



HM Government

Getting smarter: a strategy for knowledge & innovation assets in the public sector

The Mackintosh report

April 2021



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Preface

The UK's public sector is a remarkable source of innovation. It is bursting with potential, and rich with ideas and insights that could help to shape the future of our country as we emerge from the coronavirus pandemic. From an innovative sepsis test which could save millions of lives globally to Met Office weather sensors that may make possible the next generation of autonomous vehicles, we are already in the vanguard of technological progress.

However, we need to manage these so-called 'knowledge assets' wisely. Only by investing in them properly – giving them the attention and resources they need – will they deliver the enormous benefits they offer to our economy and society, boosting productivity and improving the quality of life in the UK.

In that context, this strategy seeks to capitalise on the full breadth of ideas, research, technology, data and insight found across the UK's public sector. This begins by making sure public organisations know how to identify, manage and protect the knowledge assets they hold. It also means seizing opportunities to develop and deploy our capabilities in new ways for new purposes; marketing valuable intellectual property through spin-out companies or licensing; and improving how we share and access public sector data.

This strategy will also improve the public sector's knowledge and technology transfer infrastructure, and support the crucial 'last mile' of innovation, which is essential to securing the UK's status as a 'science superpower'.

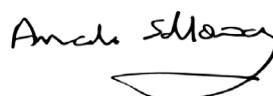
Finally, it will contribute to the government's efforts to 'level up' the whole of the UK: by providing organisations nationwide with expertise, networks and investment to match those of advanced innovation ecosystems, we will maximise potential all across the country. Realising these opportunities may take time - and bring its own challenges and risks – but the rewards could be transformational.

In short, the UK can be a world leader in managing its knowledge assets, using public sector ideas and innovations in new ways to deliver the best results for our public services, economy and society. This report puts forward an implementation strategy to make that possible by defining good practice, creating incentives and providing access to support, networks and investment.

We want to conclude by expressing our gratitude to Dr Andrew Mackintosh for his contributions to this important work, and for sharing his wealth of expertise and experience in developing the strategy. We wait with excitement to see the results.



Steve Barclay MP
Chief Secretary to the Treasury



Amanda Solloway MP
Minister for Science, Research and Innovation

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Foreword

Modern economies across the globe are increasingly built on knowledge rather than physical assets. They trade in innovation, in cutting edge ideas and capabilities, and in data and insight. These are the intangible or 'knowledge assets' (KAs) that underpin the most successful modern businesses and are vital to the long-term success of the UK.

This is well understood by business, reflected in the long-term upward trend of expenditure on research and development (R&D) performed by UK businesses. It has been recognised by UK universities, where a growing focus on generating impact from research has helped to build some of the most vibrant and exciting business ecosystems in the world, centred around our leading higher education institutions. The coronavirus pandemic has created new challenges for these sectors, particularly around investment, but the response has energised organisations to take forward ideas at pace, and to work with new partners in ways previously unseen.

As well as encouraging the conditions and providing the support to keep the UK at the forefront of global R&D, government is itself also a major source of innovation and has made science and R&D a central priority. This includes the range of advanced research carried out in government laboratories, as well as the many skills and capabilities generated across departments, arm's length bodies (ALBs) and the wider public sector in the course of delivering world-leading public services. These assets play a vital role in effective modern government and were vital in the fight to control coronavirus and protect lives, but they also have huge wider potential to be used in other organisations or in different ways to generate further value. However, other than in some pockets of government, the wider potential of these assets tends to be poorly understood.

This was highlighted by the report 'Getting smart about intellectual property and other intangibles in the public sector' published alongside the 2018 Budget. It acknowledged the scale of the KAs across the public sector, the potential to generate greater social, economic and financial value from these, and put forward ten high-level recommendations to support this potential being realised.

This latest report is the culmination of a programme of work to translate those recommendations into a set of concrete proposals that will support real change on the ground. Built around three pillars, the implementation strategy it outlines will: provide clarity to organisations about how to manage their KAs effectively; create new incentives and other structural changes to encourage organisations to engage with this often neglected activity; and provide practical support to unlock and develop the most promising opportunities.

The work of my colleagues since the 2018 report has involved extensive consultation across government and more widely, and I have been struck in these discussions by the ambition of public sector staff at all levels and across very different organisations. There are more mature organisations that have a good understanding of their KAs and the opportunities they could bring but lack some of the resources needed to realise their full potential. Other organisations have a less developed

understanding of KAs and need support and guidance to identify and manage the KAs they hold and realise their wider benefits.

This is a significant step on an important journey. The increased focus on KAs requires both a change in approach in response to new incentives, and the patience to support new businesses and services while they incubate and grow. This takes time and long-term commitment, as well as a willingness to take risks in order to pursue opportunities. However, the benefits to the wider economy and to the organisations themselves are considerable. While this report lays out a starting point for action, the priorities and detailed plans will evolve in response to client organisations and with the existing centres of relevant expertise across government. These groups have been advising the project and can support the implementation, as well as benefitting from the increased resource being applied to this area.

The vision that continues to drive this work is clear: a future where government organisations recognise that the knowledge, skills and capabilities they develop while fulfilling their public purpose often have broader applicability across and outside of government, and that the efficient use of public funds includes exploiting these for wider benefit. In doing so, organisations have the opportunity to become more innovative, more used to engaging with ideas from outside and more collaborative in their approach to addressing their core activities.

This work has received sponsorship from HM Treasury, Cabinet Office, Department for Business, Energy and Industrial Strategy and the Intellectual Property Office, and has involved considerable collaboration across these and other organisations. I would like to thank these departments along with many others for their contributions.

A handwritten signature in black ink, appearing to read 'Andrew Mackintosh', written in a cursive style.

Dr Andrew Mackintosh

April 2021

Executive summary

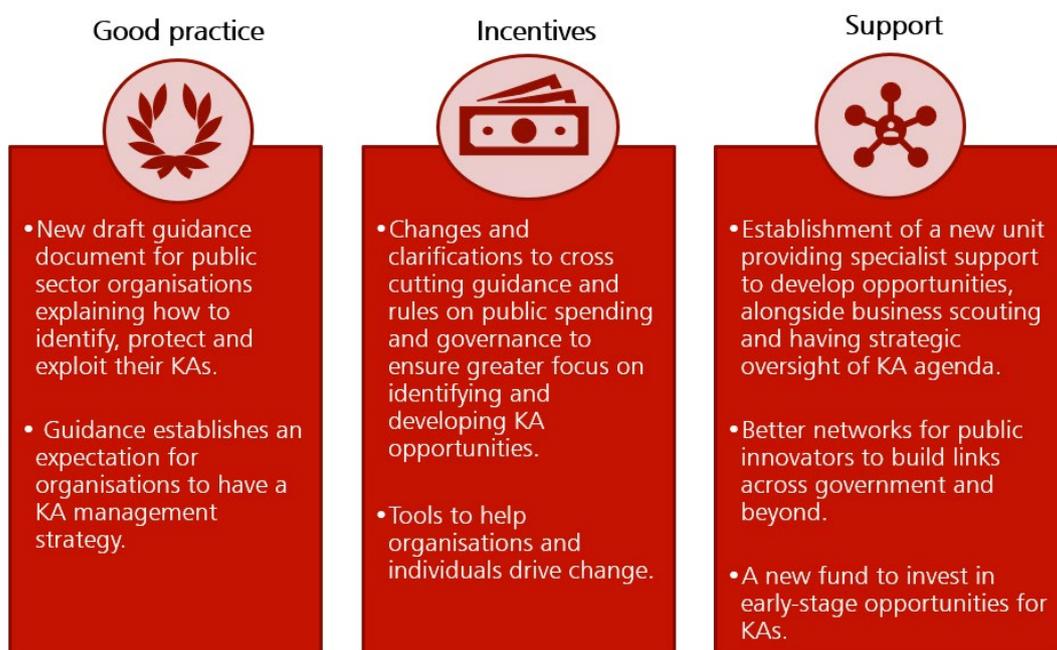
Investment in intangibles or 'knowledge assets' (KAs), examples of which include intellectual property (IP), innovation, R&D, data, know-how, business processes, expertise and other intellectual resources, is of large and growing importance to both the UK and global economy. In the UK public sector, these assets are fundamental to the successful delivery of government's objectives and can bring significant social, economic and financial benefits.

This report set out a new implementation strategy to get greater value from KAs in the public sector. It builds on the report published at Budget 2018 'Getting smart about intellectual property and other intangibles in the public sector', which highlighted how KAs are both undervalued and underexploited in the public sector and that organisations face a number of barriers to effectively managing and realising the full value of their KAs.¹ This includes organisations often not knowing what KAs they hold or their potential value, while also lacking the expertise to identify, protect and exploit these assets. Furthermore, the incentives for organisations to invest in KA generation and exploitation are limited, and there is a lack of support and access to investment for those who do wish to pursue these opportunities.

This implementation strategy supports organisations and individuals to overcome these barriers and is focused around three pillars: good practice, incentives and support, which has been illustrated overleaf. Each pillar provides the building blocks to improve how government manages KAs and a summary of the changes announced in the implementation strategy can be found overleaf.

¹ [Getting smart about intellectual property and other intangibles in the public sector](#) (2018), HMT.

The implementation strategy is built around three pillars



Summary of changes announced in the implementation strategy

Support

- 1 **A new unit** – The Government Office for Technology Transfer, within the Department for Business, Energy and Industrial Strategy (BEIS). The unit will scout for new opportunities and support government departments and organisations on how to identify, protect and exploit their knowledge assets. This includes responsibility for taking forward the strategy.
- 2 **New funding to invest in innovative ideas**, benefitting both the public sector and the wider economy. The expansion of the UK Innovation and Science Seed Fund to include dedicated investment funding for KAs will be explored, while the new unit will also distribute small amounts of grant funding.
- 3 **Better networks for public sector innovators**. This includes improving connections between public sector innovators, business, investors and academia; and levelling up support for regional public sector research institutions and innovation ecosystems outside of London, Oxford and Cambridge. The new unit will facilitate the operation of this network.

Incentives

- 4 **Changes to incentives** within government to support the development of innovative ideas and entrepreneurial culture, which include:
 - updated HM Treasury budgeting guidance to make it easier for departments to keep the proceeds from successful innovations
 - updated Orange Book guidance on risk management to emphasise the importance of KAs and the need to manage both opportunities and risks
 - encouraging better recognition and reward for innovators, and better training, across the civil service
 - supporting the application of the Green Book principles for central government appraisal and evaluation to KAs in forthcoming updates

-
- embedding a focus on managing KAs into the business planning process and wider functional agenda, starting by reviewing government’s performance and planning framework and functional standards to achieve this
 - introducing Senior Responsible Owners (SROs) for KAs within each organisation to improve accountability and leadership, alongside new reporting frameworks for KAs in government.
 - ensuring non-executives in civil service departments can bring their expertise and focus on valuable KA opportunities

Good practice

- 5 **New guidance** – on how to identify, manage and derive maximum value from public sector KAs. The guidance, a version of which has been soft launched alongside this report, is structured to support a range of audiences, from senior officials, to practitioners working through the detail. All public sector organisations headed by an Accounting Officer, responsible for upholding MPM, should have a strategy for managing their KAs, as part of their overall asset management strategy, which reports into an SRO. The new unit will also offer further advice and guidance.
 - 6 A new **‘knowledge and innovation assets bank’** to capture and share intelligence on high potential opportunities across government, allowing KA holders and innovators to connect and pursue opportunities. There is the option for the new unit to help manage this bank.
-

These changes have been developed in consultation with a range of departments and other public sector organisations. This implementation strategy has also been informed by engagement with numerous innovation experts in the public, private and academic communities.

