HM Treasury

Getting smart about intellectual property and other intangibles in the public sector:

Budget 2018

October 2018

HM Treasury

Getting smart about intellectual property and other intangibles in the public sector:

Budget 2018

October 2018

This publication is available at www.gov.uk/government/publications

Any enquiries regarding this publication should be sent to us at public.enquiries@hmtreasury.gov.uk

ISBN 978-1-912809-08-0

PU2204

Contents

Foreword

The world's five most valuable companies are worth £3.5 trillion together but their balance sheets report just £172 billion of tangible assets. 95% of their value is in the form of intangible assets, including intellectual property, data and other knowledge assets.

Knowledge and innovation are central to the UK's future productivity and growth and to ensure we are investing in a Britain fit for the future. They are a key focus of the government's Industrial Strategy. These strengths are apparent in the public sector as well as the private sector, where research has highlighted a large growth in the value of the UK public sector's knowledge assets.

Work undertaken as part of the Balance Sheet Review, launched at Autumn Budget 2017 and tasked with getting better value from government's wide range of assets and liabilities, has brought to light the scale and variety of knowledge assets held by the public sector. Engagement with experts from across government and the wider public sector revealed examples of ground-breaking innovations that were delivering huge public benefits, including financial returns for government.

However, the work also found that a range of barriers stand in the way of those enterprising public servants and agencies who want to realise the full impact of their innovations. This report makes a series of recommendations for how to overcome these barriers and help to unlock the full value of public sector knowledge assets. They would involve a radical transformation in the way that government manages its knowledge assets, increasing its visibility across the public sector and ensuring that the right expertise is deployed to maximise the social, economic and financial returns on these important intangible assets.

This analysis and the options it has identified have been a truly collaborative effort. We are grateful for the ongoing contributions and case studies from all the departments and agencies involved, with special thanks to Department for Business, Energy and Industrial Strategy (BEIS), the Intellectual Property Office (IPO), Cabinet Office (CO), Department of Health and Social Care (DHSC) and their agencies, Department for Digital, Culture, Media and Sport (DCMS), Ministry of Defence (MoD), Department for Work and Pensions (DWP), Defence Science and Technology Laboratory (Dstl) and Highways England (HE). We would also like to thank colleagues at the Behavioural Insights Team and Oxford University Innovation for their input to our thinking.

Chief Secretary to the Treasury

October 2018

Executive summary

Knowledge assets (KA), in the form of intellectual property (IP), software, data, technological expertise, organisational know-how, and other intellectual resources, are of large and growing importance to both the UK and global economy. In the UK, the Office for National Statistics estimates that around 50% of all new private sector investment is in KA and other intangible assets. As part of the Balance Sheet Review, the government has been reviewing the management of KA in the public sector.

Knowledge assets are both undervalued and underexploited in the public sector in the UK. Despite considerable investment in research, software, data, and expertise, the value of KA and other intangible assets reported in government accounts is just £34.5 billion or 2% of total public sector assets in 2017. Given KA and other intangibles account for between 52% and 84% of the value of publicly listed companies today, the true value of KA in the public sector is likely many multiples of this. More comprehensive estimates give a value of public sector KA of at least £150 billion or 8% of total public sector assets. Based on the expected annual return on other public assets, these KA should generate at least £5 billion financial, economic, and social benefits per year.

Realising the full value of knowledge assets in the public sector requires careful consideration of the balance between financial returns and the wider economic and social benefits these assets can generate. It also requires a series of deliberate actions to generate, protect, develop, deploy and scale the asset. Examples of good practice at each stage of the KA value chain can be found across the public sector in areas as diverse as defence, healthcare, transport and project management. However, the public sector faces a number of barriers to realising the full value of their KA holdings, including:

- Identification – public sector organisations often do not know what knowledge assets 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 knowledge asset holdings
- Infrastructure – there is limited central support for public sector organisations looking to improve the management of their knowledge assets
- Incentives – there are limited incentives for organisations and individuals in the public sector to invest in knowledge asset 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 knowledge assets

Based on a series of consultations with knowledge asset experts across the public and private sectors, this report makes 10 recommendations aimed at realising greater value from KA held by the public sector.

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 knowledge assets

2 Network: build a network across the public and private sectors of experts and leaders focused on generating value from knowledge assets, to share best practices and exploit synergies across organisational boundaries

3 Valuation: develop new standards and approaches for measuring and reporting the value of knowledge assets in the public sector

4 Recognition: establish a central repository detailing government knowledge asset 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 knowledge asset holdings and progress in their exploitation

7 Guidance: design and implement best practice protocols for development, protection and commercialisation of public sector knowledge assets

8 Data: as part of the National Data Strategy, explore how the public sector can further exploit its data and the associated knowledge assets it generates

9 Investment: develop financial, contractual and organisational structures that facilitate knowledge asset commercialisation and effective partnerships with the private sector

10 Incentives: enhance organisational and professional incentives for knowledge asset development and exploitation

Chapter 1

Intangible assets and their value

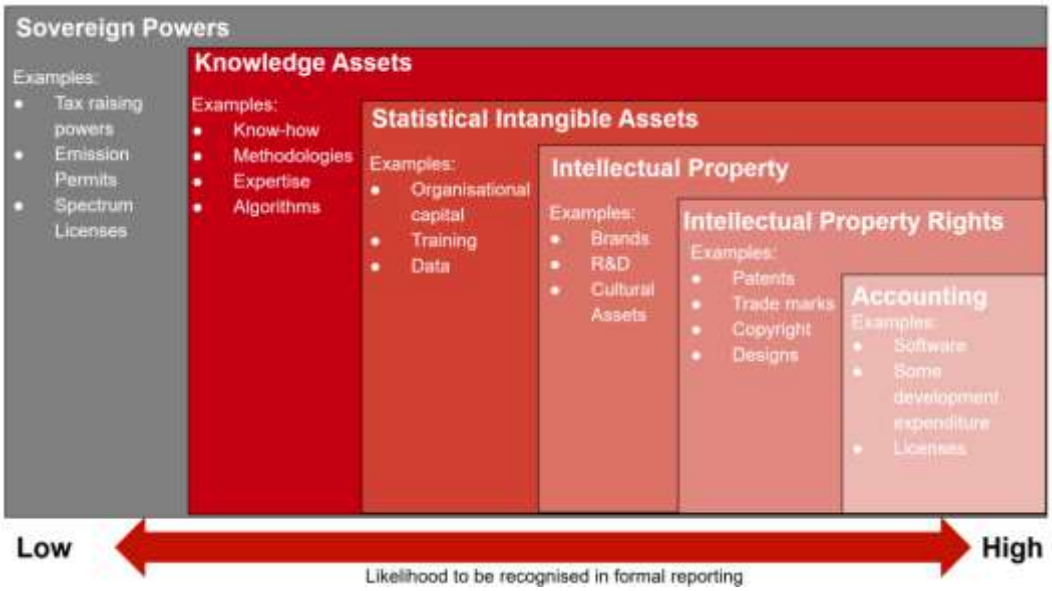
Types of intangible assets[1]

1.1 Intangible assets are of growing importance to the economy of the 21st century and are attracting interest from diverse fields including business, finance, law, economics, statistics and accounting. The term 'intangible assets' refers to those which are not physical in nature and covers a wide range of types of asset, from patents, brands, and licences to data, expertise and organisational know-how. In the public sector, intangible assets can also be said to include the financial value of the government's sovereign powers, including the authority to issue pollution permits, auction radio spectrum or, according to the most expansive definition, levy taxes on current and future citizens.

1.2 Chart 1.A seeks to provide an illustration of the broad spectrum of intangible assets from the narrow range recognised in the IFRS-based Whole of Government Accounts (WGA), to knowledge embedded in organisations, people, and data which may not have any legal or contractual protection but nonetheless generates, financial, economic and social value. This spectrum includes intellectual property (IP) and other forms of intangible assets that are recognised in economic statistics. Within this broad spectrum of intangible assets, this report focuses on all forms of intangible value generated by human intellect, and therefore excludes those assets that derive from the exercise of the government's sovereign authority. This report refers to this subset of intangible assets as 'knowledge assets' which are coloured in red in Chart 1A.

