

# Commoning Intellectual Property: Public funding and the creation of a knowledge commons



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—Duncan McCann  
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# Executive summary

The UK public sector spends over £14.4bn every year, directly and indirectly, funding research and development (R&D) to address some of the major challenges we face as a society today. Often, these are challenges that the market is either the primary driver of, or unable to address, such as climate change, youth unemployment, obesity, aging, and inequality.

However, any intellectual property that results from publicly funded research does not belong to the public, who paid for it, but instead is available for the private sector to enclose and profit from. Indeed, the state does not recoup anything directly for that investment. The state is left to cross its fingers and hope that it receives a satisfactory return on its investment in R&D through economic growth, the creation of new jobs and the corporate and private tax that this leads to. However, what historically may have been true is today highly contested. Many companies are very good at minimising their local tax bills by creatively structuring their businesses while the innovative new companies, especially the tech-based ones, do not generally create mass employment opportunities. We contend that this needs to change, with the public sector taking more direct ownership of the resulting IP in order to share more broadly in the rewards, rather than just the risks.

The idea that the state should just facilitate, administer and regulate the economy, rather than engage in more direct directing and management, started gaining wide acceptance in the 1970s.

This is now changing.

Probably the most important piece of intellectual property (IP) being worked on now is the search for a vaccine to Covid-19. This discovery, which could probably be written on a small piece of paper, would be one of the most valuable assets on the planet, both socially and economically. This IP could have been generated in broadly three different ways. Firstly, it could have been developed using purely public sector money, including the fundamental research as well as testing and trials. Secondly, it could have been created purely through private endeavour (although actual cases of this are rare). Finally, and most likely, it could have been created through a mix of private and public sector money. Although each of these three cases differs in the contribution that public money played in generating the result, they also share some things in common, notably that the public sector would not own any part of the resulting IP. All the profit would flow to the private sector owner of the IP and that should the public sector wish to use the IP it would need to pay for it. This makes no sense economically and does not represent good value for public money.

We urgently need a new system that allows the public sector to leverage the investment that it makes in R&D. The goal of any new system should be to recognise the role of the state as a major funder of R&D by changing the ownership regime, maximise innovation, license that IP from publicly funded R&D with purpose in mind and ensure that the non-monetary value of IP can be leveraged.

We proposed the creation of a Public IP Commons that would change the way that the IP from publicly funded R&D is owned and managed. We propose that the public should retain ownership of the IP that results from publicly funded R&D. The public sector also contributes significantly to private R&D by offering substantial tax

credits, through R&D tax credits, or relief, through the Patent Box relief scheme, to companies and there is a strong rationale for the public sector should retain some ownership of the IP covered by these subsidies.

We then propose that all public IP should be managed by the IP Commons Management Body. The body would operate a licensing regime that would need to avoid the problems of being too exclusionary and too open, learning from the management of other commons. Just like all successful commons, we must ensure that there are proper rules and mechanism to govern and manage access to this new IP commons.

Although these arrangements would be novel with regard to the distribution of public funds for R&D these arrangements are commonplace in any private sector organisation where the output of the work that one is paid to do, either as an employee or consultant, becomes the property of your employer. The government would merely be adapting and improving on existing practice within the private sector.

Our proposal has several benefits over the existing model. It clearly acknowledges the nature and significance of the investment of public money into R&D and ensures that any resulting IP is owned collectively. The proposal for the Public IP commons also aligns the public sector's risk and reward when funding R&D. At present the state certainly takes its share of the risk, often investing in early stage innovation, with its hyper speculative returns. The public sector should be able to reap direct returns. A system where the IPCMB retains direct ownership and control of the IP offers an opportunity for the public sector to set different targets for the use of its IP. We believe that this will ensure that the IP is utilised to maximise potential innovation, since it will be available for all to use,

while ensuring a return for those using the IP commercially, all the while retaining the power to provide special licenses when there is a real social return.

When companies are required to pay for licenses the IPCMB should allow for that payment to be made in money or equity. Being able to pay for the license in equity reduces any potential pressure on company balance sheets while also further increasing the sharing of risk and reward in the innovation process. Another benefit of the proposed IP Commons is that it does not necessitate any reform of the national and international IP regime, which is complex and difficult to change, but merely seeks to align the private sector regime to the public sector.

We need to urgently need to change from the status quo. We hope that this paper will be part of the important discussion that needs to take place about how best to recognise the new role of the state and how to ensure that the IP that we the public fund delivers most benefit to us. The Public IP commons will radically change the domestic R&D sector and enable a large quantity of IP to be accessed by more companies and individuals fostering a more innovative economy.

# 1. Introduction

Many of the most valuable assets in contemporary capitalism are not physical assets like land, buildings or machinery, but creations of the collective human intellect, such as a copyright on a design or patent on an innovation. Because these ethereal concepts cannot be possessed and protected like physical objects or space, a specific legal and policy architecture has been created giving extensive rights to the owners of this ‘intellectual property.’ The principle right is the exclusion of others from using one’s intellectual property without explicit permission, with those who do subject to legal action.

Intellectual property is a relatively new concept, emerging in the late 15<sup>th</sup> century in the Venetian Republic, where exclusive rights began to be offered to those introducing new innovations, either through import or invention.<sup>1</sup> In 1624, England enacted the Statute of Monopolies<sup>2</sup>, which rewarded inventors with strong property rights over their innovations and enabled them to capture significant monetary rewards. Some have argued that this incentivised innovation and enabled the industrial revolution to flourish in Britain<sup>3</sup>. This idea was so powerful that it was incorporated into Article One of the US constitution, which states that Congress should, “promote the progress of science and useful arts, by securing for limited times to authors and inventors to the exclusive right to their respective writings and discoveries.”<sup>4</sup>

As time progressed, and the US established itself as a global innovation superpower, it became received wisdom that intellectual property in the form of copyright, trademark and patent protection

was necessary to encourage innovation and the creation of new ideas and inventions such as machines, drugs, computer software, books, music, literature and films.

As the products of collective thinking, wide-reaching intellectual communities and the sharing of ideas, this logic of protecting the fruits of private resource and capital investment does not, in many respects, make intuitive sense, although some have argued forcefully against this, by positing that impedes innovation and concentrates wealth.<sup>5</sup> However as the public sector has engaged more actively in funding research and development (R&D) using public money, the intellectual property that emerges from that research has not become the protected property of the public realm; rather, it is currently enclosed and appropriated by private owners. Although public sector intervention has often been focused on addressing specific market failures - with benefits accruing to the public sector through the newly functioning markets, thereby creating jobs and extra tax receipts, the following section outlines, how this role for the state in investment has changed over time.

Today, the UK public sector is a major player in the innovation business. Our analysis<sup>6</sup> of ONS data shows that the UK currently invests over £9 billion per year directly into research and development (the primary means by which new IP is created) through the various research councils and Innovate UK, the UK's innovation agency. The state also provides over £5.4bn in tax credits and relief to encourage the private sector to invest further in R&D. Under the current model, any intellectual property output of this directly or indirectly publicly funded R&D is left for the private sector to enclose and develop. We contend that this needs to change, with the public sector playing a more active role and sharing more broadly in the rewards, rather than just the risks.

In section 2 this paper will expose the changing nature of the role of the public sector in making investments, which now go far beyond market fixing, and address why it has become an ‘entrepreneurial state’ setting the direction of innovation. Yet, while the public sector takes on considerable risk in this new landscape, it does not share directly in the upside of its investments. Section 3 will look in detail at the UK direct public investment in R&D both in terms of scale and direction as well as the tax credits and reliefs that are used to incentivise further R&D in the private sector. Section 4 will explore problems with the current model of private enclosure of publicly funded R&D. The final section will describe how a Public IP Commons, as well as other models, could both spur more innovation and ensure that the public realises rewards for the risky investments it makes.

# **2. Beyond Market Failure – the Rise of the Innovative State**

The role of the state in the economy has always been contested. Neoclassical economic theory, which dominates most major economic departments of universities and thinking within national treasuries, holds that the primary goal for the state should be simply to correct market failures. These failures could be an externality that is not properly accounted for; a public good that is currently not being funded; or a monopoly exercising undue power or price gauging. The theory then holds that once the failure has been addressed, the state should step back in order to reap the rewards of now properly functioning market which should deliver growth together with increased jobs and tax revenues.

