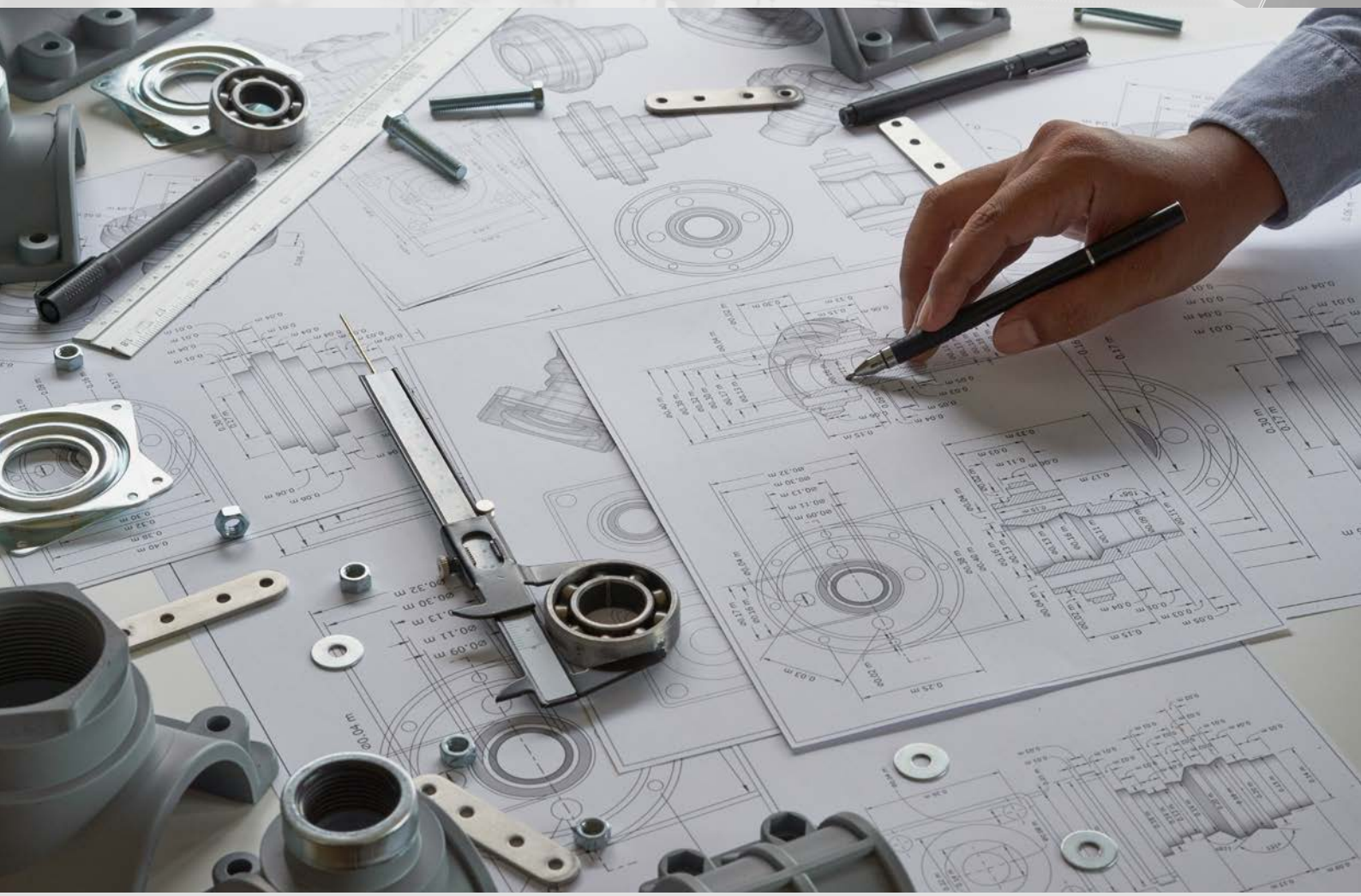
CBI Economics



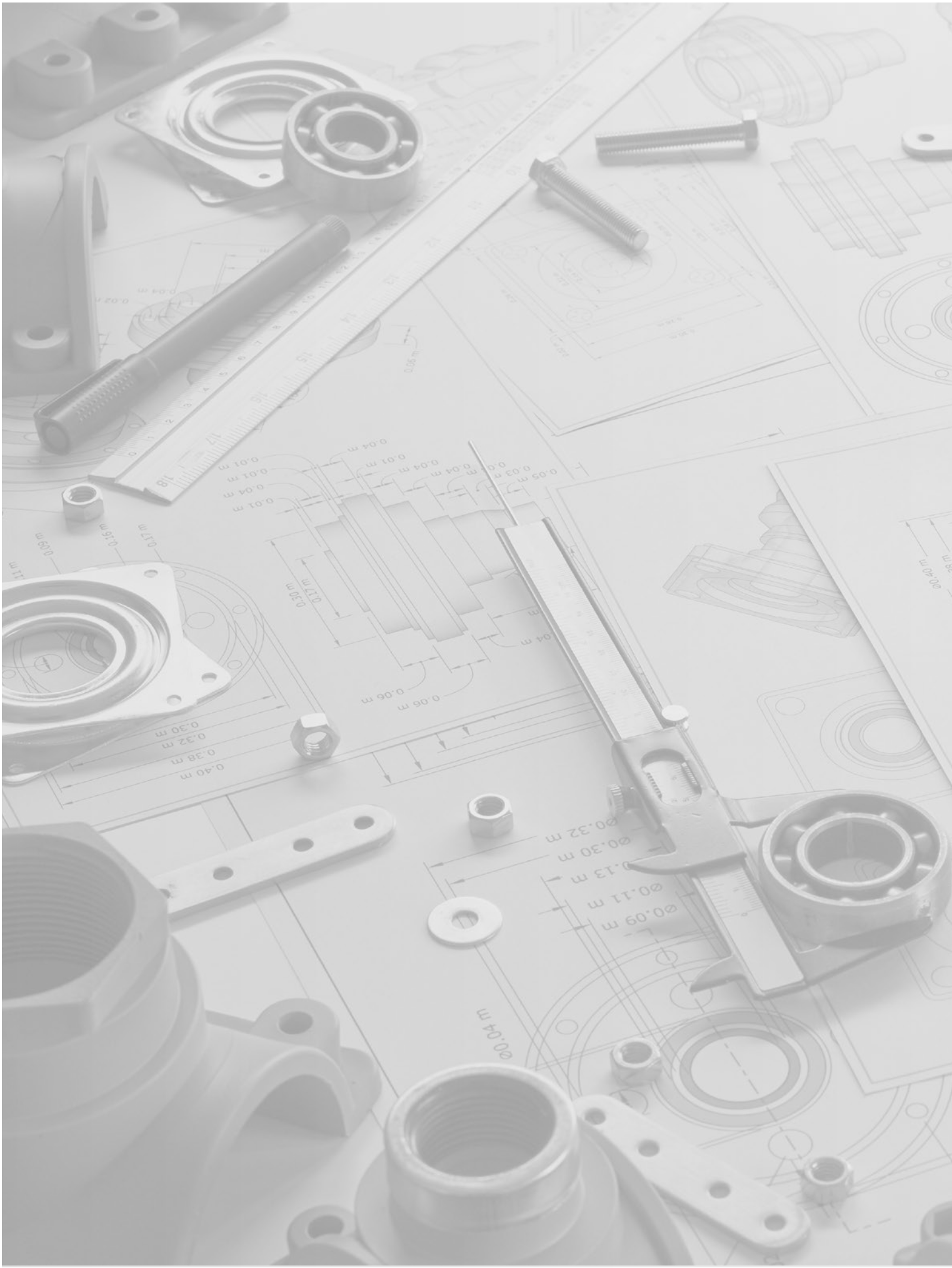
Prosperity Pending

Unpacking the drivers of the UK's underperformance on the commercialisation of ideas