[1] With thanks to Jonathan Haskell and Mariana Mazzucato for their help with this report

Chart 1.A: Spectrum of intangible assets



Source: HMT

Growing economic importance of knowledge assets

1.3 Since the development of the personal computer in the 1980s and arrival of the internet in the 1990s, countries have seen a growing share of employment and value creation coming from the 'knowledge economy'. Increasingly, economic growth in advanced economies like the UK depends upon the generation, development, and dissemination of ideas and information rather than on investment in physical assets such as land, buildings and equipment.

1.4 This is reflected in the economic data produced by the Office for National Statistics (ONS), which estimated that just under half of all new investment in the UK economy in 2015 was in knowledge assets and other intangibles. Analysis by the Chartered Institute of Management Accountants (CIMA) has found that recognised intangible value in the private sector is 22% of total asset value[2] with a further 42% of intangible value that is unrecognised in accounts.

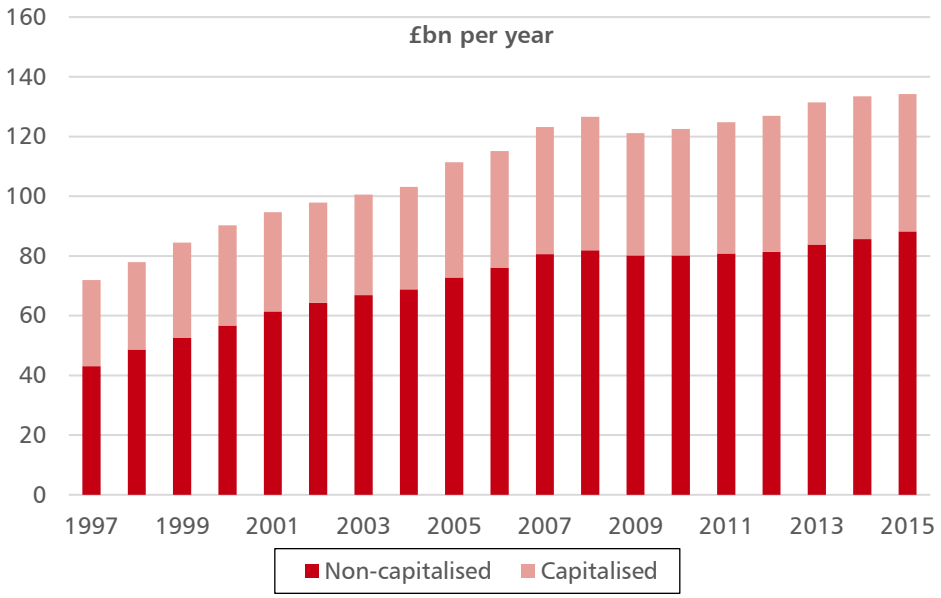
1.5 This growing importance of knowledge assets is also evident in the wider global economy. There were 137% more patent applications across the G7 in 2016 than in 1980.[3] Among the world's five most valuable companies

[2] Chartered Institute of Management Accountants (CIMA), combining UK disclosed intangibles and goodwill in 2014. Global estimates put the total value of intangibles at 52%

[3] WIPO IP Statistics Data Centre, using total patents applications for G7 countries

(Apple, Amazon, Alphabet, Microsoft, and Facebook),[4] 95% of their £3.5 trillion of value is in the form of intellectual property and other intangible assets.[5] Only 5% (£172 billion) is in the form of tangible assets on their balance sheet, such as land, buildings and equipment.[6] Analysis of intangible value in the US, which looks at the difference between the equity value of companies in S&P 500 and their tangible assets estimates that intangible assets compromise 84% of total assets in US's largest companies. This is a dramatic increase from the 17% seen in 1975 and 32% in 1985.[7]

Chart 1.B: Growth of investment into intangible assets in the UK private sector



Source: ONS 2015

1.6 Investment in knowledge assets and other intangibles plays an important role in all sectors of today's economy, and is particularly important in modern manufacturing, IT, financial services, and professional service sectors. As shown in Chart 1.C, the highest proportion of investment in intangible assets is in professional and scientific activities (74%), financial services (74%), information and communication (68%) and manufacturing (64%). Collectively, these four sectors contribute over 31%[8] of the total economic output of the UK.

[4] Top companies in the world by market value, Statista, as at 11 May 2018

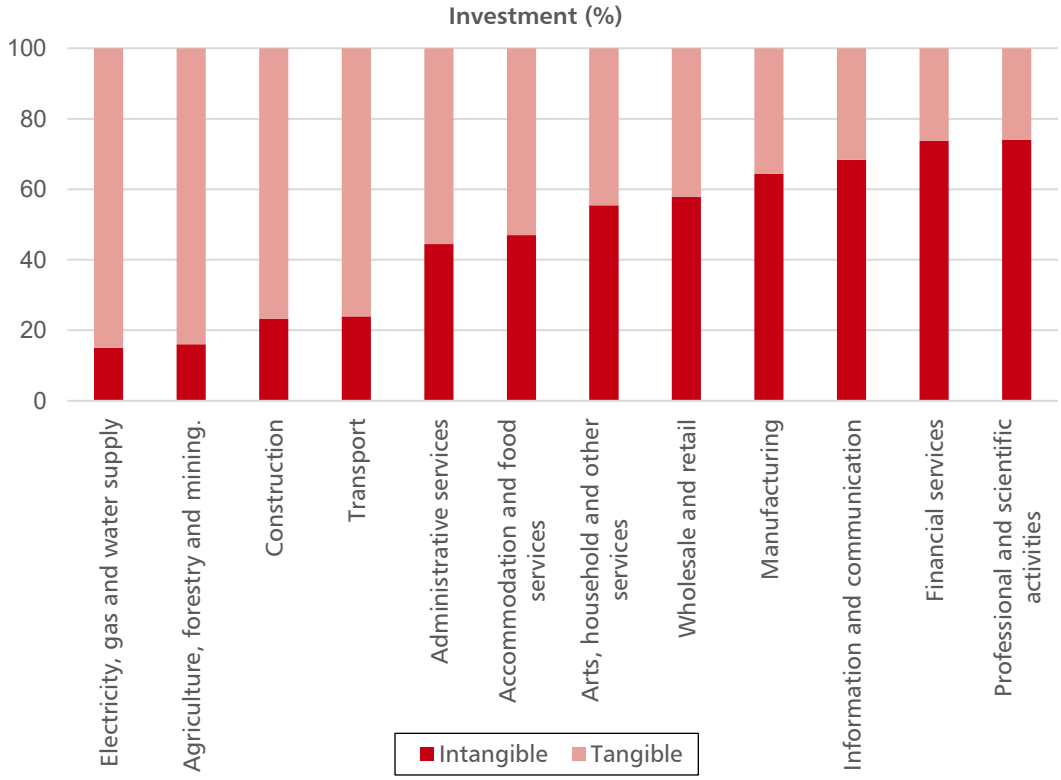
[5] HMT calculation using figures from the Times, Jonathan Haskel and Stian Westlake, 18 August 2018

[6] HMT calculation using figures from the Times, Jonathan Haskel and Stian Westlake, 18 August 2018

[7] Intangible Assets Market Value Study, Ocean Tomo, 2017

[8] HMT calculation from ONS GDP output using low level aggregates, current price 2017

Chart 1.C: Proportion of UK intangible investment by industry 2015



Source: ONS 2015

Valuing knowledge assets in the public sector

1.7 Valuing knowledge assets poses a number of methodological challenges. Unlike physical assets, such as buildings, it is often not possible to compare one type of KA with another. Its value can also be highly dependent on the wider environment and availability of complementary technologies. For example, combining geospatial data, online payment technology and 3G mobile phones has enabled the rise of taxi-hailing smartphone applications which create much more value than any component technology can provide individually. This environment is often rapidly changing in ways which can render once valuable KA obsolete. A well-known example is home cinema technology, which over the last 40 years has evolved from VHS to DVD and then to Blu-Ray which is in turn now threatened by internet streaming services.

1.8 While organisations such as the OECD[9] and IPO[10] provide guidance on valuing certain types of knowledge assets, due to the subjective assumptions that are often involved in valuing KA, accounting standards do not allow many types of KA to be capitalised and recognised on corporate accounts.[11] The challenges associated with valuing KA are even greater in the public sector for a number of reasons. First, the valuation of public sector KA needs to capture not only its direct financial return but also the wider economic and social benefits they can generate. Second, unlike listed private companies, governments do not have a market-determined equity value. This means that this method for valuing the KA of a private sector company, as the difference between its equity value and the value of its tangible assets, is not applicable to most public sector bodies. Third, legal constraints, budgetary regulations and security considerations can prevent public bodies from realising some or all of the potential commercial value of their KA holdings.