Even within the narrow frame of the role that such economic thinking sets out, everyone benefits considerably from the investments made by the state. As Mariana Mazzucato has written, even free market fundamentalists: “gain directly through the roads you drive down, the rules and policing which ensure their safety, the BBC radio you listen to, schools and universities that train the doctors and pilots you depend on, parks, theatre, films and museums

that nurture our national identity. You also gain, indirectly, through enormous public subsidies without which private schools, hospitals and utility providers would never be able to deliver affordably and still make a profit.”<sup>7</sup>

The idea that the state should just facilitate, administer and regulate the economy rather than engage in more direct directing and management started gaining wide acceptance in the 1970s. These ideas have received newfound popularity in the aftermath of the recent global financial crisis and used to target reductions in government spending and debt, often arguing that reducing government spending will not lead to stagnation and collapse but instead generate additional private investment.

This kind of thinking led to policies like the one introduced by the Labour Party in 2002, which reduced the time that private equity funds must be invested to be eligible for tax reductions from ten years to two years.<sup>8</sup> As Mazzucato argues, such policies ‘increase inequality, not investment, and by rewarding short-term investments at the expense of long-term ones, they hurt innovation.’<sup>9</sup>

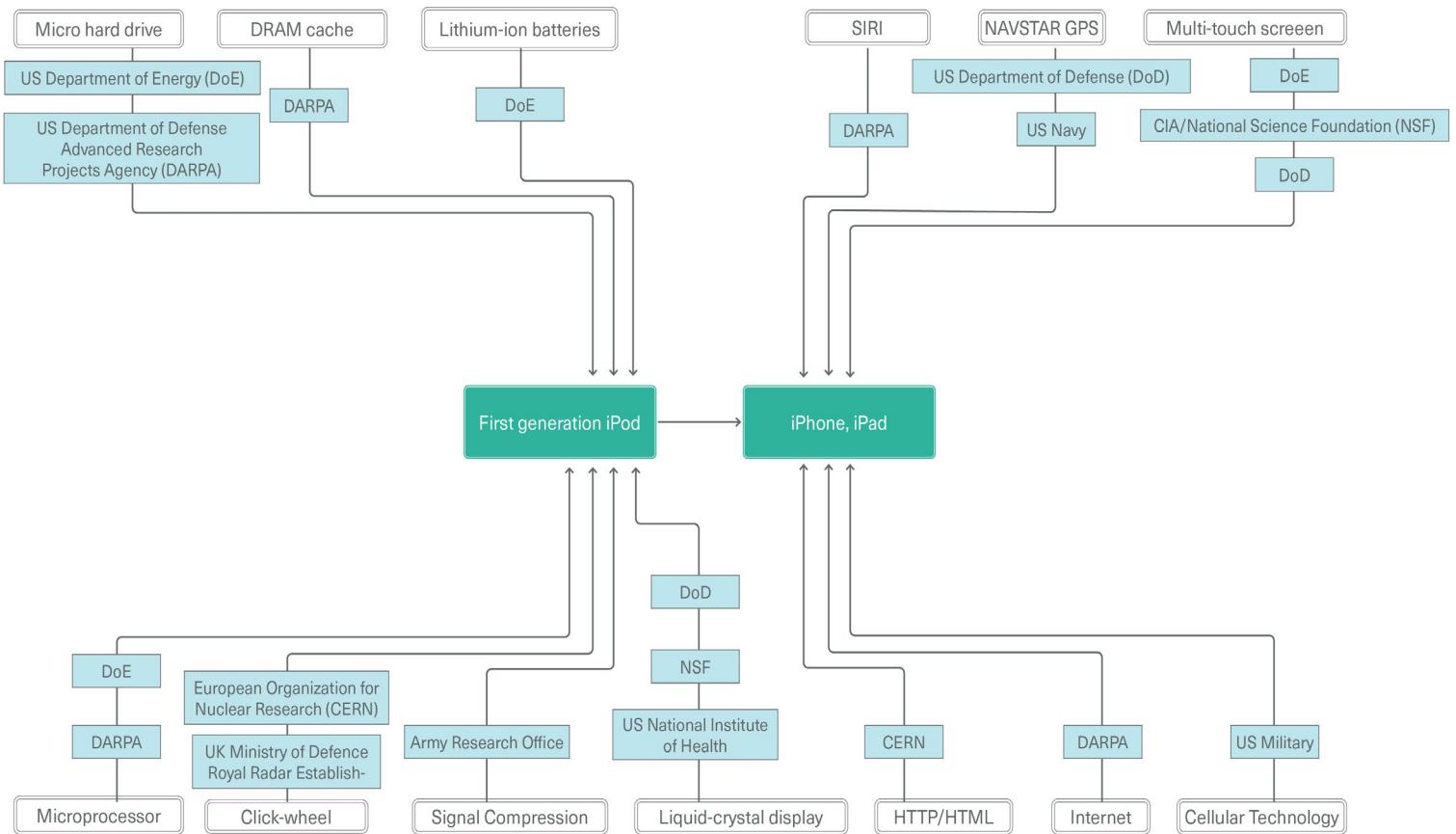
Just as the state has led the development of infrastructure that makes our lives possible it will also need to take a lead in addressing some of the major challenges that we face as a society today, often ones that the market is either unable to address or in fact the primary driver of the problem, things such as climate change, youth unemployment, obesity, aging, and inequality. The development of the Covid-19 public health emergency has made these challenges more acute.

Despite these enormous challenges, many governments are reluctant to explicitly target large-scale investment programmes to tackle them. Often, their actions are limited to creating tax

incentives, enabling legislation or providing public money for R&D, usually implemented in such a way that the state gets nothing direct in return. However, as our analysis of ONS data reveals in the following section, these limited actions operate at considerable scale, with tax incentives and public R&D spending totalling £14.4bn in the UK in 2017-18. The same is true in the US, where even though publicly funded R&D has been happening quietly, it has nevertheless delivered significant results as evidenced by the development of key components of the iPhone, outlined in Box 1

## **Box 1 – The public money behind the iPhone**

One of the icons of the modern world is the smartphone and within that category the iPhone still rules the roost since it was first launched in 2007. For many it seems like the culmination of private sector genius, embodied by the likes of Apple's CEO Steve Jobs and Chief Design Officer Jony Ive, and they, as well as many others, certainly played a very significant part in the success of the product. However, as Mariana Mazzucato revealed in her book *The Entrepreneurial State*, in fact, the US government directly funded and developed many of the key technologies that make up the iPhone. The diagram below, taken from the same book, shows some of these technologies alongside the US public sector bodies that developed them. This analysis highlights the fact that most useful innovations are not the product of a single genius or even a single company but instead are derived from a multiplicity of sources, with the public sector playing an important but under-appreciated role in the process.



Source: Mazucatto, "The Entrepreneurial State: Debunking public vs. private sector myths" (2015, p. 116)

The moral of this story is not that the government could have developed the iPhone or that the team at Apple were not exceptionally gifted in making transformational products. The key takeaway from this example is that the state made a huge investment in multiple diverse technologies, from the microprocessor to the internet to GPS. Moving forward, however, there remains a need for the state to reorient its investment toward tackling today's social challenges. To fail to recognise this in the narrative of innovation hampers the ability of the state to replicate this vital innovation in the future. Also, much of this innovation would never have been funded by the private sector, because the investments were too large, the risk too high, and the pay-off (at the time the investments were being made) seemed implausible.

These issues beg key aspects of innovation that need to be managed to ensure an evolving and successful economy. First, there is the question of scale. An economy needs to conduct R&D and invest in innovation in order to ensure that new businesses, jobs, products and services are created. Second is the question of direction, and whether the R&D is pursuing the right questions to meet the challenges that we face today and will face in the future. The state is an important actor addressing both questions.