Scope

This implementation strategy is focused on UK central government, including government departments, agencies and public bodies, which are typically funded wholly or mainly through public money. It does not cover local government or devolved administrations, although these organisations are encouraged to also engage with this report and the new guidance published alongside it. Universities are also not targeted by this strategy.

Managing Public Money establishes that each public sector organisation is expected to develop and operate an asset management strategy which should consider intangible, as well as physical, assets.² Organisations in scope of the new guidance are those headed by an Accounting Officer, responsible for upholding Managing Public Money and managing that organisation’s assets.³ It should however be considered alongside the legal framework, and other relevant guidance or principles

² [Managing Public Money](#) (2019), HMT. See Annex 4.15 of MPM for further detail on the expectation to develop and operate an asset management strategy.

³ [Managing Public Money](#) (2019), HMT. See Chapter 3 of MPM for further detail on the role of an Accounting Officers in central government organisations.

which may apply to individual organisations. Feedback on the draft guidance is invited from these organisations during the coming months.

Taking forward the strategy

The publication of this strategy is a major step in a long but important journey. The next phase is the testing of the draft guidance with organisations and launching the new unit and fund. This is discussed in more detail in the final chapter, although implementation dates will be kept under review in light of changing circumstances.

Chapter 1

Introduction

Summary

- £104 billion of knowledge assets are estimated to be held by central government and there is a wide geographical spread of organisations with potentially valuable assets.
- This new implementation strategy will support public sector organisations to effectively manage and realise greater value from their knowledge assets.
- It responds to recommendations made in the Budget 2018 report, which identified a number of barriers to the effective management of knowledge assets in the public sector.
- The strategy is focused around three pillars: good practice, incentives and support.

Background

- 1.1 Knowledge and innovation assets play an ever-increasing role in the UK and global economy, and investment in KAs is central to driving productivity and growth. This is reflected in the UK private sector spending more on intangible assets than ever before.¹
- 1.2 The UK's first ever Balance Sheet Review was launched at Autumn Budget 2017 and concluded its review alongside the 2020 Spending Review.² It brought to light the scale and variety of KAs held by the public sector and led to the publication of the Budget 2018 report 'Getting smart about intellectual property and other intangibles in the public sector', which examined the management of public sector KAs in more detail. This report identified barriers that lead to these assets being undervalued and underexploited in the UK public sector, and included recommendations

¹ [Developing experimental estimates of investment in intangible assets in the UK \(2019\)](#), ONS.

² [The Balance Sheet Review Report: Improving public sector balance sheet management \(2020\)](#) HM Treasury

aimed at realising greater value from these assets. Those recommendations are summarised in Annex A.

- 1.3 At Budget 2020 it was announced that, to unlock more value from its KAs, the government will establish a fund to invest in innovative public sector ideas and a new unit to scout for and develop these opportunities. The recent Spending Review has confirmed the unit will be taken forward within BEIS, while the government will explore expansion of the UK Innovation and Science Seed Fund to include dedicated funding for public sector KAs.

- 1.4 The unit and fund are one element of a broader package of measures to drive productivity and innovation, and support the government in achieving its vision of the UK as a world-leading science superpower, as set out in the R&D roadmap published in July 2020.³ The unit and fund will focus on the 'last mile' of innovation, an important step in realising this vision, and will help secure best value from increased investments in public sector R&D and improve the wider impacts of innovations originating in the public sector.

- 1.5 The UK science and innovation community has been fundamental to the global coronavirus response, helping to improve our understanding of the virus, advance new treatments and work towards developing vaccines. These efforts have helped save lives and have involved a number of public sector organisations, including government labs. The work of these organisations is more important than ever before, and it is vital they develop and maintain the KAs they generate. Along with the support and funding that forms part of this implementation strategy, further investment in these assets can help transform the future of our country and our economy as we emerge from the coronavirus pandemic.

Building and understanding of knowledge capital in the public sector

- 1.6 The 2018 report highlighted the likely scale of knowledge capital held by the UK public sector. It estimated the value of this capital could be as high as £150 billion and made recommendations on the valuation and recognition of KAs in the public sector.
- 1.7 In developing this implementation strategy, further analysis of expenditure on KAs in the public sector has been undertaken. It identifies £104 billion of KAs held by central government. The analysis shows that Department of Health and Social Care (DHSC), Ministry of Defence (MOD) and Department for Business, Energy and Industrial Strategy (BEIS) are the most significant KA holding departmental groups. This includes the arms-length bodies (ALBs) and other bodies sponsored by these departments, such as the Met Office and NHS. Alongside wider analysis, it also indicates that there are KAs being generated in a wide range of other departments, and that high potential KA opportunities are to be found across the public sector and throughout the

³ [UK Research and Development Roadmap \(2020\)](#), BEIS.

country. Further detail on the expenditure-based analysis is included in Annex B.

- 1.8 In those parts of the public sector where the management of KAs is supported, the evidence shows that it delivers significant benefits. An independent assessment of Ploughshare Innovations Ltd⁴, who act as the technology transfer office for the MOD's Defence Science and Technology Laboratory (Dstl), calculated that its activities generated £117 million in net additional gross value added (GVA) and £152 million in new additional exports since it was established in 2005. Many of the case studies in this report showcase the broad range of social, economic and financial benefits organisations have generated by successfully managing their KAs.
- 1.9 However, as identified in the 2018 report, public sector organisations face a number of barriers to managing and realising the full value of these KAs. These include:
- identification: public sector organisations often do not know what KAs they hold or how much they might be worth
 - insight: public sector organisations often lack the technical, legal and commercial expertise to develop, protect and exploit their KAs
 - infrastructure: there is limited central support for public sector organisations looking to improve the management of their KAs
 - incentives: there are limited incentives for organisations and individuals in the public sector to invest in KA generation and exploitation
 - investment: the budgeting system does not always support the long term and necessarily speculative investment that is often required to generate value from KAs
- 1.10 This implementation strategy focuses on how to overcome these barriers and build better capabilities within the public sector. However, there is no one-size-fits-all approach for achieving this. Engagement with organisations and staff across the public sector has highlighted the variation in organisations' abilities to effectively manage their KAs. This strategy therefore includes changes that target differing levels of capability, from basic awareness raising and training to more sophisticated tech transfer-style business development support.
- 1.11 There is also a diversity in the geographical spread of those organisations with potentially valuable knowledge and innovation assets. For example, government research hubs are based across the country, from Exeter through Oxford to Liverpool and Cumbria (a map of selected organisations is included in Annex B). These organisations are at the forefront of innovation and knowledge generation in the public sector and can play an important role in building regional innovation ecosystems. One example is the Hartree Centre described in Box 1.A.

⁴ Unpublished dataset

Box 1.A: Supercomputing spin outs driving local growth in the North West

Sci-Tech Daresbury is a National Science and Innovation Campus located near Warrington. It hosts world leading public research institutions such as the Hartree Centre, a high-performance computing, data analytics and artificial intelligence research facility. By integrating world-class science and technology, innovation and business enterprise, the campus has become home to nearly 150 high-tech companies, ranging from local start-ups to international corporates. One example is Formeric, a company that spun out of this site. Formeric's cloud-based platform makes supercomputing affordable and accessible to industrial users and scientists who would otherwise be unable to benefit from these capabilities. The company aims to grow and contribute to the local economy while the technology it offers is targeted at making UK science and businesses more internationally competitive.

- 1.12 However, many sites outside of the 'Golden Triangle' of London, Oxford and Cambridge have limited access to support, networks and investment, which curbs their ability to capitalise on their work and generate wider benefits for the area in which they are based. This reinforces the need for a strategy that identifies and advances opportunities across the public sector and levels up support for regional innovation ecosystems.

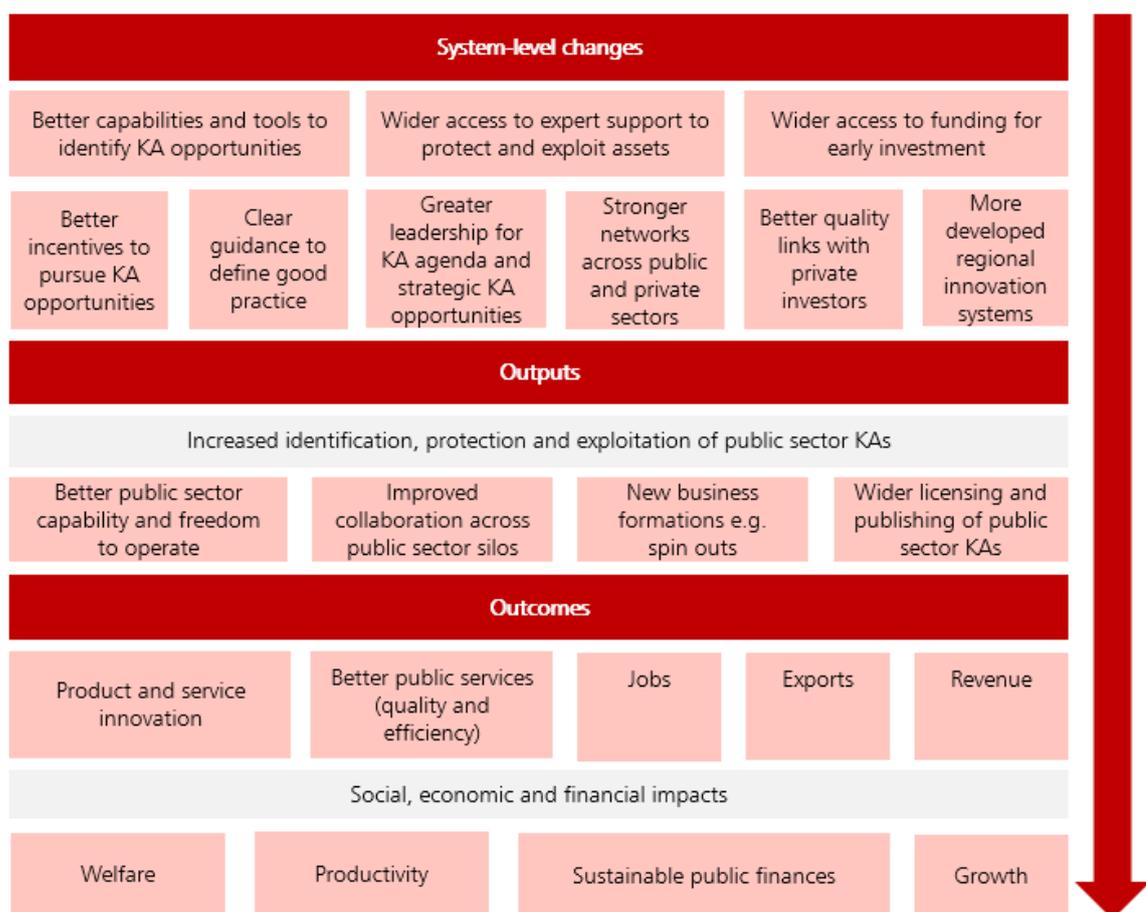
A new implementation strategy for knowledge assets

- 1.13 The implementation strategy set out in this report is focused around three pillars: good practice, incentives and support. Each pillar is structured to respond to recommendations and barriers identified in the 2018 report. Annex A shows how each pillar interacts with the 2018 recommendations.
- 1.14 The first pillar of the strategy aims to establish and share good practice for KA management in the public sector. Through the provision of new guidance on KAs, a draft of which is published alongside this report, organisations will have access to clear advice on how to identify, protect and exploit their knowledge and innovation assets. It also sets an expectation that organisations develop a strategy for managing their KAs and provides advice on how to do this.
- 1.15 The second pillar introduces new incentives to encourage better management and exploitation of public sector knowledge and innovation assets, as well as removing barriers to achieving this. This pillar sets out the ongoing changes the government is making to increase focus on KAs within organisations, create a willingness to take risks in order to pursue opportunities to develop KAs, ensure organisations are able to benefit from successfully exploiting their KAs (including improved mechanisms for income retention), drive better reporting and accountability, and provide tools to reward, recognise and assist individual KA generators and owners.
- 1.16 The third pillar provides greater levels of support and investment to ensure organisations can realise the full potential of their knowledge and innovation

assets. Under this pillar, a new unit – The Government Office for Technology Transfer - will be established within BEIS. Its responsibilities will include working with public sector organisations to identify promising KA opportunities and providing specialist support for their development. It will exercise strategic cross-government leadership and increase awareness and capability including through training and the facilitation of better networks for public sector innovators. This includes working together with existing areas of expertise and capability in government, such as the Intellectual Property Office (IPO). This pillar also introduces the government’s ambition to provide up to £40 million in new funding for investments in public sector KAs, to overcome early stage funding gaps that exist for the most promising KA opportunities, with initial funding available in 2021-22 and further funding to be confirmed at a future spending review.