1.9 As discussed above, any attempt to estimate the full value of public sector knowledge assets must capture the three types of value it can create. First and foremost, public sector KA generates social value by supporting the provision of public services such as healthcare, transport and defence. This intrinsic value is typically why the KA was developed in the first place. Second, public sector KA can have wider economic value to the extent that it stimulates innovation, competition or development in part of the private sector. Third, public sector KA can also have financial value to the extent that it can be sold, licensed or otherwise exploited for a commercial return for the taxpayer.

1.10 Available estimates of the value of knowledge assets and other intangibles captured in public sector accounts almost certainly underestimate the true value of these assets. The Whole of Government Accounts (WGA) recorded that the UK public sector had £32.4 billion of intangible assets in 2015.[12] The majority of these (£19.7 billion) were intangible military equipment, which primarily covers the development of new equipment and improving the capability of existing equipment.

1.11 WGA is prepared under International Financial Reporting Standards (IFRS) which takes a deliberately narrow view of knowledge assets as a cautious accounting approach. This is reflected in the fact that WGA records intangible assets as only 2% of total public sector assets. While estimates of intangible value in the private sector are uncertain and range from 52% to 84% of assets, even the lower end of that range is many times larger than the 2% recorded by the WGA. This suggests that there is significant value in

9 Deriving capital measures of intellectual property products, OECD handbook, 2010

10 Valuing your intellectual property, Intellectual Property Office, 2016

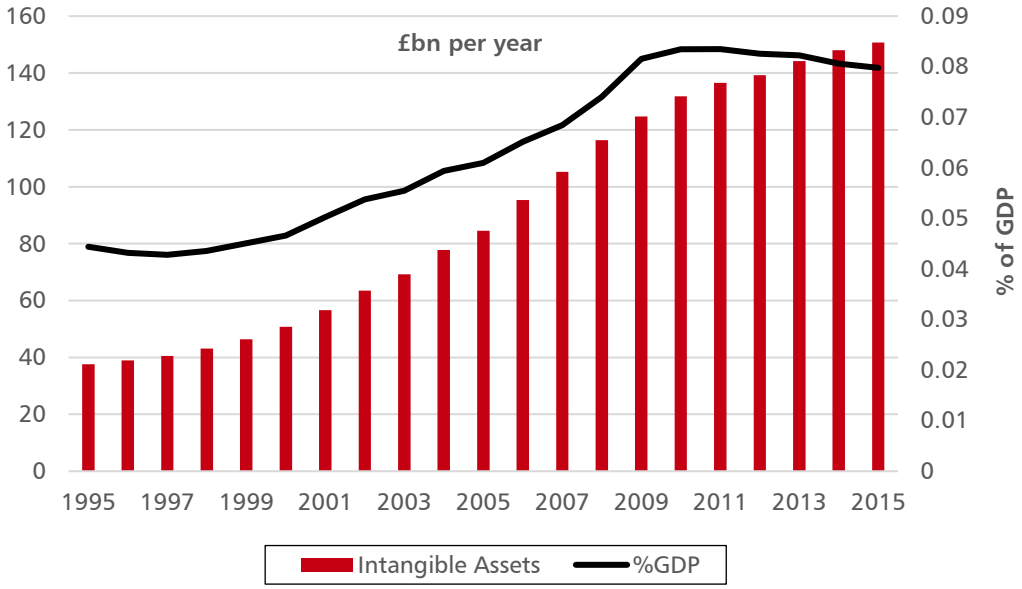
11 IAS 38 Intangible Assets Current International Financial Reporting Standards do not allow capitalisation on all internally generated intangible assets. Intangible assets cannot be recognised on the balance sheet until it is probable that there will be future economic benefits and the cost can be measured reliably. When costs are expensed in the year and not capitalised, it can be hard to recognise that an intangible asset has been created

12 We are using the 2014-15 WGA figure as SPINTAN data is from 2015 to ensure they are comparable. WGA intangibles are also 2% of total assets in 2016-17

public sector KA and other intangibles that is not fully recognised in the WGA, especially after taking account of its wider economic and social value.

1.12 A more comprehensive estimate of the total value of public sector knowledge assets can be derived by looking at the capitalised net present value of past investment in knowledge-generating activities such as research, software and organisational capital. Using this method, the SPINTAN (Smart Public Intangibles) Project estimated a time series for cumulative public sector investment in KA for the UK and other EU Member States. Based on this approach, SPINTAN estimates the total value of public sector KA in the UK has more than tripled in real terms over the last two decades from £40 billion in 1995 to at least £150 billion in 2015 (Chart 1.D).[13] At 9% of GDP, the UK public sector has the fifth largest stock of KA after Sweden, the US, Austria and Finland (Chart 1.E). This relatively large stock of KA reflects the greater investment in public sector KA in the UK, with the UK being the third largest investor as a percentage of GDP in 2015, behind only the US and Sweden.

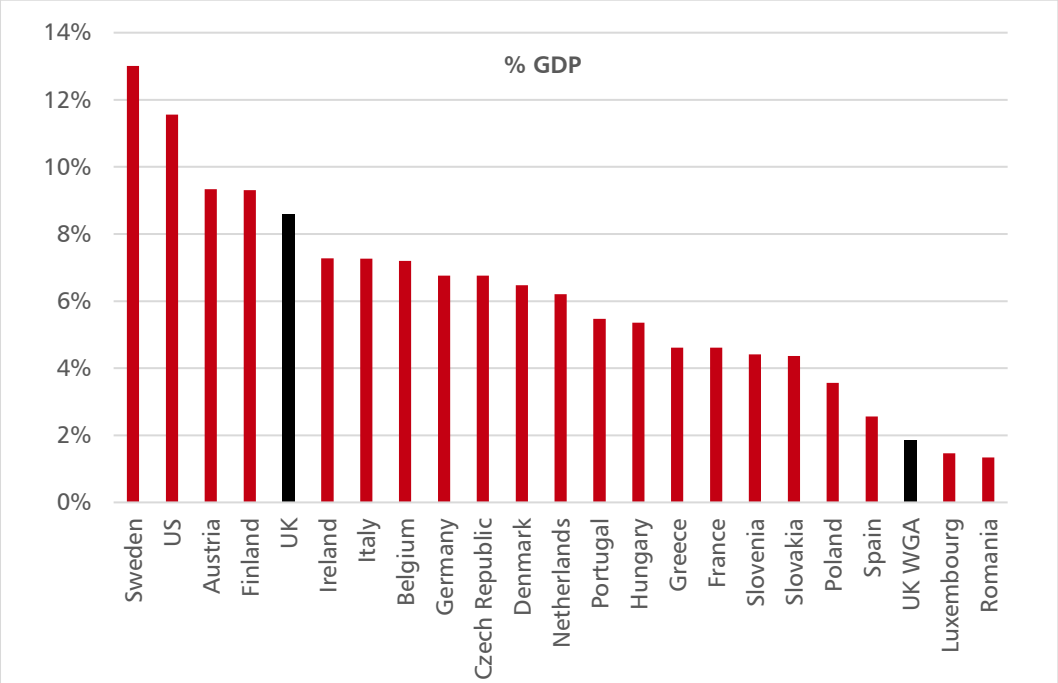
Chart 1.D: Growth in UK public sector knowledge assets and other intangibles



Source: SPINTAN

[13] 2015 is the most recent year for which SPINTAN data is available. This figure can be considered to reflect the cost of producing the intangible assets, adjusting for depreciation and inflation. In practice an intangible asset may be worth much more or less than the investment that was required to make it. SPINTANs scope broadly covers the intangible spectrum up to and including the statistical definition in Chart 1.A. The coverage of WGA and SPINTAN does not overlap perfectly. SPINTAN does include public corporations which are captured under WGA and captures some non-profit entities, such as charities, that are not captured in WGA. WGA also uses a much narrower accounting definition of intangible assets. Despite this limitation this is the best data available and illustrates the large gap between the intangible assets that are currently recognised and the potential value that is unrecognised.