May 2021

Commissioned by

GovGrant



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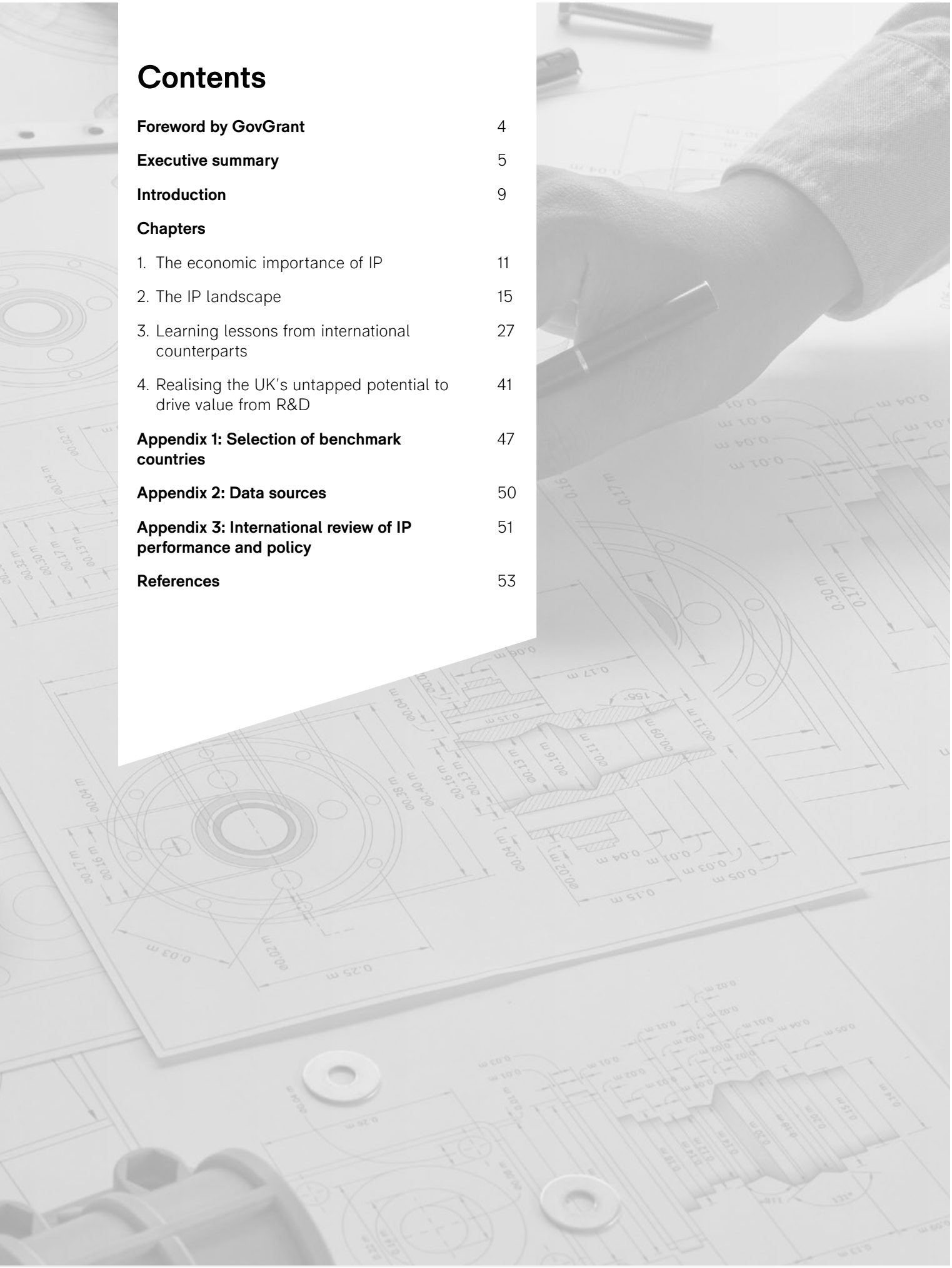


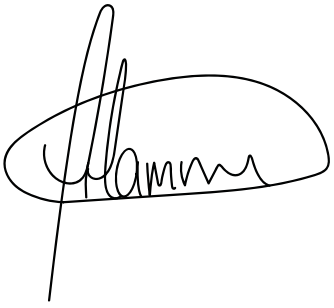
Foreword GovGrant

After one of the most challenging events our country has ever gone through there is a clear appetite from every corner of the country to build back better and put in place an economic framework that is strong, resilient, and capable of exponential growth.

Whilst there is plenty of positive sentiment when it comes to R&D and innovation, there are some frank conversations that need to focus on addressing the weaknesses in how the UK takes world leading academic prowess and leverages it into commercial gain. The UK is lagging behind when it comes to driving prosperity from intellectual property which is a value lever that continues to be underutilised. There is an opportunity for change.

At GovGrant we believe that innovation needs to be the driving force behind the UK's economic growth. We see the wonderful work that goes on in UK businesses every day and we need to ensure that businesses have support for their future investment in innovation.

We need to understand how the UK stacks up on the global stage, what success looks like and what needs to be prioritised. GovGrant is delighted to have partnered with the CBI to deliver this important research that signposts what we need to explore if the UK is going to be an innovation powerhouse.



Luke Hamm
CEO, GovGrant

Executive summary

Innovation has a key role to play in driving UK economic growth. The UK government has multiple levers at its disposal to enable this growth. CBI Economics analysis has identified opportunities to improve the commercialisation of Research & Development (R&D) and the generation of Intellectual Property (IP) in the UK.

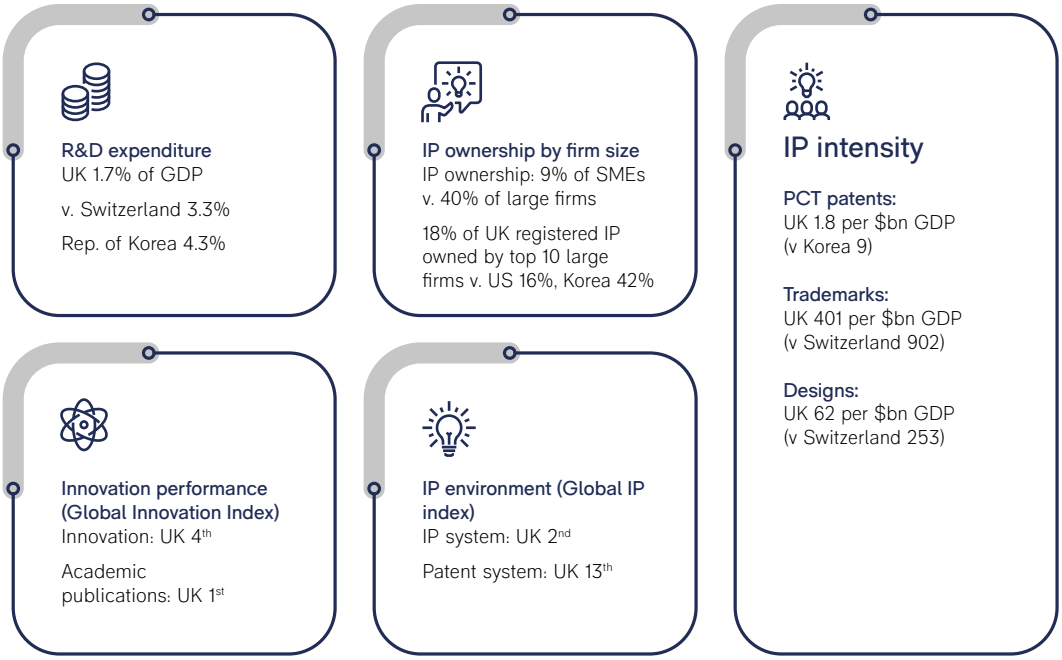
GovGrant commissioned CBI Economics to develop the evidence base on the landscape for IP in the UK and internationally. This research highlights several gaps in the UK's current performance and therefore areas where UK policy could play a greater role to drive innovation at all stages of the R&D process, boosting economic growth and prosperity. The analysis points to several areas for policy development which could unlock the potential of UK businesses to invest in IP in the UK:

- Enable the commercialisation of ideas from earlier stages of the R&D process to capitalise on academic success, encourage collaborations, and incentivise the generation of IP.
- Target the barriers to R&D spend and IP investment faced by SMEs to unlock valuable and disruptive innovations and increase the share of high-growth SMEs.
- Develop the UK's patent box and extend its scope to encourage increased patent and other IP related activity.

The UK could drive further value from R&D by increasing investment in IP, as evidenced by its performance against international counterparts.

The UK has a long history of underperformance in business investment across all asset types, reflected in the UK's long-standing productivity gap. While growth in intangibles has outpaced growth in physical assets and has shown a greater resilience to the pandemic, business investment in intangibles, such as R&D and IP, underperforms international counterparts. The UK's lower propensity to invest in IP is reflected in a lower concentration of IP (particularly, patents) relative to GDP than most other innovation leaders. Despite the UK being well-renowned for many elements of its innovation environment, including its academic research, the UK could go further in driving commercial value from its R&D, boosting productivity and economic growth.

Exhibit 1 Summary of UK innovation and IP performance



Source: CBI Economics analysis

Policy is crucial in ensuring businesses have the confidence to invest in R&D and ultimately in the commercialisation of ideas.

Optimising the benefits of increased investment in innovation is a shared goal for business and government. The policy environment is crucial in ensuring businesses have the confidence to invest. This is important in the current economic climate where many firms are struggling with a slow recovery in demand and are facing higher levels of debt.

Analysis by CBI Economics, comparing the UK's IP landscape against international counterparts, highlights three main areas of underperformance in the UK and therefore where government policy could play a greater role. Embedding these into the government's innovation strategy would improve the UK's global standing on innovation, boosting UK productivity, resilience, and economic growth. The evidence set out in this report demonstrates that policymakers should do the following:

1. **Enable the commercialisation of ideas from earlier stages of the R&D process to capitalise on academic success, encourage collaborations, and incentivise the generation of IP.**

   Measures such as the Global Innovation Index place the UK in the top 10 of the rankings for innovation, driven by the UK's success at producing high-quality academic research. The UK scores less favourably on the commercialisation of ideas. To encourage UK businesses to develop ideas and take them to market, as well as to attract IP investment from abroad, the policy environment for innovation needs to be a balanced and integrated one. This involves supporting and enabling businesses to be successful at all stages of the R&D lifecycle. The earlier stages of the R&D process, which result in the creation of knowledge, are found to generate the largest spillover benefits to the wider economy. Moreover, while the evidence shows that all UK regions underperform on IP by international standards, each region shows potential strengths on different types of IP and in different sectors.

   Policy interventions must therefore be tailored to the needs of business at each stage. Policy support should include capital investment for new machinery and equipment, R&D expenditure to develop and test ideas, collaborations between business and research institutions, incentives and support for IP creation (including, but not limited to patents). Alongside this, the wider environment for doing business matters, as businesses need the right infrastructure, skills, and digital connectivity to be able to develop, test and commercialise ambitious new ideas. Policy interventions must also account for the variations observed across the UK's regions, as well as building on existing strengths across certain sectors, such as digital.

2. **Target the barriers to R&D spend and IP investment faced by SMEs to unlock valuable and disruptive innovations and increase the share of high-growth SMEs.**

   Business spend, as well as IP filings, are driven by large firms, with 9% of SMEs registering IP rights compared to 40% of large businesses across European countries. Unlike larger firms, many SMEs lack the capital, finance, and IP management expertise to test their ideas and take them to market. While this trend is observed across many countries, the gap in the UK relative to other EU countries is stark: 10% of SMEs in the UK own IP rights compared to 13% in Germany and Denmark.[1] This is partly explained by barriers to finance for UK SMEs, as credit availability is typically reported by SMEs as 'poor' or 'very poor'.[2]

   There is therefore a role for policy to play in addressing these barriers. Financial assistance from the earlier stages of R&D, as well as the development of an IP process supportive of SMEs would help increase the share of SMEs typically characterised as 'high-growth', or 'innovation-driven' to unlock untapped potential for innovation and IP in the UK.

3. **Develop the UK patent box and extend its scope to encourage increased patent and other IP related activity.**
   CBI Economics analysis suggests the current patent box framework is not working to its full potential. While the UK has one of the most developed patent boxes, the presence of this support is not reflected in its IP intensity.[3] The UK patent box could therefore play a greater role in driving the UK's IP investment. Patent boxes in other countries differ in design, suggesting that different policy models for IP can prove effective depending on their objectives.

   While the presence of a patent box is not always an indicator of a high patent concentration, the UK's patent box should be developed to ensure it remains internationally competitive. CBI Economics analysis concludes that the UK could extend the scope of its patent box to include other forms of IP (in addition to patents), as well as ensuring better integration within the overall R&D suite of policy support. Improvements to the patent box process would help encourage IP applications from SMEs. For example, through options for more accessible IP rights, such as utility models, with shorter time frames for protection, as well as the provision of financed IP legal advice.

This study demonstrates gaps in the UK's IP landscape that, once addressed, will benefit the UK economy. The case for policy action is clear. This study identifies several target areas where policy can play a greater role in increasing the commercialisation of ideas in the UK. There is no silver bullet to do this, closing these gaps will require a package of policy support, as well as action from the business community. Good policy development and execution is often difficult and further investigation will be required to assess the effectiveness of policy interventions that could fulfil this objective.