1.17 Together these pillars constitute the building blocks to deliver system-wide change in how government manages and derives value from its KAs. Figure 1.A describes the system-level changes, outputs and outcomes targeted by this strategy.

Figure 1.A: System level changes, outputs and outcomes



Vision

- 1.18 Underpinning this implementation strategy is a vision where public sector organisations use the knowledge, skills and capabilities they develop while fulfilling their public purpose to have broader applicability and impact, thereby catalysing innovation, driving productivity and growth, and improving public services and finances. In achieving this the public sector will also attract experts, investors and other partners to explore and support the development of high value knowledge and innovation assets. This will create opportunities for public servants to contribute to and learn from innovative, exciting and value-adding collaborations with other parts of the public sector, the private sector, academia and the third sector.
- 1.19 There are areas of high potential growth where public sector organisations have significant knowledge and expertise, and which present opportunities to improve the value derived from the associated KAs. These areas include digital health, where there is a huge opportunity to use the scale of the NHS and the data it holds to improve outcomes for patients, the NHS and UK science and innovation. Agri-tech is another high potential area, contributing £14.3 billion to the UK economy, employing 500,000 people and helping to fuel rural growth.⁵ By taking action now, and introducing the good practice, incentives and support needed, we can ensure public sector organisations are best prepared to make the most of these and future opportunities. Realising these benefits will, however, take time and must therefore be part of a long-term initiative.
- 1.20 The longer-term vision of this implementation strategy has also looked at what has been achieved in other advanced organisations and ecosystems for KA development. A good example is the tech transfer offices and dedicated seed funds found in the UK's leading universities, which are summarised in Box 1.B. This gives the UK public sector something it can aspire to and learn from. However, building an ecosystem for KAs in the public sector presents its own challenges, which in turn demand their own solutions and incentives.

Box 1.B: Learning from UK universities

Over the last 20 years UK universities have created vibrant ecosystems for knowledge asset exploitation. In 2017-18, 140 new spin off companies were formed from university-owned IP, while higher education providers were granted 1707 patents and generated over £207 million of revenue from IP.⁶ This has also contributed to building academic excellence, with the best universities acting as central nodes in the modern knowledge economy.

This has been enabled by the development of an effective support network which includes advanced technology transfer offices and dedicated seed

⁵ Press release: 'Business Secretary calls for new tech revolution in agriculture' (2018), BEIS.

⁶ 'Higher Education Provider Data: Business and Community Interaction' (2019), HESA.

funds. For example, Cambridge Enterprise supports the University of Cambridge with academic consultancy and advises on IP management, licensing and spin out companies. 'SETsquared' supports Bath, Bristol, Exeter, Southampton and Surrey, and has helped raise over £1.5 billion for start-ups since 2002.⁷ And in Oxford, a dedicated investment fund of £600m - the world's largest university-partnered venture firm - has been established with investors such as GV, Sequoia and the Wellcome Trust to build transformative science based businesses from University IP.⁸

⁷ [The Economic Impact of SETsquared Partnership](#) (2018), WECD.

⁸ www.oxfordsciencesinnovation.com

Chapter 2

Good practice

Summary

- Many organisations in the public sector face a gap in their understanding of the knowledge assets they hold and how they should be treated. Therefore, this pillar aims to establish and share good practice for knowledge asset management.
- This includes the provision of new guidance, a draft of which is soft launched alongside this report, to show organisations how to identify, protect and exploit their knowledge assets.
- The guidance is based on some fundamental knowledge assets principles, which reiterate the expectation – already established in Managing Public Money – that organisations have a strategy for managing both their physical and intangible assets.

The objective of the good practice pillar

- 2.1 The first pillar of this strategy is focused on good practice. A clear message from the work leading up to the Budget 2018 report and in discussions since then is that it is not always clear to organisations what ‘good’ looks like when it comes to the management of KAs. This includes organisations who are not always aware of the KAs they hold, as well as others that know they have valuable KAs but are not sure what they should be doing to realise that value.
- 2.2 The objective of this pillar of the strategy is to fill this gap in understanding and to set much clearer expectations for how organisations should act with regard to these assets.¹ This includes publishing new draft guidance for managing public sector KAs.

¹ This pillar of the strategy therefore addresses the recommendation in the Budget 2018 report around guidance (recommendation 7) and, by providing information about how to protect KAs, also supports the delivery of the recommendation on protection (5). This element of the strategy also seeks to respond to recommendations on recognition (4) and valuation (3), by showing organisations how to identify the KAs they hold and providing tools that support an initial assessment of value. Readers interested in further discussion of work to recognise and value KAs held within government should also read Annex B. The clarity around

- 2.3 The draft guidance has been subject to internal testing and consultation, and the good practice it establishes is relevant to a wide array of public sector activity. However, it will be most relevant to those working in innovation rich areas of government and ALBs, such as R&D, the science profession and data. It should also be considered by groups including the commercial and finance professions, as well as areas of government where KAs may exist but are not being properly valued and developed. The draft guidance will continue to be tested with these groups and wider audiences throughout 2021 before it is finalised.

Key elements of the guidance

Knowledge asset management principles

- 2.4 The guidance sets out three high level principles. The intention is that these simple principles capture the main concepts from which the detailed guidance flows. They are:
- 1 Knowledge assets are valuable public assets, critical to the effective delivery of public services. It is the responsibility of every public servant to manage them in order to ensure that their value is maximised and not lost or under-utilised.
 - 2 All central government organisations should have a strategy in place to support the effective management of knowledge assets. This will include measures to:
 - identify KAs
 - consider and execute appropriate protection of KAs
 - support exploitation of KAs
 - 3 Knowledge assets can have considerable value and impact beyond their original purpose and exploiting this is part of good asset management. This value can be social, economic and financial, and is often a combination of these.

Knowledge asset management strategies

- 2.5 The core requirement of the guidance, which builds on Managing Public Money and is reflected in the principles, is that central government organisations should have a strategy in place to support the effective management of their KAs. Existing expectations around good asset management are set out in Managing Public Money, which requires public sector organisations to devise an appropriate asset management strategy

good practice provided by this pillar also takes the first step in addressing the recommendation on data (8) by asking organisations to consider and assess a range options for managing and exploiting data, with the aim of identifying which delivers the greatest social, economic and financial benefits.

and that all kinds of assets should be considered, including both physical and intangible.²

- 2.6 This requirement is designed to be flexible to accommodate the wide range of organisations within central government, for which KAs will play a varying role. For example, a KA management strategy could be integrated into a wider asset management or even organisational strategy. The guidance explains how to devise and operate such a strategy. Box 2.A gives an example of an organisation that is advanced in its approach to managing its KAs and illustrates the benefits this has delivered.

Box 2.A: Exporting The National Archives' expertise internationally

The National Archives (TNA) is a world leading official archive which provides access to over 1000 years of England and Wales' national documents. It is also an entrepreneurial public organisation that generates 25% of its income from external activities. TNA has been at the forefront of digitising archival material and has established significant technical and commercial expertise which has become essential to its core operations. Digitisation requires leveraging significant capital and careful attention to securing the investment for future generations. TNA recognises the strategic importance of this expertise to the organisation, but also its potential to be applied more widely to generate a return which can be invested back into its openly accessible archival service. A good example of this is the structuring and brokering of a service offer to the United Arab Emirates to develop its digital archive. Drawing on its digitalisation expertise, TNA provided the overall strategy and specification for the work, as well as content and descriptive expertise and standards, and partnered with a UK SME to deliver the remainder of the project. This meant that TNA did not have to commit such a significant staff resource to the project delivery phase and enabled a UK SME to generate export revenue.

Three steps for knowledge asset management: identify, protect and exploit

- 2.7 The guidance establishes three steps for managing KAs and gives organisations more information to help them understand how to manage these assets more strategically. The three steps are illustrated and explained in Figure 2.A.

² [Managing Public Money](#) (2019), HMT. See Annex 4.15 of MPM for further detail on the expectation to develop and operate an asset management strategy.

Figure 2.A: Three steps for managing knowledge assets



Identifying knowledge assets

2.8 Before any management of an asset can take place, a necessary first step is to identify and record the asset. This can be challenging in the case of KAs; they are not visible and they can arise in unexpected places. The guidance helps organisations identify the different types of KAs they may hold, as well as highlighting how these KAs can be combined with other assets to become even more valuable.

2.9 Early identification of when a KA is likely to be generated allows the potential wider benefits of the resulting asset to be optimised. Procurement is a particularly crucial stage. If an organisation is aware of how a potentially valuable KA may be generated by a provider it intends to contract with, it can take necessary steps during the procurement stages to manage and protect its stake in the asset. The example in Box 2.B highlights how MOD ensures a focus on KAs in procurement.

Box 2.B: Securing MOD R&D in procurement

The Ministry of Defence (MOD) spends around £16 billion per year on procurement and acquisition activities. MOD recognises the significant KAs involved in these activities and has a team of specialists who ensure that they are protected, while securing the access and rights to use KAs developed by its contractors that are required to meet government's needs. The MOD also operates a commercial exploitation levy, which is a form of royalty for any sales of a capability where the MOD has contributed to R&D. The levy is negotiated on a contract-by-contract basis to ensure that the MOD gets a financial return on any research it develops which is then commercially exploited by a contractor.

2.10 The guidance explains the importance of recording these assets systematically. It provides a tool designed to help organisations understand whether a KA, or a cluster of KAs, has the potential to generate value beyond its original purpose. There is also the option that this information could form the basis of a government 'knowledge assets bank', that identifies some of the most valuable KAs generated in the public sector, and

to share this information with others inside and potentially even outside of government. The new unit introduced under the support pillar of this strategy could help in managing the bank. By exposing a KA to a wider audience, it can support the identification of different markets and contexts in which the asset can be exploited to generate wider value, as illustrated by the case of Cobalt Light Systems in Box 2.C.

Box 2.C: Improving passenger safety with advanced lasers

The Science and Technology Facilities Council (STFC) is a research council that focuses on particle and nuclear physics, space science and astronomy. At one of its sites near Oxford, where it employs 2000 staff, scientists developed a novel way of using a light beam to analyse the chemical properties of an object. A team within STFC that looks to apply its technology to areas outside its core field of research developed a way of using this testing technique in airports. After some seed funding from UK Innovation and Science Seed Fund (UKI2S), they went on to establish a separate company, Cobalt Light Systems, to pursue this opportunity along with other investors. A highly successful product was developed that now tests for bombs and other chemicals in 70 airports around the world, improving passenger safety and reducing queue times at airports. In 2017 Cobalt Light Systems was sold to the US company Agilent for £40 million, which has made Cobalt the new global centre for Agilent's Raman Spectroscopy business. Part of the proceeds from the sale returned to UKI2S and are available for further investment into other high potential public sector KAs.