Chart 1.E: Value of public sector knowledge assets and other intangibles



Source: SPINTAN, WGA and OECD

Estimating returns from public sector knowledge assets

1.13 As with tangible assets, public sector knowledge assets generate a stream of future benefits for their owners. However, like the assets themselves, the value of these returns can be difficult to estimate directly. The most reliable method is to estimate their returns indirectly using the Social Time Preference Rate (STPR),[14] which is the minimum return required for a government project. The HM Treasury Green Book discount rate, which is based on the STPR, is 3.5%.[15] On this basis public sector KA should be generating at least £5 billion per annum.

1.14 However, successful exploitation of knowledge assets should lead to higher returns than this minimum expected of all government investment. For instance, over the 11 years to 2016, spin-outs and licensing deals from Ploughshare Innovations, which converts technology developed for military purposes to civilian use, are estimated to have created £118 million of gross value added (GVA) benefits to the wider economy from £140 million of

[14] SPINTAN recommend using STPR when lacking the data to calculate returns from the ground up. OECD and SPINTAN have produced estimates for the UKs STPR and these estimates fall between 2 and 4%

[15] The Greenbook, HM Treasury, 2018

investment.[16] This implies a return on investment of 5.7% per annum. This return is also forecast to increase significantly in the coming years as their investments yield growing returns, with an additional £107 million benefit forecast for the period 2016/17 to 2018/19.[17] In addition, Ploughshare has provided benefits to UK defence through innovation that have not been quantified in the GVA figures.

1.15 Estimated financial returns on public sector knowledge assets are nonetheless below the 12.6% average return that the private sector would expect to earn from its KA.[18] This figure assumes the returns from its KA are at least the same as returns from tangible assets, which given evidence suggesting intangible assets contribute more value than tangibles,[19] can be considered a conservative assumption. In practice the public sector may not be able to achieve the same returns as the private sector owing to the public good nature of such KA and the legal, policy, security, or privacy considerations that limit the commercial potential of many public sector KA. Nonetheless, the 12.6% return for private investment in KA could provide an indicative upper bound for feasible returns on public KA.

1.16 Releasing the full value of public sector knowledge assets requires smarter management of these intangibles. While there are examples of active exploitation of KA across the public sector, there is also evidence of significant barriers to realising its full social, economic and financial return. Overcoming these barriers and accessing this untapped value requires concerted action to identify, protect, develop and exploit public sector KA assets. These issues are discussed in more detail in the rest of this report.

16 Assessment of the economic and wider benefits of Ploughshare Innovations Ltd's commercialisation activities, SQW, April 2017

17 Assessment of the economic and wider benefits of Ploughshare Innovations Ltd's commercialisation activities, SQW, April 2017

18 ONS, net rate of return on private non-financial corporations, October 2018 dataset

19 World Intellectual Property Report, WIPO, 2017

Chapter 2

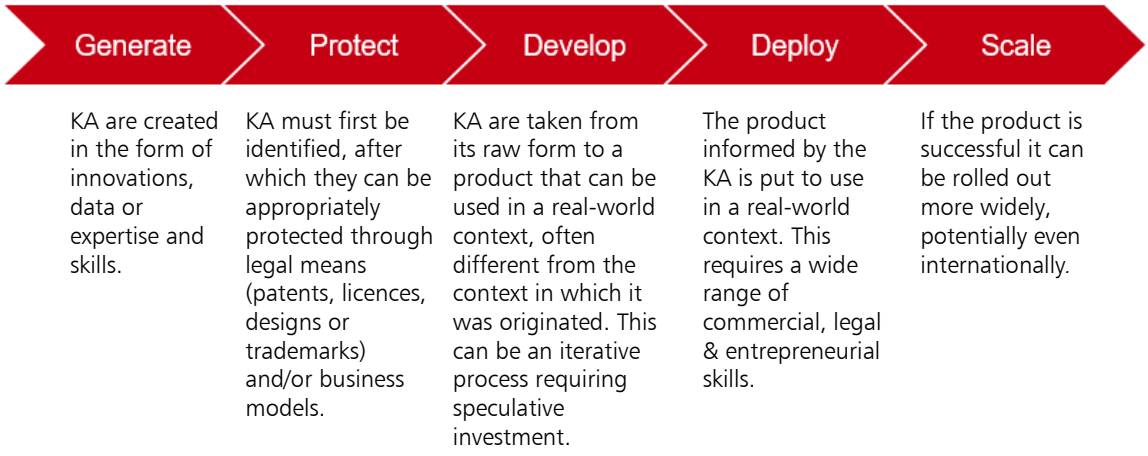
Managing knowledge assets in the public sector

2.1 The process by which knowledge assets are generated, managed and exploited is complex and can be opaque. This is particularly true in a public sector context where KA take a wide range of forms and services a range of financial, economic and social objectives which can sometimes come into conflict.

2.2 This chapter discusses how knowledge assets generated in the public sector are currently managed, drawing on a wide range of case studies. It seeks to highlight the many examples of good practice across the public sector, but also illustrate the challenges involved in realising value from KA. In doing so it exposes the potential to improve the management of, and generate further value from, public sector KA.

2.3 Chart 2.A illustrates steps involved in the management of knowledge assets. In reality, these steps are rarely followed in a linear fashion, nor would all steps be applied to all KA. However, it provides a stylised framework to understand and examine the process of KA management. Discussion with KA holders across the public sector has highlighted examples of good practice at each stage in the process steps. It has also highlighted some of the key barriers they can face in managing each stage and moving onto the next.

Chart 2.A: Steps to managing knowledge assets



2.4 The UK government already recognises the importance of knowledge assets to the economy. The UK Intellectual Property Office (IPO) is the Executive Agency responsible for granting UK patents, trade marks and design rights, but also leads on wider policy around IP. They offer a number of tools to

educate businesses about their rights and responsibilities with regard to IP, many of which are highly relevant to knowledge assets generated in a public sector context. Their success is reflected by the Taylor Wessing Global Intellectual Property Index, which currently puts the UK as one of the top 3 global IP jurisdictions.[1]

2.5 This report seeks to build on this, considering how that support can be better targeted at and integrated into the public sector. As explained in chapter 1, its scope is also wider than that of the IPO, considering knowledge assets such as data and know-how which do not fall under the legal IP regime. Finally, while the IPO provides support to business to manage their intellectual property proactively, its work is largely focused on the 'protect' step of the KA management process, whereas this work is looking at how KA is managed in the public sector across each of the process steps outlined above.

Generate

2.6 The public sector is not widely credited as a generator of knowledge assets. However, some of the most innovative organisations in the world operate in the public sector. The UK public sector generates a significant volume of KA through its primary and applied research, large repositories of data, and specialist skills and knowledge. It has played significant roles in the invention of ground breaking-innovations that have had a global impact, some of which are outlined in this chapter.

2.7 Today, the UK public sector remains at the forefront of innovation with programmes ranging from the 100k Genome project to novel cybersecurity products. It has a network of world-famous institutions extending beyond the public sector that create highly valuable knowledge assets, such as the National Physical Laboratory, the National Graphene Institute, the Medical Research Council, Genomics England, the Alan Turing Institute, and the NHS.[2] Many public sector innovations are developed for one purpose, but find much wider applications in other fields. As discussed in Box 2.A, the MoD's Defence Science and Technology Laboratory's (Dstl) pioneering test for sepsis which was developed as a means of reducing the risks arising from traumatic injuries on the battlefield is now being developed for use in the health service.

Box 2.A: A new test for early detection of sepsis

Sepsis, also known as blood poisoning, happens when the immune system overreacts to an infection or injury and attacks the body's own organs and tissues. It affects around 30 million people each year worldwide, results in the death of 6 million, and is increasing at a rate of 8 – 13% each year. In the UK,

[1] Global Intellectual Property Index, Taylor Wessing, 2016

[2] Some of these institutions receive public funding but are not classified as public sector bodies. See the ONS public sector classification guide for a list of public sector bodies

it results in more than 44,000 deaths annually and leads to costs of around £15 billion.

Early detection of sepsis is very important to its effective treatment. Once the infection has developed and become more severe, the vital organs are often affected. In these circumstances up to 4 in every 10 people with the condition will die. Without early detection, the infection can also lead to septic shock, where an estimated 6 in every 10 cases are fatal.

A new test for sepsis could soon be available thanks to an innovation by scientists at Dstl. Originally developed for use in a military context where deaths from infection can be high, the new test can diagnose with 97% accuracy which patients will develop sepsis up to 3 days before any symptoms develop. This will mean that patients with sepsis stand a much better chance of survival as diagnosis and treatment can take place before symptoms even appear.