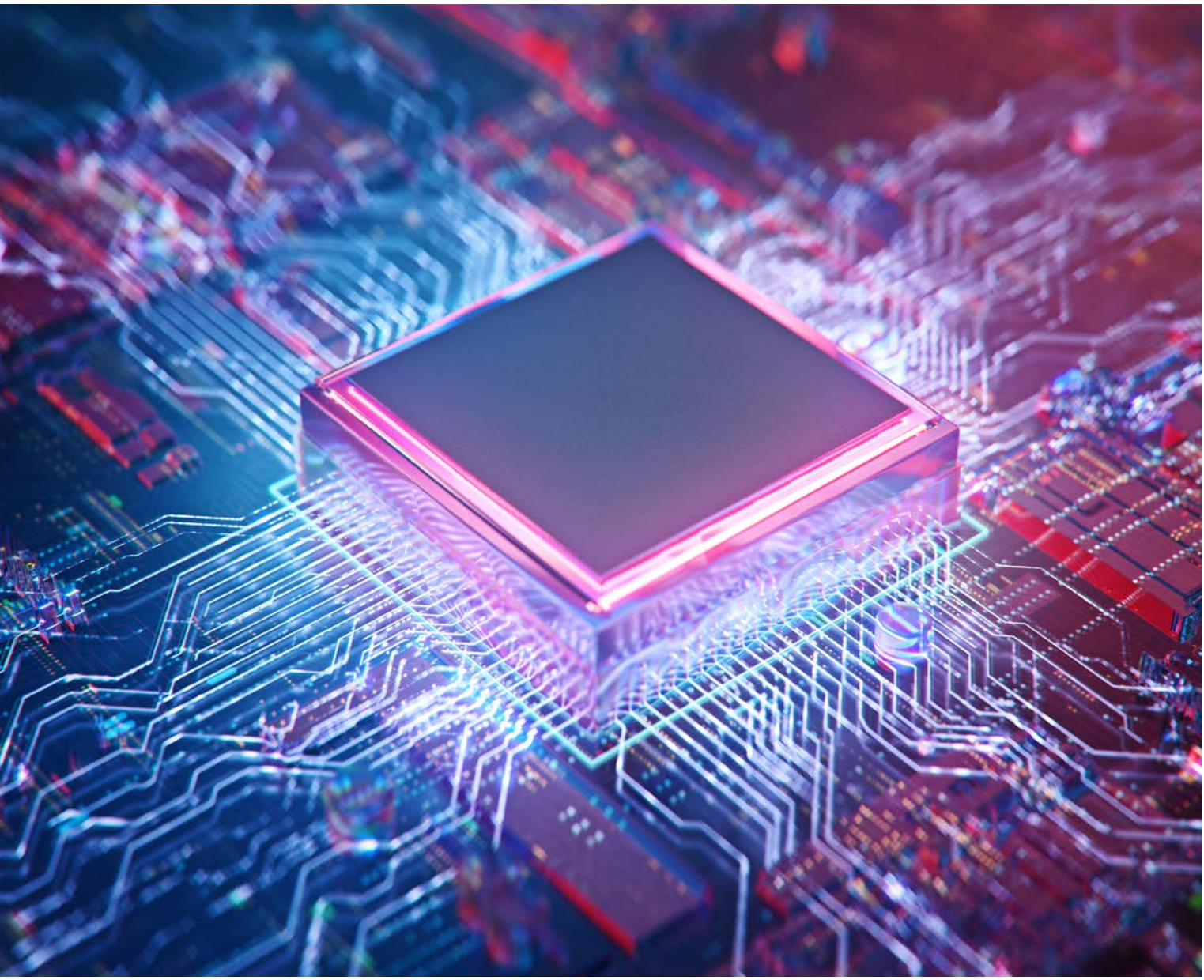
Introduction

Innovation is a key driving force for new solutions to societal and environmental challenges. It delivers productivity improvements, economic growth, and prosperity. Reaping the benefits of this is a responsibility shared between business, government, universities, and research institutions. While the UK is renowned for many elements of its innovation environment, evidence suggests there are opportunities to improve the landscape when it comes to the commercialisation of Research & Development (R&D) in the UK, and the creation of IP.

To better understand the factors behind the UK's underperformance on the commercialisation of ideas and IP creation, GovGrant has commissioned CBI Economics to develop an evidence base on the landscape for IP in the UK and internationally. This paper highlights the areas where UK policy could play a greater role in driving innovation at all stages of the R&D process, and ultimately boost economic growth and prosperity.

The paper is structured into four parts:

- **The economic importance of IP to the UK** sets out how the commercialisation of ideas, and IP more specifically, drives key economic benefits and therefore why encouraging this activity is crucial to productivity and economic growth.
- **The landscape for IP** takes a closer look at the UK's performance on R&D and IP at a national level and across regions, sectors, and business size to understand the UK's current performance on IP and to identify areas of untapped potential.
- **Learning lessons from international counterparts** analyses how the UK fares internationally on the commercialisation of R&D by comparing the UK to a set of benchmark countries. Drawing on international evidence informs a set of areas where the UK could improve its performance on the international stage.
- **Realising the UK's untapped potential to drive value from R&D** brings together both the UK and international evidence to identify the areas where UK policy could play a greater role in driving commercial value from R&D and realising the multitude of economic and societal benefits this brings.



The analysis throughout this report is primarily based on an international comparison of the UK against a set of benchmark countries selected based on two main criteria: success on innovation across a suite of measures; and success on the creation of IP. **Appendix 1** outlines the rationale behind this selection and sets out the details underpinning the criteria.

The assessment of the UK's performance relative to the selected benchmark countries draws on several sources, including data on business investment in IP, R&D expenditure, and IP ownership, filings and grants, but also on composite indices of innovation and IP, such as the World Intellectual Property Organisation (WIPO) 2020 Global Innovation Index and the Global Innovation Policy Centre (GIPC) 2021 International IP Index. The full list of data sources used in this study is provided in **Appendix 2**. The analysis is further complemented by the academic literature, as well as a detailed investigation into the different policy tools used in each benchmark country.

The economic importance of IP

Encouraging innovation at all stages of the R&D lifecycle drives productivity and economic growth.

Innovation underpins productivity and economic growth. Encouraging innovation at different stages of the R&D lifecycle – from the initial research to the implementation of new and improved products or services – will support not only the creation of knowledge, but also the absorption and diffusion of knowledge.[4] This fosters the knowledge exchange and the collaborations which allow the spillover benefits to reach the wider economy and enable processes, products, and services to be continually improved and technology to be developed.

The earlier stages of the R&D process, which result in the creation of knowledge, are found to generate the largest spillover benefits to the wider economy.[5] This is because ideas are developed and improved at these stages, creating a cycle of continued refinements and improvements of ideas before they are commercialised. For knowledge and ideas to ultimately contribute to employment and productivity, and help address societal challenges, they must first be shared, diffused, and translated into improved processes and new products and services.

When an idea reaches the commercialisation stage, the stage at which IP is created and new solutions are brought to market, countries can fully reap the benefits that innovation can bring to the economy. IP produces several positive benefits, by creating powerful incentives for domestic innovation, inducing knowledge spillovers that help others to innovate, and promoting international diffusion of technology, innovation, and know-how.[6] One study, for example, shows that IP boosts a country's levels of R&D, but also its inward Foreign Direct Investment (FDI), and exports of goods and services.[7] This is because stronger patent rights attract FDI into industries high in patent use and help to build domestic production and productivity, which in turn supports export growth.

As a result, many governments around the world place emphasis on innovation policy, with the aim of boosting productivity and economic growth, and ultimately prosperity. Within this drive for innovation-led growth, governments recognise the importance of supporting innovation at all stages of the R&D process to fully reap its rewards - from the initial stages of R&D through to the development of IP and end products or solutions.