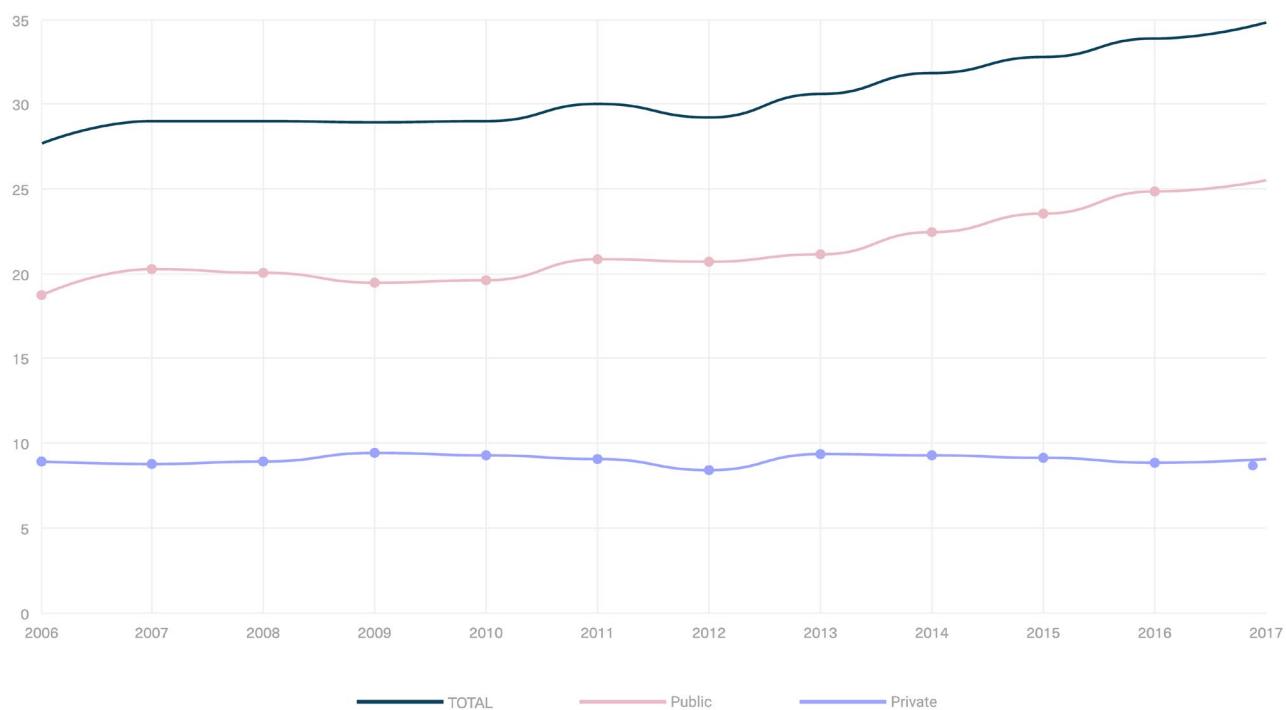
The argument that the state should be written (back) into the story of how innovation is driving the modern economy ‘in letters ten foot high’ is agreed by all but the most libertarian commentators, even by those who question whether this conclusion merits any significant policy change.<sup>10</sup> The primary contention of this paper is that not only should the story of innovation be amended to include the active role of the state but, given its major role in directly and indirectly funding R&D, that we should also rethink the way in which the state shares in the upside of its risky investments as well as shouldering the costs.

When the private sector invests in R&D, it does so with the explicit goal of creating new products and services, often in the process creating IP to protect and monetise them. Under the current system, all public sector investment that does the same thing (that is, create new products and services) is subsequently free to be enclosed by the individuals and companies that are funded, using public money, to do the research. This is the case even when the public R&D spending has proved transformative, creating entirely new markets and sectors, including the Internet, nanotechnology, biotechnology, and clean energy.

# 3. UK Investment in R&D

Within the UK, analysis of ONS data shows that almost £35bn was spent on R&D in 2017, up from £27.7bn a decade earlier in 2006 (in 2017 prices). Chart 1 makes clear that the entirety of that increase in R&D spending has come from the private sector, which in 2017 accounted for £25.5bn of the total, up from £18.7bn in 2006. This contrasts with the direct public sector spend on R&D, which has remained substantial but stable at around £9bn.

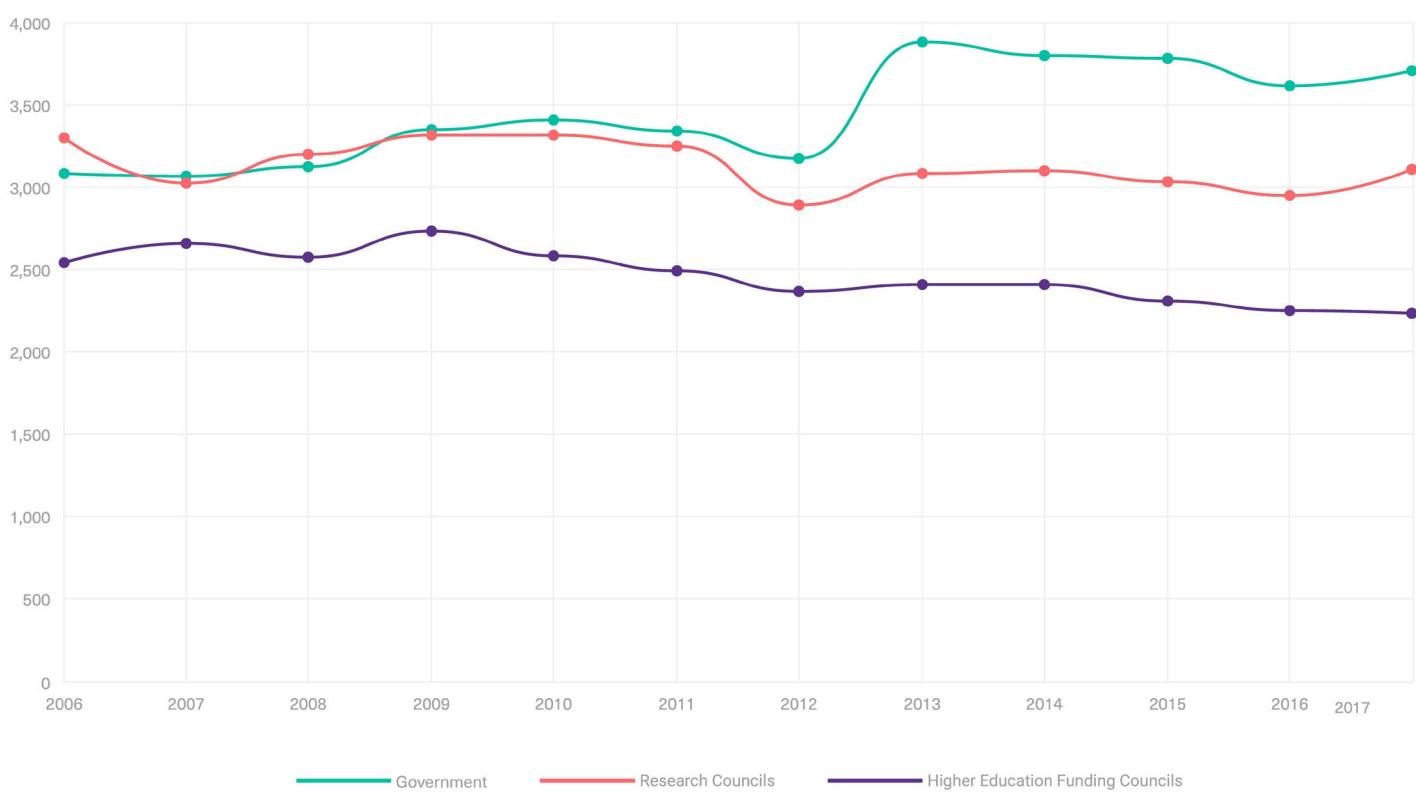
**Chart 1: Total UK R&D spend, including by Funder type, in constant 2017 prices (£m)**



Source: ONS UK Gross Domestic Expenditure on Research and Development (R&D), 2017, published 14 March 2019

There are three main funders of R&D in the public sector: The Government, the research councils and the higher education funding councils. Chart 2 below shows the amount of spending on R&D that these three different parts of the public sector spend per year. The breakdown shows that higher education funding councils and research councils spending has dipped slightly from £2.5bn to £2.3bn and £3.3bn to £3.1bn respectively, whereas the government has increased its spending on R&D slightly, from £3bn to £3.8bn.

