



Government Venturing

Leveraging knowledge assets to
build greater financial sustainability
for public services in the UK

Capita

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Contents

Executive summary	4
Chapter one: Deploying national assets to meet national challenges	6
Chapter two: Untapped knowledge assets	12
Chapter three: Barriers to commercialisation of knowledge assets	24
Chapter four: Routes to unlocking commercial value	36
Chapter five: How to build successful Government Ventures	48
Chapter six: Scale of possibility	54
Chapter seven: Recommendations for Government	58
Bibliography	62
Acknowledgements	64

Executive summary

At a time of unprecedented economic challenge, we highlight a valuable latent income source to help offset greatly increased UK public sector expenditure and reduced tax revenues.

We estimate that returns of some **£5 billion** per annum could be derived from publicly owned knowledge assets, whilst fostering innovation, productivity and growth.

Assessed to be worth c.£150 billion¹, publicly owned knowledge assets (KA) comprise data and digital services, brands and designs, knowledge and research, and capabilities and skills, created in the course of delivering public services. These can and should be deployed to unlock innovation, stimulate economic activity and drive productivity across the country.

Doing so would open the route to some £5bn in annual returns, including £1bn in exports and up to 20,000 jobs². Greater innovation would also help to strengthen the UK's future competitiveness in a global economy that is increasingly comprised of knowledge-based industries.

Such significant potential economic and social value, particularly as the UK contends with the Covid-19 pandemic, should put knowledge asset commercialisation near the top of current government strategic priorities.

Governments across the world have implemented programmes to exploit knowledge assets. Singapore and Australia have set out clear principles on how to commercialise publicly-held intellectual property (IP); France has developed training programmes to upskill public officials; and Canada has developed an IP marketplace to help public bodies to find commercial partners from the private sector.

The UK public sector has also begun to take steps towards realising this opportunity. Its 2018 Budget paper 'Getting smart about intellectual property and other intangible assets' made ten recommendations on how the public sector can exploit its knowledge assets³ and led to the formation of a Knowledge Assets unit and fund within HM Treasury, which is taking positive steps to develop these valuable assets.⁴

Public sector bodies have long struggled to manage knowledge assets effectively and maximise the commercial return for the citizens who have funded their creation through taxation.

With a few notable exceptions, knowledge assets remain either neglected, sold before they can fully appreciate in value, or partially monetised within settings not designed for scaling and commercialising products and services.

In our view, the key obstacles include:

- Challenges in identifying and valuing knowledge assets
- Limited commercial, product and scaling capabilities
- A risk-averse culture
- Funding and investment constraints

To overcome these challenges in a way that combines income generation with public benefit, this paper outlines the concept of 'Government Venturing' (GV). This is a flexible type of mutually beneficial strategic partnership which combines public and private resources to make the best use of untapped knowledge assets, creating value, new revenue streams and in turn, better public services.

This approach has been successfully deployed⁵ to effectively unlock value from publicly owned knowledge assets. Based on first-hand experience, we set out a six-step process to help public sector organisations to establish Government Ventures. This includes identifying a potentially valuable asset, matching it to a defined market need and developing a long-term entity to successfully scale the opportunity.

We believe that government needs to implement an end-to-end strategy to build new revenue streams for government, overcome limitations on innovation, drive up productivity and make public services more financially sustainable. This white paper makes seven recommendations, that the government could take forwards immediately.

Seven steps towards more financially sustainable public services

- 1. Adopt Government Venturing** Public authorities should make it a priority to add the Government Venturing model to their portfolio of commercial strategies.
- 2. Mandate departmental KA plans and reporting** HM Treasury and the Cabinet Office should support every department to produce, and report against, a KA plan.
- 3. Initiate knowledge assets training** The Cabinet Office, the Treasury, and the Intellectual Property Office should establish a training programme to equip public officials with the relevant skills to identify and exploit government-owned KA.
- 4. Pioneer public sector venture studios** Government departments should work together with commercial partners to set up venture studios in strategic sectors to nurture early stage opportunities.
- 5. Establish venture leads and networks** The Knowledge Assets unit and dedicated 'venture leads' within departments, should foster networks of partners to aid commercialisation.
- 6. Promote data exchanges** Government departments and industry should create sector-specific data exchanges to improve data sharing between the public and private sectors.
- 7. Create a 'knowledge assets marketplace'** Government should build an official marketplace for public sector knowledge assets.

¹ SPINTAN. (Smart Public Intangibles) project. 2015. Total value of public sector knowledge assets in the United Kingdom. 61.

² The methodology behind these estimations is outlined in more detail in chapter six.

³ HM Treasury. 2018. Getting smart about intellectual property and other intangibles in the public sector. 31.

⁴ HM Treasury. 2020. Introduction to the Knowledge Assets team. 32.

⁵ These case studies are outlined in more detail in chapter three.

Chapter one:

Deploying national assets to meet national challenges

Harnessing the potential benefits of public sector knowledge assets represents an opportunity to help the UK government in addressing some of the most pressing economic and social challenges faced by the country today.

Opportunity one – creating new income streams to support public services

The Covid-19 pandemic has had a significant impact on public finances. By July 2020, public spending to address the crisis had risen to nearly £190bn - more than the entire planned health budget for 2020-21. Public sector net borrowing has increased from 2.6 per cent of GDP in 2019 to 19 per cent in 2020.⁶

The risks surrounding economic recovery mean that government borrowing will likely remain high into 2021. Local authorities across the UK have been particularly vulnerable to the financial effects of the crisis and will need to find sustainable ways to generate revenue to ensure their long-term financial resilience.⁷

To repair public balance sheets, decision-makers will need to find enterprising ways of financing their core activities. One of the most important opportunities comes in the form of commercialising its assets. An improved approach to KA monetisation can be pivotal in turning a loss making service into a viable and sustainable one.

HM Treasury stresses that:

“efficient management of government assets... contributes to the effective delivery of public services and the long-run sustainability of public finances”.⁸

There is a pressing need, therefore, for the government to identify new ways to generate social and economic value from its balance sheet. By maximising the value derived from existing assets, tangible or intangible, the government can focus resources on where they're needed most.

Opportunity two – improving productivity and delivering quality public services

As the UK recovers from the economic downturn, it will also need to address the country's long-term productivity crisis⁹. Productivity is one of the most important indicators of the country's living standards and total economic performance. Yet the average annual increase in productivity over the last decade has been just 0.3%.¹⁰ This has only been exacerbated by the pandemic, with output per hour falling by 0.4% in the first quarter of 2020.¹¹ The Office for Budgetary Responsibility has stated that 'the UK is on track to record the largest decline in gross domestic product for 300 years'.¹²

There is a growing recognition that knowledge assets - data, software, brands, patents, trademarks, and expertise - are a key component of productivity growth and value generation.¹³ The five most valuable companies in the world (Apple, Microsoft, Alphabet, Amazon, and Facebook), with a combined value of £3.5tn, are technology companies that leverage 95% of their value in the form of KA.¹⁴ The UK has also witnessed growing interest in KA, with the private sector investing £134bn in 2016 (vs. £148bn in tangibles).¹⁵

The public sector is another key investor. Over decades of governing and investing in public R&D, it has amassed a large and highly valuable stock of knowledge assets, estimated to be worth £150bn.¹⁶

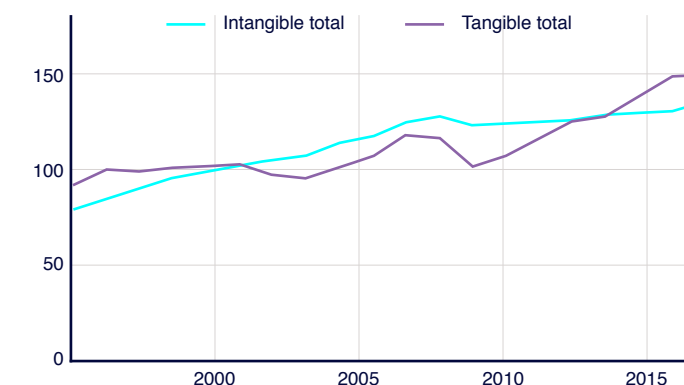


Figure 1 – Intangible and tangible investment in the UK, 1997-2016

These assets can help to drive productivity improvements in the public sector and improve the quality of public services. For example, government data can help agencies to offer more efficient and citizen-centric services, reduce waiting times, improve transport services, and deliver new health treatments.

Figure 1 shows that intangible investments were more resilient than tangible ones after the 2008 economic crisis. With government policy pointing to increased R&D spending to promote innovation during the current downturn, the public sector is likely to see an expansion of its KA portfolio.

The Spring Budget 2020 committed an increase in public investment in R&D to £22 billion by 2024 to 2025.¹⁷ Successful commercialisation of KA will support government's ambition to develop new technology sectors, create new jobs and ensure the country secures a return on this significant investment.

⁶ Office for Budgetary Responsibility. 2020. Fiscal Sustainability Report - July 2020. 44.

⁷ Institute for Fiscal Studies. 2020. The financial risk and resilience of English local authorities in the coronavirus crisis. 35.

⁸ HM Treasury. 2019. Asset sale disclosures: guidance for government. 29.

⁹ HM Government. 2019. Business Productivity Review, November 2019. 25. "The UK has a longstanding productivity challenge; even before the financial crisis labour productivity was on average 13% higher in the rest of the G7 countries compared to the UK."

¹⁰ ONS. 2019. Productivity economic commentary: July to September 2019. 47.

¹¹ ONS. 2020. UK productivity flash estimate: January to March 2020. 50.

¹² OBR Fiscal Sustainability Report - July 2020. 44.

¹³ OECD. 2019. Productivity growth and finance: the role of intangible assets - a sector level analysis. 43.

¹⁴ HM Treasury. 2018. Getting smart about intellectual property. 31.

¹⁵ ONS. 2019. Developing experimental estimates of investment in intangible assets in the UK: 2016. 45.

¹⁶ SPINTAN. 2015. 61.

¹⁷ HM Treasury. 2020. Budget 2020. 30.

Opportunity three – reducing regional inequalities and ‘levelling up’ Britain

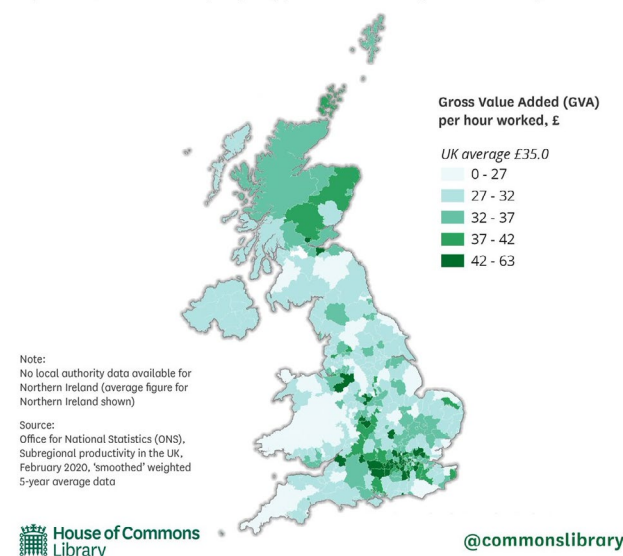
Levelling up the country is one of government’s most important policy ambitions. The UK has one of the most geographically imbalanced economies in the Organisation for Economic Co-operation and Development (OECD), with a recent report finding that London’s growth since 2010 is nine times higher than the area covered by the ‘Northern Powerhouse’.¹⁸ In 2018, total expenditure on R&D per head was £250 in Wales, compared to £1,064 in the East of England.¹⁹

The government has therefore committed to dramatically increasing its public R&D expenditure, with the Budget 2020 pledging £400m to research institutes across the UK, with an emphasis on those outside of London and the South East. The UK Research and Development Roadmap (July 2020) commits to ensuring that UK R&D systems make their fullest contribution to the levelling up agenda, with a UK R&D Place Strategy set to be released in late 2020. This should take greater account of the potential for developing and commercialising KA held across the country. This is important as KA are generally not restricted by place or geography. Knowledge-based work can be typically undertaken from almost anywhere, using tools that have found such pre-eminence during the Covid-19 crisis.

KA offer a powerful instrument to drive innovation, productivity, and regional growth in parts of the country that have struggled to capture the benefits of innovation. But investment alone does not necessarily translate into better local economic performance, unless those innovations are developed and scaled such that they reach end users to improve quality or efficiency.²⁰

Budget 2020: Regional productivity

£ per hour, economic output (GVA) per hour worked by local authority, 2018



Opportunity four – enhancing UK competitiveness and promoting UK plc

The UK faces new challenges and opportunities as it adapts to leaving the European Union. It has had a persistent current account deficit in recent years, which has been exacerbated by the recent economic downturn: the trade deficit increased by £4.5bn to £19.3bn in the first quarter of the year.²¹

In our view the government must develop a commercially-viable export strategy to strengthen the country’s future competitiveness in the global economy. Knowledge assets and innovation should form a core element of any strategy that is adopted. Whether it is our globally-renowned pharmaceutical sector, our world-leading creative industries, or our burgeoning technology ecosystem, UK exports are already driven by IP-intensive industries.

The government’s knowledge assets can play an important role in unlocking new trade opportunities. As the government improves its ability to secure a rapid return from its existing assets, it will become a better investor in creating new KA for domestic use and export. In chapter five, we estimate that commercialising government KA could contribute c.£1.25bn per year to the UK’s balance of payments²². It will further stimulate knock-on benefits, such as creating high-value technology jobs and new tax revenues for the Exchequer.



¹⁸ University of Manchester. 2020. Report calls on leaders to “think big” to tackle UK’s severe regional inequality. 67.

¹⁹ House of Commons Library. 2020. Research and development spending briefing paper. 33.

²⁰ Connected Places Catapult. 2020. Identifying potential growth centres across Great Britain. 10.

²¹ ONS. 2020. Balance of Payments. 48.

²² The methodology behind these estimations is outlined in more detail in chapter six.

Opportunity five – positioning the UK as a world leader in technology and innovation

This is also a question of global leadership. The UK has long been a leader in innovation and technology with globally important technological breakthroughs finding their origin in government laboratories, such as the CT scanner and the microchip.²³ That leadership is increasingly being challenged.

Other governments have developed new strategies, units, and funding mechanisms to invest in and commercialise public sector IP. France, for example, has had a centralised government unit for leveraging knowledge assets since 2007, while Singapore has set out clear expectations for public officials to exploit publicly-owned IP in its National IP Protocol.²⁴ To stay competitive, the UK must also adopt a strategic approach to exploiting its knowledge assets.

This is particularly important as the UK has the 5th largest stock of KA as a percentage of GDP, after Sweden, the US, Austria, and Finland (see chart).²⁵ Effective management of these KA can act as a differentiator in the global economy, and allow the government to find new opportunities to identify and spin-out new innovations.

In turn, generating demonstrable positive returns on its knowledge assets would create a virtuous circle for the government, both in making further public funding affordable for it and in attracting greater levels of private investment.