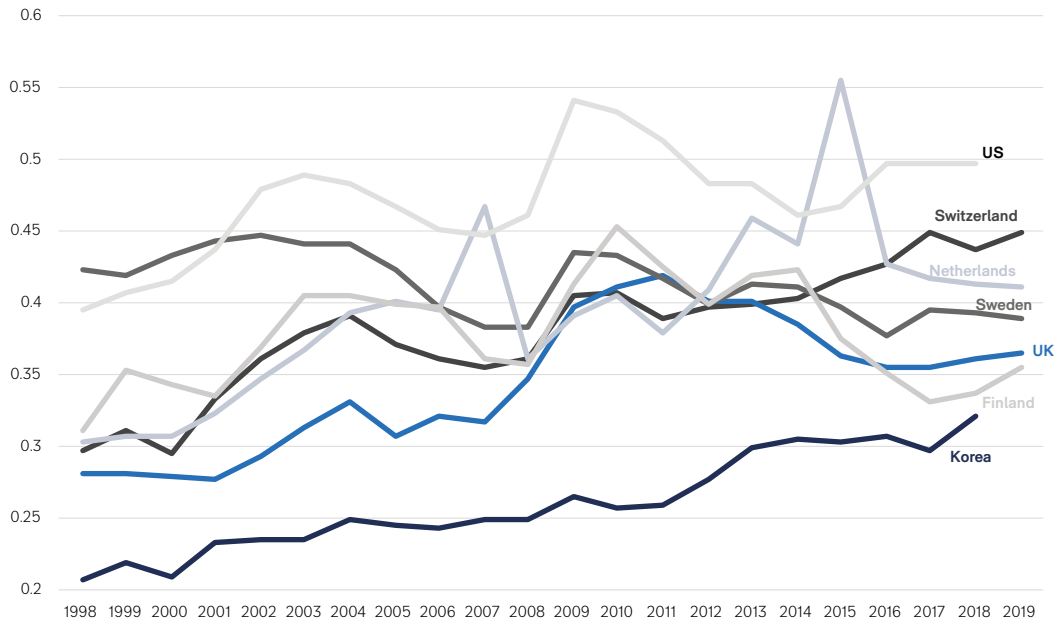
IP investment is increasing in global importance, with intangible assets forming a core component of overall business investment.

As innovation continues to drive the global economy, evolving technology, processes, and knowledge will increasingly become a core component of business investment, and intangible assets (including IP) will continue to grow in importance relative to physical assets such as plant and machinery (P&M) or buildings. This trend is already becoming apparent, with the importance of IP in the UK growing from 27% to 36% of total business investment between the late 1990s and 2019.[8] Over the same period, the share of buildings and P&M of total business investment shrunk from around 67% to 56%, demonstrating a clear shift in the types of investment businesses make.[9]

Over the past year, business investment in IP products (IPP) has shown greater resilience through the pandemic compared to investment in other asset types. Between the third quarters of 2019 and 2020, investment fell by 9% for IPPs, compared to 26% for buildings and 19% for P&M.[10] This suggests IP investment has been more resilient to the economic shock of the pandemic, which is likely explained by the nature of the shock and its differential impact across different sectors of the economy.

While this trend has been mirrored in other developed countries, the relative importance of IP assets to total business investment is higher across many economies than in the UK. As demonstrated by **Exhibit 2**, IP assets represented between 40% and 50% of all business investment in the US (50%), Switzerland (45%), and the Netherlands (41%) in 2019, compared to 36% in the UK. This is due to faster growth in IP assets relative to all business investment in these countries, indicating a greater shift away from physical assets over the past two decades than that seen in the UK. For example, Switzerland's investment in IP assets quadrupled between 1998 and 2018, while the UK's doubled.[11]

Exhibit 2 Business investment in IP assets (% of total business investment) by country



Source: OECD (2020), National Accounts at a Glance

This contrast is more stark when set against the overall decline in UK business investment observed over the last four decades, from a peak of 14.7% of GDP in 1989, to a low of 10% at the end of 2019.[12] This left the UK lagging behind many other advanced economies, while business investment in the US and Sweden grew over the same period.

Despite the pandemic being a global crisis, hitting many economies around the world, the latest available data shows that business investment in the UK has been impacted more than many other developed economies. Between the last quarter of 2019 and the second quarter of 2020 the US saw a 9% contraction in business investment while the UK's business investment declined 27%.[13] The UK's decline is driven by large falls in business investment in physical assets (-37% for transport equipment, -26% for property, and -19% for IT and other P&M), while investment in IP assets contracted by only 9%.

The historical trends observed in UK business investment coupled with the relative lag in growth in IP investment indicate structural barriers to investment that has been exacerbated by the pandemic.

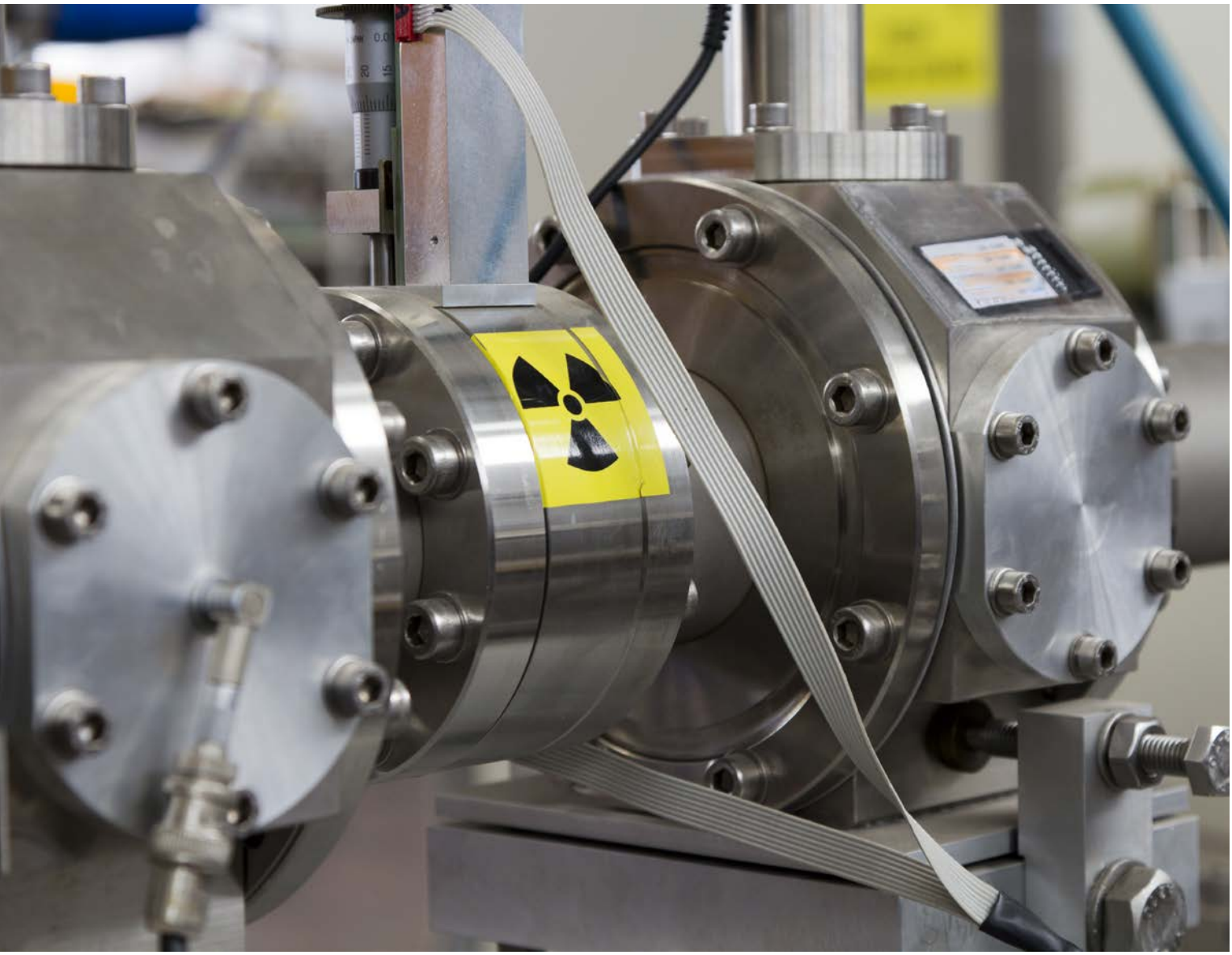
Securing IP investment can help to drive a productivity-led recovery in the UK.