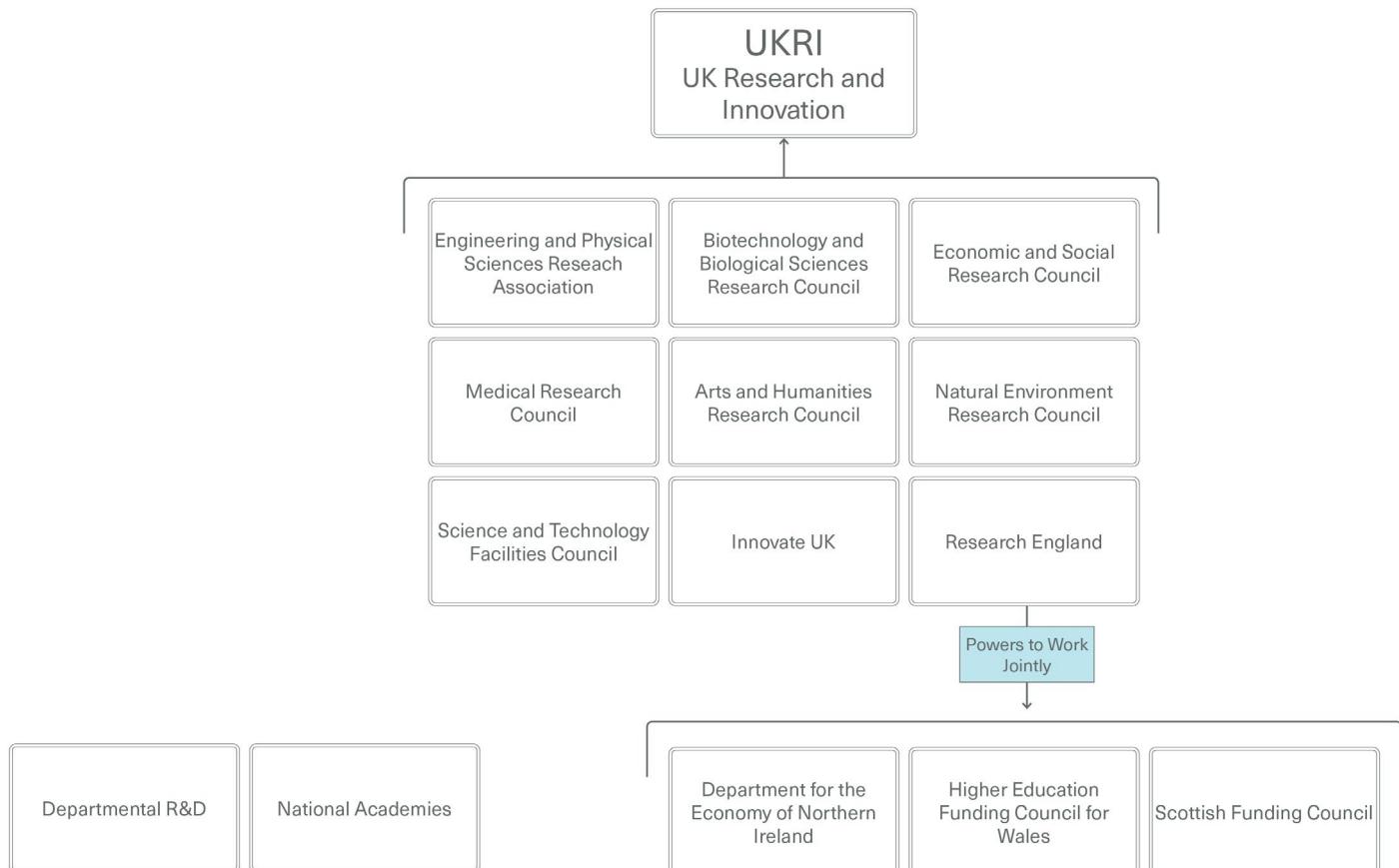
**Chart 2: Breakdown of UK Public Sector Funding, constant 2017 prices (£m)**



Source: ONS UK Gross Domestic Expenditure on Research and Development (R&D), 2017, published 14 March 2019

There are currently five different types of public organisations that fund R&D. As we will see this demonstrates that the public sector already has a diverse range of organisations through which it can target R&D spending in specific areas. Three of those sit with UK Research and Innovation: Innovate UK, research councils, and Research England. Innovate UK is the UK's innovation agency, which gives grants directly to companies with the intention of de-risking, enabling and supporting innovation. The seven Research Councils,

divided by discipline and shown in the diagram below, support R&D by providing grant funding for specific projects to independent researchers. Finally, Research England takes over the England-only funding of knowledge exchange through the distribution of quality-related block grants to higher education institutions, especially universities. They have the power to work jointly with equivalent bodies in Northern Ireland, Scotland and Wales. The collective experience of all these organisations and the people within them will be vital as the public sector seeks to expand its capacity to not just manage a sophisticated grant programme but also take ownership and control over the resulting IP.



Source: The Royal Society. "How does the UK government invest in R&D?". 2017

In addition, two types of funders of public R&D sit outside of UKRI. These are government departments and the national academies. Government departments, including those of devolved

administrations, fund specific R&D activities intended to contribute to good policy development and evaluation. This can be carried out through a wide variety of institutions including Public Sector Research Establishments (PSREs) such as the Met Office. The UK's four independent National Academies receive funding for key programmes that help to deliver Government priorities, including supporting excellent researchers and distributing some of the funding for schemes such as the Global Challenges Research Fund (GCRF) and Newton Fund.

Those doing the funding and those doing the research do not always sit within the same part of the economy, as table X demonstrates. It shows, for instance, that of the £3.7bn that the UK government spent on R&D, nearly £1.8bn was carried out by the private sector, representing almost 50%. In contrast, of the £25.5bn spent in total by the private sector on R&D only £3.1bn, just 12.2%, was carried out by public bodies. It is important to note also that the research councils and Research England (including other UK nation bodies) fund R&D almost exclusively in the public sector since that is what their mandates require.

**Table 1: Flows of research and development funding in the UK, 2017 (£m)**

	Sector doing the R&D				
	Public Research	Higher Education	Business Enterprise	Private Non-Profit	Total
Sector providing the funds:					
Government	1,220	590	1,793	102	3,705
Research Councils	681	2,246	4	174	3,106
HEFCs	-	2,236	-	-	2,236
Higher Education	18	-	210	13	241
Business Enterprise	35	358	18,285	23	18,700
Private Non-Profit	56	1,288	93	359	1,796
Overseas	187	1,455	3,299	84	5,024
<b>Total</b>	<b>2,197</b>	<b>8,173</b>	<b>23,684</b>	<b>755</b>	<b>34,808</b>

Source: ONS UK Gross Domestic Expenditure on Research and Development (R&D), 2017.

One particularly interesting aspect of the public sector spend on R&D are the grants given directly to companies through Innovate UK in order to support pre-defined areas of strategic importance. The types of investment category that Innovate UK use can be seen in table X along with the level of investment since 2003. Some recent examples saw Jaguar Land Rover receiving a grant to improve autonomous car sensors, while another was given to a company developing swarms of robots to work on building projects.

These investments of public sector money into private companies do not only help drive innovation, which should benefit us all, but also have a material benefit to the companies themselves. Beauhurst, a company that tracks innovation and high growth companies, found that receiving public backing also made it easier for those companies to secure other private investment and that companies that received both public support, through Innovate UK grants, and private support, through equity investment, outperform those that receive only one.<sup>11</sup>

**Table 2: Grants provided by Innovate UK by Investment Category, 2003-2020 (£)**

Innovate UK Investment Category	Sum of Grant Offered (£m)
Ageing Society, Health & Nutrition	1570
AI & Data Economy	602
Clean Growth & Infrastructure	1315
Connect	122
Global	58
Investor Portfolio Lending Investment	0.15
Manufacturing, Materials & Mobility	4951
Open & Commercialisation	1043
Strategy	1.7
<b>Grand Total</b>	<b>9667</b>