Protecting knowledge assets

- 2.11 Unlike many physical assets, KAs can be easily replicated or used by others simultaneously, and investment in KAs often creates significant positive spillovers that benefit people other than the original producer or owner. This can sometimes disincentivise investment in developing an asset as competitors can effectively copy or benefit from an innovation. In the context of KAs, 'protection' therefore means the control or restriction of their use to ensure the asset can still fulfil its primary purpose and that the owner of the asset receives an appropriate benefit.
- 2.12 The protection of KAs should not be viewed as acting in opposition to openness and transparency; protection does not necessarily mean secrecy. The IP regime is applicable to many types of KA and, in return for temporary exclusive rights that allow them to retain an appropriate share of the benefits, requires an asset owner to make their idea available to others. In this way, protection measures can allow greater openness and collaboration, as well as support the adoption of new technologies in the wider economy, as shown in Box 2.D.

Box 2.D: Placing LCD technology into the economy

Liquid Crystal Displays (LCDs) are an example of where technological breakthroughs made in government were protected with a patent portfolio. In the 1970s, researchers in UK defence labs made significant discoveries that led to LCDs becoming a commercially viable product. The patents protecting these inventions enabled government to licence and control the way new LCD technologies were exploited, supporting adoption across industry and attracting investment to develop the technology, thereby growing the LCD market and expanding its application. This also brought significant returns for government, such as with the supertwist nematic display, which was patented and licensed by the MOD and yielded royalties of over £100 million.³

- 2.13 The guidance is designed to support organisations in their decision-making around protection, providing information about the benefits of protection, and the options available for different KAs. It acknowledges that protection is not always appropriate, not least because there is usually an associated cost. However, it should be considered before KAs are shared or made public, as once this has occurred, it is rarely possible to put in place protections retrospectively.
- 2.14 More than half of all UK research is a product of international partnerships. With this in mind, HMG has also published Trusted Research⁴ guidance which provides advice on the importance of properly protecting valuable information. The Trusted Research guidance covers: how to protect research; safe international collaborations; use of legal frameworks; and who researchers are at risk from, and where.

Exploiting knowledge assets

- 2.15 Sometimes, the management of a KA may simply involve using them for the purpose that they were designed, but there are many instances where they can have much wider applicability. The government has vast expertise in designing and delivering solutions to some of the most difficult challenges faced by society. But it is not always accustomed to thinking about the know-how, information and innovation that might accompany this as an asset that has the potential to be of great value to others. Box 2.E provides an example of where fulfilling this potential can save both money and lives.

³ Flat-panel electronic displays: a triumph of physics, chemistry and engineering (2010), Hilsum.

⁴ Trusted Research Guidance for Academia (2021), Centre for the Protection of National Infrastructure (<https://www.cpni.gov.uk/trusted-research-guidance-academia>)

Box 2.E: Preventing amputations with a thermal imaging breakthrough

The National Physical Laboratory (NPL) develops and maintains the national primary measurement standards. It was once where Alan Turing designed the Automatic Computing Engine. Nowadays, NPL uses its expertise to support the development of a range of next-generation technologies such as quantum communications and superfast 5G, and recently turned to the health sector.

Using £1.2 million of funding from the National Institute for Health Research, NPL has combined high accuracy temperature measurement with state-of-the-art thermal imaging technology, to create a breakthrough prototype medical imaging device. This device enables the early detection of diabetic foot ulceration (DFU), a severe complication of diabetes of which 15% of sufferers are prone, costing the NHS c.£1 billion per year. On average, it causes 20 amputations a day in England alone, and 50% of people die within 2 years of an amputation. The potential of what NPL has developed is therefore enormous, both for saving lives and sustaining the NHS. In order to maximise the impact of this technology, NPL has established Celsius Health, a medical technology spinout, to create an approved version of the device for use in clinics.

- 2.16 The guidance focuses on how to identify those KAs where there is an opportunity for wider exploitation, as was the case in the previous example. All organisations should be encouraged to explore these opportunities, as the National Nuclear Laboratory has done, shown in Box 2.F below. But organisations should also approach this process iteratively, accepting that many opportunities that show early potential will fall away as further examination uncovers their limitations.

Box 2.F: Powering regional SMEs into new export markets with nuclear know how

The National Nuclear Laboratory (NNL) is the UK's government-owned nuclear research organisation. It operates from six sites across the country, although most of its work is focused around its Central Laboratory on the Sellafield site in Cumbria, the most advanced nuclear research facility in the world, and the older Windscale Laboratory on the same site. NNL operates as a commercial business with no direct grant government funding and works across the complete nuclear fuel cycle. However, it also uses its know-how to take existing sectorial technologies in the local supply chain and adapt them to the nuclear industry.

For example, Rawwater, an engineering company based in Warrington, is working with the NNL to adapt its metal alloy technology for sealing abandoned oil wells for the nuclear sector. This SME made the transition into the nuclear sector through Sellafield's Game Changers innovation programme. The company is exploring applications for the technology at the Sellafield site, and more recently in the Japanese market. By collaborating and engaging the

local supply chain, NNL is using its know-how to nurture and support technologies which have international reach.

- 2.17 In finding opportunities to maximise the potential of the public sector's KAs, all parts of government must be considered. For example, Box 2.G describes how an organisation such as the Royal Mint has taken its specialist know-how and expertise in coin manufacturing and sought to apply it to new areas, which includes developing and manufacturing new protective equipment for NHS workers in the fight against coronavirus.

Box 2.G: World's leading exporting mint uses coin manufacturing know-how to produce 16,000 face masks per day

The Royal Mint has its main operations in South Wales where it employs about 900 people. With more than 1000 years of experience, it is the world's leading manufacturer of coins and exports to over 60 countries in addition to manufacturing coins and precious metal products for the UK.

As the coronavirus pandemic struck, the Royal Mint has sought to apply its specialist, lean manufacturing know-how to the support the national effort to save lives and protect the NHS. Although it did not have a background in producing health equipment, it partnered with its local NHS Trust to design a simple visor for frontline NHS workers whose design lent itself to mass production in a short time frame. It then worked closely with the British Standards Institute and the Health and Safety Executive to secure the requisite approvals. After a period of iterating the product, it was able to ramp up design of its product to 16,000 face masks per day by May 2020, having only started this work in April.

The Royal Mint's main focus will continue to be on producing coins and precious metal products. However, in looking to the future, it is thinking more about how to apply its know-how to other areas – such as high security product identification, and this example of rapidly contributing to the coronavirus response – in order for the organisation to adapt and thrive in a changing world.

- 2.18 Lastly, in managing, developing and exploiting its KAs, the public sector will have a broader range of objectives than the private sector, which is principally driven by generating financial returns. Public sector organisations should think about opportunities to generate social, economic and financial value.
- 2.19 Achieving these benefits can create trade-offs. Generating a financial return from a KA can require imposing protections and restrictions on using an asset, or adopting a more commercial model to create better incentives and attract investment. However, limiting or charging for access to an asset can limit the broader social and economic benefits that the asset could otherwise

deliver. Therefore, organisations should consider whether or not the public interest is best served by minimising or restricting access to the asset. Box 2.H gives an example of a KA-rich organisation adopting a range of approaches to manage and exploit its KAs and generate social, economic and financial benefits.

Box 2.H: Combining a variety of approaches as best practice – Transport for London

Transport for London has used both commercial and open approaches to generate a range of social, economic and financial benefits from their KAs. For example, as the first public transport provider in the world to accept contactless bank card payment TFL used the opportunity to market such know-how internationally and has established a new team to serve international demand. In addition to generating new income, TfL found that, by thinking about the wider commercial application of the asset, they also improved the quality of the product they implement in London. One manager noted “if you design a new piece of technology around what could be sold in the market it changes your way of thinking. You focus on quality, rather than just going for the cheapest.”

For almost 10 years, on the other hand, TfL has been releasing a significant amount of data – timetables, service status and disruption information – in an open format for anyone to use, free of charge. The result is that there are now 600 apps such as Waze and Citymapper using the data, which are used by 42% of Londoners. In 2017, Deloitte estimated that TfL is now generating economic benefits and savings of up to £130 million by releasing its data in this format.⁵ Not only has it reduced journey times for passengers, but the apps have also grown London’s economy and provide TfL with new data it does not collect itself, allowing for further improvement to its service.

- 2.20 In the case of TfL, it has been successful in how it makes its data available to users, but there are considerations facing public sector organisations about how public sector held data is accessed and shared. These are discussed further in Box 2.I.

Box 2.I: Opening-up access to public sector held data

From healthcare to transport, the public sector collects and maintains datasets that are of great value to the delivery of public services and for the wider economy and society. However, public organisations should consider what approach they take in making this data available to others. Making data widely available without charge or restriction, as recognised in the development of government’s ‘open data’ agenda, can bring significant social and economic rewards, and create greater transparency. Other datasets may

⁵ [Assessing the value of TfL’s open data and digital partnerships](#) (2017), Deloitte, p. 5.

require considerable investment to unleash their potential and managing or charging for access may be necessary to optimise development. Certain datasets may also be too sensitive or personal to be opened up without access restrictions or controls.

This strategy does not ask organisations to change their approach where data is currently available without charge or restriction. However, attention to KA management principles – considering the best overall social, financial and economic returns in different situations – should underpin all approaches to managing public sector data, and the draft guidance includes tools to help organisations work through these questions. In 2020 the Department for Digital, Culture, Media and Sport published its National Data Strategy, which outlines what steps government will take to further support open data, along with other models and approaches, in order to drive greater value from data and data systems in the public sector.⁶

Next steps

- Organisations are invited to test the draft guidance and welcome feedback. Following a soft-launch period, which will run during 2021, the guidance will be finalised and published.
- Once the guidance has been finalised and the new unit becomes operational, the new unit will also be able to provide further advice and guidance.

⁶ [National Data Strategy](#), 2020 (DCMS).

Chapter 3

Incentives

Summary

- The second pillar of this implementation strategy introduces incentives to encourage better management of public sector knowledge assets, as well as removing barriers to achieving this.
- This includes rewarding innovative organisations that are willing to take risks in order to pursue knowledge assets opportunities, while ensuring a focus on knowledge assets is embedded within organisational processes, reporting frameworks and among senior leadership.
- It also involves recognising, rewarding and assisting individual innovators, and providing the education and awareness-raising to embed behaviour change over the long-term.
- The new unit proposed under pillar three will be tasked with implementing and further developing these and future incentives.

The objective of the incentives pillar

- 3.1 Incentives play an important role in establishing the behavioural changes that will be central to improving the management and exploitation of KAs. The objective of this second pillar is to ensure parts of the public sector have a clear reason to focus on KAs, by providing powerful incentives as well as removing disincentives and barriers where they exist.¹ Achieving this change is perhaps the most significant challenge of this strategy.
- 3.2 At an organisational level, this pillar firstly seeks to establish the right incentives for organisations as they weigh up risk and rewards around further developing their KAs, and ensures organisations can benefit from the rewards generated from successful KA management and exploitation. Secondly, it looks to ensure better management of KAs is well embedded in organisational objectives and at the earliest stages of business planning processes. Thirdly, it provides clearer accountability and senior sponsorship

¹ This pillar addresses the recommendations made in the Budget 2018 report on enhancing organisational and individual incentives (recommendation 10) and on reporting (recommendation 6).

for the management of KAs within public organisations to build commitment to this new approach, and proposes to develop frameworks to evaluate and report on maturity.