Business investment is a core determinant of sustainable economic growth and prosperity. Boosting business investment will be a pivotal part of rebuilding the economy following the pandemic. It is widely acknowledged that the UK suffers from a lag in productivity growth relative to other advanced economies. This has resulted in a slower recovery in GDP since the global financial crisis than elsewhere in the G7.[14] A large body of evidence[15] suggests that subdued business investment is a key factor constraining the UK's productivity and economic growth potential, as well as the UK's international competitiveness. Furthermore, empirical evidence shows that intangible investment accounts for more than a third of all factors found to explain the UK's productivity puzzle.[16]

While the latest data shows a growing importance in IP and a stronger resilience to the pandemic, it also highlights a potential under-investment in IP, with many advanced economies seeing stronger growth than in the UK. Reaching levels of IP investment observed in top performing countries such as Switzerland and Sweden, therefore, has the potential to realise large gains for the UK economy. However, the uncertainty around the recovery in demand for many firms, coupled with higher levels of corporate indebtedness will constrain business investment in the near term. And with firms across different sectors at varying stages of the recovery, it is likely that on aggregate the pandemic will continue to constrain business investment into the medium term.

As set out in the CBI's *Catching the Peloton* report, the UK's historical underperformance on business investment points to structural barriers to investment, which is likely to be further reflected in the UK's underperformance on R&D spend and IP intensity.[17] Addressing this will require a package of solutions from both government and business. Policy has a key role to play for the UK to realise the benefits associated with business investment growth and innovation in creating a policy environment that provides businesses with the confidence to make those investment decisions in R&D and ultimately in commercialising their ideas.

This will also be crucial for developing new solutions that support societal objectives such as reducing carbon emissions or addressing health challenges. Achieving net-zero, for example, is likely to require accelerated innovation across research, demonstration and early deployment of low carbon technologies, supporting specific government programmes to enhance early-stage technology development and a clear route to market for promising innovations. The role of government will be more pertinent in driving a productivity-led recovery by encouraging innovation at all stages of the R&D process.



The IP landscape

The UK is a world leader in innovation, but is less successful at the commercialisation of R&D, highlighting a clear area of untapped potential.

The evidence demonstrates that the UK is one of the world leaders on innovation capabilities when looking at composite measures across a range of innovation inputs and outputs, such as the World Intellectual Property Organisation's (WIPO's) Global Innovation Index (GII) – on which the UK ranked 4th of 131 countries in 2020.[18] This is driven by its success in producing high-quality academic research which is widely cited internationally – the UK ranks 2nd on the GII 2020 on the quality of its universities, and 1st on the quality of its scientific publications.[19]

However, while its academic success places the UK at the forefront of all developed economies on the quality of its research, as shown by **Table 1**, the UK has one of the lowest R&D spend relative to GDP among similar comparator countries (see Appendix 1 for details on how these were selected)[20] and one of the lowest shares of business R&D of total R&D spend. The UK government has recognised this and set out its objective to raise total R&D spend to 2.4% of GDP by 2027, which evidence shows would bring significant benefits to the UK economy.[21] However, a recent study by the Higher Education Policy Institute indicates that this target may be at risk.[22]

Table 1 Performance of UK against benchmark countries on R&D metrics[23]

Country	GII 2020 rank	R&D spend, % of GDP	Business R&D spend, % of GDP	R&D spend from RoW, % of GDP	Spend basic research, % of R&D	Spend on applied research, % of R&D	Spend on experimental development, % of R&D
UK	**4**	**1.7%**	**0.9%**	**14%**	**17%**	**43%**	**40%**
Switzerland	1	3.3%	2.3%	5%	43%	33%	27%
Sweden	2	3.4%	2.0%	10%	*N/A*	*N/A*	*N/A*
US	3	2.8%	1.8%	7%	17%	20%	63%
Netherlands	5	2.0%	1.0%	14%	26%	44%	30%
Finland	7	2.7%	1.6%	11%	*N/A*	*N/A*	*N/A*
Singapore	8	1.9%	1.0%	7%	24%	31%	45%
Korea	10	4.3%	3.3%	1%	14%	22%	64%
China	14	2.1%	1.6%	1%	6%	11%	84%

Source: WIPO Global Innovation Index (GII), 2020; OECD Science & Technology Indicators, 2020

While it is clear the UK underperforms the benchmark countries on total R&D spend, the picture becomes more complex when looking at the drivers of less effective commercialisation:

- **While UK business spend on R&D is comparatively lower, the UK attracts a higher share of business investment from abroad:** As demonstrated by **Table 1**, countries differ in the key strengths that drive their overall performance on innovation. For example, while the UK's business-funded R&D spend makes up a lower share of total R&D spend, its R&D spend funded from the rest of the world (RoW) is one of the highest. This suggests that the UK is potentially more successful at drawing foreign investment in R&D, despite falling short on domestic business investment.
- **The UK places a high emphasis on applied research, spending comparatively less on experimental development:** Looking at the profile of R&D spend, the countries analysed vary in where they focus their R&D spend, some placing a higher emphasis on research, while others on experimental development. The UK, like Switzerland and the Netherlands, spends comparatively more on research than it does on experimental development, placing a high emphasis on applied research. This can explain the success each of these countries has in producing high-quality and widely-cited research publications, as reflected in their rankings on academic outputs in the GII 2020.[24] However, while high overall spend on R&D is found to be linked to a greater chance of creating IP, experimental development is a key step in creating commercial outputs from research and increasing investment in this is more likely to result in IP creation. Countries such as Korea, the US and China spend comparatively more on experimental development relative to research (from 63% of all R&D spend, to 84%), as well as spending more on R&D overall relative to their GDP. In comparison, the UK focuses only 40% of its spend on R&D on this, suggesting that the UK could benefit not only from increasing its overall R&D spend, but also in focusing more of this spend on experimental development.

This overall underperformance on R&D spend in the UK is likely to be further translated into lower performance on commercial outputs, as empirical evidence shows that, while IP does not necessarily lead to further investment in R&D, higher R&D spend is likely to drive IP investment.[25] This is confirmed by an underperformance in the UK on its propensity to file some of the common types of IP rights: patents, trademarks, and industrial designs, as demonstrated by **Table 2.**

Table 2 Performance of UK against benchmark countries on IP metrics[26]

Country	GII 2020 ranking	Patent filings per bn $ GDP	PCT patent filings per bn $ GDP	Trademark filings per bn $ GDP	Design filings per bn $ GDP	Success rate of patents abroad, % of filings granted
UK	**4**	**18**	**1.8**	**401**	**62**	**58%**
Switzerland	1	78	7.9	902	253	61%
Sweden	2	43	7.6	612	84	65%
US	3	25	2.8	91	19	60%
Netherlands	5	36	4.0	551	129	71%
Finland	7	43	6.0	612	84	78%
Singapore	8	13	2.0	135	9	59%
Korea	10	113	9.0	172	72	61%
China	14	59	2.6	382	50	46%

Source: WIPO Global Innovation Index (GII), 2020; WIPO IP Facts and Figures, 2020

Bringing the performance on R&D metrics together with the performance on IP metrics, suggests that countries with the highest performance on IP intensity (Switzerland, Korea, and Sweden), are the same countries that have the highest business R&D spend relative to their GDP. While it is not possible to infer direct causation from this exercise, this does indicate that encouraging business investment in R&D plays a key role in driving the commercialisation of ideas.