2.8 There are also many international examples of innovation in the public sector. In the US, for example, the Pentagon's Defence Advanced Research Project Agency (DARPA) has been responsible for a range of major scientific innovations with wide-ranging economic and social benefits over the past 60 years, as discussed in Box 2.B.

Box 2.B: Defence Advanced Research Projects Agency (DARPA)

The Defence Advanced Research Projects Agency (DARPA) was established by the US government in in response to the launch of Sputnik in 1957, and the ensuing anxiety around the perceived gap in technological capabilities between the US and the Soviet Union. In 1958 President Eisenhower authorised the formation of the Advanced Research Projects Agency (later renamed DARPA) and tasked it with developing strategic technological breakthroughs in the interests of national security.

Over a number of years DARPA has developed a culture and structures that have proved very successful at delivering world leading innovation. DARPA is effectively composed of a number of projects, each headed by a programme manager who is a leading figure in their field. The projects are ambitious and focused on well-defined problems, so that basic research is conducted with that end in mind rather than the potential application being considered at a later and separate stage. Programme managers are taken on from across academia, industry and government on a time-limited basis, bringing a sense of urgency and purpose, and ensuring that fresh ideas and approaches are introduced on an ongoing basis. They are also given a large degree of autonomy and flexibility within their projects, so they can focus their efforts on the most productive avenues as these emerge.

The results have included breakthrough advances in military capabilities, including stealth technology and drones. But DARPA innovations have also

been highly transferable to a civilian context. One of its research projects into data communication played a central role in the development of the internet, and it has made significant contributions to speech recognition technology and to the development of GPS receivers small enough to embed in consumer devices.

Protect

2.9 Once knowledge assets have been generated it is important to protect it if the public sector is to realise its potential value. Some KA is automatically legally protected, as in the case of copyright, or legal protections can be obtained by applying for a patent, or registering a design or trade mark. The Intellectual Property Office is the official UK government body responsible for granting IP rights to the public and private sector, helping the UK become the most innovative and creative in the world.[3] Protecting public sector IP in this way can be a vital step to maximising its benefits for the UK taxpayer, as illustrated by the patent filed for a secure satellite signal designed by the MoD which was valued at over £2 billion (see Box 2.C).

Box 2.C: Satellite signaling for Galileo and GPS III

In 2003, in the context of work being conducted internationally to design new signal structures for the European Galileo GPS system and the US GPS III system, scientists at the Ministry of Defence (MoD) designed a new highly accurate and secure satellite signal, known as the Multiplexed Binary Offset Carrier (MBOC).

Initial feedback from the international working groups set up to design these new signal structures was that the MBOC signal design was too complicated and would not be adopted by either GPS system. In spite of this feedback, the MoD filed patents before details of the signal design were published, so that the UK would maintain rights to its use. This meant that the UK was far better placed to maximise the benefits when both the EU and the US subsequently decided that the benefits of the signal design outweighed its complexity and adopted the signals on their respective systems. These benefits were both financial, in the form of a significant licence from the European Commission, but also diplomatic, in the form of building defence cooperation between the US and the UK.

2.10 Protecting public sector knowledge assets does not preclude them later being shared free of charge, where this delivers the greatest benefits. However, failure to adequately protect UK public sector knowledge assets can result in the Exchequer losing out on the potential financial benefits of the innovations it has supported. As discussed in Box 2.D, the Department of Health and Social Security and the NHS played a key role in the development of computed tomography (CT) in the 1960s but did not secure a meaningful financial interest in the subsequent exploitation of this ground-breaking

[3] Intellectual Property Office

technology. This meant the UK did not share in the considerable commercial returns generated by the widespread use of CT scanners. However, importantly, like many other countries the UK has benefitted from the improved healthcare outcomes generated.

Box 2.D: The Computed Tomography (CT) scanner

In 1967 Godfrey Hounsfield, a research scientist working for the British Music Company EMI realised that the conventional x-ray provided limited information, and that by taking a narrow beam x-ray and a small detector, and scanning from a number of different angles, a much fuller picture of internal organs could be established. Having conceived of this idea, he developed the software that could take this information and translate it into a series of two-dimensional 'slices' of the patient.

Realising the potential health applications, the company approached the then Department of Health and Social Security (DHSS) to secure their support in developing the idea. The DHSS recognised the medical value of the technology and provided financial backing of over £600,000 which was crucial to develop a working prototype. Working with radiologists at the Atkinson Morley NHS Hospital, Hounsfield and his team soon had a working prototype of a CT head scanner and in 1971 it provided the first clinical image of a patient, revealing the presence and location of a brain lesion.

The potential of this breakthrough technology, which eventually earned Hounsfield the Nobel prize for medicine in 1979, was soon recognised more widely, and a number of other companies such as General Electric and Siemens moved into this area, initially licensing the technology from EMI before investing their own R&D capability into its further development. Over time, it was these other players, rather than EMI or the NHS, that were much more successful in exploiting the commercial potential of this new technology, particularly in the US.

2.11 It is not always possible and rarely sufficient to protect KA with a legal right such as a patent. In the case of data, for example, protection is about recognising its value and controlling access. In other cases, where KA is more about know-how and experience, protection can be through establishing the business structures and strategies in which the KA is recognised and can then be exploited to its full potential. Box 2.E describes the evolution of the Behavioural Insights Team, which was spun out of the Cabinet Office in 2014. It explains how the business that this created has allowed the expertise and skills developed by the UK government to be honed and then applied in both the public and private sectors around the world.

Box 2.E: Behavioural Insights Team

The publication in 2008 of the influential book 'Nudge' by Richard Thaler and Cass Sunstein helped to propel the field of behavioural science into the

mainstream. Its ideas, and those of psychologists such as Daniel Kahneman, caught the attention of the UK government and in 2010 it established a unit of 15 people, known as the Behavioural Insights Team or the 'Nudge Unit'. They were the first government institution in the world dedicated to applying behavioural science to public policy.

This unit generated considerable and highly valuable know-how. The team quickly developed experience and expertise in applying the lessons of behavioural science to meet public policy challenges in diverse fields ranging from DWP job centres, HMRC tax processes and the NHS.

In 2014, the Behavioural Insight Team was transformed into a social purpose company, jointly owned by the Cabinet Office, its employees and Nesta (the innovation charity) who also invested in the business. Today, it operates independently of government. By establishing itself as a business it was able to grow significantly and deploy its techniques with customers all around the world. It now has 150 employees with offices in New York, Singapore, Australia and Manchester. Moreover, it has helped to catalyse a vibrant new market, with a number of providers now offering advice to businesses, governments and the third sector on how to apply these insights to improve their operations.

Develop

2.12 Once a piece of public sector KA has been identified and appropriately protected there is often a need for further development before its full value can be realised. This development takes it from a relatively raw concept, knowledge or information to the stage where it could have a real-world application and often requires substantial further investment. Over the last decade, the UK's higher education sector has been at the forefront in translating the outputs of their world-leading academic research into successful businesses. Box 2.F discusses the example of Sensyne Health, a healthcare technology company which has partnered with Oxford University and the NHS to develop and bring to market a number of innovations in advanced digital health technology.

Box 2.F: Sensyne Health

In 2016 a 5-year strategic partnership was established between Sensyne Health, the University of Oxford and Oxford University Hospitals NHS Foundation Trust to develop and bring to market advanced digital health technologies.

The partnership has seen Sensyne Health license 4 technologies from Oxford University, allowing significant resources to be focused on translating the research into high quality medical devices that are fit for use in the NHS at scale. One of these is in the field of vital signs monitoring for which a new digital system known as SEND (System for Electronic Notification and Documentation) has been developed. SEND has to date been introduced in

over 100 hospital wards, helping over 100,000 patients and, by providing effective early warning, has resulted in a 20% decrease in cardiac arrests for patients in vascular surgery and acute general medicine wards. Sensyne Health's involvement has also brought together data generated by SEND with its clinical artificial intelligence to generate new insights in areas such as cardiovascular disease that can improve patient outcomes, accelerate medical research into new therapeutic strategies and create additional value.

The commercial value that the University and the NHS Trust bring to the partnership is reflected in a £5 million equity share in Sensyne Health as well as royalties on any technology that are licensed. The partnership also delivers wider public health benefits, accelerating the realisation of value from the University's academic research and engineering expertise, through to the Trust's clinical validation and then to its commercial application by Sensyne Health.