Source: SPINTAN, WGA and OECD

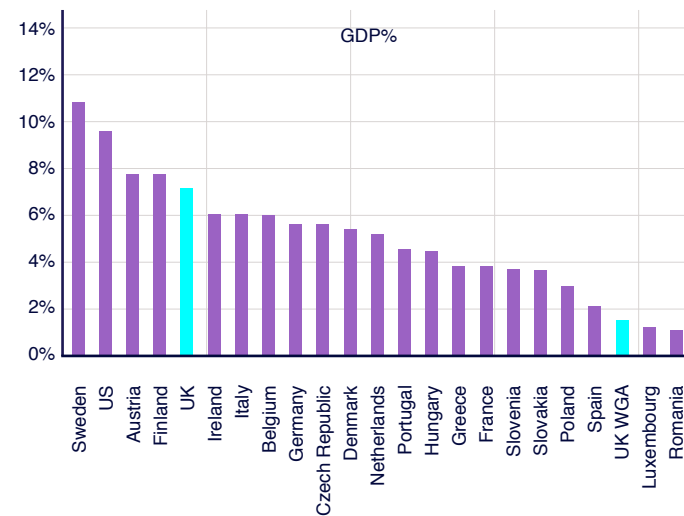


Figure 2 – Value of public sector knowledge assets and other intangibles

Opportunity six – improving the UK balance sheet

Finally, in our view the government has so far failed to properly account for KA in the public sector balance sheet. The Whole of Government Accounts (WGA) 2019 reports KA to be worth just £37.4bn or 2% of total public sector assets - more than four times lower than the £150bn figure calculated by Smart Public Intangibles (SPINTAN)²⁶. The majority of KA recognised by the WGA are held by the MOD and relate to the development of military equipment (£24.6bn). Other assets include capitalised development expenditure (£6.6bn), software (£2.4bn) and licenses (£3.8bn) – totalling £37.4bn, up from £36.0bn in 2018. The WGA follows the International Financial Reporting Standards (IFRS) definition of intangible assets, which sets out strict rules over what assets can be recognised on the balance sheet. These accounting standards (IAS 38) do not allow many types of KA to be capitalised and recognised in national accounts, including branding, design, organisational capital and training.²⁷

Moreover, these assets only have notional value on the balance sheet unless they are effectively exploited. Improving their ability to value and commercialise knowledge assets will help bolster confidence among public sector organisations to include them fully in annual accounts, and positively impact public sector net debt.

Taking into account the rising challenges faced by the economy, government can no longer neglect the opportunity offered by untapped government assets to generate economic and social value for the UK. Hence we believe that the government needs to implement an end-to-end strategy to systematically and effectively unlock value from publicly owned knowledge assets.

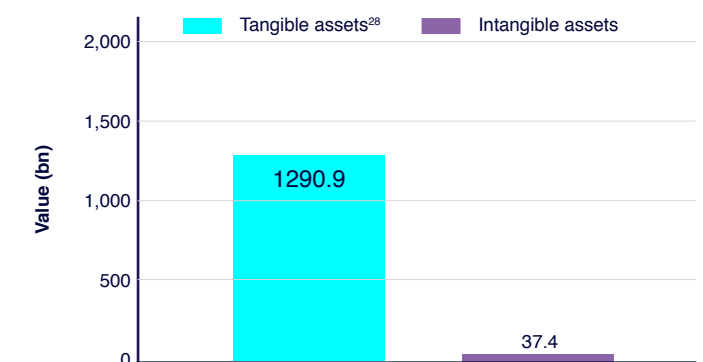


Figure 3 – Intangible assets count for just 2% in the whole of government accounts 2019.

²³ The CT scanner was developed by EMI in the late 1960s, with funding from the Department for Health.

²⁴ Further detail on what the UK can learn from other countries in is outlined in chapter three.

²⁵ SPINTAN. 2015. 61.

²⁶ HM Treasury. 2019. Whole of Government Accounts. 28.

²⁷ The Office for National Statistics is currently working together with the Intellectual Property Office to develop better guidance on how to recognise all KA in national accounts.

²⁸ HM Treasury, 2019, Whole of Government Accounts. 28. (Tangible assets derived from Property, plant & equipment + Investment property)

Chapter two:

Untapped knowledge assets

Thanks to historic investment, the public sector owns a valuable stock of knowledge assets, now estimated to be worth around £150bn, which have untapped potential to deliver significant financial, economic, and social benefits to the taxpayer.

Historic investment in knowledge assets

'Knowledge assets' is the collective name given to a wide range of intangible assets, such as data, software, brands, patents, trademarks, and expertise. They are generated and developed when an organisation spends time, money, and other resources to acquire, develop or improve non-physical assets that create value over time. Some KA are created less by deliberate investment, but as a by-product of business-as-usual operations.

The UK public sector has a long track record of financing, researching, developing and rolling out breakthrough innovations with significant public value, such as the jet engine, the World Wide Web, and the MRI and CT scanners. It is home to some of the most innovative organisations in the world, including the Ministry of Defence, the National Physical Laboratory, and the National Cyber Security Centre. Furthermore, public R&D has long been a priority area for the government, with £116bn dedicated to science, engineering and technology (SET) over the last decade.²⁹

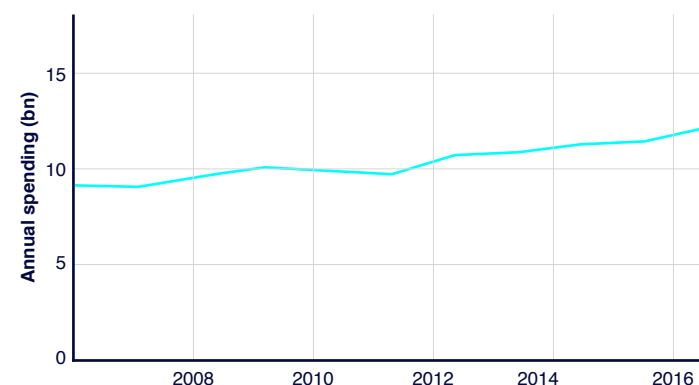


Figure 4 – Government expenditure on Science, Engineering and Technology (SET) 2007-2017

²⁹ Analysis of science, engineering and technology (SET) expenditure 2007-2017.

As a result, the government owns a highly valuable portfolio of knowledge assets, which we have grouped into the categories overleaf, that has developed organically from its R&D investments and the activities that it carries out in the public interest.

And yet, as we show in chapter three, bringing that portfolio of ideas into the economy and capturing fair value for UK citizens, remains a challenge.

To unlock their value, we believe the government must develop a deeper understanding of what KA it holds and their potential to deliver public value.

£150bn worth of public sector knowledge assets

The EU funded project SPINTAN (Smart Public Intangibles) estimated cumulative public sector KA investment across 26 countries over 20 years³⁰. It estimates that the value of public sector KA in the UK has risen in real terms from £40bn in 1995 to £150bn in 2015, or 8% of UK GDP.³¹

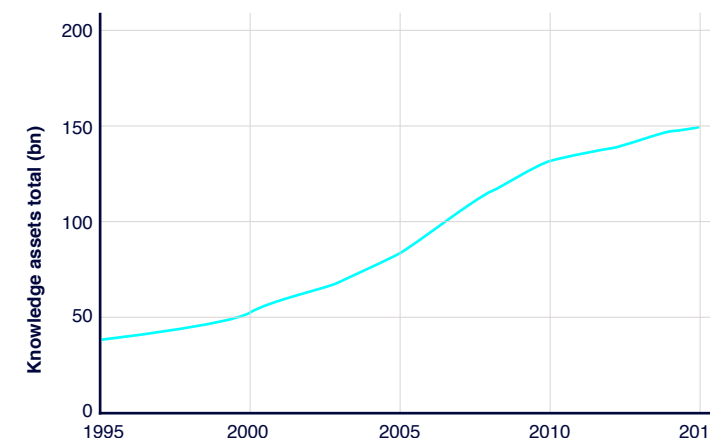


Figure 5 – Growth of knowledge assets (SPINTAN), 1995-2015

³⁰ The SPINTAN Project estimated a time series for cumulative public sector investment in KA for 22 EU economies, as well as the USA, China, India and Brazil for the years 1995-2012, with real time estimates for 2013-2015 for the European economies

³¹ SPINTAN. 2015. 61.



Shortcomings in exploiting UK public sector knowledge assets

The SPINTAN (Smart Public Intangibles) Project was an EU-funded academic research project that ran from 2012 to 2016, aimed at developing a methodology for measuring and valuing public sector intangible assets and investments.

It estimated a time series for cumulative public sector investment in KA for 22 EU economies, as well as the USA, China, India and Brazil for the years 1995-2012, with real time estimates for 2013-2015 for the European economies.

This was calculated by quantifying the capitalised net present value of past government investment into seven knowledge-generating activities. The £150bn figure therefore reflects the cost of producing the KA, while adjusting for depreciation and inflation.³²

The figure includes KA stocks owned by public corporations, universities and non-profit entities, such as charities, which are not included in the Whole of Government Accounts.

In practice, an intangible asset could have a different value to the investment that was required to create it. Value is also subject to the wider market environment, where rapid advances in technology and innovation can increase the value of an asset when combined with other intangibles or tangibles, or alternatively render it obsolete.

Notably, the SPINTAN estimation does not account for databases and branding assets in the UK, due to a lack of available information on investments into those knowledge-generating activities. It further does not account for KA created organically as a by-product of BAU activities. The value of public sector KA may well be higher than the figure calculated by SPINTAN.

Despite these limitations, SPINTAN provides us with the most comprehensive data on KA stocks in the UK public sector.

Categorisation of Public Sector KA types (and SPINTAN estimation of value, 2015)

Data & Digital services Page 16-17		Brands & designs Page 18-19		Knowledge & research Page 20-21		Capabilities & Skills Page 22-23	
Software	£7.2bn	Designs	£7bn	R&D	£42bn	Training	£80bn
Databases	n/a	Advertising	£2bn	Market research	£0.8bn	Organisational know-how	£11bn
Archives	n/a	Brand recognition	n/a	Copyrights	n/a	Methodology	n/a
		Logos	n/a	Trademarks	n/a	Processes	n/a
		Networks and customer bases	n/a	Patents	n/a		
Sub-total	£7.2bn		£9bn		£42.8bn		£91bn
Total	£150bn						

Further commentary on asset valuation is included on page 57 of this report.

32 HM Treasury, 2018. Getting smart about intellectual property. 31.

HM Treasury has explicitly stressed that knowledge assets are both ‘undervalued and underexploited’ in the UK -public sector.³³

These shortcomings are important: the government justifies future investment in innovation by making a return on past investment.

By failing to capture commercial upside from its previous investments, the government isn’t taking advantage of the vast economic and social opportunities presented by its knowledge assets.

We have categorised four lost opportunities for knowledge asset commercialisation, as follows:

Shelved concepts

This first category is focused on innovations created by public R&D. Many ideas developed in the public sector fail to bridge the ‘valley of death’ - the point where a product has reached a prototype stage, but has not received sufficient funding and resources to turn it into something commercialisable. Greater access to public or private sector funding can help to bring these innovations to market.

Dormant assets

Next, knowledge assets are often created as a by-product of delivering public services. Once an asset has served its immediate purpose, it is often stored away and neglected, with agencies failing to recognise the commercial and longer-term potential of these dormant assets for alternate use cases. The LocalGov Digital Pipeline, for example, lists digital projects that have been paused at a local government level, whether due to costs, technical challenges, or policy change. A knowledge assets marketplace could enable the public sector to identify commercial partners for dormant KA.

Underexploited assets

This next category is where the government has sought to commercialise its KA, but struggled to realise their full potential. Consider the example of the PRINCE2® methodology prior to the establishment of Axelos. The government created a suite of project management standards over the course of 30 years. Taxpayers received royalties from certification tests but no proceeds from utilisation of the IP, while the government did not have the capacity or capability to stimulate global demand for the product. The public sector therefore missed out on important opportunities to generate revenue and drive product innovation, until it sought to scale the product with a private sector partner as Axelos.³⁴

Undervalued assets

Finally, the government has often undervalued the commercial potential of its KA, sometimes giving them away below their value to third parties, or neglecting their value completely. Examples include some of the most important breakthrough innovations to society, such as the microchip and the computed tomography (CT) scanner. The NHS played a key role in development of the CT scanner, but didn’t secure a ‘meaningful financial interest’ in its exploitation, thereby missing out on the vast commercial returns as it was adopted worldwide.³⁵

33 HM Treasury. 2018. Getting smart about intellectual property. 31.

34 This case study is outlined in more detail in chapter three.

35 HM Treasury. 2018. Getting smart about intellectual property. 31.

Data & digital services - databases, archives and software

The public sector is one of the biggest producers of data. Every day, officials collect, create, process, analyse and distribute vast amounts of information: from spending statistics, to weather forecasts, to economic indicators and arrest numbers.

This data underpins all government activity, informing policy and delivery of public services, as well as promoting democratic transparency and accountability.

Value potential

Business models for commercializing data and digital assets include licensing, royalties or a share of the profits generated from enabling private actors to foster new products, markets and service improvements. These commercial structures can support greater investment in government data so that it can be used more widely and effectively, and ensure that taxpayers benefit financially from the investments they have funded³⁶.

Government data also delivers significant economic value by stimulating the development of innovative products and services in the private sector³⁷. For example, Transport for London's (TfL) decision to open its data has been estimated to generate annual savings and economic benefits of £130m to the city's economy, with businesses such as Waze and Citymapper using this data to develop commercial services that help citizens to plan their journeys better³⁸. This has created a debate as to whether government should focus on making its data free to the citizen³⁹.

Simultaneously, concerns around information, its ownership and entitlement to use it for greater gain are cited as an obstacle to innovation.

The reality is that the treatment of each data set needs to be considered on its own merits: In some situations, the public interest is best served by monetising data for the public purse, whilst in others it will be outweighed by the advantages of free-sourcing. In still others, public sensitivities have, until now, made reuse for any purpose unpalatable, irrespective of potential large benefit to the public.

HM Treasury has noted 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 public⁴⁰.”

Some public corporations, such as the Met Office, the DVLA and the UK Hydrographic Office, already generate revenue by charging fees for the private or commercial use of information. Ordnance Survey, for example, received £157m in commercial revenue from licensing data to the private sector⁴¹.

But this only scratches the surface. Geospatial data – ranging from address data, to real-time traffic data, to land use data - has been estimated to offer £6bn to £11bn per annum in economic value to the private sector⁴². Many new technology companies in mainstream commercial sectors - such as Deliveroo and Just Eat in the food delivery sector - rely on geospatial data to coordinate riders, timing, delivery navigation and tracking. Public sector geospatial data could help to support service improvements in this sector (and multiple others) while generating commercial revenue for the taxpayer - provided a fair proportion of the benefits derived are captured by the public sector.

The NHS is home to highly valuable data assets that could be used to develop new treatments and procedures, deliver more personalised care, and improve patient outcomes⁴³. A recent report found that data held by the NHS could be worth nearly £9.6bn a year through operational savings and benefits to the economy⁴⁴. In his Ditchley Annual Lecture (June 2020), the Chancellor of the Duchy of Lancaster noted that:

“...the deep and broad pool of health data we have can improve diagnostics and treatment, support life science innovation and close the health inequality gap.”

