership'. Press Release. GOV.UK, 12 January 2021.

Clayton, Vicky, Michael Sanders, Eva Schoenwald, Lee Surkis, and Daniel Gibbons. *Machine Learning in Children's Services: Does It Work?* What Works For Children's Social Care, 2020.

Cloud Industry Forum. 'Public Sector IR Skills Shortages Puts Brakes on Digital Transformation of Government Services', n.d.

Coffey MP, The Rt Hon Therese. *Oral Statement to Parliament: DWP's Response to Coronavirus (COVID-19)*, 2020.

Cunnington, Kevin. *Digital Government: Oral Evidence*. HC 1455. London: The Stationery Office, 2019.

Dembrower, Karin, Erik Wåhlin, Yue Liu, Mattie Salim, Kevin Smith, Peter Lindholm, Martin Eklund, and Fredrik Strand. 'Effect of Artificial Intelligence-Based Triaging of Breast Cancer Screening Mammograms on Cancer Detection and Radiologist Workload: A Retrospective Simulation Study'. *The Lancet Digital Health* 2, no. 9 (1 September 2020).

Department for Culture Media & Sport. *National Data Strategy*, 2020.

Department for Work and Pensions. '2010 to 2015 Government Policy: Welfare Reform'. Webpage, 2015.

Digital, Data and Technology Profession. 'About Us'. Webpage, n.d.

———. 'Digital Leadership Course'. Web Page. GOV.UK, 31 March 2020.

Freeguard, Gavin, Marcus Shepheard, and Oliver Davies. *Digital Government during the Coronavirus Crisis*. Institue for Government, 2020.

Gould, Matthew, Dr Indra Joshi, and Ming Tang. 'The Power of Data in a Pandemic - Technology in the NHS'. Webpage. Department of Health and Social Care, 28 March 2020.

Gould, Matthew, Indra Joshi, and Ming Tang. 'The Power of Data in a Pandemic - Technology in the NHS'. Web Page. Department of Health and Social Care, 28 March 2020.

Government Digital Service. 'GDS Hiring for a Head of Technology'. Webpage. GOV.UK, n.d.

———. 'Managing Legacy Technology'. Webpage. GOV.UK, 21 February 2019.

———. 'Moving to Modern Network Solutions'. Webpage. GOV.UK, 23 January 2020.

Hancock, Matt. 'My Vision for a More Tech-Driven NHS'. Speech at NHS Expo. Department of Health and Social Care, 6 September 2018.

Harwich, Eleonora. 'Garbage in Garbage out: The Dangers of Training Algorithms on Biased Data'. Webpage. THINK Digital Partners, 22 June 2017.

Harwich, Eleonora, and Kate Laycock. *Thinking on Its Own: AI in the NHS*. Reform, 2018.

Heitmueller, Axel. 'The Future NHS Is out There'. Webpage. Royal Society of Arts and Manufacturing, 28 April 2020.

Hill, Rebecca. 'HMRC Confirms It Will Use Alternative to Flagship GOV.UK Verify Identify Service'. Webpage. Civil Service World, 14 February 2017.