Deploy

2.13 Having understood the potential of the KA through its development, its owners need to consider how it might best be rolled out or deployed. This requires a broad range of skills, including commercial, product development, investment, marketing, licensing and legal expertise. Tech transfer organisations, alongside incubators and accelerators often play a leading role in connecting holder of KA rights with investors and commercial partners. Box 2.G provides examples of such organisations working across a range of sectors.

Box 2.G: Tech transfer organisations

As the role of knowledge assets in the economy has grown, an increasing number of technology transfer organisations in the public, private and academic sectors have been established.

One example in the UK public sector is Ploughshare Innovations. Their role is to take IP developed by MoD research laboratories and convert them into civilian applications. One success includes the use of a coating originally developed for Nuclear-Biological-Chemical suits in mobile phones to make them waterproof. This IP has now been spun out into a UK SME company which supplies the technology under licence globally to mobile phone manufacturers, providing financial returns for UK taxpayers. To date, over 300 million smartphones have been protected.

The Medical Research Council has also delivered significant successes through its tech transfer arm. It partnered with scientists working in antibody therapeutics to establish Cambridge Antibody Technologies (CAT) in 1989. CAT developed the drug adalimumab, used for the treatment of Rheumatoid arthritis, and in 2006 was acquired by AstraZeneca for £702 million.

Tech transfer organisations have also been successful in the university sector, partnering world-class academic research with the right skills to identify and protect core IP, develop a business case and find commercial partners. One example is Oxford University Innovation, who have supported the establishment of companies such as Oxford Nanopore which is developing next generation DNA technology. In March 2018 Oxford Nanopore raised £100 million of investment, at a valuation of over £1 billion.

2.14 This can be even more challenging in a public sector context. The public sector's role in funding, incubating and catalysing KA differs from a private sector organisation, and a purely commercial approach would not be appropriate. For example, maximising unused government KA could support the growth of the wider economy if dispersed freely into the private sector where entrepreneurs can use it to create new services and enterprises. In other circumstances the public benefit will be much greater than the financial revenue stream the KA might generate, as was the case with the Ebola testing kit developed by Dstl and described in Box 2.H.

Box 2.H: Ebola testing kit

In 2014 a significant outbreak of the life-threatening Ebola virus spread through Sierra Leone in West Africa. It affected more than 24,000 people and killed 10,194 within a year of the epidemic taking hold. It can take three weeks for Ebola symptoms to appear with typically 80-90% of loss of life occurring within the following two weeks. Rapid diagnosis of the condition is therefore key to effective treatment and control of the virus.

Scientists from Dstl responded by partnering with industry to develop a simple test to help with the critical task of diagnosing patients. The team identified a set of Ebola antibodies that could be used to create a rapid diagnostic test which was then successfully incorporated into compact device that works in a similar way to a pregnancy test kit.

Through a partnership between Ploughshare Innovations and BBI Solutions, a leading developer and manufacturer in the global diagnostics industry, the technology was licensed to enable quick manufacture of 10,000 devices to support the demand in Sierra Leone. The devices were 100% effective in identifying Ebola cases and played an important role towards bringing the Ebola outbreak under control.

2.15 However, these different objectives are not always in competition. A commercial approach that delivers some financial returns can also help to maximise wider social and economic impact of a public sector innovation. Projects in Controlled Environment 2 (PRINCE2) is an internationally recognised project management method that was developed by the UK government. Establishing a licensing arrangement and then a joint venture for the wider deployment of this methodology provided income for the UK government, but more importantly it supported the wider roll out of a

valuable management tool, delivering valuable skills to government and the wider economy. Further details of the PRINCE2 story are set out in box 2.I.

Box 2.I: Projects in a Controlled Environment 2 (PRINCE2™)

PRINCE™ started in 1989 as the UK government's internal standard to manage IT projects. Over time the methodology was developed and the scope of the protocols broadened significantly, beyond IT projects. This led to the relaunch of PRINCE2 in 1996 as a generic project management standard. As the use of the methodology grew across government and beyond, the Cabinet Office established licensing arrangements with private sector partners. Under these agreements, the licensee could provide accreditation to trainers and offer examinations to become formally PRINCE2™ qualified, in return for a fee.

In 2013, having achieved a good reputation and wide user base the UK government created Axelos, a joint venture with Capita plc, with the objective of further developing products and international reach.

PRINCE2 and its related products such as ITIL™ and RESILIA™ have now expanded internationally, into over 150 countries and 19 languages, offering three different products. Its users have included British Telecom, Disney Corporation, the government of Poland, Muller Dairy and Nasa.

2.16 In some cases, a commercial structure can support investment in government data so that it can be used more widely and meaningfully by the private sector. As discussed in Box 2.J, the UK Hydrographic Office provides an example of a public sector body investing in its data capabilities to develop the service it offers as well as to provide a commercial return.

Box 2.J: UK Hydrographic Office

Founded in 1795, the UK Hydrographic Office (UKHO) has a long history of producing charts used by mariners all over the world to safely navigate the world's oceans. Traditionally this was done through paper charts, but these sales have halved in recent years as the use of digital maps has grown.

In response the UKHO has developed significant digital capabilities, which have more than offset the reduction in its traditional revenue streams. This has gone beyond simply transferring its paper charts into a digital format. The service it offers to mariners today is an ability to draw together datasets from all around the world, combining this information with the data it has gathered from its own surveys. This allows it to provide real time updates, such as tidal information, against its maps.

The UKHO has recognised that the value of the service it can offer is not the core mapping data it owns, but its ability to aggregate that with diverse sources of information and apply analytical services. This is packaged as a series of new and innovative products for customers on a global scale. Today

over 90% of ships trading internationally rely on its charts and digital services, and the UKHO generates annual revenues of £151 million.

Scale

2.17 The final step in releasing value from KA is to scale the product that has been developed, allowing it to be rolled out more widely and maximise its impact and return. This is a process requiring a very diverse set of business development expertise, such as knowledge of diversification, investment appraisal and business case experience as well as the ability to secure significant investment. But there are examples of the UK public sector harnessing this expertise and using it to develop a product with a global reach. One is Dysport™, a biotherapeutic product also used in non-surgical cosmetic procedures. The successful mass commercialisation of this innovative product now delivers Public Health England a significant annual income, as set out in box 2.K.

Box 2.K: Dysport™

In the 1970s public health scientists working for the UK government generated significant IP from research into a bacterial neurotoxin and developed a biotherapeutic product, Dysport™, for the treatment of dystonia and spasticity in humans.

They recognised another application of this IP, particularly in the context of non-surgical cosmetic procedures as a competitor product to Botox™. As demand for the product increased Public Health England (PHE), as the agency responsible, entered into a royalty bearing licensing agreement with a global manufacturer, to manufacture, market and sell Dysport™ worldwide. Dysport™ is now a major player in a huge global industry. The licensing arrangements for the product have now been in place for 24 years and return significant royalties to PHE, currently in the region of £20 to £30 million a year.

Chapter 3

Barriers to getting public value from knowledge assets

3.1 While the potential returns on public sector knowledge assets are large, government departments and agencies and the wider public sector can face significant barriers to unlocking that value. These barriers arise at various stages of the KA value chain in Chapter two and fall under five broad headings:

- Identification – public sector organisations often do not know what knowledge assets they hold or how much it might be worth
- Insight– public sector organisations often lack the technical, legal and commercial expertise to develop, protect and exploit their knowledge assets
- Infrastructure – there is limited central support for public sector organisations looking to improve the management of their knowledge assets
- Incentives – there are limited incentives for organisations and individuals in the public sector to invest in knowledge asset 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 knowledge assets

3.2 This chapter examines these barriers in more detail, while Chapter 4 makes a series of recommendations for overcoming them.

Identification

3.3 The public sector often struggles to clearly identify the knowledge assets they hold and attach a value to their holdings. This may be a reflection of the fact that KA in the public sector are diverse in nature, dispersed between departments and their arm's length bodies and, as described in Chapter 1, often not recognised by accounting standards. Chapter 1 also describes some of the challenges of KA valuation, which can be context specific and change rapidly over time, and in the public sector should capture its social and economic value as well as its financial value. But this lack of understanding of what KA the public sector holds, and an appreciation of its potential value inhibits its effective management; in order for KA to be managed, it first needs to be visible.