In the wake of unprecedented sharing of patient data to address Covid-19, health stakeholders must recognise the value of ethically leveraging anonymised patient data to deliver better health outcomes, as well as important revenue for the NHS. Commercialisation of health data would need to be consensual, safe, and transparent to avoid repeating the failures of care data but that should not prevent the sector from innovating for the wider public good⁴⁵.

The amount of data owned by government is set to increase exponentially as it adopts new technologies and innovations. For example, Internet of Things (IoT) sensors will increase the volume of data collected by cities, as they are deployed to monitor air quality, road conditions, and waste levels. The follow up to the National Data Strategy, published for consultation in September 2020 by the Department for Digital, Culture, Media and Sport, should address how government can develop the appropriate commercial structures to take advantage of its existing data assets and information it collects in the future. As the DCMS Policy paper states:

“Data is an incredibly valuable resource for businesses and other organisations. However, there is increasing evidence to suggest its full value is not being realised because vital information is not getting to where it needs to be.”⁴⁶

Types of Government Data

Economic and Business – includes financial information, company information and economic statistics, such as those on inflation and unemployment

Social – includes demographic information, attitude surveys, data on health and illnesses and census data

Legal – includes figures on crimes, convictions and judgements as well as information on legislation

Meteorological – includes weather forecasts and climatological data

Scientific – includes information produced within publicly-funded research and medical institutes, patents and research carried out within government departments

Transport – includes public transport information, traffic congestion, road safety statistics and vehicle registration information

Environmental, agricultural and fisheries – includes land use information, environmental quality data, farm incomes and use of resources, fish harvests and fish farming information

Cultural – includes materials within museums and art galleries, as well as library resources

Political – includes government press releases, proceedings of local and national governments, as well as green papers, law and regulation

Geospatial – includes location data, earth observation data, topographic data, aerial photographs and hydrological information

Health – includes patient records, clinical trials data, disease registries, and administrative data

36 HM Treasury. 2018. Getting smart about intellectual property. 31.

37 HM Treasury. 2018. The economic value of data. 27. data 'has the potential to enhance economic competitiveness and productivity growth [...] through fostering new products, processes, organisational methods and markets, or even enabling entirely new business models'

38 Deloitte. 2017. Assessing the value of TfL's open data and digital partnerships. 14.

39 Public Administration Committee. 2013. Statistics and Open Data: Harvesting unused knowledge, empowering citizens and improving public services. 53.

40 HM Treasury. 2018. The economic value of data. 27.

41 Ordnance Survey. Annual Report & Accounts 2018-19. 51.

42 Cabinet Office. 2018. An Initial Analysis of the Potential Geospatial Economic Opportunity. 6.

43. Reform. 2018. Making NHS data work for everyone. 55.

44 EY. 2019. Realising the value of healthcare data: a framework for the future. 19.

45 To this end, the UK's National Data Guardian for Health and Social Care has embarked on a project (April 2020) to study how people consider the benefits and disadvantages of sharing of health data for research purposes.

46 DCMS. 2020. Policy paper National Data Strategy. 12

Brands & designs – brand recognition, designs, advertising, networks and customer bases

Whether it is the BBC, HSE or even the English national football team, public sector brands are some of the most powerful and recognisable in existence.

Leveraging these brands goes hand in hand with improving public services. It entails a reflection on a government agency's core purpose, identity, and goals. In the private sector, brand recognition and loyalty play a critical role in the success of a company. Decisions made by consumers are often shaped by their attitudes towards a company's image, as much as the quality and price of a product.

Value potential

Citizens also make decisions based on their perceptions of government. Public sector branding therefore aims to build trust and recognition among citizens in order to deliver policy objectives. Brand expansion can also help provide greater visibility to government agencies. Universities and museums, for example, have long developed brand strategies to achieve national and international visibility amid wide competition. In 2007, the French government agreed to license the brand of the world-renowned Louvre Museum to the Emirate of Abu Dhabi in a 30-year deal worth €400m, demonstrating that the public sector owns valuable, albeit often neglected, brands with long-term financial value.⁴⁷

Recognising there are clearly scenarios where commercialisation would be inappropriate, brands offer a scalable revenue stream for government without having to sell assets or inventory, while also requiring relatively minimal account management. Models range from licensed endorsement or promotion, to partnership marketing, product placement and sponsorship.

The Government Communication Service (GCS) has itself recognised that there is enormous value in government's own brands, which could be realised if

“GCS can leverage partnership marketing (financial and in-kind) from private sector firms keen to work with the public sector, for either competitive advantage, corporate social responsibility or both”.⁴⁸

Private companies often engage in partnerships with the public sector to leverage the name recognition of public brands to enhance their own visibility and image, and increase their influence. In many cases, this name recognition can warrant compensation through brand licensing, sponsoring, and product placement. For example, the Japanese watchmaker Casio came to a commercial agreement with the Ministry of Defence to launch a range of timepieces in March 2020 that adopt the insignias of the Royal Navy, Royal Airforce and British Army.⁴⁹

Branding also goes hand in hand with another key public sector KA: design. This does not just refer to visual appearance or style, but also to customer experience, ease of use, and aspects of functionality. Good design can therefore explain the popularity of one smartphone over another, or the success of certain social networks.⁵⁰ The public sector has increasingly incorporated design thinking into its activities. In 2012 the Government Digital Service launched GOV.UK to replace the two main government digital brands Directgov and Business Link. The government's digital presence had previously been spread across several sites, which privileged internal and security needs over customer experience. By creating one recognisable design, government was able to improve the availability of information while developing an open and transparent identity. There is a potential opportunity for the UK government to commercialise these design standards and capabilities for other governments or organisations.

Case study

Transport for London - Licensing a globally recognised brand to the private sector

Transport for London (TfL) uses carefully chosen commercial partnerships to develop sustainable revenue streams from its brand. It has previously secured licensing deals with online furniture store Made.com, games maker Mattel, and Kirkby Design, who have designed cushions based on the tube's retro seat patterns.⁵¹

In 2016, TfL licensed its brand and contactless payment system to Cubic Transportation System in a contract worth £15m. The deal granted Cubic the right to adapt the contactless payment system for worldwide use.⁵²

In 2017, TfL signed a 5-year deal with the TSBA Group to bring its globally recognised symbols, such as the roundel logo and the London Tube map, to the global licensing market. Structured around a commission-based framework, the agreement seeks to generate funds for TfL to reinvest into improving the public transport network for millions of commuters. For example, TfL licensed its brand to the German sportswear company Adidas in 2018 to launch a range of trainers inspired by London's transport lines. The ongoing collaboration is the largest licensing deal across transport sectors globally.⁵³



⁴⁷ Reuters. 2007. France signs deal to open Louvre in Abu Dhabi. 57.

⁴⁸ Government Communication Service. 2015. The Government Communication Service: The Future of Public Service Communications.22.

⁴⁹ The Drum. 2019. Ministry of Defence leverages brand equity with Casio watch partnership. 64.

⁵⁰ OECD Observer. 2011. Untangling intangible assets. 42.

⁵¹ The Guardian. 2017. Mine the gap: Transport for London hopes to profit from licensing its brand overseas. 65.

⁵² ComputerWeekly. 2016. Cubic Transportation licenses TfL's contactless payment system. 9.

⁵³ Licensing Source. 2018. Adidas Originals teams with TfL. 36.

Knowledge & research – R&D, copyright, trademarks

Each government department has its own R&D budget to carry out in-house research or to commission outputs from third parties, leading to the production of an evidence base which contributes to policymaking activities. Beyond science, government officials also conduct significant economic and social research to ensure policy debate is informed by the best evidence from the social sciences.

Every year the public sector invests billions into research in departmental laboratories and Public Sector Research Establishments (PSREs). Latest ONS data shows that UK government expenditure on science, engineering and technology (SET) relating to research and development was £12.2bn in 2018, representing 0.59% of GDP. Civil departments represented 30% of this spending and the Ministry of Defence 13%.⁵⁴ Such expenditure has resulted in a large output of dormant and underexploited patents, trademarks, copyright, and innovations.

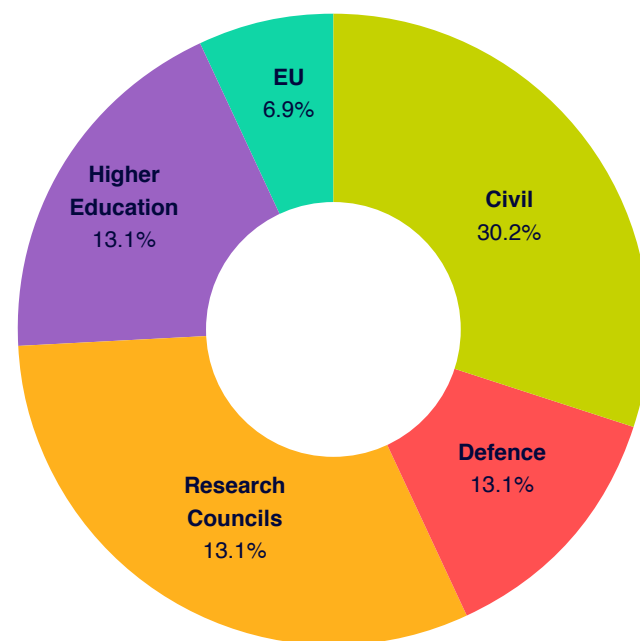


Figure 6 – Government expenditure on Science, Engineering and Technology (SET) by recipient 2017

⁵⁴ ONS. 2019. Government expenditure on science, engineering and technology, UK: 2017. 46.

⁵⁵ HESA. 2020. Higher Education Business & Community Interaction Survey. 24. Income from business and community interactions, 2018/19

⁵⁶ LifeArc. 2019. LifeArc monetises Keytruda® royalty interests to fund further research and investment. 26. MRCT scientists developed the antibodies used to make Keytruda® in 2007, before it became a successful drug selling US\$8bn p.a.

⁵⁷ Government Office for Science. 2019. Government Science Capability Review. 23.

⁵⁸ UK R&D Roadmap. 2020. 26.

⁵⁹ Science and Technology Committee. 2019. Balance and effectiveness of research and innovation spending. 60.

Value potential

Higher Education knowledge transfer models are among the more established, generating £3bn in 2019 from KA, through consultancy, training courses, IP licensing and spin-outs⁵⁵.

PSREs, such as the Defence Science Technology Laboratory, the National Institute for Health Research and the National Physical Laboratory, have generally developed commercial strategies to benefit from innovations through licensing arrangements, gain-shares and spin-outs. The Medical Research Council, for example, owns the IP rights on discoveries made by scientists employed within its units. It commercialises these findings through the LifeArc (formerly MRCT) charity, which licenses IP on its behalf, to fund further medical research. In 2019 LifeArc received US\$1.3 billion for a portion of its royalty interest in the cancer drug Keytruda® from the Canada Pension Plan Investment Board.⁵⁶

Yet the government has recognised that it must do more to realise the commercial value of its investments in R&D. The Science Capability Review 2020 states that government should ‘create commercial and business-scouting expertise and collaborative R&D’ to support greater commercialisation of this publicly-funded research.⁵⁷

The UK Research and Development Roadmap further sets out that government will strengthen the ability of PSREs and other publicly funded institutes to collaborate with the private sector.⁵⁸ UK Research and Innovation (UKRI) has suggested that public investment in R&D achieves high social rates of return, of around 20% per annum. In addition, it attracts significant private investment in R&D, with every £1 of public spend leveraging about £1.40 of private spend.⁵⁹ UKRI should use its extensive network and IP database to connect research councils with innovators.

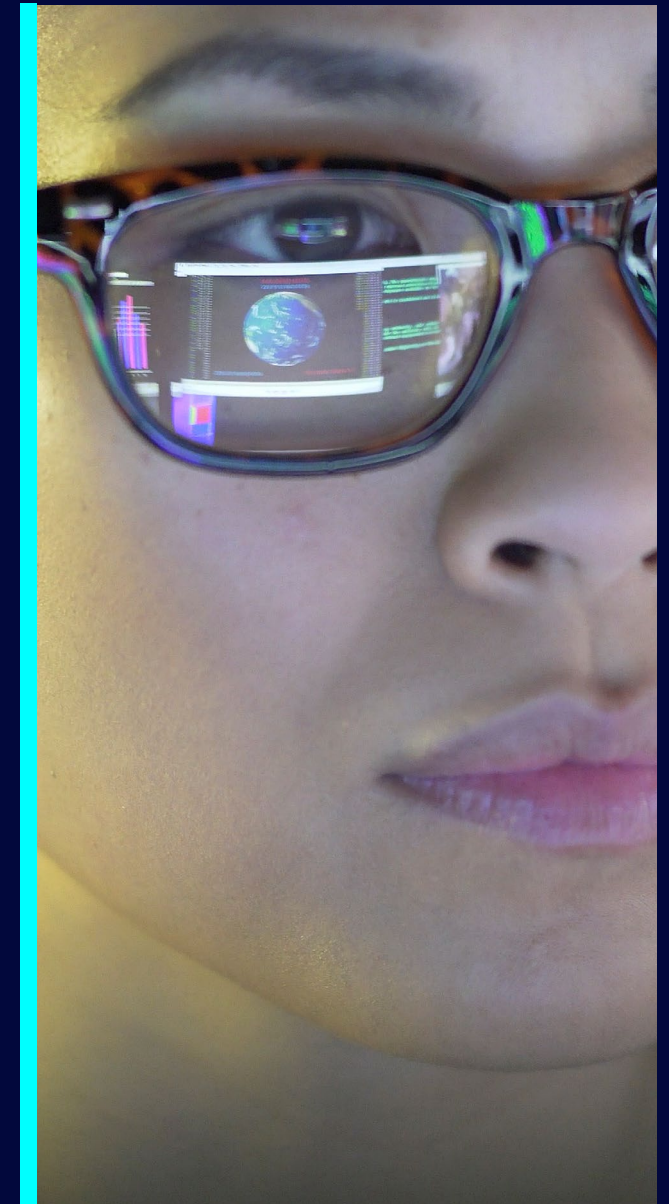
The Knowledge Assets Team in the Treasury is seeking to establish a central government unit with specialist tech transfer expertise to connect KA holders with potential commercial partners. This should lead to a broader pool of commercial opportunities relating to R&D innovations and IP.

Case study Ploughshare Innovations – Tech transfer for defence R&D

A number of public sector organisations and universities have established tech transfer organisations to identify commercial partners to bring publicly-funded IP to market. One example is Ploughshare Innovations, a wholly-owned subsidiary of the Defence Science Technology Laboratory (DSTL), which aims to convert immature technologies into civilian applications. It delivers revenue to the taxpayer via spin-outs and licensing IP to third parties.

The Cyber Defence Capability Assessment Tool (CDCAT®) – a software tool for assessing organisational defences against cyber attacks - is an example of an innovation that was created by DSTL and licensed to the private sector for commercial development. Ploughshare selected the cyber security company APMG as its licensee, who in turn made significant investment to convert the technology into a commercially viable product.⁶⁰

Since inception in 2005, Ploughshare has licensed over 125 technologies for further development across the private sector, and created 13 spin-out companies, which have in turn created more than 580 jobs and £220m in exports. However, DSTL’s annual report notes that these activities have ‘not yet resulted in a substantial direct financial return’.⁶¹ This can be partly explained by the extensive lead times to generate significant income through licence deals and spin-outs, especially when developing technologies with low technology readiness levels into market-ready products. For licensing, the main royalties only take place when the technology reaches the market, which can take several years and requires ‘patient’ capital.⁶²



⁶⁰ Ploughshare Innovations. 2018. Case Study - Cyber Security Software. 52.