- 3.3 In terms of individual incentives, this pillar of the strategy seeks to build general levels of capability and awareness and promote tools to recognise, reward and assist individuals who practice good KA management and pursue opportunities.

Managing opportunities and risk

- 3.4 Risk management is about managing the effects of uncertainty. Opportunities to exploit KAs are often relatively risky to pursue, with a high chance that many will fail compensated by a handful of significant successes. If further investment of time and resource in developing and managing these assets effectively is to be encouraged, organisations need to be encouraged to embrace risks when pursuing an opportunity to develop a KA.
- 3.5 A willingness to recognise and take risks in order to pursue opportunities will be particularly important for organisations seeking to realise greater value from their KA. Part of this involves ensuring that organisations that take risks can benefit from the rewards of doing so. But it also requires KA management principles to be embedded in government's wider approach to risk management. New changes to the latest version of the Orange Book (the government's principles on risk management) now put a clearer emphasis on the importance of taking a balanced approach to managing both opportunities and risks. The government will continue to look to make clearer links to guidance on KAs and the associated risk and opportunity management that is integral to the successful exploitation of KAs.
- 3.6 KA opportunities exist across government, and work undertaken in developing this strategy has also looked at establishing departmental 'Opportunity Committees' to focus on opportunities to capture the value of latent KAs. A role for Non-Executive Directors is envisioned in this, as they can draw on their skills and experiences drawn from private, academic and other sectors, and the government will look at the viability for introducing such a role in any future review of the Corporate Governance Code.

Embedding better knowledge asset management

- 3.7 It is important that certain requirements are embedded in everyday government operations in order to enable departments to manage their KAs more effectively. These changes benefit from working within existing structures as far as possible, rather than introducing new ones. For example, the expectation that organisations have a strategy for managing their KAs builds on existing guidance in Managing Public Money.
- 3.8 The success of this strategy in refocussing attention on the management of KAs will depend on departments taking the initiative to incorporate it into regular business planning processes and good functional management. Box 3.A outlines several proposed changes government will take forward to help

achieve this.

Box 3.A: Proposed changes to embed better knowledge asset management

- Functional standards set expectations regarding how government is managed. The functions (for example Commercial, Project Delivery and Finance) engage in a range of KA management activities. To support consistent recognition of KAs across government, these will be reviewed, including expectations for the management of KAs in updates to functional standards.
- HM Treasury's Green Book Guidance is used to appraise and evaluate policies, projects and programmes.² It is used in tandem with the HM Treasury's broader Business Case guidance when public resources are being used. To help organisations think about KAs during the early stages of business case development and appraisal, HM Treasury will review and publish updates to support the application of Green Book and Business Case principles to KAs.
- As new guidance and incentives for KAs are embedded into working cultures across government, and can be translated into departmental objectives, the incorporation of KA management into departmental performance and planning frameworks will be reviewed.
- Making updates to Managing Public Money to reflect the good practice, as set out in the draft guidance published alongside this strategy, for how organisations should manage their intangible assets as part of a wider approach to asset management.

Accountability and reporting on knowledge asset management

- 3.9** To embed good practice, KA management needs to be recognised by senior leaders within the organisation. In the future all public sector organisations with an Accounting Officer should have a senior member of staff as an SRO for KAs who has clear responsibility for the organisation's KA management strategy. Further advice to organisations on appointing an SRO for KAs is included in the draft guidance published alongside this report.
- 3.10** Reporting can highlight and celebrate successes, and act as a powerful incentive for driving improvements in KA management across government. In addition, it can provide transparency and allow organisations to be challenged and held to account. This implementation strategy has not sought to design a detailed reporting structure or assessment framework. It has also avoided a one-size fits all approach to reporting as this would not be suitable for a diverse range of organisations, and without careful design would risk introducing disproportionate burdens. Instead it has focused on

² [The Green Book: appraisal and evaluation in central government](#) (2019), HMT.

creating a new unit which will be responsible for designing and implementing a future reporting framework.

Recognising, rewarding and assisting individuals

3.11 Individual KA owners are central to managing and exploiting these assets successfully, and need to be recognised, rewarded and assisted. A significant feature in the university and entrepreneurial sector is strong recognition and reward for innovators. In the public sector, approaches to individual incentives vary between organisations. This section gives examples of individual incentives schemes, many of which relate to KA-mature organisations within the government research community. However, organisations are encouraged to develop their own approaches to staff recognition, reward and assistance.

Recognition

3.12 When it comes to recognition, Box 3.B provides details of initiatives that are already being used in government organisations to encourage good practice.

Box 3.B: Individual recognition initiatives

- Dstl, Innovator of the year award: a presentation from the Chief Executive at an awards ceremony
- Dstl, letter to inventors: all named inventors on Dstl patents get a letter from the Chief Executive upon grant of patent
- Biotechnology and Biological Sciences Research Council (BBSRC), Innovator of the year: a presentation from the Chief Executive at an awards ceremony
- Ploughshare Innovations, Pipeline and Engagement Award: awarded to the Dstl Division that has generated the most innovations
- Ploughshare Innovations, Commercialisation Award: awarded to the Dstl Division whose innovations have generated the most revenue
- NPL: breakthrough inventors and inventions within NPL are profiled on displays – for example Alan Turing’s ACE computer – and all inventors are honoured in NPL’s annual achievements dinner
- GCHQ: an annual Innovation awards ceremony to celebrate inventors, particularly for those involved in the Patent application/prosecution/grant process, as well as an IP Ambassador Network
- Ordnance Survey: inventors are featured in corporate communications, inventor workshops and other events
- Science and Technology Facilities Council has a small museum where some of its laser-enabled inventions are on display

- 3.13 A role of the new unit (see following chapter) will be to work with partners to celebrate and showcase the success of individuals as well as organisations. For example, the National Physical Laboratory recently ran a series of Innovation Webinars to highlight the game changing ideas and opportunities that already exist within government, and it is important these innovation success stories continue to be shared. This could include recognising excellence in KA management as part of Civil Service Awards, an annual event that is run as part of 'A Brilliant Civil Service'.
- 3.14 Professions in government should also look to adopt KA management skills within their success profiles. The government science and engineering (GSE) profession has set out KA management as a technical skill in its updated skills framework.³ This forms part of the success profile for GSE, and applies to scientists, engineers as well as those that work around science and engineering within government that wish to follow the GSE framework.

Assistance

- 3.15 In order to allow individuals to pursue innovative ideas and opportunities, organisations should think about what assistance they can offer to employees. Several schemes exist already in the public sector and are summarised in Box 3.C.

Box 3.C: Assistance for individual innovators

- NHS England and NHS Improvement, Clinical entrepreneur training programme: provides health professionals with opportunities to develop entrepreneurial skills and ideas through support such as mentoring, commercial training, access to events and conferences, funding opportunities, time out of work and industry placements. In 4 years since its creation, this programme has supported more than 200 clinicians develop their healthcare innovations, creating 246 start ups and 1300 jobs
- GCHQ: PhD (or similar) funding for technical staff and 'Innovation time' allowance for technical staff
- Dstl: personal Innovation awards to fund innovative technical projects delivered in-house
- BBSRC: enterprise Fellowships and Follow-on Funding
- NPL: a dedicated team of product managers and defined best practise and tools to support commercialisation of new ideas (including awards and mentoring)

- 3.16 Organisations should also consider whether their HR policies and procedures provide the necessary flexibility to allow individuals to pursue KA

³ <https://www.gov.uk/government/publications/government-science-and-engineering-career-framework>

opportunities. The cross-boundary nature of knowledge and innovation assets requires a way of working, with regular secondments in and out of organisations and flexibility to bring in specialists to develop assets.

Rewards

- 3.17 Financial rewards can also give useful signals and encourage certain behaviours. However, financial reward is rarely the primary source of motivation for public servants and such schemes should be carefully designed so not to create perverse incentives or undermine the wider ethos of the organisation. Box 3.D provides examples of existing reward schemes in the public sector for innovators.

Box 3.D: Knowledge asset financial rewards schemes in the public sector

- Ordnance Survey, Patent Incentive Plan: a bonus system, operating on similar lines to Dstl's 'Rewards to inventors'
- STFC: offer share of royalties and equity to inventors where their innovation is commercialised
- Dstl & MOD, Rewards to Inventors scheme: a bonus of c.£240 paid directly to staff who bring forward ideas in respect of which Dstl/MOD choose to file patent applications and £900 when a patent is granted plus a % share of net exploitation revenues
- Ploughshare Innovations, Rewards to Inventors scheme: a share of income from licensing, consultancy, and from sales of equity in joint ventures and spin-out companies
- NPL: Up to £1000 reward for patent plus % share of net revenue income (% is on a sliding scale)

- 3.18 As well as financial rewards, offering forms of employee equity ownership or wider forms of employee ownership through the creation of joint ventures or public service mutuals can create other incentive structures to encourage staff to pursue KA opportunities.⁴

Raising awareness and understanding

- 3.19 Creating a change in behaviour and practice is a long-term and ongoing project. Improving KA management will require ongoing efforts to raise capability and awareness, including through training. The following chapter contains more detail on the new unit that will be established to drive forward this strategy. One of its functions will be to oversee this range of activity on an ongoing basis. It is envisaged that this will be done in close

⁴ For guidance on forming joint ventures refer to: [Joint Ventures: a guidance note for public sector bodies forming joint ventures with the private sector](#) (2010), HMT. For further details and guidance on public service mutuals visit: <https://www.gov.uk/government/collections/public-service-mutuals>.

partnership with the Intellectual Property Office (IPO) and other organisations with existing expertise, resources and capabilities in this area.

- 3.20 In addition, this new unit will leverage professional networks and other important platforms, such as the Civil Service Leadership Academy, to raise awareness and understanding of KAs and their management.

The ongoing need for support

- 3.21 Developing KAs can require a considerable investment of time, resources and expertise. These constraints are often the most significant barrier to behavioural change. Changing behaviour and facilitating a focus on KAs will also mean providing access to additional resources and expertise. This is the purpose of pillar three of this strategy, which introduces new support and funding.

Next steps

- Some of these changes are already underway. For instance, new rules on income retention are included in the most recent Consolidated Budgeting Guidance and apply from the 2020-21 financial year onwards.
- As these and other changes begin to take hold, further incentives will likely be required to continue building a focus and willingness among organisations to make the most of their knowledge assets. The new unit outlined in the next chapter will look to take forward these changes, as well as evaluating and monitoring the effect of existing incentives.

Chapter 4

Support

Summary

- The aim of the third pillar of this implementation strategy is to provide greater levels of support to ensure public sector organisations can realise the full potential of their knowledge assets.
- A new unit – The Government Office for Technology Transfer - will be responsible for taking forward the strategy and providing guidance and specialist support to improve the management and exploitation of public sector knowledge assets.
- Better networks of knowledge asset professionals across government will allow sharing of expertise and experience and support wider connections in business and beyond.
- A new investment fund will support departments and ALBs as they manage, develop and exploit early-stage public sector knowledge assets and attract private investment.

The objective of the support pillar

- 4.1 The objective of this pillar is to improve the support, networks and investment available to organisations in order to realise the full potential of public sector KAs. Without the right support, it can be difficult for organisations to manage KAs. Even where an organisation recognises the KAs it has, and wants to identify, protect and exploit them, it may not have the in-house capability, networks or resources to do so. The Budget 2018 report found that KA management capability was spread unevenly across the public sector, and pockets of higher maturity capability were fragmented and mostly small scale.
- 4.2 The government is committed to developing its KA management capabilities, and the changes to promote best practice and create incentives will support this. However, in order to achieve a step change in the management of KAs, the support available to organisations must be improved and added to, building capability across the public sector and fostering regional innovation ecosystems for KAs that contribute to levelling up across the country.