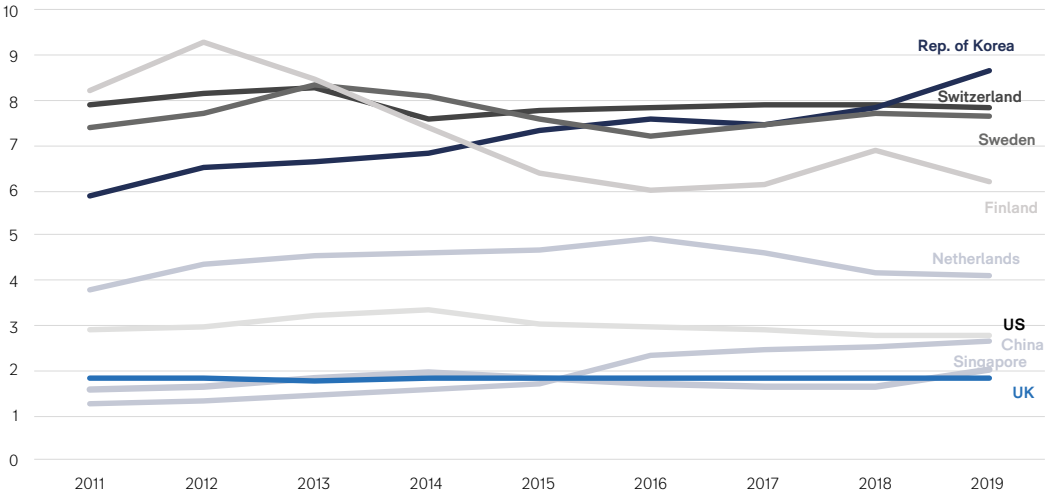
The UK's underperformance on IP is driven by a low patent intensity, explained by a low propensity and success rate amongst UK businesses seeking patent rights.

While the UK has a lower IP intensity than all benchmark countries except Singapore, this differs between different types of IP. As **Table 2** demonstrates, the UK appears to be on a similar footing for its concentration of trademark registrations and industrial design to many of the benchmark countries, ranking in the middle of the pack. In contrast, the UK's concentration of patents is the lowest of all the comparator countries – less than a fifth of Korea's and a quarter of the concentration seen in Switzerland, suggesting patents are driving the UK's overall poor performance on IP.

Businesses can apply for IP rights in their domestic IP office, but they can also apply through the international system to protect their inventions in multiple countries. UK businesses can file separate IP applications in countries where they wish to protect their inventions, or they can apply through the WIPO's Patent Cooperation Treaty (PCT), its Madrid Trademark System, as well as the Hague International Design System to protect the inventions simultaneously across all the countries that are signed up to these systems.

As demonstrated by **Exhibit 3**, the UK has consistently registered the lowest concentration of patents filed through the international PCT system (20% that of Korea or 22% of Switzerland's and Sweden's), while Korea has seen a remarkable growth in patent intensity over the past decade (nearly quadrupling between 2011 and 2019). Over the same period, Switzerland has maintained the highest concentration year-on-year, being exceeded by Korea only in 2019, and Finland has seen a marked decrease (-20%) from recording the highest concentration before 2013 and dropping to 76% of Switzerland's concentration by 2019.

Exhibit 3 Number of PCT patents filed per billion $ of GDP, benchmark comparison



Source: World Intellectual Property Organisation (WIPO) Statistics Database, March 2021

Within the PCT system, international patent applications go through several phases before the patents are granted. The patent grant is ultimately under the control of the national or regional patent offices in what is called the "national phase", which is reached 30 months from the filing date. The evidence highlights that not all patent filings make it to the PCT national phase entry, with significant variation between the benchmark countries in the proportion of filings reaching this phase. Relative to the benchmark countries, the UK sits somewhere in the middle, with 49% of its patent filings reaching the PCT national phase in 2019, significantly higher than the share of filings originating from China (4%), Korea (13%), or the US (38%), but lower than that in Sweden (69%), the Netherlands (61%) and Switzerland (56%).[27]

As applicants have the freedom to decide earlier on in the PCT process whether to enter the national phase,[28] one advantage of the PCT system is that applicants can defer the cost of the national phase applications, allowing more time to explore the commercial viability of the invention,[29] which is particularly beneficial for SMEs. While international filing is common among multinational businesses, a higher share of filings reaching the national phase may also signal a higher number of innovative SMEs and start-ups seeking patent protection as the PCT system is typically regarded as an efficient entry route for these types of businesses.[30, 31] Therefore, although this evidence suggests the UK is outperforming some of the benchmark countries, it also indicates the UK could go further.

To better understand the UK's comparatively lower concentration of different types of IP relative to GDP, comparing the origin and destination of IP filings can help shed light on whether the UK struggles to encourage and attract IP regardless of origin (which would be indicative of regulatory barriers or gaps in policy incentives), or whether the UK's underperformance is better explained by a lower propensity amongst domestic businesses to translate knowledge into commercial outputs (whether in their own country or abroad).

Performing this comparison, key insights emerge:

- **The UK's low concentration of patents is driven by a low propensity amongst UK businesses to file patents, but also by a low success rate of filings:** The analysis shows that, for every foreign patent application in the UK, there are 2.5 domestic applications, which compares to a ratio of 40 domestic applications to non-domestic applications in Finland, or 28 in Switzerland.[32] Moreover, UK businesses have a below-average success rate of patents filed abroad being granted (58%) compared to most other benchmark countries (which average at 62%), as well as a comparatively lower success rate domestically (40% of domestic patent filings are granted in the UK, compared to an average of 51% across all benchmark countries).[33] This indicates both a low propensity amongst UK businesses to file patents, and a low success rate in obtaining patents abroad.
- **UK businesses have a higher success rate in registering patents abroad than they do in the UK:** While 58% of patents filed abroad by UK businesses in 2019 were granted, a smaller 40% of patents were granted in the UK, a success rate that also does not differ between domestic and non-domestic businesses. This contrasts with many of the benchmark countries, which show a relatively similar success rate of domestic businesses in obtaining patent rights domestically and abroad, as well as similar success rates for all businesses regardless of origin in obtaining patent rights in the destination country.[34]