⁶¹ DSTL. 2019. Annual Reports and Accounts 2018/19. 17.

⁶² SQW. 2014. Assessment of the non-financial benefits of the commercialisation activities of Ploughshare Innovations Ltd. 62.

Capabilities & skills - organisational know-how, methodology, processes

Government entities have developed a vast range of expertise, methodologies and skills through the activities it carries out in the public interest. These capabilities are the results of investments in staffing, training, organisational structures, communication, and management processes.

When government invests in skills, processes and knowledge, it generally expects to see returns in the form of improved efficiency, higher quality public services, and greater productivity. However, the commercial potential of these assets is often neglected by government agencies as they are difficult to measure. This is compounded by the difficulty of applying the legal IP framework to protecting know-how and expertise.

Value potential

Competency-based knowledge assets offer government a powerful instrument to deliver economic, financial, and social objectives. Government agencies can leverage their skills and know-how to advise other areas of the public sector, as well as foreign governments and the private sector.

The Behavioural Insights Team, for example, was spun out of the Cabinet Office in 2014, as a social purpose company jointly owned by the Cabinet Office, its employees, and the innovation charity Nesta. Today, the 150+-person company advises government agencies, as well as businesses and the third sector on how to apply behavioural insights to public policy and business challenges.⁶³ The UK can also learn from other countries who have sought to export their public sector skills. New Zealand, for example, has launched a commercially-driven Government-to-Government partnerships office to share its expertise in areas such as education, agriculture, and disaster management.

Next, sharing its methodology with the private sector can help create new economic value. For example, the Cabinet Office-launched Axelos, a joint venture with Capita, in 2013 to generate low-risk returns and expand the global reach of the government's in-house project management standards to private businesses. It is now used by 90% of the world's leading organisations, benefits from ongoing innovation investment in its product portfolio and has so far returned over £125m to the UK taxpayer.⁶⁴

When combined with the reputation of UK institutions, these competencies offer a valuable opportunity for exporting expertise to international businesses and foreign countries to build local institutions. The government has already recognised its role in exporting private sector know-how. Recently, the Department for International Trade has made it a priority to export the UK's expertise in smart construction, such as Building Information Management (BIM), to position the sector at the forefront of the global smart construction market.⁶⁵

In the context of Brexit, these competency based knowledge assets offer an enormous opportunity to generate additional income for the public sector from export markets. The UK government is aware of the potential to sell education and skills products and services to key markets. In its "International Education Strategy global potential, global growth", the government has set out an ambition to grow education exports to £35bn by 2030.⁶⁶ The British Council could similarly leverage its brand to support UK companies abroad. There are also enormous opportunities in the UK's world-leading healthcare sector. The Healthcare UK Export Catalyst was launched in 2018 to help the NHS leverage its brand and expertise to access global healthcare opportunities and facilitate the export of British healthcare knowledge. It aims to target £7bn of opportunities worldwide over the next 10 years by supporting NHS Trusts to find and win contract opportunities.⁶⁷ As the government seeks to develop a high-value, export-oriented digital economy, it would be wise to realise the opportunity lying within the public sector.



Case Study

Exporting public sector expertise - New Zealand G2G Know-How

G2G Know-How is a partnership between the New Zealand Ministry of Foreign Affairs and Trade (MFAT) and New Zealand Trade and Enterprise (NZTE) to find opportunities to take government skills, systems and know-how to market on a commercial basis, and export public sector expertise internationally.

Leveraging the country's diplomatic network, G2G Know-How partners with other governments to identify challenges, and design, implement, and deliver specific programmes of work to help other countries improve public sector outcomes. They aim to improve capabilities through joint-delivery teams that co-develop solutions, drawing on expertise across New Zealand's public sector.

Launched in 2014, the joint venture signed 14 contracts and generated NZ\$9.4m in revenue in its first year of operation.⁶⁸ Areas of expertise include: agribusiness, disaster management, education, e-Government, conservation, food safety, and tourism development.

⁶³ This case study is outlined in more detail in chapter three.

⁶⁴ This case study is outlined in more detail in chapter three.

⁶⁵ Building. 2019. Government in talks to export smart construction know-how. 5.

⁶⁶ Department for Education and Department for International Trade. 2019. International Education Strategy: global potential, global growth. 16.

⁶⁷ GOV.UK. 2018. Government export support to help NHS profit by sharing expertise. 21

⁶⁸ Stuff. 2015. G2G Know-How blitzes sales target in first year selling government expertise overseas. 63.

Chapter three:

Barriers to commercialisation of knowledge assets

Knowledge assets present a particular set of commercialisation challenges, which are currently preventing government from realising their full potential. As we survey here, barriers exist at every stage along the innovation value chain, which go some way towards explaining government's struggle to extract ROI.

In the subsequent chapters, we outline mechanisms for overcoming these obstacles.

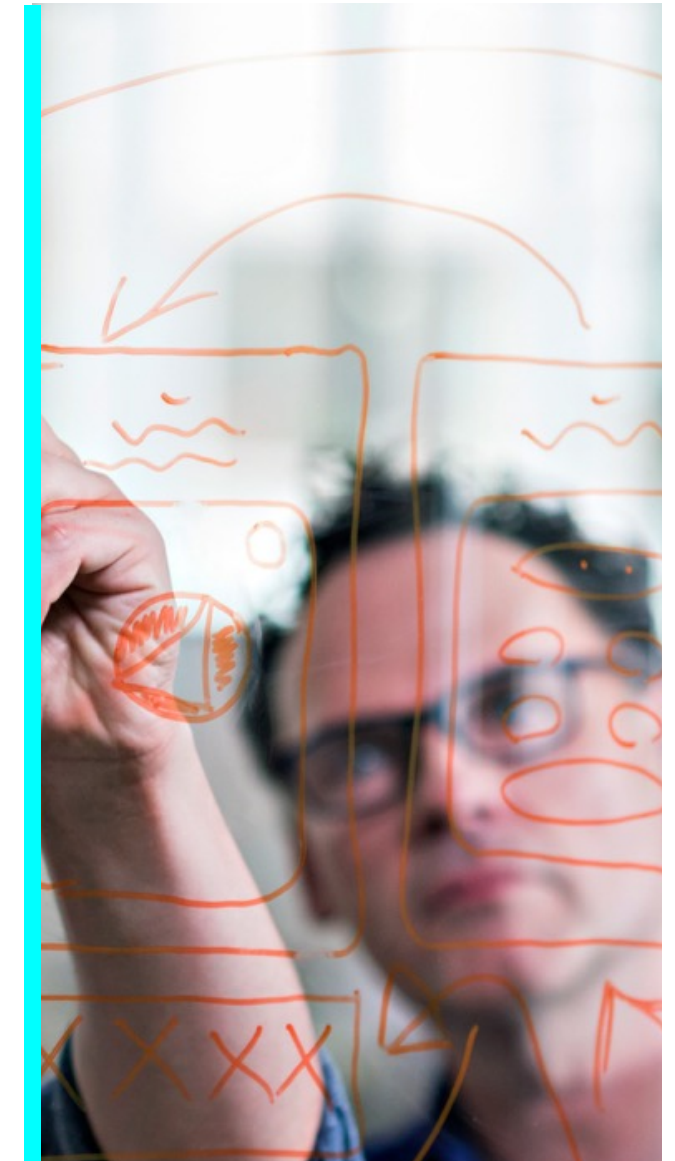
Asset identification and valuation

Firstly, public sector organisations generally lack a clear understanding of the KA they own. This is hardly surprising: few, if any, public sector organisations have developed a systematic approach to identifying, valuing, developing, and commercialising their KA. It is rare for departments to conduct IP audits or catalogue the knowledge assets that they generate. This is important: KA cannot be effectively managed unless they are identified, and until public sector leaders recognise their potential commercial value.

Ownership of knowledge assets can also be unclear as they are dispersed widely across the public sector, a consequence of being generated across multiple agencies over time.⁶⁹ Consider the vast number of data sources in the average organisation. Public officials will need to understand where the dataset is located, what format it is in, what technology is needed to access and evaluate the data, as well as how it can be extracted. Moreover, the data sources will have often grown organically over time, meaning that individual datasets are siloed from each other, impeding extra value creation through combination. The Metropolitan Police alone uses over 750 different systems, many of which are incompatible with each other, making it difficult to identify and join-up valuable datasets.⁷⁰

This leads us to another barrier: determining the value of an asset. As we have shown earlier, certain KA (brands, organisational capital, training) are not accounted for in public sector balance sheets, while national accounting standards are only now being adapted to measure KA.⁷¹ Moreover, the valuation of a knowledge asset is context-specific and can change over time with additional investments, or when combined with other tangible or intangible assets.

Undervaluing KA creates weak incentives for public sector organisations to prioritise their commercialisation.



⁶⁹ HM Treasury. 2018. Getting smart about intellectual property. 31.

⁷⁰ Reform. 2018. Sharing the benefits: How to use data effectively in the public sector. 56.

⁷¹ ONS. 2019. Developing experimental estimates of investment in intangible assets in the UK: 2016. 45.

Commercial, product and scaling capabilities

Successful management of knowledge assets requires a unique commercial, technical, and legal skillset that is not customary to the public sector.

There are, of course, important clusters of expertise, from commercial know-how in UK Government & Investments and the Cabinet Office, to technical competency in the Government Digital Service, and IP skills at the Intellectual Property Office. Nonetheless, it is rare to find the necessary combination of skills within a public sector organisation to properly exploit an asset. In addition, there is no official framework for public officials on how to use KA for value generating purposes. This can result in public officials lacking the confidence or capability to extract value from KA.

HM Treasury has itself stressed the importance of 'expertise and specialist skills through every step of the process of delivering value from knowledge assets'.⁷² As we show in chapter four, public officials might seek support from partners in the private sector who can bring the relevant commercial know-how to find and develop opportunities and the technical skills required to identify and prepare assets for the digital economy.



Case study CONSTRUCTIONLINE – Creating a dynamic database for the construction sector

The 1994 Latham report recommended the formation of a centralised national contractor and consultant database to replace the multiple, costly pre-qualification schemes used by government departments to select vetted contractors for construction projects. The Department for Trade and Industry (now BEIS) established Constructionline in 1998 as a concession with Capita, with a gain share payable back to government.

Capita provided the start up funding to get the venture going and underwrote the expected losses in the early years. Constructionline invested in developing a digital portal platform to offer simplified and streamlined pre-qualification procedures to conduct procurement in the sector, thereby reducing costs and risk for both buyers and suppliers. It increased visibility of the platform by targeting relevant trade press and offered discounted rates for endorsers, leading to an increase in end users. The platform was developed regularly to ensure value for the end user. For example, the platform introduced star ratings so that buyers could reduce the risk of project delivery.

Through collaboration and product innovation, Constructionline grew steadily by meeting a clear set of buyer and supplier needs in the market for construction services, as well as expanding into the private sector and extending its reach beyond construction services. It witnessed an uptake in 8,000 buyer organisations and 23,000 suppliers.

The taxpayer benefitted financially from the beginning, in the form of annual gain share payments. After 19 years of growth, government decided to divest of Constructionline to Capita in 2014 under a competitive sale process, with proceeds of £35m returning to the taxpayer.⁷³ Ultimately, government was able to secure a sizable return and bear relatively little risk by working with the right partner.



⁷² HM Treasury. 2018. Getting smart about intellectual property. 31.

⁷³ Department for Business, Innovation & Skills, 2015. Capita announced as new owner of Constructionline. 15.

Culture of innovation and risk

Commercialisation of knowledge assets has historically not been seen as an essential or core public service activity. No formal expectation or mandate exists for public sector leaders to recognise themselves as KA owners and actively generate returns. As a consequence, there are limited incentives for public officials to prioritise IP exploitation over other pressing duties, particularly when the benefits of commercialisation are delayed or uncertain.

In this regard, one of the most important challenges facing public officials is the lack of clear guidance on how they should manage and exploit their KA. Public sector leaders have legitimate concerns about the high risk involved with commercialising its KA, where investment is substantial and internal skills are limited. This is made more difficult by the complexities and numerous nuances of decision-making – particularly around risk – within the public sector.

Public officials can often conflate commercialisation with privatisation, despite their distinct objectives: commercialisation can broadly be understood as generating income from a publicly-owned asset, while privatisation seeks to transfer ownership of the asset from public to private hands.

We therefore welcome the creation in 2020 of the new Knowledge Assets Team within the Treasury to 'scout and develop' knowledge assets, as well as a fund and a tech-transfer organisation to support such opportunities.⁷⁴ This is a very positive development, but to maximise its impact, leaders across every level of the public sector will need to recognise themselves as key generators and owners of a portfolio of KA with significant commercial value. The unit should therefore support every department to create internal strategies to find and develop opportunities to commercialise their KA, and develop networks to identify suitable commercial and technical partners where necessary.

In addition, KA are also created by third party contractors when delivering services for the public sector. Existing government policy requires delivery partners to hand over IP created by the private sector during a contract which can disincentivise companies from building partnerships with the public sector. The government needs to adopt an enlightened approach towards IP and not always attempt to retain full or sole ownership as this will often deter private sector investment.

There can also be motivational barriers preventing public officials from pursuing commercialisation where generating a knowledge asset takes significant investment of time and effort. Offering greater professional incentives through secondments or leadership opportunities in new ventures can encourage greater exploitation of knowledge assets.

⁷⁴ In July 2020, HM Treasury set out its plans to launch its Knowledge Asset Strategy to implement its recommendations from its 2018 paper "Getting smart about intellectual property and other intangible assets" which made 10 recommendations on how the public sector can exploit its KA.

Case study Behavioural Insights Team – Spinning out employee know-how

The Behavioural Insights Team (BIT) was set up by the coalition government in July 2010. Commonly known as the 'Nudge Unit', it was the first government body in the world dedicated to applying behavioural science to public policy challenges.

Applying behavioural science to problems across the public sector, the unit generated considerable expertise and knowhow and saved over 20 times its running costs within its 2 year trial period. BIT soon found itself faced with growing demand from new large corporations and other governments seeking to adopt similar methodologies.

In 2014, BIT was therefore spun out of the Cabinet Office as a social purpose company, jointly owned by the Cabinet Office, its employees and Nesta. By establishing itself as a business, BIT was able to bring in additional investment and commercial capability to rapidly grow the business. It had revenues of £17.1m in the year ending March 2019, making £1.1m in profit.⁷⁵ Today, BIT has expanded to over 150 employees with international offices in New York, Sydney, and Singapore.

It continues to work closely with government departments in the UK.⁷⁶ Most recently, it has been involved with government's communication around hand washing as a response to Covid-19.



⁷⁵ Behavioural Insights Ltd. 2019. Report and Financial Statements, 2018/19. 4.

⁷⁶ Apolitical. 2019. What is behavioural insights? 2.