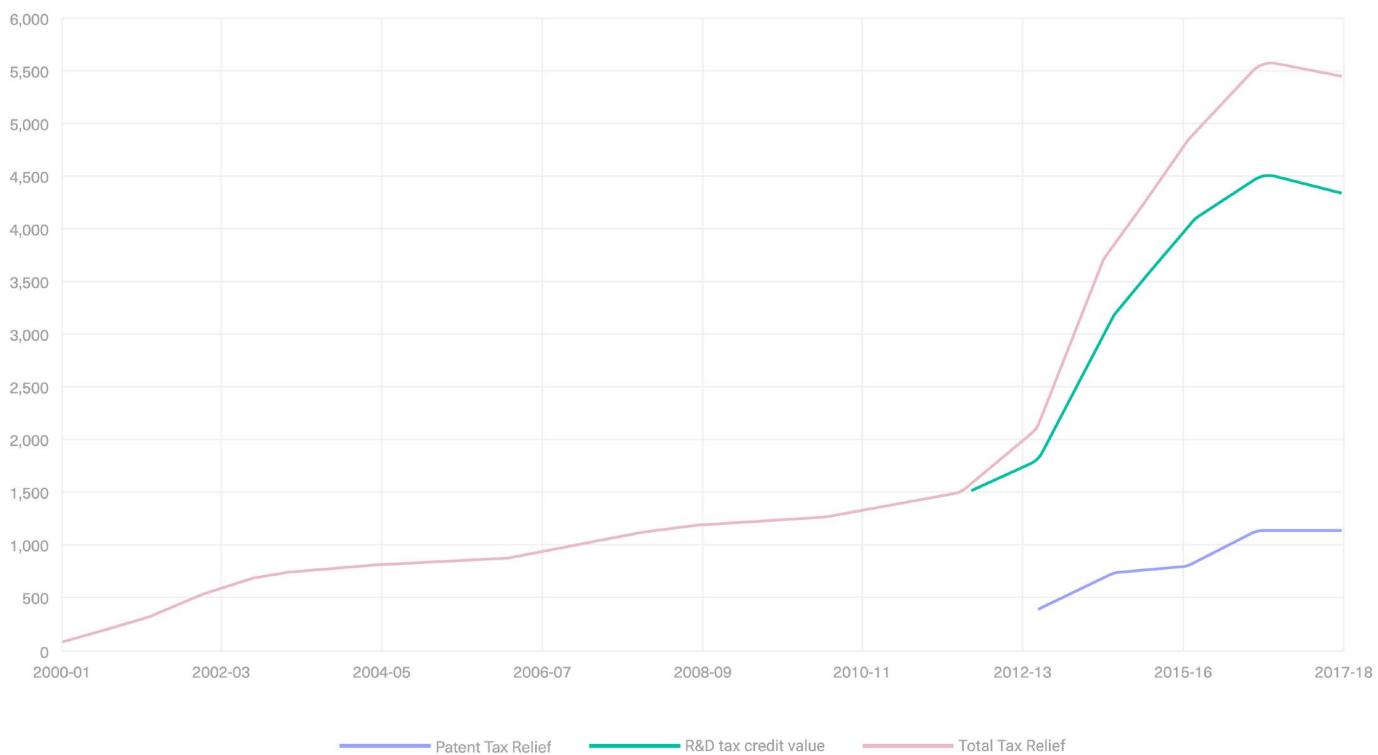
Source: Innovate UK Total Funded Project Data, downloaded 28<sup>th</sup> Feb 2020

The final way that the public sector supports R&D is through the UK tax system's allowances, reliefs and credits. There are two principle policies that apply here: The R&D tax credit system and

Patent Box tax relief system. R&D tax credits support companies that work on innovative projects in science and technology that researches or develops a new process, product or service or improves on an existing one. It can be claimed by a range of companies, from SME to multinational. In 2017-18 the tax credits claimed by the SME sector amounted to £2.5bn while for large companies it amounted to £1.8bn. It can even be claimed on unsuccessful projects. As Chart 3 shows it has grown from a minor part of the tax system accounting for only £98m of relief upon introduction in 2000-1 growing to a substantial £4.3bn in 2017-18. [12](#)

Patent Box tax relief, introduced in 2013, allows companies to apply the lower rate (10% versus the main rate of 20%) to profits earned after that date that are specifically ‘attributable to patents and equivalent forms of intellectual property’.

**Chart 3: Cost of support claimed for the R&D tax credit and Patent box tax relief, by financial year, in constant 2017-18 prices (£m)**



Source: HMRC Research and Development Tax Credits Statistics

# 4. Why we need a new model

Total public sector spending on R&D, both directly and through tax relief, was £14.4bn in 2017-18, and yet receives no direct return.<sup>13</sup> Given the scale of this investment of public resources, it is therefore important to look at the value that the public sector gets in return. Unlike when the private sector invests in R&D - whereby it would seek direct monetary returns either by monetising the specific product or service that had been created or improved through the investment, or by licensing the IP itself to others - the public sector currently expects to receive its return indirectly, through increased tax receipts and employment. As well as making sense to seek more direct returns, albeit not always financial, for the public from the state's spending on R&D the changing scale and nature of the public investment in R&D outlined in the previous sections re-enforces the reason why we should also rethink the way in which the state shares in the upside of its risky investments.

## — **Indirect Value Capture not enough**

Many economists believe that the state already receives a satisfactory return on its investment in R&D through economic growth, the creation of new jobs and the corporate and private tax that this leads to. The reality, however, is more complex. Many large companies are very good at minimising their local tax bills by creatively structuring their multinational businesses in order to record as much profit as possible in low tax jurisdictions. Google, for example, whose game-changing search algorithm was developed

with funding from the National Science Foundation,<sup>14</sup> is a master at this tactic.

The employment benefit is also somewhat questionable, especially around tech driven automation businesses none of which are mass scale employers. Earnings per employee are often wildly higher in modern business than they have been in the past.

NESTA's Stian Westlake argues in a direct response to these arguments that the corporation tax system still raises a considerable amount of money, totalling £54.4bn in 2018/19. He asserts that '[t]his isn't the Late Roman Empire. The tax system raises a lot of money, enough to fund generous innovation investment.'<sup>15</sup> Such commentators also raise the point that if tax collection from large multinationals is the core of the problem, we should focus on fixing that system, which already employs many thousands of people, rather than create an entirely new mechanism to reward the state for its investment. Enacting country by country accounting systems<sup>16</sup>, which force multinational companies to report on revenue and profit by country thereby enabling local tax collection, or revenue-based taxes (as opposed to profit-based taxes), such as the proposed Digital Services tax,<sup>17</sup> would be good examples of potential solutions.

A clear counter argument to 'fixing' the corporate tax system is that since capital and business is now so mobile, even the threat of additional taxes could result in the company moving staff and operations abroad. This risk has had a massive chilling effect on the national and global tax regime, therefore reinforcing the need to tackle the ownership of the IP rather than attempting to recoup public benefits solely through fixes to the tax system.

Although reforming the tax system is, separately, necessary and important, this need for reform is not an argument against the public sector, as the direct funder of R&D, having the right to own the IP output of the research it funds. This is especially the case if the ultimate aim of any reform, as in this paper, is to maximise innovation by making the IP as available as possible at as low a licensing cost as possible while ensuring that those companies who profit from the usage of IP generated through public funds also pay back into the pot, thereby enabling more R&D to be funded and/or release funds for frontline services and other uses.

### **— Reliefs and Tax credits are an ineffective public subsidy to private companies**

In addition to the public money that is given directly to a wide variety of companies and institutions to conduct R&D for which the public does not receive a sufficient return, we should also scrutinise the revenue forgone through reliefs and tax credits. With current revenue forgone from R&D tax credits and Patent Box relief amounting to over £5.4bn in 2017-18<sup>18</sup>, this represents a major subsidy to private companies by the public sector and should be re-evaluated as carefully as direct expenditure.<sup>18</sup>

The effectiveness of reliefs and credits at promoting additional R&D that would not otherwise have occurred is highly uncertain. For instance, the Patent Box Relief's ultimate policy aim is to increase the number of patents developed in the UK as well as to ensure that new and existing patents are further developed and commercialized in the UK. Nonetheless, the IFS notes that its 'primary stated goal .... has not been achieved' and that if the system does achieve this goal, 'it seems a fairly inefficient way to do so.'<sup>19</sup> This relief overwhelmingly benefits large companies, who account for 96% of total relief claimed.<sup>20</sup> In addition, IPPR has calculated that

the deadweight loss associated with the R&D tax credit system is significant, at over 80% for large companies and between 57-67% for SMEs.<sup>21</sup>

This means that the public is forgoing significant tax revenues for very little gain; these tax credits and reliefs must therefore be brought into the frame when thinking about any reform of the wider mechanisms through which the public captures revenue returns from R&D.

Our contention is that any public contribution through the tax credits and reliefs should also accrue a share in the ownership of the intellectual property. This would have an immediate effect in two ways. Firstly, if the consequence of receiving these reliefs and tax credits was to cede some ownership rights, we would expect the deadweight loss to reduce substantially since there would be a cost to the business of getting it, in addition to the obvious benefit. Secondly, it would be expected that total amount of corporate tax receipts would also increase because fewer businesses would request the credits and relief.

### — **Closed IP regimes reduce innovation**

There is a powerful tradition in conventional economic thinking that holds that strong IP protection, through the granting of monopoly rights by the state for a limited but substantial time, is a key driver of innovation in an economy, and consequently for economic growth and the overall health of the economy. However, recent research is challenging this narrative, and even suggests that ‘when patent rights have been too broad or strong, they have actually discouraged innovation.’<sup>22</sup> We contend that the state should not overly restrict access to IP from public research. It should certainly not behave as so many actors do today in the IP space as

they seek to maximise returns through litigation or overly restricting the use of the IP to benefit one or a small number of companies.