Hitchcock, Gill. 'Universal Credit to Be First Service "Digital by Default"'. *The Guardian*, 3 February 2012.
HM Government. *National Cyber Security Strategy 2016-2021*, 2016.
———. *Open Public Services*, 2011.
HM Revenue and Customs. 'HMRC Coronavirus (COVID-19) Statistics'. Webpage. GOV.UK, 1 December 2020.
———. *HMRC Digital Strategy*, 2012.
———. *HMRC Digital Strategy*, 2014.
———. *Making Tax Digital: An Evaluation of the VAT Service and Update on the Income Tax Service*, 2020.
House of Commons Committee of Public Accounts. *Accessing Public Services through the Government's Verify Digital System, Ninety-Fifth Report of Session 2017 - 19*. HC 1748 London: Stationary Office 2019, 201
House of Commons Science and Technology Committee. *Digital Government, Eighteenth Report of Session 2017-19*. HC 1455. London: Stationery Office, 2019.
House of Commons Work and Pensions Committee. *DWP's Response to the Coronavirus Outbreak: First Report of Session 2019 - 21*. HC 178. London: The Stationery Office, 2020.
———. *Universal Credit: The Six Week Wait, First Report of Session 2017 - 19*. HC 336. London: The Stationery Office, 2017.
Howes, Sally, and Tess Kidney Bishop. 'The Hidden Obstacles to Government Digital Transformation', October 2018.
Kearns, Ian, and Rick Muir. *Data-Driven Policing and Public Value*. The Police Foundation, 2019.
Leslie, D, L Holmes, C Hitrova, and E Ott. *Ethics Review of Machine Learning in Children's Social Care*, 2020.
Local Government Association. *Benefits of an Agile Approach*, 2019.
———. *Transforming Local Public Services Using Technology and Digital Tools and Approaches*, 2014.
McKinnon, Simon. *Digital Government: Oral Evidence*. HC 1455. London: The Stationery Office, 2019.
———. 'Supporting DWP's Critical Digital Services during the Coronavirus Outbreak'. *DWP Digital*, 7 May 2020.
National Audit Office. *Challenges in Using Data across Government*. HC 2220. London: The Stationery Office, 2019.
———. *Digital Transformation in Government*, 2017.
———. *Government on the Web II*. HC 764. London: The Stationery Office, 2002.
———. *Information and Communications Technology in Government - Landscape Review*. HC 757. London: The Stationery Office, 2011.
———. *Investigation into Verify*. HC 1926. London: The Stationery Office, 2019.
———. *Managing the Risks of Legacy ICT to Public Service Delivery*. HC 539. London: Stationary Office, 2013.
———. *Rolling out Universal Credit*. HC 1123. London: The Stationery Office, 2018.
———. *Tackling the Tax Gap*. HC 372. London: The Stationery Office, 2020.
———. *Universal Credit: Getting to First Payment*. HC 376. London: The Stationery Office, 2020.
National Crime Agency, Metropolitan Police Service, and National Police Chiefs' Council. *Policing for the Future: Written Evidence*, 2018.
National Institute for Health Research. 'Artificial Intelligence Could Help to Detect Breast Cancer'. Webpage. NIHR, 1 February 2020.
Needham, Catherine. 'Personalization: From Story-Line to Practice'. *Social Policy & Administration* 45, no. 1 (February 2011).
Nesta. 'Love Lewisham'. Web Page, n.d. Accessed 28 October 2020.
NHSX. 'AI in Imaging'. Webpage. NHSX, n.d. Accessed 17 November 2020.
———. *Artificial Intelligence: How to Get It Right*, 2019.
Revell, Timothy. 'AI Detective Analyses Police Data to Learn How to Crack Cases'. *New Scientist*, 10 May 2017.
Social Finance, Newcastle City Council, and Impetus. *New Insights into Improving Outcomes for At-Risk Youth: The Newcastle Experience*. Social Finance, 2016.
Stewart, James, and Manj Kalar. *Budgeting for Change: Four Ways the UK Government Can Spend Smarter and Deliver Better*. Amazon Web Services Institute, 2018.
Stewart, James, and Manj Kalar. 'Smarter Spending: Unblocking the Increased Adoption of Cloud Computing by the UK Public Sector'. *Amazon Web Services Institute*, 14 June 2018.

Tang, Ming. 'Examining Data Use in Healthcare and Life Sciences - Collection and Trust, Innovation and Improving Patient Care, and the Contribution to Fighting COVID-19'. Conference. Westminster Health Forum, 20 October 2020.

The AHSN Network, Department of Health and Social Care, and NHS England. *Accelerating Artificial Intelligence in Health and Care: Results from a State of the Nation Survey*, 2018.

The Institute for Government. 'Whitehall Monitor 2020 - Digital Services'. Webpage. The Institute for Government, n.d.

The Rt Hon Oliver Dowden CBE MP. 'Digital Secretary's Closing Speech to the UK Tech Cluster Group'. Speech. Department for Digital, Culture, Media & Sport, 23 June 2020.

Timmis, Sarah, Luke Heselwood, and Eleonora Harwich. *Sharing the Benefits: How to Use Data Effectively in the Public Sector*. Reform, 2018.

———. *Sharing the Benefits: How to Use Data Effectively in the Public Sector*. Reform, 2018.

Topol, Eric. *The Topol Review: Preparing the Healthcare Workforce to Deliver the Digital Future. An Independent Report on Behalf of the Secretary of State for Health and Social Care*. Health Education England, 2019.

Valcri. 'About Valcri'. Web Page. Valcri, n.d. Accessed 29 October 2020.

Wachter, Robert M. *Making IT Work: Harnessing the Power of Health Information Technology to Improve Care in England*. National Advisory Group on Health Information Technology in England, 2016.

Waller, Madeleine, and Paul Waller. 'Why Predictive Algorithms Are So Risky for Public Sector Bodies'. SSRN Scholarly Paper. Rochester, NY: Social Science Research Network, 21 October 2020.

Wilkinson, Sarah. *Digital Transformation in the NHS: Oral Evidence*. HC 680, 2020.

Yim, Jason, Reena Chopra, Terry Spitz, and Jim Winkens. 'Predicting Conversion to Wet Age-Related Macular Degeneration Using Deep Learning'. *Nature Medicine 26*, 18 May 2020.

REFORM

@reformthinktank

info@reform.uk

www.reform.uk

ISBN: 978-1-910850-46-6