Appropriate funding cycles and commercial flexibility

Rigid budgetary cycles in government can make it difficult for public sector organisations to secure the long-term investment that can sometimes be required to exploit knowledge assets to their fullest.

Consequently, public officials may find themselves competing with core statutory activities for funding to exploit KA.

This challenge is not unique to public sector knowledge assets. The government has long recognised limited access to long-term finance as a persistent barrier for commercialising the UK's scientific breakthroughs.⁷⁷ As a result, innovations in both government and the university sector often remain dormant, partially commercialised or underexploited. In turn, the lack of historic returns from KA discourage further investment in innovation.

Sustainable and long-term investment is critical for an innovation or spin-out to bridge the 'valley of death' and attain scalability. With limited financing available in the public sector, it can be necessary for officials to seek partners who can provide investment across later stages of the value chain.

The UK tax regime already favours private sector investment in knowledge intensive companies. Whilst we acknowledge there might be a material role for fiscal incentives as a lever to help accelerate the commercialisation of public sector KA, this paper does not attempt to explore them in detail.

Another inhibitor for KA exploitation within public sector entities relates to commercial flexibility. The early success of ventures should not be measured in purely financial terms - a principle which is difficult to apply within the structures of government.

The Lean Startup Method⁷⁸ recommends that the key unit of progress for an innovation project is that of 'validated learning' – experimentation to prove or disprove the viability of the company's business model. A growing body of best practice relating to "Innovation accounting" recommends tracking lead indicators as a prediction of ultimate financial success, such as customer behaviour and learning velocity.

This thinking applied in the public sector needs to account for outcome tracking associated with investment for longer term improved economic sustainability.

Case study AXELOS – Scaling government know-how globally

In 1989, the government adopted the PRINCE methodology as an internal standard to manage IT projects. These project management standards expanded in scope beyond IT projects, leading to the relaunch of PRINCE2 in 1996 as a generic project management standard. As the methodology gained prominence across the public sector, the Cabinet Office established licensing arrangements with private sector partners to provide examinations to become PRINCE2® qualified, in exchange for a fee.

However, whilst this valuable know-how was delivering significant value to taxpayers in reducing the costs of poor quality on major government programmes, its full value-creation potential was not being exploited.

Having demonstrated a revenue stream and opportunity to scale, the next step for the host authority was to find a commercially-focused external partner, able to bring investment and capabilities to achieve greater reach in public and private markets – under the Government Venturing model we describe in further detail in chapter four.

The government therefore engaged in a strategic partnership with Capita in 2013 to develop new commercial opportunities. A new joint venture, Axelos, was set up to invest in the development of new products and grow its user base internationally. Axelos built a new team, an internal operational infrastructure and mutually-aligned commercial processes, with the new governance structure enabling agile decision making and investment into the product portfolio. The team consolidated its distribution channels, increasing promotion in the UK and globally, and revised pricing to make its products more competitive based on user engagement.

Today Axelos products are used in over 150 countries and across 19 languages, as well as by over 90% of the world's leading organisations (such as BT, Disney and NASA). Customers have benefited from the development of an expanded line of products, including RESILIA®, PRINCE2®, Agile®, and ITIL Practitioner®.

Axelos has further delivered considerable financial benefits to the taxpayer since inception, contributing £21m in corporation tax and returning £104m to the Cabinet Office (comprising £37m in dividends and £66m in consideration for the KA).⁷⁹

⁷⁷ Science and Technology Committee. 2017. Managing intellectual property and technology transfer: Government Response to the Committee's Tenth Report of Session 2016–17. 59.

⁷⁸ Ries, Eric. 2011. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. 58.

⁷⁹ Capita plc. 2013. Full year results 2013. Axelos Ltd. 2013-2019. Directors' Report and Financial Statements

What can the UK learn from other countries?

While the UK has generally struggled to exploit its publicly owned KA, countries across the globe have introduced strategies, programmes, units and guidelines support its commercialisation.

France - A centralised unit to support public agencies to leverage their knowledge assets

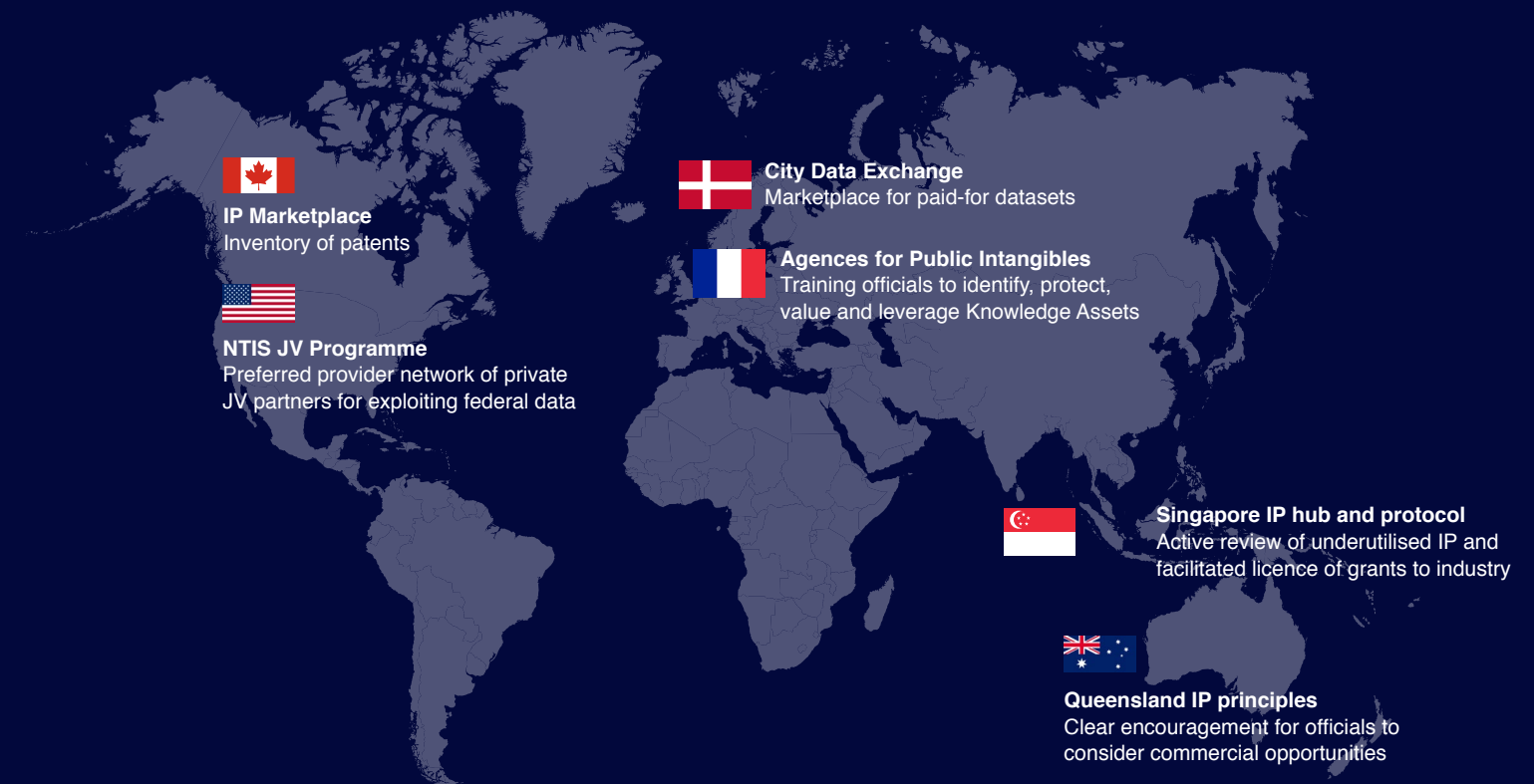
The Agency for Public Intangibles (APIE) of France was created in 2007 to encourage and assist public agencies to leverage their knowledge assets. It supports government bodies to identify their KA, determine their potential, implement appropriate protection, and find opportunities to exploit them.⁸⁰ For example, APIE helps government ministries to develop branding strategies - from identifying to registering, managing and leveraging brands. Since 2015, it has also been responsible for managing state trademarks and licensing opportunities.

APIE also plays a crucial role in training public officials to understand the value of their assets. APIE organises inter-ministerial workshops, shares best practices, and provides direct support to public agencies to create a standardised approach to leveraging knowledge assets. In 2018, more than 350 public officials attended 13 thematic workshops on IP, brand strategy, digital strategy, and innovation. The Agency also provides training for public officials seeking to develop expertise in KA: in 2018, it organised four courses in brand law, IP law, heritage, and brand strategy. APIE provides its services to ministries and national organisations at no charge. Significantly, two-thirds of the unit have private sector backgrounds, bringing legal, commercial and technical expertise from outside of the government.

Australia - Queensland IP Principles - Guidelines for officials to consider commercial opportunities

One of the most important challenges facing public officials is the lack of clear guidance on how they should manage and exploit their KA. The UK would do well to learn from countries such as Australia that have set out clear guidelines on commercialisation. In its IP Principles, the state of Queensland in Australia has stressed that officials should seek to 'commercialise IP for the benefit of the state by acting on opportunities that bring in revenue from sales or licensing their IP, taking account of the associated risks'.⁸¹ Clearly encouraging officials to consider commercial opportunities will help to address risk aversion and give them the confidence to act entrepreneurially.

Lessons from overseas – International approach to overcoming barriers



Canada - IP Marketplace - An accessible inventory of all government patents

As part of the IP Strategy, the Canadian Government launched an IP Marketplace called ExploreIP in 2019 with the aim to help businesses, creators, entrepreneurs and innovators to discover IP held by public sector institutions. Designed as a searchable database, ExploreIP showcases an inventory of public sector patents held by government, academia or other public sector institutions. All Canadian public sector patent holders are eligible to have their IP included in the database. In addition to its search function, ExploreIP also allows users to locate and contact patent holders and research organisations to discuss and negotiate a licensing arrangement or exchange details for potential collaborations. The Canadian government hopes that the tool will help leverage ground-breaking research and stimulate collaborations that could help launch the next big innovation.

Denmark - City Data Exchange Copenhagen - Experimenting with new commercial models for data assets

The City Data Exchange (CDE) was a public-private collaboration project between the Municipality of Copenhagen, the Capital Region of Denmark, and Hitachi to explore the possibility of creating a marketplace for the exchange of data between citizens, public institutions and private companies. It examined the purchasing, selling, and sharing of a range of data types - transportation, telecom, sensor, financial transactions, energy data, water usage, event, environmental, social media – between different users in the city. The site hosted 159 datasets, of which 25 were sold at a price. While it is no longer active, the project partners found that successful data monetization is based on demonstrating the value that paid-for data can unlock for users.⁸²

⁸⁰ Agence du patrimoine immatériel de l'État. 2011. Public Sector Intangible Assets : The Main Issues. 1.

⁸¹ Queensland Public Sector. 2013. Intellectual Property Principles. 54.

⁸² Municipality of Copenhagen and Capital Region of Denmark. 2018. City Data Exchange - Lessons Learned from a Public/Private Data Collaboration. 41.

USA - NTIS Joint Venture Programme – A preferred provider network of private JV partners for exploiting federal data

Actively building networks across the government and private sector can help agencies to find the right commercial partners. The US federal data agency, the National Technical Information Service (NTIS), runs a Joint Venture Partnership (JVP) programme to create private-public partnerships that will speed up the development of data solutions for the federal government. For its JVP program the NTIS works with private sector suppliers that have expertise in applied data science areas, such as artificial intelligence, machine learning, robotics, and cybersecurity. The private organisations selected for the 2019 JVP program include technology giants, like Intel and IBM, research institutes, like the National Center for Supercomputing Applications, and innovative SMEs like data.world.

A recent project for the Pentagon's Joint Artificial Intelligence Center, valued at \$10 million, brought multiple NTIS joint venture partners together to help the Center increase the speed and agility of its AI-enabled capabilities, by creating and implementing new methodologies for collecting, analysing and disseminating data. The NTIS partners, including the 1901 Group and Excella, helped build out the Pentagon's core AI capabilities and created an intelligent business automation platform for Department of Defence-wide use. In the near future, the agency will also release another notice for separate joint venture agreements through which entities can provide innovative solutions in the realm of assistive technologies.

Singapore - A national strategy for commercialisation of government-owned IP

Singapore has set out a clearly-defined strategy to manage publicly-owned IP, and has created a range of mechanisms to support its objectives and create an IP hub in Asia. In 2018, Singapore launched its National IP Protocol to develop a standardised approach to managing IP from publicly-funded R&D. Principle 1 of the Protocol stresses that 'IP created using public funds shall be managed and exploited with a view to creating and capturing value and for the benefit of Singapore'. The IP Protocol thereby allows public agencies to grant licences to industry - with the end-goal of encouraging commercialisation.

The Protocol requires public sector organisations to actively review their patent portfolios to identify and exploit underutilised IP. This includes periodic review of all patents filed by an agency to determine whether they should be maintained or licensed to a staff inventor or to a private enterprise. Under Principle 5, agencies can also give monetary incentives to staff researchers to encourage their commercialisation.

In parallel, the Singapore government has set up a new unit - the Intellectual Property Management (Government) - within the national Intellectual Property Office of Singapore (IPOS) to support public agencies in the management of publicly-funded IP. The department partners with public agencies to develop IP policies and strategies and to implement the National IP Protocol. The unit aims to centralise whole-of- government IP management expertise, while companies supporting commercialisation of government IP can also benefit from access to these experts.

Whilst standalone products and initiatives have their place, few of these approaches are part of an end to end strategy to build greater financial sustainability for public services.

In our view, what is required is a wider commitment and framework to address each of the barriers inhibiting the leveraging of knowledge assets in the UK.





Chapter four:

Routes to unlocking commercial value

Whilst there are circumstances in which the conventional approaches of asset sale or organic commercialisation are appropriate, many successful examples involve partnering with the private sector.

We recommend that public authorities add Government Venturing and Venture studios to their portfolio of models for commercialisation of knowledge assets.

Approaches to commercialisation of knowledge assets
Alternative options for the public sector

	Asset Sale Pages 38-39	Organic commercialisation Pages 40-41	Venture studios Pages 42-43	Government Venturing Pages 44-47
Description	Public sector divests KA to third-party	Authority exploits KA to create value itself by licensing, fee-for-service, fee-for-access or product sale	Authority combines KA with private sector incubation and capital to spin out start-ups	Authority combines KA with private sector capabilities through strategic partnership
Considerations	<ul style="list-style-type: none"> ✓ Immediate proceeds × High risk of being undervalued × Surrender control over whether/ how innovation reaches the economy 	<ul style="list-style-type: none"> ✓ Retain control and use of asset ✓ Retain all returns, though likely suppressed × Barriers (investment, risk appetite and scaling capabilities) constrain likely returns × Retain all risk × Innovation may never reach market at scale 	<ul style="list-style-type: none"> ✓ Barriers to returns overcome ✓ Retain share in greater returns ✓ Greater likelihood that innovation reaches the market × Reduced immediate proceeds × Carry share of risk × Control passed to founders 	<ul style="list-style-type: none"> ✓ Barriers to returns overcome ✓ Retain share in greater returns ✓ Existing operational infrastructure to exploit IP ✓ Greater likelihood that innovation reaches the market × Reduced immediate proceeds × Carry share of risk
Recommended where	KA is depreciating, surplus to requirements and its market potential can be reflected in the sale price	KA involves critical national infrastructure or security risk too sensitive for third party involvement	KA has unfulfilled development potential, undeveloped use-cases or unrealised income streams	KA relates to immature technologies where sales cycles and regulatory oversight may add lag and where public finances will not accommodate investment requirements alone
Examples				

Choosing a model to unlock the latent value within KA depends on the nature of the asset and the public sector organisation’s long term risk/reward appetite.