Establishing a new unit for knowledge assets

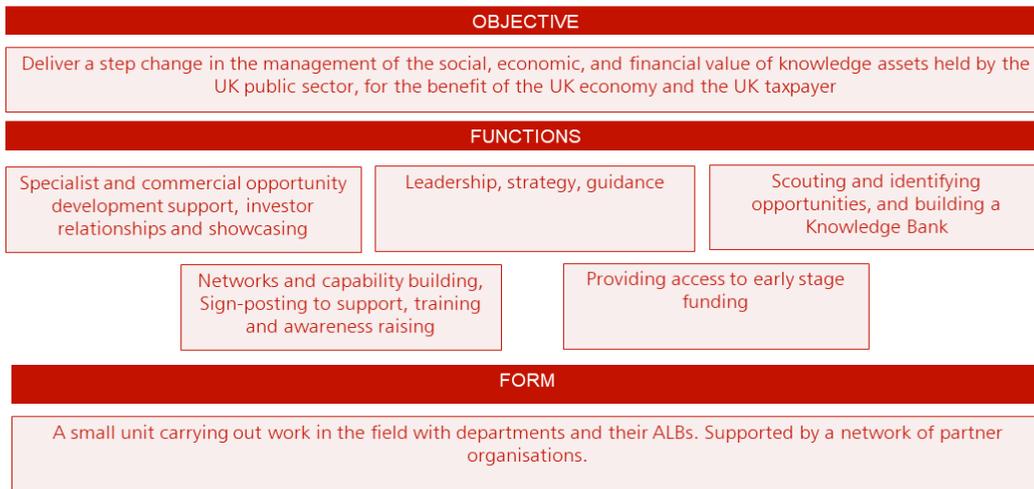
- 4.3 A core element to this implementation strategy is the establishment of a new specialist unit for KAs in government. The new unit will add value, both by directly providing support, and driving forward changes to improve the ecosystem for the management of public sector knowledge and innovation assets. This unit was first announced at Budget 2020, and the recent Spending Review has confirmed this unit will be established within BEIS, starting up over the course of 2021.
- 4.4 To bridge gaps in infrastructure and KA management capabilities across parts of government, a new unit is needed to provide specialist capabilities where they are required, while also enhancing the existing capabilities of more mature organisations. This will not only build general levels of KA capabilities in government, but also help create stronger delivery networks which enable existing KA capabilities such as the IPO and those in the MOD to grow and deliver greater value.
- 4.5 A dedicated unit can also promote government innovation by supporting dialogue exchange and better networks with organisations and individuals in the private and academic sector, with benefits for the skills, market knowledge and experience the different sectors.

What the new unit will do

- 4.6 The new unit will serve central government departments and their ALBs, and will act as a leader and convener across government and a focal point for those that can enable the asset to reach its potential, including private sector investors. It will provide guidance and advice to central government organisations and offer more focused specialist support. Its core functions will be:
- opportunities, scouting and mapping: scouting for opportunities which could be developed for wider social economic or financial gain, employing venture capital style expertise
 - opportunity development: providing support to take an idea to market or repurposing for use elsewhere in the public sector, employing “tech transfer” style expertise
 - funding support: providing grants and helping central government bodies access funding or to find other investment opportunities, employing specialist commercial and administrative expertise
 - networks and capability building: promoting networks and building capability, employing expertise in comms, stakeholder relationships and strategic marketing, but partnering to deliver training with the organisations including IPO
 - strategy, guidance and reporting: developing policy and implementing a detailed strategy to drive forward change and further embed incentives, providing advice and guidance, and piloting evaluative frameworks, employing customer service, policy and strategy expertise

- 4.7 A blueprint for the new unit is included in Annex C, while Figure 4.A below describes the main features of this organisation

Figure 4.A: Main features of The Government Office for Technology Transfer



Building better networks

- 4.8 Being able to find and connect new opportunities for KAs is a valuable characteristic of an ecosystem that successfully manages and exploits its KAs. This is facilitated by strong networks, where experience and ideas come together, and opportunities with cross-sectoral applications, as well as skills and know-how, can be shared. In a system as dispersed as government, strong networks and connections will prove powerful enablers for wider KA exploitation.
- 4.9 This strategy seeks to facilitate better connections in a number of ways. Ideas are shared through the 'knowledge asset bank', which supports the identification of synergies between different assets, while the new unit will be heavily networked with delivery partners, such as the IPO.

What better networks will do

- 4.10 The new unit will bring together and expand the different networks that already exist, giving them a clear KA focus. This will include those from the finance and commercial functions, IP professionals, KA SROs, the government science community, digital and legal professionals, and anyone who works on, or has an interest in KAs. This also includes building strong links with regional public sector research bodies. It will share best practice and experience and make connections within and beyond government, while offering professional training, networking and formalised events, with the aim of building a community of ideas and opportunities around KAs.
- 4.11 At least as important as facilitating links within government, will be to promote networks that reach outside of government. There is a range of

dynamic and effective networks operating around KAs in the private and university sectors, including those facilitated by membership bodies such as the Association for Innovation, Research and Technology Organisations (AIRTO), and the Royal Academy of Engineering, as well as non-profit organisations such as PraxisAuril or the Innovation Policy Platform. The new unit should look for opportunities to work with these wider networks, and develop new and deeper relationships, including with investors.

Investing in knowledge asset opportunities

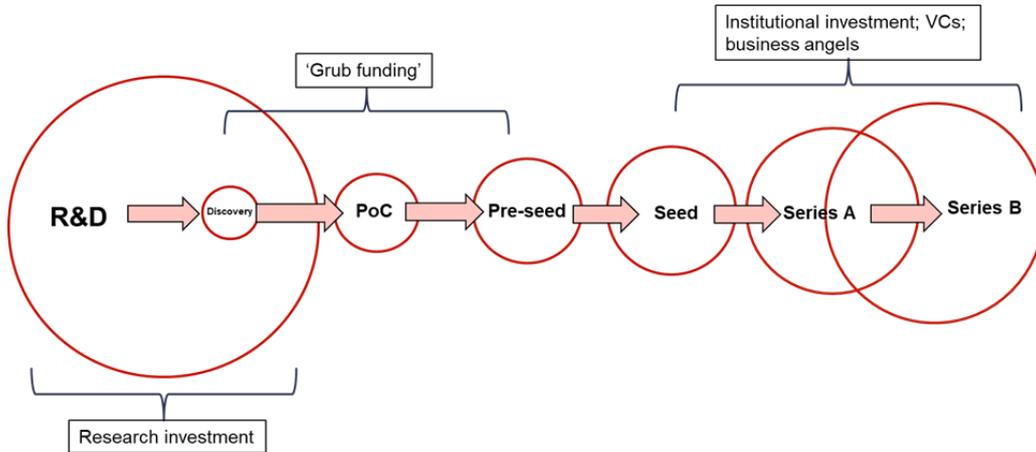
- 4.12 To take a KA with potential and turn it into a valuable product or service, investment is typically required. However, in the early stages of development or exploitation, private sector investors are typically unwilling to provide funding, due to information failures which affect their ability to price and manage risk.
- 4.13 In the university sector, a response has been to establish dedicated funds, working alongside technology transfer offices. This approach has been replicated, though not to the same scale, among public sector research establishments. For example, the UK Innovation and Science Seed Fund (UKI2S) is backed by BEIS, Dstl and works with UK Research & Innovation to provide pre-seed and seed funding.
- 4.14 However, there is potential for greater private investment in publicly funded R&D outside the universities sector, particularly as the technologies being developed for the practical purposes of the research establishment are often closer to a real-world application than the less mature KAs typically arising from the university system.
- 4.15 It is equally clear that valuable KAs, particularly around technology, data and know-how are being created in a wide range of public sector bodies, and not just those whose mission is focused on science and research. In the wider public sector, most organisations do not have access to external dedicated funding to help them fully exploit their KAs to achieve wider benefits. Many such organisations would find it difficult to prioritise internal funds into uncertain investments, particularly where the main benefits are beyond the organisation's core mission. For this reason, there is a strong case for such funding to open up pathways to exploiting KAs across the public sector.

How a new fund could operate

- 4.16 Figure 4.B below illustrates the funding requirements at the different stages of development of a KA. The main funding gap in the public sector (as is also often seen in the private sector) is for investment at the earliest "grub" and "seed" funding stages, before a product is investable or ready to be licenced. This funding could be required, for example, for market research, proof of concept and repurposing work, further technical testing, marketing, cleaning data or engaging legal advisers. The quantum of funding required can vary significantly, from small amounts in the region of £50,000 in the

earliest stages of grub funding, to amounts of up to c.£3 million in later stages, depending on the type of asset and target market.

Figure 4.B: Funding requirements at different stages of KA development



4.17 In many cases a relatively small amount of funding in the early stages will be essential to unlocking an opportunity and bridging a gap to private investment. The government will therefore establish a new investment fund to expand the provision of early stage funding to a much wider range of public sector clients. This will include exploring the option of expanding UKI2S to host this fund. The government has committed £12 million through the 2020 Spending Review as part of an ambition to support a fund of up to £40 million, with later year funding to be confirmed at a future spending review. While further detail will be developed, the key features of the fund proposed are summarised in Box 4.A. Alongside this investment fund, the new unit will also be able to distribute smaller amounts of grant funding to innovators in the public sector in order to pursue early-stage KA opportunities (e.g. to develop an initial proposal or secure a patent).

Box 4.A: A model for a new fund

- public funding is needed for early proof of concept and seed investment to bring a KA to market, whether through private sector co-investment (e.g. at the point of spin out) or through a licencing deal
- the fund should be able to finance early stage investment in return for a share of equity or royalties from licences; and leverage private co-investment for later stages
- this would be done with a view to moving to a model where up-front private capital is increasingly provided at early funding stages
- the ability to be sustainable over the long term will be an essential proof of value, but the fund will need to demonstrate social and

economic benefits, as well as financial ones, and provide a degree of public funding that is proportionate to the market failure

- using UKI2S to establish the new fund will be explored, which will work closely with the new unit. The new unit will provide much of the support activity that goes alongside funding (writing business plans, market testing, establishing new management teams' access to cross-government, and investor networks). As part of this, the new unit will be able to provide small amounts of grant funding.

4.18 The government recognises the funding requirement to bridge the gap to private investment varies across different KAs. Where management and exploitation costs are very significant and ongoing, as they could be for large scale data and technology projects, they will need to be prioritised against other calls on public funding. A role of the new unit will be to provide expert strategic advice to HM Treasury and Cabinet Office on the relative merits of KA development to ensure these opportunities are given suitable expert scrutiny and support.