The case studies included below on the sewing machine and steam engine, two vital innovations for the industrial revolution graphically illustrate the problems of creating and enforcing too broad and strong an IP regime. Although in the historic cases the counterfactual to IP protection was no protection at all, even in these cases, as Petra Moser of the National Bureau of Economic Research finds, ‘data indicate that the large majority of historical innovations occurred outside of the patent system. Moreover, they reveal that countries without patent laws, such as Switzerland and the Netherlands, were at least as innovative as countries with patent laws.’<sup>23</sup>

## Case Study 1: Sewing Machines

The sewing machine in its many forms is an integral part of the modern economy. But this was not always the case, and the transition to more automated forms of the machine in the mid-19<sup>th</sup> century provides an illustrative example of patents and patent boxes holding back innovation.

In 1846 the US Patent and Trademark Office issued patent 4750 to Elias Howe for an “Improvement in Sewing Machines” which was so broad that most sewing machines were covered. Howe then tried to enforce his patent by collecting fees from all those he considered to be infringing it, allowing him to collect millions. Other firms ended up counter-suing Howe, resulting in the production of any machines coming to a standstill for 5 years.<sup>24</sup>

In order to resolve the situation and the competing patents, the first ‘patent pool’ was created in 1856. A patent pool is a consortium of at least two companies agreeing to cross-license patents relating to a technology. Although this resolved the problem of litigation, with sewing machine production subsequently restarting, it also resulted in a reduction in new patents being generated, only increasing again after the pool terminated in 1877.<sup>25</sup> As well as the number of patents, sewing speed - a generally agreed proxy for innovation in sewing machines - also slowed after the creation of the pool and increased after 1877. An interesting comparison can be drawn with the UK, which did not experience the dip after 1856 nor the upswing after 1877.<sup>26</sup>

## Case Study 2 – The Steam Engine

The steam engine, almost more than any invention, is central to the industrial revolution. The story of its development is also one of the most common examples given of the damage that patents can do when their owners use them to restrict access and hamper innovation. As great an inventor as Watt was, he was also ‘had a highly detrimental impact on the rate of innovation in steam technology.’<sup>27</sup>

There are two strands to the evidence for this accusation. Firstly, the behaviour of Watt himself and his many successful attempts to stop rivals from either copying his designs outright or improving on the design at all. He did this by ‘deftly played the patent card to out-trump rival steam engineers—even, perhaps especially, those who promoted more efficient engines.’<sup>28</sup> Secondly economist Boldrin and Levine developed a measure for the speed of innovation in steam engines which showed that until 1800, when Watt’s patent expired, ‘there was no increase in the duty of steam engines<sup>29</sup> at all,

as Boulton and Watt successfully sought to prevent competition by suppressing innovation.<sup>30</sup>

After 1800 two developments increased the rate of innovation dramatically. First was the expiration of Watt's patent and the second was the development by Richard Trevithick of his more efficient high-pressure steam engine, and his momentous decision not to patent it.

There are couple of clear lessons that come from the economic literature looking at the impact of IP rights regimes. The first is that, in general, the best balance between the rights of the owner of IP and society at large is to have an IP regime which bestows 'narrow and short-lived' ownership rights.<sup>31</sup> The second is that when competitors form patent pools to share IP between themselves this can lead, as in the case of the sewing machine, to a reduction in innovation.

It is therefore vital that any Public IP commons does not act to overly restrict access to the IP that it holds even though this may be a way for it to maximise its revenue. However, as the following section outlines, just making the IP fully open is also not the answer, as this would be likely to have similarly negative consequences.

### — **Fully open regimes have downsides**

Although making all IP from publicly funded R&D fully open would ensure that anyone could freely use it, while also encouraging more innovation that could build on the freely available IP from the Public commons, this strategy is not without issue, and risks the most powerful companies benefiting disproportionately.

The primary issue with fully open IP regimes is that the benefit tends to be captured most effectively by the most powerful players in a sector. This is often at the expense of the individuals who have dedicated time and effort to produce the IP, quite often in an unpaid capacity.

Modern technology has given us several interesting examples, from the world wide web, gifted to the world by Sir Tim Berners-Lee, to open software, with the most famous example being Linux. While both are in fact examples of private R&D being made open, they show that great innovations - once opened – are catalysts to support further innovation.

### Case Study 3 – Linux

Linux, a free operating system kernel<sup>32</sup>, which now supports a multi-billion-dollar industry was started in 1991 by one man, Linus Torvalds. What started out as ‘just a hobby, won’t be big and professional’<sup>33</sup> now counts Intel as its most active contributor, since it shapes how it designs its chips, and is the core product of RedHat, which had revenue of \$3.4bn in 2019.<sup>34</sup> Today everyone from Google to NASA, IBM to the New York Stock Exchange all use the open source software within their operations in some form.<sup>35</sup> However, a report for Linux’s 25<sup>th</sup> birthday did highlight that over 13,500 people have actively contributed to the project over its life.<sup>36</sup>

While the development of Linux clearly shows is that operating an open regime can lead to increased innovation in that product as well as increased economic activity, what is also shows however is that in the end the major benefits are being harvested by a small group of companies.

An interesting alternative was the mapping of the Human Genome which was a race between private sector corporations who wanted to own and control the blueprints to life itself and the publicly funded project that wanted to ensure that the results were open and could not be owned by any individual or company.

### Case Study 4 – Human Genome Project (HGP)

The HGP was officially launched in 1990 with a goal to map the genes in the human genome. It was formally declared complete in 2003 at an estimated cost of \$3bn<sup>37</sup>. The project and the open data about the blueprints of the human body that it created is being used by a wide variety of fields from molecular medicine to understanding diseases better, to the advancement of forensic science to biofuels.

These massive benefits were almost enclosed within corporate IP rights. In 1998 a private company, Celera Genomics, recognising the huge potential monetary value, decided to enter the race. In 1999 Celera filled over 6500 patents for whole or partial human genes.<sup>38</sup>

Fear of life being patented ultimately led to Clinton and Blair to broker an agreement in 2000 between the HGP and Celera to share data and jointly publish under open standards the results of their research.<sup>39</sup>

The case study illustrates that there is some material which we should never allow to be patented and that in this case a fully open regime was the only way that such intrinsically important data should be published.

The conflict between open and closed IP regimes have also spawned two interesting projects that attempt to tread a middle ground and give the creators of IP some control over how their creation is used. These are creative commons and copyleft. Although both have emerged for specific types of IP with creative commons for any copy-writable material, such as text or a picture, and copyleft mainly for software and artistic works, they both try and maximise the openness of the use while also tackling the propensity of those who want to profit either by making them pay, as in the case of creative commons, or by forcing them to make the resultant work also open, as in the case of copyleft.

### **Case study 5 – Creative Commons**

A Creative Commons (CC) license is one of several public copyright licenses that enable the free distribution of material. A CC license is used when an author wants to give other people the right to share, use, and build upon a work that they (the author) have created. CC provides an author flexibility (for example, they might choose to allow only non-commercial uses of a given work) and protects the people who use or redistribute an author's work from concerns of copyright infringement as long as they abide by the conditions that are specified in the license by which the author distributes the work.

Unfortunately, Creative Commons licenses vary greatly and can be difficult to understand in themselves. Although most have a basic understanding of copyright most would not be able to differentiate between a CC BY vs. a CC BY-SA vs. a CC BY-NC-SA license. Also, because CC permits a range of protections from quite open and quite closed it is interesting to note that many authors who use the system prefer the more closed options.<sup>40</sup>

Although systems like CC are complex and are hard to enforce and use for individual authors and other creators this does not necessarily pose a massive challenge at the institutional level. Should the state wish to retain ownership over the IP that it funds and license it under many different types of licenses each would be understood by the two parties involved in the transaction and could be enforced by law. What is challenging when dispersed and where enforcement is often between individuals becomes more straightforward when between organisations.

## Case Study 6 – Copyleft

Copyleft is ‘is a strategy of utilizing copyright law to pursue the policy goal of fostering and encouraging the equal and inalienable right to copy, share, modify and improve creative works of authorship.<sup>41</sup> At its core is the principle that any piece of software or artistic work may be used, modified, and distributed freely on condition that anything derived from it is bound by the same conditions. Under a copyleft license it is therefore always possible to use the piece of IP but never possible to enclose it.