Whilst there are circumstances in which the conventional approaches of asset sale or organic commercialisation are appropriate, neither is likely to consistently achieve optimal societal and economic returns across the government’s knowledge asset portfolio.

In the former, assets risk being sold before they fully appreciate. In the latter, public authorities are required to leverage them within organisational environments not designed for scaling and commercialising products and services.

Many of the key competencies and capabilities required to achieve commercial scale reside more naturally within the private sector, making partnerships an attractive route. We show that Venture Studios and Government Venturing – combining the capabilities from public and private sectors through strategic partnerships - can become key tools for unlocking the value of the UK government’s existing knowledge assets.

We strongly recommend that public authorities, from central government departments to local councils, to universities and hospitals, add these models to their commercial portfolio.

This represents a viable monetisation route for any public authority with potentially valuable IP, data, brands, trademarks, capabilities or skills. Impetus should be led by central government, especially the Cabinet Office and HM Treasury.

Case study

ASSET SALE

Essex County Council – IPV4 Internet Protocol addresses

Internet Protocol addresses are numerical labels assigned to every device connected to a communications network. IPv4 is the fourth instalment of the Internet Protocol, with hundreds of thousands of addresses distributed across the public sector in the early 1990s and additional addresses only available via resale. As new standard IPv6 addresses are adopted across the global marketplace to 2025, the monetary value of IPv4 addresses is set to continuously decline.⁸³

In 2019 Essex County Council found that it had 65,000 unallocated IPv4 addresses that were surplus to requirements. It was able to generate more than £0.7m from selling a rapidly depreciating knowledge asset with few long-term value creation opportunities within the council. The one-off income generated from the transaction has been reinvested into supporting frontline services.⁸⁴

Asset sale

Where the government is unable to justify public ownership of an asset, it may choose to fully divest of it via a sale to the private sector for onward development. This may be appropriate where the asset is surplus to the requirements for efficiently delivering public services, where its value is depreciating and confers no synergies (or even negative synergies) with other assets, or where its potential is already established and can be reflected in its sale price.

Advantages

In the short-term, selling an asset or asset-driven entity can be an effective way to raise proceeds to plug funding gaps and reduce public debt. Taxpayers gain one-time receipts from the sale that can be reinvested into frontline services.

An example can be found in Essex County Council's divestment of unused and depreciating IPv4 Internet Protocol addresses in 2018, realising £0.7m for reinvestment into frontline services. Similarly, after five years of development the sale of the Green Investment Bank (GIB) to Macquarie Group Limited in 2017 by UK Government Investments (UKGI) generated a £186m surplus after repaying all taxpayer funding and additionally allowed it to benefit from full access to the capital markets.⁸⁵

Disadvantages

In selling an asset, the government gives up the opportunity to realise its long-term value, only benefiting indirectly via tax returns.⁸⁶ It further forfeits the right to benefit should new opportunities emerge to combine KA. This is particularly important when selling knowledge assets due to their synergistic nature, which typically renders them more valuable when combined with other assets. This means that it is unlikely that a knowledge asset has accrued maximum value without deliberate intervention.

Even where an asset is eventually divested, value accretion is greater if the vendor can demonstrate tangible market demand and the ability to service it with a profitable business model. The Public Record Office's premature sale of the 1901 census data to Genes Reunited via its PFI contract with QinetiQ resulted in the taxpayer missing out on significant upside (see case study).

Policymakers have to be careful to ensure that the potential short-term upside of an asset sale does not outweigh the longer-term economic benefit of retaining it or partnering with the private sector to accrue greater value.

Case study

ASSET SALE

The Public Records Office and Genes Reunited – KA - 1901 Records

In 2002, the Public Records Office - now the National Archives - made the 1901 census data available online via QinetiQ, under a PFI to digitise the data. Three years later, Genes Reunited – a commercial genealogy website - acquired the data and associated website rights for £3.3m. The government thereby gave up its rights to the newly digitised data.

Soon after the purchase of the census data, Genes Reunited was acquired by media company ITV for £120m. 4 years later, in 2009, ITV sold Genes Reunited to Scottish publisher DC Thompson & Co. for £25m. The genealogy website went on to become the largest family tree and ancestry website, with over 5 million members. Arguably, the Public Records Office missed out on a significant opportunity to benefit financially from its data by selling it to Genes Reunited prematurely.⁸⁷

⁸³ ESSEX.GOV.UK. 2019. IPv4 addresses - the 'hidden' asset. 18.

⁸⁴ Daily Gazette. 2019. Essex County Council could make £700,000 from selling IP addresses. 11.

⁸⁵ UK Government Investments. 2018. Green Investment Bank. 66.

⁸⁶ Depending on the method of sale, the asset value might take into account the discounted value of future cashflows. The government might therefore receive future benefits discounted for risk and the time value for money.

⁸⁷ Competition Commission. 2010. A report on the anticipated acquisition by Brightsolid Group Limited of Friends Reunited Holdings Limited. 8.

Organic commercialisation

Where public sector knowledge assets have commercial potential but transferring ownership would pose unacceptable risks, it may be more appropriate for government to commercialise them itself, either alone or through a third-party route to market.

Organic commercialisation is most visible in government trading funds, such as the Met Office or the UK Hydrographic Office, which must finance their operations via trading activity. Under this model the department itself generates income by permitting a third party to use its KA, most often through a licensing arrangement. In some cases, trading funds have been restructured into government companies ('GovCos') to allow for greater commercial focus and operational flexibility, as in the case of Ordnance Survey, the UK's national mapping agency.

Regulatory agencies are also having to become increasingly self-reliant, recovering their costs via commercial activities to make up for reduced grant funding. The Health and Safety Executive (HSE) received 8% of its income last year from commercial revenue, capitalising on its knowhow by sharing its research and expertise with domestic and international clients.⁸⁸

Organic commercialisation of knowledge assets can therefore be an effective instrument to generate additional, albeit sometimes limited, revenue streams for the public sector.

Advantages

Wringing greater value from an asset while maintaining it in public hands can confer certain benefits for a public authority. From the outset, the public authority can set the direction for development of the product and service. In turn, by retaining full control of the business, government is able to keep all of the financial rewards from its investment, as well as keep all of the risks within its control.

Disadvantages

Operating across political, commercial and organisational constraints, the public sector has not been designed to scale innovative products and services or to develop existing capabilities for alternative use cases, leaving many of its KA underexploited. The government often finds it difficult to self-fund the speculative investments needed to exploit assets or to fund over a long enough period to see the investment pay out.

There is a material risk that the government misses out on important trading opportunities and that valuable innovations do not reach the mass market in a form that enhances productivity and service quality. In the case of the earlier Prince2™ methodology example, prior to the creation of Axelos, the host authority had been servicing demand rather than driving it. This resulted in sluggish growth and limited product development, with the majority of value creation captured by other parts of the value chain and fewer organisations deploying best practice standards⁸⁹.

Case study

ORGANIC COMMERCIALISATION

Met Office – Customer-specific premium services

The Met Office is the UK's national meteorological service provider and a trading fund of the Department for Business, Energy and Industrial Strategy (BEIS). It is a global leader in climate science and weather forecasting. As with other Public Sector Information Holders (PSIHs), the Met Office operates a dual approach to sharing its data. For all citizens and businesses, it offers a range of freely available weather and climate data on its website.

It also offers a large number of bespoke services for customers in exchange for a fee. The prices are set to reflect customer benefits relative to the market, and how the market is expected to develop. The pricing depends on the amount of data required and the time of locating the data within the archives, extraction, analysis and formatting.⁹⁰

The Met Office received £239.1m in revenue in 2018/19, with BEIS receiving dividends of £8.5m.⁹¹ Met Office data and know-how offers enormous potential for innovation, such as developing climate forecasting tools for industry and the opportunity to provide expert advice to the emerging space and satellites sector.



⁸⁸ HSE. 2019. HSE Annual Report and Accounts 2018/19. 34.

⁸⁹ This case study is outlined in more detail in chapter three

⁹⁰ Met Office. 2020. Pricing Policy. 39.

⁹¹ Met Office. 2019. Annual Report and Accounts 2018/19. 38.

Case study

VENTURE STUDIOS

Building GovTech ventures - PUBLIC

PUBLIC is a start-up accelerator and venture builder specialising in technology start-ups working to solve public sector challenges ('GovTech'). Since its inception in 2017, PUBLIC has launched, seed-funded and scaled a number of GovTech ventures in-house, aiming to create new companies that can transform the delivery of government services.

In 2018, PUBLIC launched FreeUp (now called 'Earnd'), a FinTech platform that partners with employers to deliver loan securitisation against employees' earned salary, allowing employees to access money from their salary quickly and at low-cost in advance of their payday. This helps employees to avoid reliance on payday lenders, or other forms of short-term credit when they face liquidity problems, or immediate cashflow requirements. Reliance on these forms of credit is particularly high amongst frontline NHS staff, so the long-term ambition for this product is to become a central part of an operationally efficient and sustainable healthcare system in the UK.

PUBLIC's model for identifying and scaling ventures begins with identifying key customer needs and pain points within the public sector before undertaking a market and competitor analysis. Ventures that are deemed to be commercially and strategically viable are then provided with seed capital, with PUBLIC establishing a founding team to drive them forward.

Public sector venture studios

Where knowledge assets involve immature technologies or risky and protracted sales cycles, a government start-up 'venture studio' may be an appropriate route to securing commercial returns.

In this model a commercial partner, usually a venture capital fund or a specialist venture builder, works with the government to spin out knowledge assets into a new start-up, in which both the government and the venture partner take an equity position. Unlike traditional R&D spin-outs, the third-party commercial partner acts as a strategic investor and equity holder, helping the public sector to capitalise, scale and commercialise the new business.

As with venture studios in the private sector, a key success factor is to assemble high-performing founding teams capable of scaling and commercialising a knowledge asset, supported and funded by a trusted commercial and investment partner.

This founding team of carefully selected operators, technologists and entrepreneurs could include the experts and technologists who originally created the knowledge asset within the public sector, as well as professionals with significant start-up and venture experience. The founding team (and beyond that, early employees of the start-up) retain the majority of the equity and control of the business.

The venture studio model focuses on perfecting a product-market fit over a long period of time by testing the product with multiple partners. A collaborative focus can allow for faster technology acceleration through testing across multiple use cases.

Given the various benefits that the government can offer beyond investment (including environments for early-stage testing, access to important datasets, relief from certain regulations, ability to provide first customers or contracts, brand signalling etc), it has many of the elements in place required to successfully seed and grow a business serving a public sector market: while retaining a stake in the commercial success in the company through an equity position.

The government's unique position in the market allows it to provide the necessary environment to test and develop a commercially viable product with public and private sector application. This process allows government authorities to de-risk the process of developing a start-up idea.

Public sector venture studios could adopt two approaches to create multiple long-term value-based businesses:

- A sector-based approach, with government finding venture partners to invest in and develop new ventures in key strategic sectors, such as healthcare, policing and security, and local government.
- A KA-based approach, with public sector organisations partnering with commercial partners to build ventures focused on a specific KA, such as transport data or healthcare IP.

An in-house team of entrepreneurs would identify and prioritise market opportunities with commercial potential and then work with the public sector partner not only to test and evaluate the idea, business case and go-to-market strategy, but also to bring together a team of founders capable of driving the idea forward. The venture partner would also deploy seed capital for getting the start-up off the ground, which could sometimes be complemented by government seed capital. To reflect the complexity, timeframe and risk involved in developing, launching, scaling and underwriting these ideas to the point at which they can seek external funding, the venture studio will typically receive a stake of between 10-40% in the company.

Studio ventures are geared towards further investment from venture capital players and, eventually, an 'exit' where the government and the venture partner both receive a final cash return at the point of private acquisition or public offering.

Case study

VENTURE STUDIOS

Supporting start-ups and spin-outs to scale – Capita Scaling Partners

Capita Scaling Partner (CSP) supports start-ups to scale, by providing them with strategic access to its network of clients, suppliers, investors and subject matter experts to support their long-term growth. CSP forms long term and strategic relationships with partner start-up businesses – these companies receive two dedicated resources who focus on helping them to grow. Recognising that growth outcomes take time to deliver, these relationships can last for 3-5 years.

Since being formed in 2018, CSP has worked closely with seven start-up businesses to help them scale. An example case study is Adepto, an HR Technology business which grew its top line by a factor of more than six times during an 18-month relationship with CSP, before the business was successfully sold to Degreed Inc (a US-based HR technology company). 65% of this growth was generated from business introduced to Adepto by Capita.

A further case study is Dragonfly AI, a predictive visual analytics platform which can predict with 89% accuracy what a person's attention will be drawn to when presented with an image. The technology was originally designed in research labs at Queen Mary University of London and is now being used by GSK, NBC Universal, Sony, CMS and CNBC, among others.

Government Venturing

Where assets have unfulfilled development potential, undeveloped use-cases or unrealised income streams, the most appropriate approach may be to combine the complementary capabilities of the government and existing private sector commercialisation infrastructure under a collaborative value creation model: 'Government Venturing' (GV).

We define Government Venturing as an innovative, flexible type of partnership, where the public sector and private operating companies venture together to release value from underexploited latent government assets. It is an end-to-end strategy to realise maximum value generation from latent assets, from the process of identifying an opportunity to creating a long-term revenue generating vehicle. This collaborative approach combines the best of public and private sector capabilities into a strategic partnership, developing innovative products whilst retaining benefit and ownership for the public sector.

Government assets increase in value as they become closer to commercial application. This is particularly true for knowledge assets, which require specialist expertise to be transformed from their raw form into something monetisable and useful to society. Where government is unable to maximise the benefits of its knowledge asset alone, a GV partner can offer the necessary support to develop and exploit it to deliver maximum financial, economic and social returns.

The Government Venturing model can provide access to the latest technology, business processes and technical knowhow developed in the private sector. This increases the speed of developing innovative solutions from government assets, important in a world of fast-changing technology where markets are shifting quicker than ever before.

Alongside know-how and skills, the private sector partner also brings access to financial resources to fund the development and growth of an asset. This can be particularly effective where an existing asset or asset-based function has increasing costs, or where it faces reduced government funding.

Case study

GOVERNMENT VENTURING

Fera – Building a world-class, commercially viable research institution

The Food and Environment Research Agency (Fera) provides scientific services, evidence and advice to government and commercial customers across the agri-food supply chain, in the UK and overseas.

The Agency's historic business model- 75% reliant on government funding- was becoming increasingly unsustainable under budget cuts, while its services were not being used to capacity. In 2015, the government therefore partnered with Capita under a joint venture with a view to defraying the cost of its services for public goods across a much wider business base while preserving its critically important national science capabilities.