3.4 Clear identification of knowledge assets would also bring greater clarity around its ownership and management. Legal boundaries are often blurred,

with KA such as IP having been developed by multiple agencies including third party contractors. A more detailed consideration of KA ownership at an appropriate stage in its development would help ensure KA are commercialised appropriately and strategically. It can also sharpen incentives for active management of the KA by the owner.

Insight

3.5 Earlier chapters highlighted the importance of expertise and specialist skills at every step of the process of delivering value from knowledge assets, for example to provide insight into how different users or contexts may enhance the value of the KA, or to support the development of commercial structures for its exploitation. There are already significant pockets of existing KA know-how within government, which we will harness and build from. Examples include the Intellectual Property Office, their wide-ranging tools and the training they deliver, protocols within the National Archives, and IP legal specialists within CO and BEIS.

3.6 However, there is no central source of such support available to all public sector holders of knowledge assets, and so it can be very challenging to get the right expert input at the right stage of the process. In addition, an understanding of KA and its potential value is not a mainstream skill within the public sector. This prevents much KA from being identified as such and means that important opportunities to realise value may be missed.

3.7 The example of Constructionline, a database used by the construction industry that was first developed by the UK government, is set out in box 3.A. It illustrates that there may be opportunities to maximise value to the public sector by bringing further expertise to bear.

Box 3.A: Constructionline

Constructionline is the UK's register for pre-qualified contractors and consultants used by the construction industry. It is designed to streamline pre-qualification procedures for public sector construction projects. The database contains details for over 46,000 suppliers and is accessed by more than 4,000 buyer organisations. It was established by the then Department for Trade and Industry (DTI), now BEIS, in 1998.

After some years of static performance, BEIS recognised that public ownership was holding back potential for significant growth and the creation of new and improved services to the construction supply chain and its clients. Following a competitive process, the database was sold to Capita for £35 million in January 2015.

Capita made a number of investments to develop the database and created new services for industry and in June 2018 sold Constructionline to a private equity firm. The investments they had made in the service developed its potential and allowed them to secure a price of over 4.5 times the £35 million they paid in 2015.

Infrastructure

3.8 Within the public sector there is no clear guidance to holders of public sector knowledge assets on how they should manage their KA to maximise the benefits it can deliver. When the potential value of a piece of public sector KA is recognised, it can be difficult for the holder of that KA to determine how to harness its full financial, economic and social return. This can be seen in the experience of Highways England who recognise that there is potential value in the KA they are generating, but recognise they have limited experience in managing KA and would benefit from clearer guidance and support within the public sector to develop and exploit it. This is described in more detail in box 3.B.

Box 3.B: Highways England

Highways England is a government-owned company charged with operating, maintaining and improving England's major roads. It is currently delivering the government's five year, £16 billion investment programme into the road network in England.

The road sector both in the UK and internationally is undergoing major change driven by new technologies. These include the application of big data techniques, road safety techniques and smart road systems that will support driverless cars. Highways England has a five year £150 million fund that is dedicated to exploring and testing innovation.

Highways England expects that new IP will arise as a result of this innovation, including through their collaboration with universities and businesses. However, they recognise that they have limited experience in managing an IP portfolio and are initiating a standalone project to develop a more robust IP strategy and policy.

3.9 Another key lesson drawn from this work has been the importance of working across organisational boundaries, and in partnership with the private sector. While there are a number of examples of work across organisational boundaries, some of which are highlighted in chapter 2, at the moment there are limited structures in place to support these links taking place more systematically, helping KA holders to find the right partners that will identify and unlock its value. The case studies looking at Singapore and Queensland in boxes 3.C and 3.D provide international examples of the infrastructure that can support value generation from public sector KA.

Box 3.C: Singapore's public innovation ecosystem

In 2017, Singapore's Ministry of Finance announced several programs to incentivise innovation, as part of a 10-year road map for strengthening Singapore's innovation eco-system. They include:

- training for government scientists and officials on IP commercialisation and procurement
- a dedicated unit in the Singaporean Intellectual Property Office that supports public agencies in the management of publicly-funded IP
- the National IP Protocol, which sets out principles and guidelines on how public agencies should manage IP generated from publicly-funded R&D

Chart 3.A: Queensland's management of intellectual property

The Australian state of Queensland has established a set of Intellectual Property Principles to provide high-level policy guidance on the management of intellectual property in Queensland's public sector. In addition, the principles support agencies in determining when to seek expert advice about IP.

The principles encourage agencies to:

- commercialise IP for the benefit of the state by acting on opportunities that bring in revenue from sales or licencing their IP, taking account of the associated risks
- harness commercial expertise to secure the best possible deal when disposing or licencing an IP asset
- establish and implement an IP management policy
- identify IP through log books and registers, with an emphasis on recording copyright information with potential commercial applications
- ensure that IP is not disclosed too early to preserve its value prior to commercialisation
- address the ownership/control of IP to protect potential commercial returns to agencies, through stipulation of who legally owns IP

Incentives

3.10 At an institutional level, the incentives to generate value from knowledge assets can be weak. Management objectives in departments are focussed on meeting core business goals, and rarely include specific objectives around investment in the UK's future prosperity. As a result, initiatives designed to exploit KA often struggle to compete for limited funds, and management is more likely to be focused on the risks than the potential rewards. The higher risk intrinsic to KA development can also mean that decision-making has to be escalated to a very high level within the organisation, affecting the speed with which the public sector can respond to opportunities.

3.11 A further potential barrier to effective incentives is the presumption, particularly around government data, that the value of public sector knowledge assets are best harnessed by sharing them free of charge. In the discussion paper on the economic value of data, published in August 2018, the government noted that while opening public sector datasets has had clear economic and social benefits in a number of sectors, this does not mean an 'open data' approach is appropriate or beneficial for all forms of data. The paper added that "there may also be instances where the government wishes to retain control of valuable datasets that can be used for commercial purposes, in order to ensure that a fair proportion of the benefits derived from public data accrue back to the general public."[1]

3.12 At the individual level, there is little to encourage a holder of a public sector knowledge asset to maximise the value it could deliver. Government is limited in its ability to provide financial rewards to innovative individuals where there are no agreed protocols. Instead government tends to rely on the rewards of public service and peer recognition. This may be appropriate and sufficient in some contexts, where developing the KA provides meaningful social or economic benefits that are aligned with the wider organisational purpose. However, there are other situations where this may lead to KA assets being under-exploited, particularly from a commercial perspective.

3.13 Models that allow the development of knowledge assets outside of the structures of central government and in a more commercial setting can be valuable in creating more powerful incentives. Here there are a range of models from the mutuals to joint ventures to retention of equity stakes in spinout companies. Further advantages of such commercial structures are that they can allow for greater autonomy and agility, reflecting the need for KA-led organisations to work at pace, and they can attract the speculative investment needed to develop KA which can be challenging for public sector budget holders to provide. Such structures must also offer an appropriate balance between the rewards they offer to employees and investors and the benefits that flow back to the public.

Investment

3.14 The final barrier is securing the investment in the knowledge assets, to develop, deploy and scale them so that their value is maximised. This type of investment does not fit easily with existing public sector budgeting cycles. Departments have limited flexibility in their annual or even three-year budgets, which can be a poor fit for the unpredictable investment requirements of KA. In addition, the returns of KA investment are often only realised in the long-term, which provides a further challenge to prioritising short-term funding for the most beneficial projects.

3.15 Existing departmental funding structures can also inhibit the cross-public sector working that delivers much of the most valuable KA. For example, one of the largest producers of KA in the UK public sector is the MoD's research laboratories but the most valuable applications of these KA tend to be within

[1] The economic value of data, HM Treasury, August 2018

the NHS. However, there is little incentive for an MoD budget-holder to invest in research where the benefits are primarily non-military.

3.16 The investment requirements and the need for a range of specialist expertise means that the later stages of KA value generation can lend themselves to working in partnership with the private sector. However, identifying potential partners and developing structures that deliver value for the public sector as well as the private sector investors requires expert advice and support.