Copyleft licenses are much less common than Creative Commons licenses since the requirement that any development built on the IP should also be copyleft is a much greater protection against enclosure, but also makes monetisation harder. This can be problematic for those in the private sector, spending their own money on R&D and taking all the risk, but this is not the case for publicly funded R&D. In this case those doing the research are paid with public money and the public therefore also take on the risk. These positive, but niche, innovations in IP licensing offer us a glimpse of what might be possible for a much wider portion of our collective intelligence.

# 5. Beyond Private IP – Towards an IP Commons

In this section we will explore what, given the type (section 2) and significance (section 3) of the public sector investment R&D, together with the issues with the current model of value capture and restrictive access (section 4), that could look like. In this section we will look at how the IP generated from public funds could be managed.

Many different institutions and organisations have produced interesting alternatives to the existing system. Here our goal is to have a system that: recognises the role of the state as a major funder of R&D on changes the ownership regime, maximises innovation, ensures that IP from publicly funded R&D is licensed with purpose in mind and ensures that the non-monetary value of IP can be leveraged.

We will now explore two of the most exciting proposals for reform in this area before offering our own contribution, the Public IP Commons and evaluate how they meet our goals.

## Publicly Funded Venture Capital Funds and Innovation Dividends

The government would establish a publicly funded and owned venture capital firm which would actively invest in companies, in the same way as private venture capital firms, for which it would receive an equity stake. Alternatively, if the money was used for R&D then it could negotiate a stake in the resultant IP through a licensing agreement.

Marianna Mazzucato points out that many countries from Israel to Finland already have funds that manage public money and actively invest and manage shares in companies.<sup>42</sup> The UK already has Innovate UK, which currently hands out grants to companies, but it could equally give money in exchange for equity, and work towards more strategic ends.

In order to understand the sort of opportunities that Innovate UK and the public sector are missing out on I want to look deeper into the two grants that were given to UK unicorns.<sup>43</sup> In 2009, Innovate UK granted £199k to Oxford Nanopore, which delivers disruptive technologies to the market, (a company now valued at £1.5bn), and in 2016 it invested £788k in the technology company Improbable (now valued at £1.55bn). It is worth considering the difference in outcome for the public good had equity stakes been taken into these two, fast-growing and now very successful companies.

Oxford Nanopore was started in 2005. In the 2008-9 fiscal year they generated a revenue of only £159k compared to almost £14m last year, with the company's valuation hitting £47.5m. This means that had the equity stake taken by Innovate UK been

proportionate to the value of the grant it would now be worth almost £5m. The numbers are harder to crunch for Improbable, but the company started in 2012 and was still losing money when it received the £788k from Innovate UK, along with £30m from private investors in series A funding. It then went on in 2017 to secure over £500m from Japan's Softbank Vision Fund which catapulted it to Unicorn status. Although the exact value is hard to calculate the equity stake would now be worth many millions of pounds. The head of Innovate UK has openly questioned whether taking equity stakes might be the future for the organisation acknowledging that 'political winds are changing.'<sup>44</sup> In 2017 the chancellor announced that a new national investment fund would 'help cutting edge start-ups become world leading unicorns.'<sup>45</sup>

To be clear, in most cases the public sector would not seek a controlling stake in any company, but instead hold minority shareholding. The size of the shareholding would be determined by the size of the investment, the current balance sheet of the company along with the company's future prospects. In some cases, it might be appropriate for it to receive preferred shares that have additional benefits such as priority in receiving dividends or increased voting rights.

This model has the state playing the private sector venture capital game, including being an active shareholder, and would only get a return if it made good investment decisions. This could allow the change in R&D funding to get support from a wider spectrum of actors.

This approach to innovation could be made more interesting by ensuring that any profit beyond that needed to further the investments of the fund would be distributed equally as an 'innovation dividend.'

This reform certainly would recognise the role of the state more explicitly since the fund would directly own a stake in many companies. Regarding the other three goals of maximising innovation and looking beyond the bottom line when making licensing decisions would depend on the detail of how the fund were to be established. However, it is conceivable that the desire to provide the innovation dividend could put pressure on maximising the monetary value which could hamper its ability to meet our goals.

### — **Specific Conditionalities on use of publicly generated IP**

Another way to align the risks and rewards for the public sector that avoids taking ownership stakes in companies and IP directly would be to impose specific conditionalities such as pricing controls for public goods and services or a requirement to manufacture locally, to stimulate productive entrepreneurship and job creation. The purpose of setting these conditions would be to ensure that the public sector has a greater ability to direct the benefits of investing in R&D are spread more evenly throughout the economy.

The excellent paper by Andrea Laplane and Marianna Mazzucato outlines four different areas in which conditions could have a positive impact on the local economy and society; pricing, knowledge governance, reinvestment and ‘other conditions’.<sup>46</sup> The logic around setting price controls is that it prevents the public sector pay twice for the same thing. This can occur when the public sector first funds the research, with the resulting IP enclosed by a private entity, who then uses that IP within a product or service that the public sector purchases. Therefore, setting conditions can be designed to minimise the burden of double payment by the public sector.

Andrea Laplane also highlights the potential of knowledge sharing as a key potential conditionality, noting that ‘the history of mission driven public finance shows that the creation and diffusion of knowledge were not spontaneous, but heavily reliant on the decisions of public funding agencies.<sup>147</sup> The benefits of sharing knowledge are greatest at the earlier stages of development, exactly when much private R&D is kept highly confidential. Thus, conditions that mandate knowledge sharing, especially in new technologies and innovations, can be hugely beneficial to society.

Conditions which require companies receiving public money to conduct R&D to reinvest a portion of profits or require local infrastructure or manufacturing can be a much more direct way of recovering some benefit for society beyond the indirect reliance on economic growth, job creation and their increased tax receipts.

While this reform should also be commended it is clear that this does not recognise the ownership of the state of the IP nor does it explicitly maximise innovation but it does allow the non-monetary value of the IP to come through as well as pursuing specific purposes with publicly generate IP.

## Creating an IP Commons

Our contribution to this debate is to put forward a new model that meets our four goals outlined at the beginning of this section. We propose to change the way that the IP from publicly funded R&D is owned and managed. We propose that the public should retain ownership of the IP that results from publicly funded R&D. We then propose that all public IP should be managed in order to avoid both the problems of being too exclusionary and too open, learning from the management of successful commons. Just like all successful commons we must ensure that there are proper

rules and mechanism to govern and manage access to this new IP commons.

### — **How it would work**

Under the new regime all intellectual property that is the result of publicly funded research would have to be assigned to the government by its creator.<sup>48</sup> This would require a change in the terms of the funding given out by the UK government which would stipulate that any IP resulting from the grant would need to be assigned to the government. Although these arrangements would be novel regarding the distribution of public funds for R&D these arrangements are commonplace in any private sector organisation where the output of the work that one is paid to do, either as an employee or consultant, becomes the property of your employer. The government would merely be copying existing practice within the private sector.

The government would create an IP Commons Management Body (IPCMB) which would administer the IP that was transferred to the government. The IPCMB would license out its IP using a variety of different licensing arrangements depending on the type of use and the nature of the entity requesting access to the IP. A licence is an agreement between the IP owner and another party. It grants them permission to do something that would be an infringement of the rights of the IP owner without the licence. The IPCMB should consider making all the IP Commons available under as 'licenses of right.' This is a designation endorsed by the Intellectual Property Office (IPO) and means that the patent holder has agreed to licence their patent to anyone who asks. The licence will still be an ordinary, commercial licence and the terms and fees will be a private matter between the owner, in this case the IPCMB, and the licensee, but the IPO will step in if terms cannot be negotiated. The main

advantages of having IP endorsed with a licence of right is that it sends a clear signal to companies and organisations that the IPCMB is happy to licence their IP.

The IPCMB would operate a different strategy than many companies and organisation that hold large quantities of IP. The IPCMB would not seek to maximise the monetary return but would focus on encouraging innovation while at the same time seeking a reasonable return. The IPCMB could use a variety of measures, including potentially Social Return on Investment,<sup>49</sup> to decide the appropriate license structure on a case by case basis. Once again, although these would be new activities for a government to conduct they are commonplace within the private sector and there are many companies and organisations that manage large and complex portfolios of IP issuing a variety of licenses with a variety of conditions and prices depending on the entity asking for the license and the aims of the holder of the IP.