Next steps

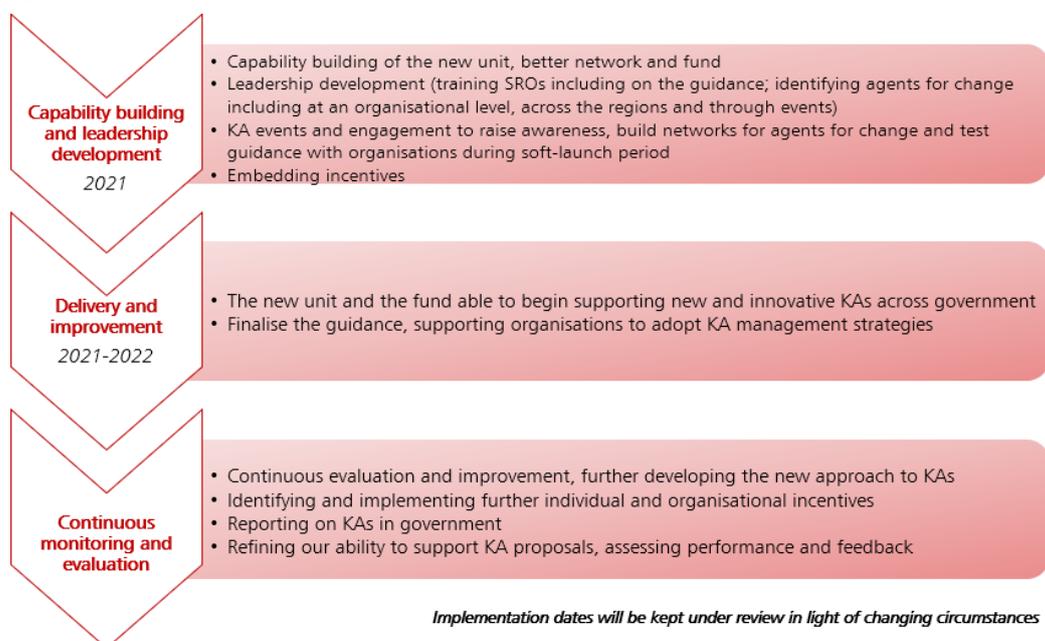
- Capabilities for the new unit and the fund will be developed throughout 2021, working with agents for change in organisations to facilitate better networks and run wider knowledge asset engagement and events.
- By the end of 2021, the unit and the fund will be available to support organisations, alongside better networks for public sector innovators.

Chapter 5

Taking forward the strategy

- 5.1 As the government continues to invest in knowledge generating activities, it is committed to ensuring the KAs it generates are managed effectively and delivering the widest possible benefits. This will only happen if mechanisms are put in place to recognise the potential in a timely fashion and the subsequent development of those opportunities is integrated into the management processes governing the regular operation of departments. This report has summarised the practical guidance, incentives and support to help realise this. Success will be a government which is more open to new ideas and better at managing and exploiting them, with consequent social, economic and financial benefits for the UK.
- 5.2 These changes have already started being implemented and the next step is the detailed planning and other preparations necessary to establish the new unit and the fund. An overview of the phases and plans for implementation is included in Figure 5.A.

Figure 5.A: Implementation overview



5.3 It is important to emphasise that the returns from the better management of KAs will not be immediate and that the potential benefits, while significant, can take five to ten years to be realised. There will also be a number of public sector specific challenges to overcome on the way, and it is vital that the implementation of these changes is responsive to these as they arrive. However, the public sector must also be confident and ambitious in pursuing KA opportunities. As the examples in this report and the 2018 report have shown, parts of the UK public sector have had great successes in developing their knowledge assets. Now is the time to take the opportunity to do even more to get the most out of these assets.

Annex A

2018 report recommendations

A.1 The report published at Budget 2018 examined the management of public sector KAs in detail, and whether more could be done to enhance the social, economic and financial benefits they deliver. It made ten recommendations aimed at improving management and realising greater value from KAs held by the public sector. These recommendations are listed below and Figure A.1 shows how each one maps on the three pillars of our implementation strategy.

- 1 central support: establish a centre of expertise within government to provide advice and support on the technical, legal, commercial and financial aspects of generating and exploiting KAs
- 2 network: facilitate better networks across the public and private sectors of experts and leaders focused on generating value from KAs, to share best practices and exploit synergies across organisational boundaries
- 3 valuation: develop new standards and approaches for measuring and reporting the value of KAs in the public sector
- 4 recognition: establish a central repository detailing government KA holdings and their value
- 5 protection: register intellectual property assets with the most commercial potential so that their value to the UK is maximised
- 6 reporting: publish an annual report on the government's KA holdings and progress in their exploitation
- 7 guidance: design and implement best practice protocols for development, protection and commercialisation of public sector KAs
- 8 data: as part of the National Data Strategy, explore how the public sector can further exploit its data and the associated KAs it generates
- 9 investment: develop financial, contractual and organisational structures that facilitate KA commercialisation and effective partnerships with the private sector
- 10 incentives: enhance organisational and professional incentives for KA development and exploitation

Figure A.1: Mapping the Budget 2018 report recommendations onto the three pillars

Recommendations			Pillars	Key points
Guidance	Protection	Data	I. Good Practice	<ul style="list-style-type: none"> • Guidance, showing organisations how to identify, protect and exploit their KAs • Establishes three key high-level principles, which includes the expectation that organisations will have a strategy for managing their KAs • Provides tools to assess and record details of KAs with potential for wider exploitation
	Recognition	Valuation		
Incentives	Reporting		II. Incentives	<ul style="list-style-type: none"> • Clarification of the rules for income retention from KA exploitation • Organisations to nominate SROs for KAs • Embedding a focus on KAs in organisational objectives and business processes • Changes to guidance around risk management • Tools organisations can use to incentivise individual KA innovators • Reporting alongside education and awareness to embed behaviour over long-term
Expertise	Networks	Investment	III. Support	<ul style="list-style-type: none"> • Establishment of a new unit to provide specialist expertise and support, as well as providing a locus for the wider strategy • A network of professionals across government and the private sector to allow sharing of expertise and experience, and to support connections business and investors • Establishment of a new investment fund to support opportunities at the earliest stages

Annex B

Improving the understanding of the value of knowledge assets in the public sector

Summary

- Further analysis of expenditure on knowledge assets in the public sector has identified £104 billion of these assets held by central government organisations. It breaks these down by departmental groups and by broad category of spending.
- The analysis identifies that DHSC, MoD and BEIS are the most significant knowledge asset holding departmental groups. However, along with other findings, it also suggests that there may be interesting knowledge assets in a wide range of other departments.

Expenditure analysis

B.1 The 2018 report highlighted the likely scale of KAs held by the UK public sector and estimated there to be potentially £150 billion of intangibles in the public sector. This was much higher than the £37.5 billion attached to intangibles in the Whole of Government Accounts, where international accounting rules not many KAs are recognised, particularly where they are challenging to value.¹ A better understanding of the scale, type and location of KAs held by the government is crucial to effectively directing and prioritising efforts to maximise their social, economic and financial value.

B.2 The estimate that the UK government holds £150 billion of KAs was based on work from an academic project known as SPINTAN (Smart Public Intangibles).² This used Eurostat data that is broken down into broad functions of government expenditure to maintain consistency and comparability internationally. However, this data cannot be broken down so that it maps onto the expenditure of UK government departments. A similar analysis was therefore applied to more granular

¹ [Whole of Government Accounts \(2020\)](#), HMT.

² For more detail on SPINTAN visit: <http://www.spintan.net/>

government expenditure data, to develop a picture broken down between government departments and by broad types of KA generating expenditure.

B.3 Mirroring the approach taken by SPINTAN, our analysis examined the following categories of expenditure over time:

- software
- research and development (R&D)
- cultural assets – expenditure on cultural activities
- brand – proxied through expenditure on advertising and marketing
- organisational capital – this is mainly produced by managers and leaders of organisations
- human capital – proxied by investment in formal training, on-the-job training and informal training

B.4 The analysis used assumptions for each of these categories about the proportion of the expenditure which translated into investment and the rate at which it depreciated. It also faced challenges in gathering complete data over the period being examined, which required analytical techniques to be used to make estimates where those values were missing. These challenges are often encountered when using data for a purpose other than which it was originally intended. In addition, the analytical approach used here will not capture the wealth of all KAs generated in the course of delivering government policy and programmes, which will not fall into any of these expenditure categories. Most notably, this could include data, where it is not collected as part of an R&D project, or innovative approaches to solving a range of public policy challenges in fields as diverse as transport, defence and welfare. Data is perceived to be potentially one of the most valuable KAs held and generated within the public sector, and much of its potential value will not be captured in this analysis.

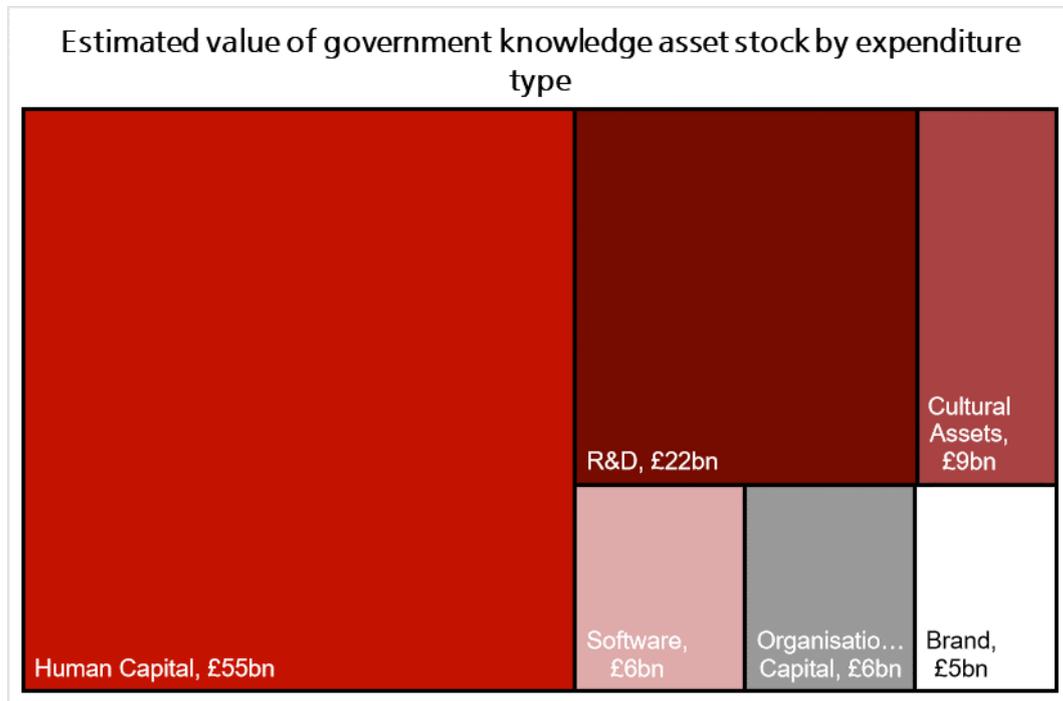
B.5 While it has limitations, the analysis provides a valuable layer of detail to the £150 billion estimate, allowing a broad understanding of what parts of government are likely to have larger stocks of KAs and what types of asset these are. In total the analysis has estimated a stock of £104 billion of KAs held by central government.³ It is not possible to map this exactly against the SPINTAN estimate of £150 billion, but the analysis indicates that the primary driver of this difference is scope, in particular the exclusion of local and devolved government in this more detailed analysis compared to SPINTAN.⁴ Figure B.1 shows the result of the analysis, broken down by category of expenditure. Proportionally this breakdown maps well to the SPINTAN analysis. It shows that much of the value is in the category of human capital. Figure B.2 uses the same data but breaks this down by government department. The dominance of the Department for Health and Social Care (including NHS trusts) is

³ Given the nature of the analysis to produce this figure, the £104 billion estimate is not suitable for inclusion in the Whole of Government Accounts, which adopts the IFRS definition of intangible assets.

⁴ The SPINTAN analysis included spending by local or devolved government, which we have not sought to incorporate given that these organisations are not formally within the scope of this project. In addition, the SPINTAN estimate included expenditure by 'Non-Profit Institutions Serving Households', which includes a range of non-government organisations such as charities, religious organisations and universities and for similar reasons we have not sought to include in this analysis.