Capita acquired a 75% stake in the joint venture in exchange for a £20m contribution to secure the agency's IP generation capabilities, as well as committing £14.5m in investments in the company to create new product and service offerings.⁹²

The cash injection enabled Fera to transform its operations through better recruitment, training and marketing. The Agency's back office systems and processes were replaced, thereby increasing efficiency through better project scheduling and resource planning. In addition, there has been a focus on business development to onboard new customers, including supermarkets, food manufacturers, chemical manufacturers, and other government agencies.

The strategic partnership has delivered considerable benefits to the taxpayer. Defra has described Capita as successful in reducing the operating costs by a third whilst enhancing the service level that the government requires. Before creating the venture, ownership of Fera cost Defra a total of £40m p.a.. Since 2016, the cost of Fera services to Defra have fallen from £17.6m to £14m, while total revenues have grown by more than 8% to £40m⁹³.

A key national capability - scientific services for the agri-food sector – has been made sustainable. Crown bodies have easy access to Fera's services through a 10 year supplier framework. Today, 600 research projects are conducted annually, from food packaging to insect bio-conversion.

⁹² DEFRA, 2015. Food and Environment Research Agency new £14.5m investment. 13.

⁹³ Companies House, 2019. Fera Science Ltd Annual report and financial statements for the year ended 31 December 2018. 20.

On one side of the partnership is a public sector organisation (central government department, Arms-Length Body, government agency, local authority, etc.) which owns a portfolio of knowledge assets. These assets can be at any stage of development - in raw form as IP, or partially commercialised. It may also confer synergistic benefit from other tangible or knowledge assets, such as brand signalling, product testing environments or customer channels.

On the other side of the partnership, an established private sector operating company brings the specific combination of skillsets required to overcome those barriers outlined in chapter three and unlock the asset's value including:

- Commercial know-how
- Digital and design expertise
- Product development knowledge
- Sales and marketing skills
- Transformation and programme management
- Operational delivery capability
- Access to capital investment
- Distribution channels and international routes to market
- Access to a diverse and innovative supplier ecosystem.



A Government Venture is not dependent on a specific financial or corporate structure. It can take the form of a joint venture (with varying equity stakes, share classes or other funding arrangements for each partner depending on value contributed at foundation and willingness to bear risk), gain-share, concession or licence (including the established Government Licence model). The choice of appropriate commercial arrangement is driven by the attributes of the asset, the nature of the commercialisation opportunity, and the ability of different parties to invest and take on risk. The common factor is that each party retains a share in the enhanced returns and carries some portion of risks.

Unlike Public-Private Partnerships (PPP) where the private sector invests in a project in return for a long term services contract, or traditional customer-supplier models where government is primarily seeking to cost-effectively deliver already-established services, a Government Venture combines public and private resources to co-create value and generate new revenue streams from untapped assets under a long-term mutually-beneficial partnership. It is this emphasis on long-term income generation and value creation which also sets it apart from corporate venturing, venture capital and private equity models that traditionally seek to pursue a short-term exit to a third party.

Ultimately, Government Venturing is an ambitious, long-term play that has public value creation at the heart of its mission. It offers a new way for the government to realise better value from its assets and achieve policy objectives, from driving innovation, to creating jobs, to developing sustainable new income streams to fund essential public services.

It represents an important new way for the government to work with the private sector to find new export opportunities and promote UK plc at a global level.

Key benefits

- Complementary capabilities increase development speed
- Assets can be at any stage of development
- Ventures can take a variety of forms of commercial arrangement
- Risks are shared and better managed
- Costs of core services can be defrayed across a wider base
- Funding, technology and distribution channels are broadened
- Emphasis is placed on long-term income generation and value creation
- Benefit and ownership is preserved

Chapter five:

How to build successful Government Ventures

Whilst each combination of asset, application and ownership requires a bespoke path to success, we have distilled a common set of implementation principles, based on our experiences of effective commercialisation through Government Venturing.

Success depends on identifying a clear and differentiated customer need, testing and iterating the solution, and deploying capital once product-market fit has been established.

This is achieved by working with the KA owner to identify which of its knowledge assets are potentially valuable to which end customer groups, devising a strategy for commercialisation (testing demand, financial viability and strategic alignment) and assembling the resources required to bring it to market.

Dedicating time and resources from the outset to collaborative discovery and validation, allows both partners to assure themselves that there is clear value creation potential for each party and that the opportunities being identified are compatible with their respective organisational objectives and strategies.

In practice these steps are followed iteratively, but we show them here in approximate chronological order.



Six steps to successful venturing

Outcome	01: Refining a clear, differentiated customer need	02: Identifying asset availability and suitability
	For a venture to have commercial viability, it must resolve a challenge for a specific end-user. The first stage of the Government Venturing process is therefore to understand and validate the potential 'market pull' for a concept.	At the same time it is necessary to determine which knowledge assets, owned by the public sector organisation, could have value to which end-user groups.
	<ul style="list-style-type: none">• Expert interviews• Desktop research• Stakeholder workshops• New and existing customer insight (past surveys, old interviews, existing customer bases and networks etc)	<ul style="list-style-type: none">• Knowledge assets and IP registers• Informational registers and software product logs• Observation and discussion with individuals within the host organisation including communications, commercial, R&D, operations and management
Approach	Together with expert interviews and desk research, stakeholder workshops help to explore the causes and effects of problems faced by potential end users, which could theoretically be resolved through the application of knowledge assets. This produces a clearly-defined problem statement so that the level of unmet need and customer willingness to pay can be validated with potential customers and against existing data (such as past surveys, old interviews, existing customer bases and networks etc). High level analysis of the target market should determine what solutions are available to address the problem and where gaps exist in the market. In some circumstances, the end-user challenge will be readily apparent as the asset is already serving a specific purpose or customer need, as in the case of Constructionline. For these assets, the focus at this stage is to identify new use cases to extend their reach.	Unless already understood, the initial discovery phase should include a rapid 'asset audit' to understand which KA are held, where and how they are being used and (where applicable) their registration status and rights ownership, through: <ul style="list-style-type: none">• Discussion with the communications team to understand which brands & designs are in use or dormant;• Review of knowledge assets and IP registers along with interviews with the commercial team, IP managers, R&D or programme leads and patent specialists;• Identifying ownership of information registers and software products, their quality, accuracy, and completeness of data, as well as opportunities to combine them to create new value propositions;• Observation and discussion with operational and management teams to log capabilities, methodologies, processes and skills.

Outcome	03: Developing the opportunity and assessing feasibility	04: Validating value potential and strategic alignment
	Thereafter, the discovery and validation stage helps to prove demand and viability of the solution, before a full business case can be developed. This materially de-risks the eventual product or service development.	Both partners must assure themselves that there is clear value creation potential for each party and that the opportunities being identified are compatible with their respective organisational objectives and strategies.
	<ul style="list-style-type: none">• Collaborative development involving government officials, developers, product designers and potential customers• End-user research and pilot user-group feedback• Seed capital	<ul style="list-style-type: none">• Discovery phase outputs• Target customers and go to market strategy• Addressable market and share forecasts; margin and potential pricing strategy• Development plan, likely investment, risks and time to bring the product to market
Input	Prototyping involves rapidly creating initial versions of a service or product (often referred to as a 'Proof of Concept') before obtaining feedback and updating, changing, or even abandoning features of the prototype. Each round of testing leads to relevant insights to the idea and a revised prototype.	A key feature of successful Government Ventures is alignment between public and private partners to follow a common set of objectives. The opportunity must be compatible with the public sector organisation's remit and the private sector partner's corporate strategy.
	In parallel, deep end user research is critical to developing successful products and services. Designers of new products must be prepared to engage regularly with end-users in order to ensure that they are building a product that fits a genuine need ('product-market fit').	The government must consider the commitment of the private sector partner to delivering public value objectives beyond commercial returns. They should further evaluate the company's previous experiences of working with the public sector, its expertise in building ventures, its ability and willingness to invest, and determine what return they are seeking from the venture.
	Once new ideas have been prototyped and tested with potential end-users, they should be piloted and tested to gather feedback and quality assessments in advance of full-scale commercial roll-out.	At the same time, the venturing partner must understand the strategic ambitions of the government organisation and their willingness to take on risk. They will also need to ensure that the government organisation is willing to commit to the timeframes involved in Government Venturing, as well as time and resources.
Approach	This stage typically requires some speculative investment to help prove demand and viability of the solution, before a full investment case can be developed.	Qualification and prioritisation decisions should be based on a robust business plan and go to market strategy, drawing on findings from the discovery and validation stage.

05: Shaping, creating and incubating the entity	06: Investing in assets, operations and growth
Each round of testing leads to relevant insights to the idea, a revised prototype and ultimately a Minimum Viable Product (MVP).	In turn, the executive team will aim to develop a customer base and enhance the asset to drive growth opportunities with the ambition to scale across the target market.
<ul style="list-style-type: none">• Entity structure, ownership, governance and constitution• Start up capital• Experienced senior team• Systems and infrastructure, technology selection, organisational design	<ul style="list-style-type: none">• Long-term finance• Resources, recruitment, training and embedded entrepreneurial culture• Engineering, marketing, product & scaling capabilities
The choice of commercial structure for the new venture will depend on the type of opportunity and the attributes of the asset: it could take the form of a joint venture, revenue share, or product licensing, among others.	The measures required to develop and optimise value generation from the KA will have been outlined in earlier stages but will be subject to iteration as new learnings are continuously identified.
Consideration should be given to ultimate exit paths allowing the government to fully divest its interest in full or in part at an appropriate point.	Priority areas are likely to include:
Typically, representatives from both parties will take seats on the Board or chosen governance structure.	<ul style="list-style-type: none">• accessing investors with long term return horizon and appropriate risk appetite• engineering product/service lines to market-fit,• developing technology, culture and service design• implementing pricing and channel strategy, alongside bidding, promotion and customer management infrastructure• deploying commercial product & scaling capabilities to establish the market or respond to opportunities• Tracking and delivering against agreed outcomes
In the case of an existing entity, the priority will be to optimise existing operations and adapt to a new operating model.	
In either scenario, training and communication are critical in establishing the accountable and entrepreneurial culture necessary for commercial success.	

Critical success factors

Real life experience shows how Government Ventures have been able to overcome the practical obstacles to equitable and effective value release, in a way not possible under organic commercialisation or asset sale. Below we survey five factors that are critical to the success of any Government Venture partnership:

1. An understanding that Government Venturing is fundamentally different to normal customer-supplier models

Government Venturing is a new approach that requires a change in the mindset of both the government and the private sector. Its success is dependent on both parties working collaboratively for mutual benefit.

The government therefore needs to understand that Government Venturing is fundamentally different to traditional customer-supplier relationships. Rather than seeking payment for delivering a service, the private sector partner is typically investing its own funds into the venture and may be the majority shareholder.

At the same time, it is the responsibility of private sector organisations to be responsive to changing objectives and circumstances among their public sector partners.

The governance structure of a venture, beyond simply commercial arrangements, is therefore crucial to enabling speed and innovation. This should find the right balance between meeting the unique requirements of the respective partners while allowing the venture itself the necessary freedom to achieve them.

2. Trust and transparency with respect to assets and their value

A Government Venture can only succeed if there is sufficient visibility of what assets are owned by a public sector partner, so that both parties can determine if they can be exploited in potential use cases. As we have argued 'earlier', identification and valuation of KA pose significant practical and methodological challenges that require a skillset rarely found in the public sector.

Government agencies should therefore be willing for the partner to audit its IP to understand what assets it owns, their value, and how they can be meaningfully applied to address concrete problems. The 'going in' value when an asset is made available to the venture must be agreed by both parties on a fair basis.

This depends also on a commitment to commercial transparency on the part of the private sector partner.

3. A commitment to dedicate resources and high-performing individuals

A successful Government Venture is built on the talent and potential of its team. The combination of public/private skills of the team are particularly important as Government Ventures often operate across both markets.

Alongside an experienced management team, the government should therefore encourage high-performing officials to be seconded to the entity to contribute to its long-term growth and direction.

In turn, the private sector partner must commit to bringing its capability and resources to bear, blending private and public sector skills and cultures and being transparent where it needs to access a wider supplier ecosystem.

4. A willingness to share risks and rewards under a different definition of success

Government Venturing is an ambitious commercial approach, and not every venture will be successful. Both partners must be open to taking risks to reap potentially long-term payoffs.

In particular, decision-makers must be willing to see Government Ventures as projects where returns are sometimes only realised in the long-term. Both public and private partners must be able to define success in a new way and to adopt more flexible key performance indicators (KPIs) to track innovation projects.

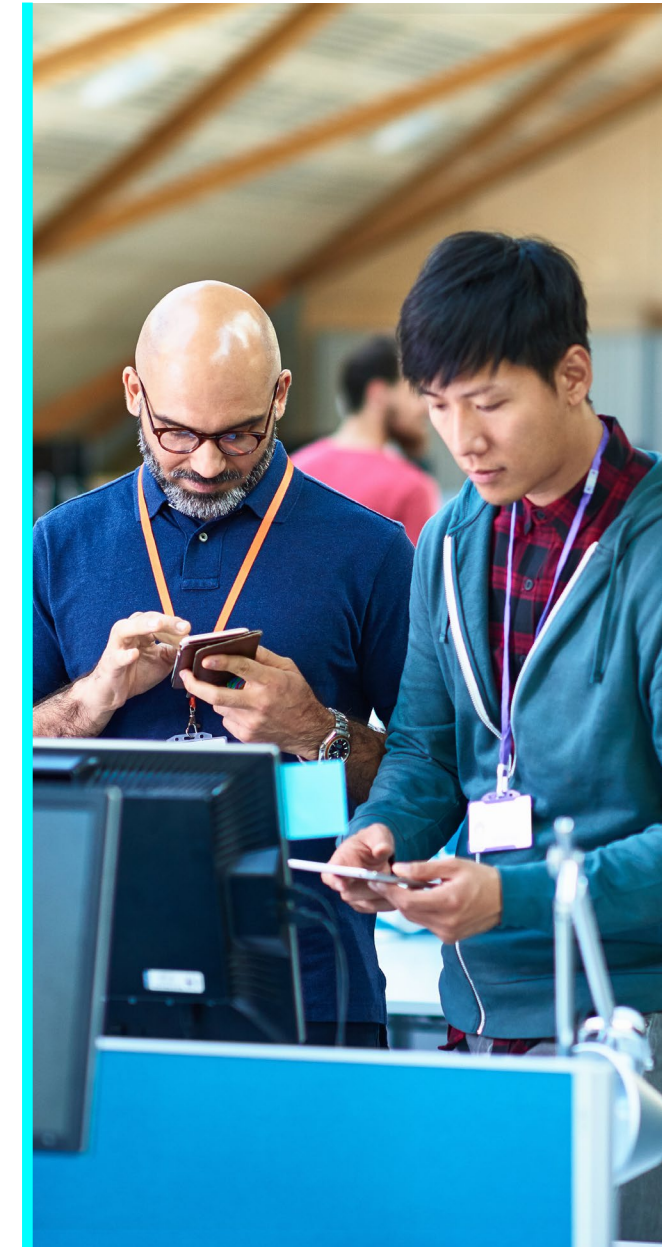
They should adopt a portfolio view to Government Ventures - whilst each individual venture may not succeed, at a portfolio level the successes should be able to outweigh any failures if well managed.