Chapter 4

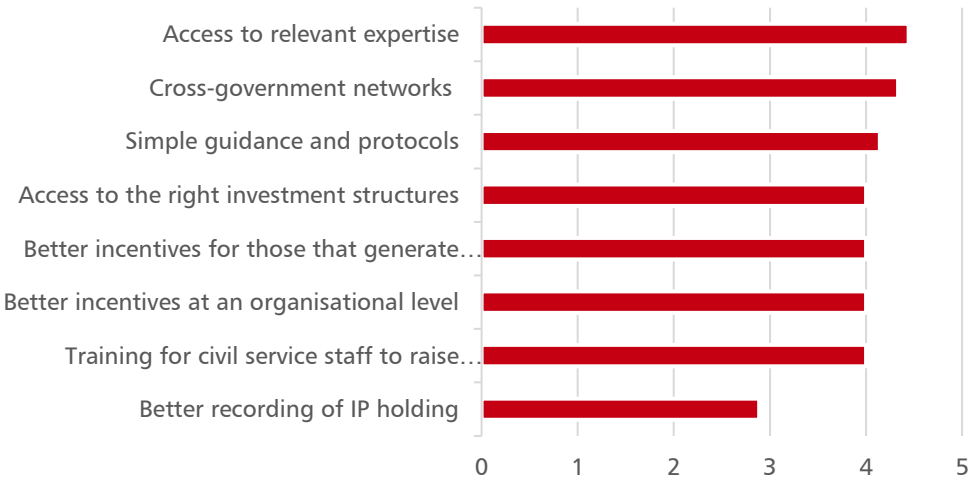
Recommendations

4.1 This report highlights the potential value of more effective management of government knowledge assets, to deliver financial, public service and economic benefits. It also highlights many examples of good practice from across the public sector where KA has been successfully identified and exploited.

4.2 The government also recognises that it can go much further in maximising the benefit derived from KA developed in the public sector. This chapter makes a number of broad recommendations to address the barriers that currently stand in the way. These will be taken forward by an implementation study, drawing on expert input to design the right structures and practical tools to improve the management of knowledge assets across government.

Box 4.A: Barriers to realising value from public sector knowledge assets

A survey of KA experts and practitioners from across government was undertaken at a roundtable in October 2018, to give an indication of how significant they viewed some of the barriers to the realisation of value from knowledge assets in the public sector. They were asked to give a score of 1 to 5 against each potential barrier, where the higher the number, the greater the importance. There was broad agreement that all the barriers identified were important, with lack of access to expertise and cross-government networks highlighted as the most significant. The average results of this survey are shown below.



Recommendation 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 knowledge assets.

4.3 This work has highlighted the importance of accessing the right expertise to deliver value from public sector KA. Much of the good practice identified was supported by specialist organisations such as Ploughshare Innovations, resourced with the relevant experts, and tasked with delivering value from public sector innovation. This demonstrates how tech-transfer organisations working with government can make a real difference to the success of KA being developed.

4.4 As the size, scope and resources of public sector organisations varies, it follows that larger organisations with more systematic engagement with KA are more likely to maintain their own standing capability and expertise. However, this will not be practical for all organisations for whom a central capability that they could access for support and expertise on an ad hoc basis would be more appropriate. For example, this central function could give them access to the right tech-transfer skills and investment to move an innovation from concept to practical application.

4.5 In fact, all organisations surveyed during our engagement process on KA, even those with existing capability, such as MoD, agreed that a central source of advice and support would be key to harnessing the value of KA in the public sector.

Recommendation 2: Network: build a network across the public and private sectors of experts and leaders focused on generating value from knowledge assets, to share best practices and exploit synergies across organisational boundaries.

4.6 Many of the case studies set out in this report demonstrate the value of working across organisations and disciplines, to support cross-sector learning as well as to generate innovative ideas and applications for those ideas, and then deploy them for the public good. An original discovery may be generated by one party, such as an NHS clinician, early stage investment may be provided by an investment fund, commercial advice provided by a business incubator initiative, product proof of concept could be developed by another organisation, and the final product could be marketed by an international company. Effective KA management therefore requires well developed networks across government, as well as effective links into a range of private sector partners.

Recommendation 3: Valuation: develop new standards and approaches for measuring and reporting the value of knowledge assets in the public sectors.

4.7 Identifying and valuing KA is both important and highly challenging. Existing accounting frameworks do not provide the means to record all KA, nor would this be appropriate. However, given the estimated value of these assets it is necessary to develop some experimental approaches to value and record KA that can inform their management. These will need to carefully consider that KA value can lie in its potential applications in another part of

government or in a commercial context, as well as its broader potential social and economic potential.

Recommendation 4: Recognition: establish a central repository detailing government knowledge asset holdings and their value.

4.8 Establishing what KA already exists within the public sector will be one of the first steps to overcome the barrier of 'identification' and provide a strategic overview of KA in the public sector. The central capability would work with organisations to help identify existing KA, record it and track it. This information would also enable the central team to spot patterns, synergies and exploit opportunities between individual pieces of KA. In addition, this information could be used by a central KA capability to develop a portfolio of opportunities to present to potential private sector partners and investors.

Recommendation 5: Protection: register intellectual property assets with the most commercial potential so that their value to the UK is maximised.

4.9 This is a key element of protecting KA, and often a very challenging one for organisations. Experience dealing with IP registration is not widespread in government, and knowing when is appropriate to patent or not is a tricky judgement in some cases. Setting out a broad policy of protecting IP is important to ensure organisations are aware of the issue, and embed the strategic approach of assessing IP for its commercial potential at an early stage. This policy should look to build on and exploit existing capabilities and expertise within the Intellectual Property Office.

Recommendation 6: Reporting: publish an annual report on the government's knowledge asset holdings and progress in their exploitation.

4.10 It is important to have transparency around the progress government makes to highlight, protect and exploit KA. Committing to publish an update annually will provide this and help to demonstrate the social and economic good that can come from better harnessing KA. It will raise the profile of KA, encourage greater engagement with KA management and help to foster more networks across organisations.

Recommendation 7: Guidance: design and implement best practice protocols for development, protection and commercialisation of public sector knowledge asset holdings.

4.11 It is clear from engagement with public sector organisations that standard protocols would be a critical foundation to the effective management of KA. This does not mean a one-size-fits-all approach is appropriate, as every piece of KA within every organisation will require different expertise, input and support. But a protocol supported by guidance would give departments the tools to start the process of generating value from KA. For IP, this could build on existing guidance and support provided by the IPO, which is currently primarily aimed at the business community.

4.12 Furthermore, as this report demonstrates, there are distinct types of value that KA can generate (social, economic and financial). Publishing protocols that recognise the tension that can sometimes exist between achieving these

different types of benefit will provide valuable support to organisations navigating those potential trade-offs.

Recommendation 8: Data: as part of the National Data Strategy, explore how the public sector can further exploit its data and the associated knowledge assets it generates.

4.13 In maximising the value of its KA the public sector must carefully consider the balance between financial and wider social or economic benefits. For this reason, it is often appropriate for public sector KA including data to be provided free of charge. However, our work has shown that this approach does not always allow the public sector to maximise the benefits of its data for the public good. Commercial models, and the investment that they can facilitate, can be a valuable tool. They can help to develop the application and maximise the reach of public sector data and to ensure that the UK taxpayer benefits proportionately from the value of the KA it has funded. The National Data Strategy will explore this balance in detail, and look at where more can be done to ensure that the UK is exploiting its data for the benefit of its citizens.

Recommendation 9: Investment: develop financial, contractual and organisational structures that facilitate knowledge asset commercialisation and effective partnerships with the private sector.

4.14 Our work has shown that maximising the value of KA often requires investment, which can be speculative and long-term, so is not served well by existing departmental budgeting structures. That is why much of the good practice identified has relied on partnership with the private sector. However, these partnerships can be hard to set up, requiring both time and expertise. A cross-cutting approach to investment in key KA priorities, either in partnership with private sector investors or through better use of internal public funding, would help to open up access to investment to high potential KA development projects.

Recommendation 10: Incentives: enhance organisational and professional incentives for knowledge asset development and exploitation.

4.15 Greater profile and recognition of KA will help build the professional and organisational incentives needed to generate greater value from public sector KA. However, there may be scope to create more powerful incentives, for example through mutuals models, joint ventures or offering equity stakes in spinout companies, that give public sector workers a financial share in the value that they create.

HM Treasury contacts

This document can be downloaded from
www.gov.uk

If you require this information in an alternative format or have general enquiries about HM Treasury and its work, contact:

Correspondence Team
HM Treasury
1 Horse Guards Road
London
SW1A 2HQ

Tel: 020 7270 5000

Email: public.enquiries@hmtreasury.gov.uk