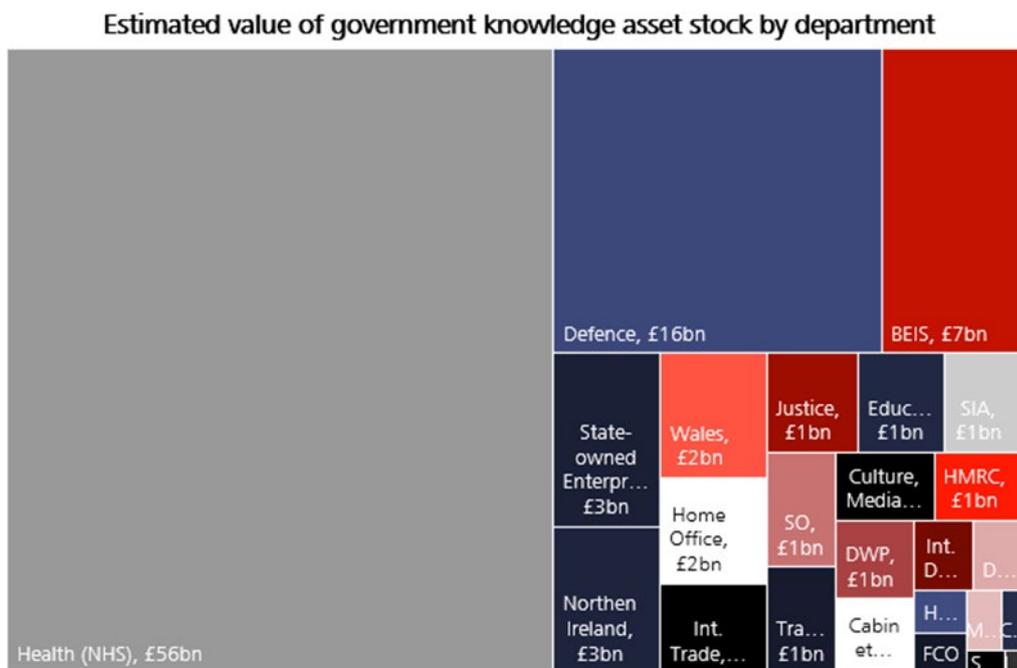
also driven to a significant degree by human capital, likely reflecting the significant expenditure on training within the NHS.

Figure B.1



Source: HM Treasury

Figure B.2



Source: HM Treasury

B.6 This expenditure analysis relies on the assumption that cost is a good indicator of value. It is certainly an indicator, particularly on an aggregate level, but this assumption has limitations, particularly as you examine specific KAs in further

detail. For example, the value from R&D investment tends to be driven by particular pieces of breakthrough research, rather than all projects contributing equally in line with their costs. Factors unrelated to cost, such as the wider applicability or marketability of a KA can also have a significant impact on their value. That is why other methods, such as looking at the market value of an asset or calculating likely future income streams, are often used to value KAs. However, these methods are usually more complex and rely on data that is not widely or consistently available across government.

B.7 In this way, the expenditure analysis should be viewed as an indicator only and used to support a more detailed discussion, at an organisational level, of KAs. This discussion can be made richer by combining expenditure analysis with other indicators or analysis. For example, there has been specific analysis of the potential economic value of some types of government data, which include an estimate of the benefits from the better use of geospatial data of £6-11 billion.⁵ A recent EY report on realising the value of health care data in the UK estimated an indicative market value of several billion pounds with the potential, with the right investment, to unlock benefits of £9.6 billion per annum (this includes NHS benefits worth £5 billion and patient benefits worth £4.6 billion).⁶

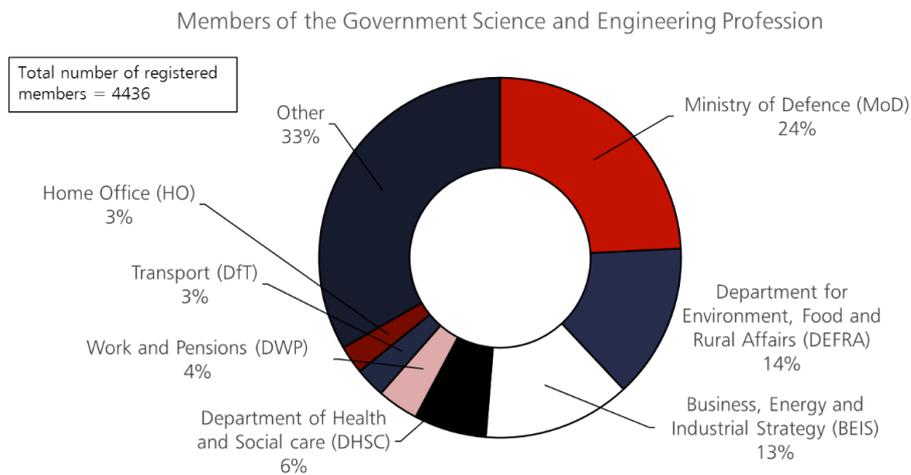
Other indicators of knowledge asset distribution

B.8 Given the innovation and expertise inherent within science, the distribution of the government science profession as shown in Figure B.3 could provide an interesting additional lens through which to examine the distribution of public sector KAs. It indicates that there are potentially assets of significant interest being generated in a wide range of departments.

⁵ [An analysis of the potential geospatial economic opportunity](#) (2018), Cabinet Office.

⁶ [Realising the value of future healthcare data: a framework for the future](#) (2019), EY.

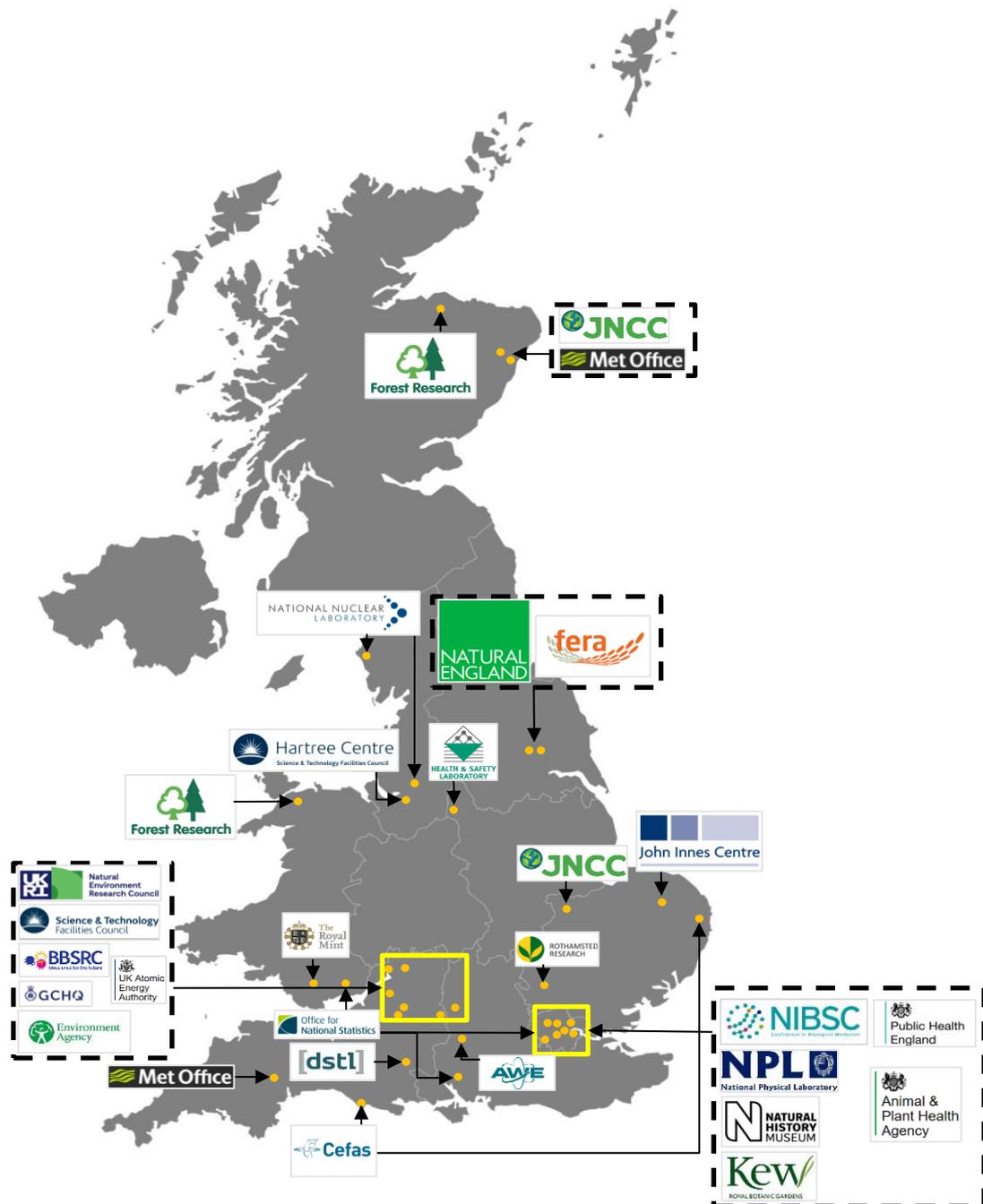
Figure B.3: Distribution of the government science profession



Source: GO-Science

B.9 Lastly, as the case studies in this report have highlighted, high-potential KA generating institutions themselves are distributed across the country, from London and Exeter to Liverpool and Cumbria. A map showing a number of these sorts of institutions is included in Figure B.4. As well as developing sector specific KAs, these institutions also support regional innovation systems and supply chains, capturing a wide base of talent and opportunity. This suggests that the potential economic impacts of developing these assets goes beyond the value of the assets themselves.

Figure B.4: Map showing selection of knowledge asset generating public sector organisations⁷



B.10 This map provides a snapshot of some of the UK-wide institutions which generate high-potential KAs. This does not include a number of strong research institutes within the devolved administrations, such as the James Hutton Institute in Scotland. While outside the scope of this study, strong collaboration will be sought as the programme develops.

⁷ Note: Fera is a joint venture between Capita and Defra, while AWE work under contract to the Ministry of Defence through a government-owned-contractor-operated arrangement.

Annex C

The Government Office for Technology Transfer Blueprint

Leadership

- **Lead the unit, including but not limited to** – Set and realise a strategy for public sector KA identification, protection and exploitation; advise and influence senior decision makers across Whitehall; and convene and lead organisational network

Strategy, guidance and reporting

- **Strategy** – Oversee delivery of implementation strategy and report recommendations
- **Policy guidance** – Advise in response to queries on guidance, co-ordinate publication of best practice notes
- **Reporting** – Publish annual reports on KA cross-public sector and launch reporting frameworks

Opportunity development

- **Business development** – Evaluate opportunities and advise whether to protect assets or market assets (licensing, JV, partnerships), conducting market research and providing business case support
- **Commercial deal support** – Negotiate licensing deals and spinouts, JV set ups and provide post deal support and advice

Networks and capability

- **Networks** – Create a network with links to private sector and academia, with supporting events, career pathways and a sub group for functions
- **Education** – Develop training, establish and run mentoring programme, and manage professional network
- **Sign-posting and awareness raising** – Develop online presence, interactive tools, comms and raise profile of UK KAs

Funding support

- **Investment Strategy** – Design and review investment strategy, with criteria and evaluation framework and governance established
- **Governance and investment decisions** – Support funding applications and ongoing evaluation of investments
- **Procurement and contract management** – Support management of fund, including legal and contract administration, and market engagement with external investors

Scouting and mapping

- **Identifying opportunities** – Proactively scout opportunities across the public sector, support organisations conducting KA assessment, market surveillance and investor relationships.
- **Knowledge Asset Bank** – Create a single map of KA opportunities. Promote practical use of knowledge bank, develop prospectus for funding

Other/ Admin

- **Non-executives** – Supported by non-executives offering specialist expertise and advice
- **Legal services** – Legal advice will be obtained from specialists outside the unit
- **Admin, finance & unit comms**

HM Treasury contacts

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