The Government Venturing model allows the public sector to transfer some or all of the risk to the delivery partner, while offering them the opportunity to develop profitable long-term partnerships. This is important. Commercial officials – understandably – rarely feel comfortable investing on their own in non-priority projects where they see higher risks. The Government Venturing approach, however, is designed to leverage the expertise of the venturing partner to identify and mitigate risks from the outset while enabling them to sit with the party best able to manage them.

5. Recognition of HM Government's role as an innovator

Ultimately, successful commercialisation of KA depends on the government reimagining itself as a genuine innovator, moving away from solely business-as-usual activities to develop a culture of experimentation and balanced risk-taking.

Leaders across the public sector must be empowered and encouraged to understand and exploit the innovative potential hiding among its assets.



Chapter six:

Scale of possibility

Government Venturing has the potential to transform the way government derives value from its knowledge assets. Executed at scale, it will generate important income to offset growing government debt, create new export opportunities, and unleash innovation in the economy



Commercial returns

We estimate that Government Venturing could, in time, generate over £5bn in annual commercial returns for the UK⁹⁴.

This would represent a significant income stream as the government manages the financial consequences of Covid-19, as well as the financial benefits of new tax revenues for the Exchequer and new jobs contributing to a higher employment rate.



UK balance of payments contribution

Once KA are able to generate a steady stream of revenue via commercialisation, the next step would be to scale products and services to international markets where possible. Capita's own experiences of Government Venturing, points to anywhere between 25% and 80% of commercial returns via exports. Even at the lower end, we might assume that KA could bring in as much as £1.25bn in export returns. These export values will contribute to the government's objectives of improving net trade balance.



Job creation (and executing at scale)

Achieving these returns will depend on the government's ability to commercialise KA at scale. For example, applying benchmarks from Microsoft and Axelos - companies that generate returns mostly through intangible assets, we might assume that achieving £5bn in returns would require a workforce of over 20,000 FTEs. Building up to this scale would obviously take time.

Auxiliary benefits to the UK

The potential benefits of Government Venturing are not only financial: The economic and social returns from innovations are just as important.



Bring innovation into the public sector

Government Venturing enables public sector organisations to apply the latest digital technologies and skills to their knowledge assets, to find new ways of exploiting them. It thereby seeks to drive product innovation that can benefit public officials, as well as its customers. In turn, exposure to market-leading technology products and services will ensure that the government stays up to date with current and future trends in technology and innovation.



Transform working cultures in the public sector

As the government attempts to develop its skills and working cultures to be fit for the modern economy, working with external innovators can play an important role. This idea is often referred to as 'open innovation' – 'the paradigm that assumes that firms should use external ideas as well as internal ideas, and internal and external paths to market'.⁹⁵ Exposure to new ways of working will allow the government to embrace new ideas such as working in small, agile units, as well as developing a better understanding of risk.



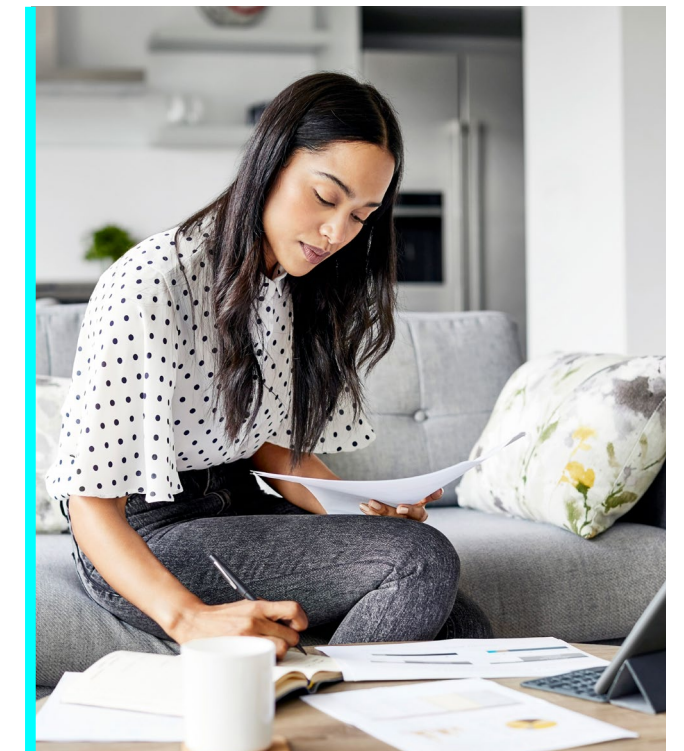
Create high-value technology jobs

Innovative new companies generally experience high organic employment growth, with a focus on developing highly-skilled workers with the technical skills and commercial acumen to navigate digital markets. Building Government Ventures can drive job creation and create a new generation of talented officials with the ability to manage the assets that are defining the digital age.



Position the UK as a global leader in key areas of the digital economy

Exploiting its knowledge assets through Government Venturing will allow the government to find new opportunities to identify and commercialise important innovations at scale, positioning the UK as a global leader in emerging technologies.



⁹⁴ The methodology behind these estimates is detailed later in this chapter

⁹⁵ Chesbrough, Henry. 2005. Open Innovation: A New Paradigm for Understanding Industrial Innovation. 7.

Methodology

Calculating potential return

We have adopted the following approach to calculating the potential return from KA, based on the overall value of KA in the public sector and the potential rates of return set out below.

Ultimately, we would expect it to be possible to generate indicative benefits of over £5bn per year from commercialising knowledge assets.

	a) Asset base	x	b) Rate of return	=	Theoretical income stream
High	£150bn	X	14.9%		= £5.57bn
Low	£37.4bn		3.5%		= £5.35bn

Estimating employment

Using proxy ratios from Microsoft (a company that exploits KA generate most of its revenue) and Axelos (an established Government Venture) creates indicative estimates of the potential for job creation were the public sector to fully leverage its Knowledge Assets.

	Microsoft ⁹⁶	Axelos ⁹⁷
Net profit	£30,909m	£20m
Employees	144,000	97
Relative scale of UK KA opportunity	1/6 x	250 x
Equivalent employees per £5bn net profit	23,000	24,000

Quantifying the asset base

As we have set out throughout this paper, there are a number of methodological and practical challenges to identifying and valuing KA. This means that existing data on KA stocks is incomplete and limited.

Nonetheless, the UK public sector officially records ownership of £37.4bn worth of knowledge assets in the Whole of Government Accounts (WGA).⁹⁸ The majority of these KA are held by the MoD and relate to the development of military equipment (£24.6bn), with the remaining assets categorised as capitalised development expenditure (£6.6bn), software (£2.4bn) and licences (£3.8bn). As we mentioned earlier, current government accounting standards do not recognise several classes of KA, including data, brands, training and know-how, and organisational capital. To use the example of Axelos, the Cabinet Office’s project management expertise was not previously registered on the public sector balance sheet, despite its subsequent success when commercialised.

A more comprehensive estimate by the SPINTAN project of the total value of the knowledge assets owned by the UK public sector shows that the number has grown strongly in recent years and puts the current figure at £150bn. Nonetheless, this number also excludes several classes of assets, such as data and brands, meaning that the knowledge asset base could be higher in the UK public sector. While some assets will have greater potential than others, it could be assumed, theoretically, that every KA could be commercialised.

We take these data sources as the upper and lower end of our asset estimation range.

Range: £37.4bn (Low) to £150bn (High)

Determining the rate of return

SPINTAN recommends use of the ‘Social Time Preference Rate’ (STPR) to determine the return from KA. At 3.5%, the STPR is the rate used for discounting future benefits and costs in order to trade-off the value society attaches to present, as opposed to future, consumption. This rate is the minimum return required by the HM Treasury for a commercial project, as set out in its Green Book.⁹⁹

The ONS has estimated the private sector non-manufacturing rate of return to stand at 14.9% in Q4 2019. The rate of return is calculated as the economic gain (profit) shown as a percentage of the capital used in production. ‘Net’ refers to the rate of return after having accounted for the current value of capital consumed and capital stocks. According to this measurement, services have experienced a higher net rate of return than manufacturing for the past five quarters.¹⁰⁰

We use these figures as lower and upper bounds for the rate of return. Within these bounds, two further reference points include the return on assets through commercialisation of IP created at DSTL by its subsidiary Ploughshare Innovations (5.7%)¹⁰¹ and the net rate of return on private non-financial corporations, including manufacturing (9.3%).¹⁰²

Range: 3.5% (Low) to 14.9% (High)

⁹⁶ Microsoft Corporation. 2019. Annual Report. 40
⁹⁷ Axelos Ltd. 2020. Report and financial statements 2019. 3.

⁹⁸ HM Treasury. 2019. Whole of Government Accounts. 28
⁹⁹ The STPR does not include compensation for taking risk.
¹⁰⁰ ONS. 2020. Profitability of UK companies: October to December 2019. 49.
¹⁰¹ SWQ Ltd, Assessment of the economic and wider benefits of Ploughshare Innovation. 62.
¹⁰² ONS. 2020. Profitability of UK companies 49.

Chapter seven:

Recommendations for the government

We believe that government needs to implement an end-to-end strategy to rapidly and effectively unlock value from publicly-owned knowledge assets.

We outline seven key recommendations that the government should implement to harness this enormous opportunity.

01:

Public authorities should make it a priority to add the Government Venturing model to their portfolio of commercial strategies.

Government Venturing

This paper has shown that the government can gain significant rewards from exploiting its knowledge assets. But existing models for commercialisation have generally failed to deliver sufficient returns to the taxpayer.

Government Venturing, as set out in chapters four and five, offers a novel way of realising their value.

As demonstrated through case studies, it helps to overcome each of the barriers set out in chapter three – enabling collaboration to identify and value assets, offering access to investment with an appropriate risk appetite, and establishing organisations in which commercial capabilities and a culture of innovation are intrinsic.

Executed at scale, it can transform government's role as an innovator in the digital economy, generate new revenue opportunities and help drive economic growth.

02:

The Knowledge Assets unit and the Cabinet Office should support every department to produce, and report against, a Knowledge Assets plan.

Departmental KA plans and national reporting system

The departmental strategies should be guided by a KA framework that provides public officials with a step-by-step approach to managing their assets and reviewed annually at the Spending Review. Each one should set out one or two pilot opportunities to exploit KA within a year.

Every public sector organisation should submit an annual report on what knowledge assets it owns, their individual values, and how they have been exploited. These reports should be published on a new national data reporting platform so that decision-makers can track their development internally and recognise opportunities for collaboration across the public sector.

Properly recognising the value of knowledge assets on balance sheets will keep the focus on departments' obligation to exploit them. As in Singapore and Queensland, this would provide a clear expectation and mandate for public sector leaders to recognise themselves as Knowledge Asset owners on which they have a responsibility to generate returns, offsetting the cultural barriers outlined in chapter three and giving them the confidence to act entrepreneurially.

03:

The Cabinet Office, the Treasury, and the Intellectual Property Office should establish a training programme to equip public officials with the relevant skills to identify and exploit government-owned KA.

Knowledge assets training programme

Implementing a French-style training accelerator would support government bodies to identify their KA, determine their potential, implement appropriate protection and find opportunities to exploit them.

This should include forums for cross-fertilisation of experience from established public sector KA businesses, such as the Behavioural Insights Team, Fera, Axelos and Transport for London, as well as members of the commercialisation ecosystems such as Ploughshare, Public and Capita.

<p>04:</p> <p>Government departments should work together with commercial partners to set up venture studios in strategic sectors to nurture early stage opportunities.</p>	<p>05:</p> <p>The Knowledge Assets unit and dedicated ‘venture leads’ within departments should foster networks of partners to aid commercialisation.</p>
<p>Public sector venture studios</p> <p>Drawing on lessons from successes such as Ploughshare Innovations, Public and Dragonfly AI, we have shown that working with specialist venture builders offers an alternative funding model with the long-term risk/return appetite required to allow faster acceleration of immature technology which might otherwise never reach the economy.</p>	<p>Venture leads and networks</p> <p>As we outline in chapter three, it is rare to find the necessary combinations of skills, supply chains and investment sources within a public sector organisation to properly bring an asset into the economy.</p> <p>Part of the remit of the Knowledge Assets unit should be actively to build networks with the private sector to help agencies find the right commercial partners, along the lines of the USA’s NTIS preferred provider network.</p> <p>Each government department should also appoint a ‘venture lead’ with the responsibility to manage and build partnerships with the private sector.</p>

<p>06:</p> <p>Government departments and industry should create sector-specific data exchanges to improve data sharing between the public and private sectors.</p>	<p>07:</p> <p>Government should build an official marketplace for public sector knowledge assets.</p>
<p>Data exchanges</p> <p>We welcome the observation in the National Data Strategy consultation document, that</p> <p>“ To succeed, we need a whole-government approach led by a Government Chief Data Officer from the centre in strong partnership with organisations. We need to transform the way data is collected, managed, used and shared across the government.”</p> <p>We encourage the government to set up data exchanges across several public sector verticals to provide a streamlined approach to data sharing between the government, businesses, citizens and data-users. For example, Ofgem is currently in the process of launching a Data Exchange to improve the sharing of energy market data. This model should be expanded to other sectors, including transport and mobility, geospatial, and smart cities.</p> <p>As an interim step, we hope that the National Data Strategy will clarify guidance and frameworks on the safe, ethical and acceptable usage of information across organisations for greater public gain.</p>	<p>A ‘knowledge assets marketplace’</p> <p>We have shown throughout this report that commercialisation is often most successful when the government partners strategically with the private sector. However, it can be difficult for the government to identify the right partner.</p> <p>Building an IP marketplace, along the lines of Canada’s ExporeIP¹⁰³, would allow public officials to advertise ownership of their knowledge assets transparently and attract potential collaborators.</p> <p>As far as possible, it should contain all of those categories outlined on page 15, including shelved concepts and dormant assets.</p> <p>Such a marketplace would offer a centralised online platform for businesses to explore possible licensing and collaboration opportunities with public sector knowledge asset holders.</p>

103 This case study is explored in further detail in chapter three

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Acknowledgements

The analysis in this white paper was conducted through a combination of primary research, including telephone interviews, and secondary research, which included analysis of case studies and data from Capita and PUBLIC's respective databases on government innovation.

Even with the resources put into this research project, the scope and granularity of our analysis was limited by the lack of publicly available data.

This white paper is the result of the collective ideas, experience, and input from countless people, who have shaped our thinking around knowledge assets and Government Venturing. In particular, Capita and PUBLIC would like to thank the following contributors:

Alex Bjornson, Policy Advisor, Knowledge Assets Team, HM Treasury

Charles Price, Deputy Director, HM Treasury

Rikesh Shah, Head of Commercial Innovation, Transport for London

Thomas Vogt-Skard, Ex-Deputy Director, Cabinet Office

Dr Andrew Swift, Chief Executive, FERA Science Ltd

John Doherty, Chief Executive, Entrust Support Services

Matthew Hunt, Chief Operating Officer, Axelos

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