The main difference between the IPCMB and the majority of other IP holders is that it would have a specific goal to maximise innovation in the economy through the use of the IP, while seeking a reasonable return from those who profit from its use. However, the IPCMB would also grant licenses at no cost for companies and organisations wanting to use or integrate the IP but generate no profit. This could apply to company structures that specifically mandate there to be no profit, like a CIC or a charity, but could also apply to a new start-up that is currently generating no revenue or profit. The licenses for a start-up currently generating no revenue and a structure permanently focused on a social goal that generates no profit would be different though. For the start-up it is likely to be either short, given that the company almost certainly intends to become profitable, or change from free to fee paying once certain revenue of profitability milestones were met. On the other hand, a

CIC or charity could expect a longer or even perpetual license to use the IP at little or no cost.

As well as profitability being a key determinant of the type and cost of the license from the IPCMB the purpose of the use and outcomes from that use could also be considered. This could mean that where licensing some IP would provide a social return would be able to do so either at a reduced licensing fee or without paying a fee at all.

On the other hand, established companies and organisations who wanted to use the IP would be able to do so, but at a cost. These licenses would be negotiated on a case by case basis and although currently not something that the government engages in these are all activities that the private sector has a lot of expertise in. Companies, both established and new start-ups, would also be able to pay for their license fees by issuing shares into a fund that would be managed by the IPCMB. Licensing negotiations as described above are happening thousands of times every day, and although some are complex and challenging many are standard and relatively easy to conclude.

### — **Using tax credits and reliefs**

As we outlined in section 3 how the public sector contributes significantly to private R&D by offering substantial tax credits, through R&D tax credits, or relief, through the Patent Box relief scheme, to companies and that there is a strong rationale for the public sector should retain some ownership of the resulting IP. As noted, this amounts to about £5.4bn per year.

It would not be appropriate for the IP to be assigned to the IPCMB when a company had used a tax credit or relief scheme

because the company would also have invested some of their capital into the R&D and resultant IP. Under these circumstances it would only be appropriate to assign a limited license to government. This license could operate in a number of different ways from outlining how any future revenue derived from the IP could be shared to giving the IPCMB the right to license the IP themselves, while ensuring that any revenue went back to the owner of the IP. The company could also transfer shares to IPCMB in lieu of granting a license. While this would again be very new for the public sector to engage in there is extensive experience in the private sector in constructing such licenses and agreements.

One significant benefit of changing to this model would be to eliminate the dead weight issue since only companies who were not going to be able to do the R&D or that really needed the patent box relief would apply to the programmes. This would ensure that these significant subsidies were efficiently utilised while leading to increased corporate tax revenue, since the R&D that did not use the support would still be likely to happen.

## — Benefits

The implementation of the Public IP commons fulfils all of the four criteria that we set out at the beginning of this section and would ensure that the impact of publicly funded research was maximised.

The fact that ownership of an IP resulting from public funding would be assigned to the IPCMB clearly acknowledges the nature and significance of the investment of public money into R&D. The proposal for the Public IP commons also aligns the public sectors risk and reward when funding R&D. As noted at present the state certainly takes its share of the risk, often investing in early stage

innovation, with its hyper speculative returns. However, the public sector does not ever get its share of any direct rewards, instead the current model leaves it to reap indirect return through economic growth, job creation and increased corporate profits. We suggest that the public sector should be able to reap direct returns, either by ensuring that companies pay to license IP commercially useful to themselves or get free/low cost licenses to develop products and services that confer non-economic benefits.

A system where the IPCMB retains direct ownership and control of the IP offers an opportunity for the public sector to set different targets for the use of its IP. Rather than focusing on restricting use by competitors or trying to maximise the monetary value of license at all costs, the IPCMB main mission would be to increase the overall level of innovation. As explained above this would see the IP held as 'licenses of right' with start-ups and social enterprises able to access the IP held by the IPCMB at no/low cost, while established companies would be asked to pay for the license. The mandate of the IPCMB would also allow it to license the IP on more favourable terms when specifically, for social outcomes, even when the company using it is large and profit making. We believe that this will ensure that the IP is utilised to maximise potential innovation, since it will be available for all to use, while ensuring a return for those using the IP commercially, all the while retaining the power to provide special licenses when there is a real social return.

When companies are required to pay for licenses the IPCMB should allow for that payment to be made in money or equity. Being able to pay for the license in equity reduces any potential pressure on company balance sheets while also further increasing the sharing of risk and reward in the innovation process. Were a company to use the equity mechanism this would mean the IPCMB would only have a valuable asset so long as the company was successful and viable.

Another benefit of the proposed IP Commons is that it does not necessitate any reform of the national and international IP regime, which is complex and difficult to change, but merely seeks to align the private sector regime to the public sector. There are therefore no legal impediments to any of proposals in this paper since it would use the licensing system that is already in existence and would not require new IP law. In fact, the private sector already issues an almost infinite variety of licenses, even sometimes licensing at no cost.

The proposal also does not alter private sector R&D process. Under the new system if a private company conducts R&D that results in IP then they will still be able to wholly own and control it. This proposal only affects the IP resulting from R&D that is in receipt of public money, either directly or through tax credits and reliefs.

### — **Issues that require resolution**

This report paints a picture of R&D and innovation that is somewhat simplistic and assumes that all IP is generated from a single piece of R&D that is funded by a single party, be they public or private. However, IP creation is often messy and rarely down to one piece of funding. This means that the ownership of the resulting IP can be complex to determine. Although this argument certainly is true this is a feature of innovation and IP and not a reason to dismiss the proposed reform. Within the current IP system, the complex discussions, negotiations and sometime legal cases are already happening every day. Those who work within the IP licensing are used to managing these complex processes and there are established processes and systems that can be used to navigate this issue.

This raises the second issue which is that even though the skills to operate a system such as the IP commons exist in the private sector it may be difficult and expensive to build up the expertise within the public sector. This is certainly an issue and building up new expertise within any organisation, public or private, is always a difficult task. However, this is an issue that can be addressed head on and well managed. The Debt Management Office that sits within HM Treasury, for instance, have the responsibility for managing a huge variety of debt products within complex markets and interacting with private sector operators, and have built up huge expertise in the area.

Another issue raised by Stian Westlake from NESTA is that charging for the use of publicly funded IP would create preference for low R&D companies over high R&D companies, at least that relied of publicly funded R&D, because those using the IP commons would be required to pay.<sup>50</sup> This argument however seems to assume that today companies that utilise a lot of IP, at least those using publicly funded research and innovation can use it all for free now. Publicly funded IP is not freely available for companies to use. Under the present system all publicly funded IP is owned by a private person or company, who is then responsible for licensing the IP, usually at a cost to the licensee. Therefore, the issue that Westlake raises may in fact only apply in very limited circumstances and in fact the power of the IPCMB to issue a wide variety of licenses under different conditions and prices should mean that most social useful companies using the publicly generated IP will in fact see their costs reduced.

# 6. Conclusion

This report has exposed the nature of the role of the public sector in making investments, which now go far beyond market fixing, to take a more active role as an ‘entrepreneurial state’ setting the direction of innovation. Yet despite the state’s evolving role and the fact that the public now shoulder considerable investment risk, we never share directly in the upside of its investments. The UK now invests over £14.4bn every year in directly funding and facilitating R&D through tax credits. This is a substantial amount and comparable to the £25bn the private sector spends each year on R&D. We desperately need a new model both to ensure that we get a more direct return on that investment as well as use the IP that is generated to pursue specific social and non-monetary goals.

The current market failure theory, which emphasises the state’s return through indirect means such as economic growth and job creation, is no longer sufficient. However, when looking at existing model there are issues with both too closed and too open IP regimes. We therefore need to create a new system where we navigate between these two extremes.

Our proposal for the creation of a Public IP commons will radically change the domestic R&D sector and enable a large quantity of IP to be accessed by more companies and individuals. As we have outlined in this paper, we must ensure that there are proper rules and mechanism to govern and manage access to this new IP commons if it is to be successful. Our proposal meets the four goals to recognise the state as owner of the IP that it funds, to maximise the potential for innovation by licensing as widely as possible, allows the IPCMB to license to purpose-driven

and social organisation at no/low cost and recognises the huge non-monetary value of IP.

We need to urgently need to change from the status quo. We hope that this paper will be part of the important discussion that needs to take place about how best to recognise the new role of the state and how to ensure that the IP that we the public fund delivers most benefit to us.



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