- **UK businesses have registered more patents in the last decade both in the UK and abroad[35]:**The evidence suggests that UK businesses are showing an increased propensity to seek patent protection for their inventions, and more so abroad than with the UK IP Office. Patent grants by UK businesses grew 71% between 2010 and 2019 (compared to 66% in Switzerland or 62% in the US), while trademark and design registrations saw limited growth in comparison (13%, and 26%, respectively). This suggests that the UK's patent intensity has increased from a low base, while its trademark and design concentration, albeit higher, has stagnated.
- **The UK has seen significant growth in trademark and registrations, but this is driven by non-domestic businesses registering rights in the UK:** UK businesses have seen less growth in IP registrations across all IP offices (domestic and abroad) compared to the growth seen in registrations with the UK IP Office by resident and non-resident businesses, pointing to a gap amongst UK and other businesses in the propensity to file patents. At the same time, while UK-owned trademark registrations grew only 13% and designs grew 26% over the same period, registrations in the UK by resident and non-resident businesses grew much faster (+268% for trademarks and +118% for designs), showing an increase in the attractiveness of the UK as a place in which to register these types of IP rights. Comparatively, the UK has attracted fewer patent registrations in 2019 relative to the start of the decade than most other comparator countries.
- **The UK ranks highly on its IP environment by international standards, but less so on its environment for patents:** The 2021 International IP Index,[36] which measures the effectiveness of the IP system in 53 countries based on 50 indicators, ranks the UK second on its IP environment.[37] However, its ranking varies by type of IP, with the report showing a more favourable environment for trademarks and designs in the UK, and a less effective environment for patents (particularly for the enforcement of pharmaceutical rights), copyrights, and the protection of trade secrets. This could help explain why the UK underperforms more on patents than trademarks and designs. An area of underperformance for the UK is also its enforcement in relation to software piracy and physical counterfeiting.[38]

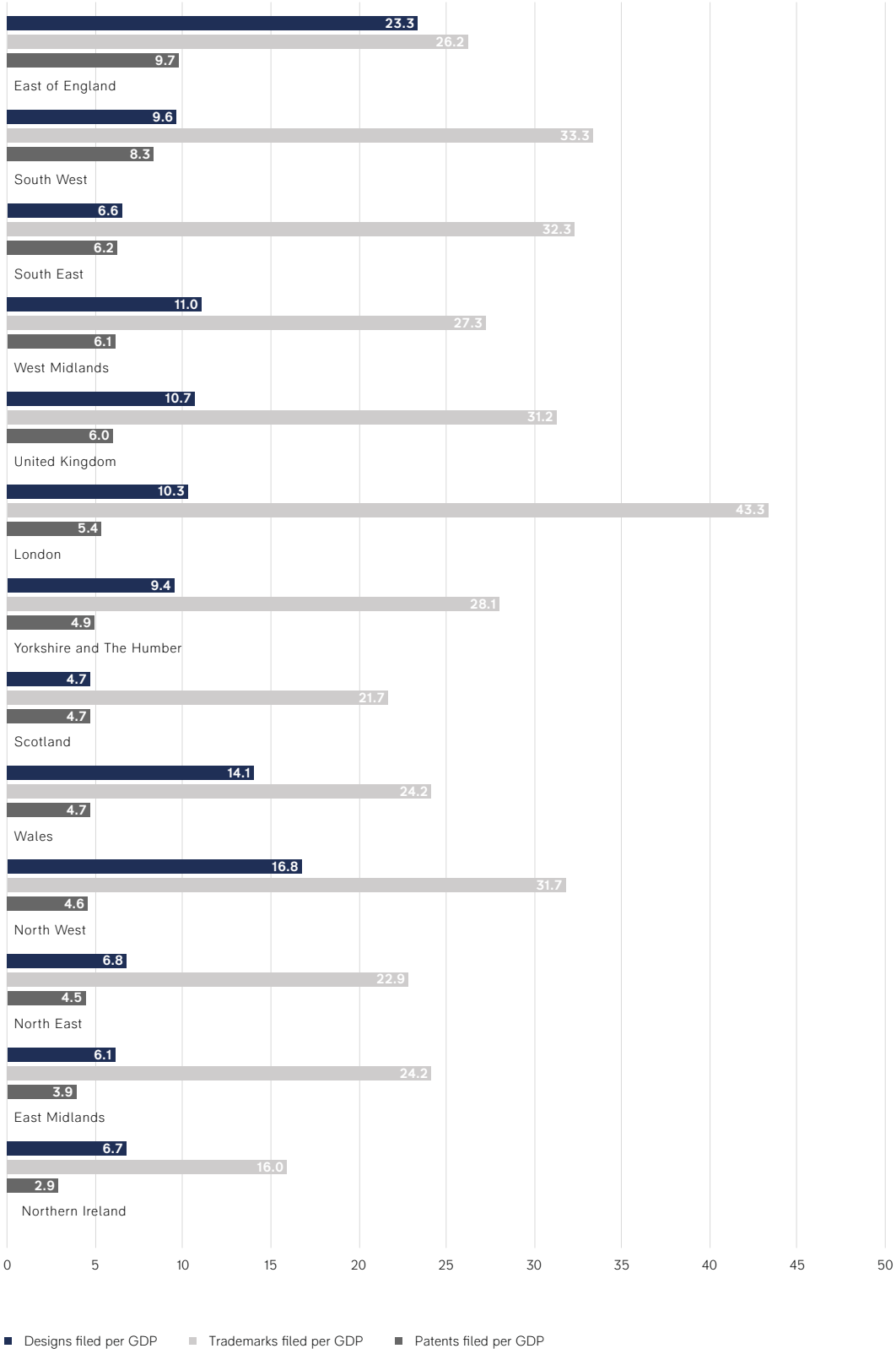
This analysis points to a complex picture when examining the underlying factors behind the UK's comparatively low concentration of IP. While the propensity for UK businesses to file and register patents has increased in the last decade, it nevertheless has a long way to go to reach similar levels to those seen by international comparators. The UK therefore stands to benefit from encouraging more of these registrations to be sought in the UK and by driving higher success rates of UK-sourced registrations over non-domestic registrations. At the same time, while the UK is proving attractive to non-domestic registrations for trademarks and designs, it could benefit from further encouraging domestic registrations for these types of IP.

Overall, the evidence indicates that the UK's underperformance on IP can be explained by both a lower propensity to patent and a lower success rate of UK businesses in translating knowledge into commercial outputs.

Regions differ in their strengths in types of IP explained by sectoral variations, but still underperform international standards across all types of IP.

As the analysis demonstrates, by international standards, the UK has one of the lowest IP intensities (except for trademarks) of all countries benchmarked and has seen weaker growth in IP over the recent decade. However, this aggregate picture masks variations between regions, sectors, and businesses of different size within the UK. As illustrated by **Exhibit 4**, IP intensity varies across the UK's regions both on aggregate, but also when looking at their varying strengths in the three different types of IP. The data shows that while London has the highest propensity for trademarks, the East of England has the highest propensity to patent and for designs, indicating that the picture on IP looks different at the regional level, with some regions driving the UK's overall performance more than others.

Exhibit 4 UK IP filings per £ billion of GDP, by UK region



Source: UK Intellectual Property Office, Facts and Figures 2019; ONS, Regional (balanced) GVA, 2019

As there is very little variation between the SME presence relative to larger businesses at the regional level, this difference in IP intensity is more likely to be related to differences in the concentrations of certain types of economic activity observed across regions. Based on IP use (IP rights per 1,000 employees), three sub-sectors of the manufacturing industry (pharmaceuticals, transport equipment, and other manufacturing),[39, 40] and the activities of holding companies are found to have the highest IP intensity. Other key industries identified as patent-intensive are: research and experimental development on biotechnology; the manufacture of electronic components and electrical equipment; other research and experimental development; and other manufacturing. In addition, the publishing of computer games and the manufacturing of pharmaceutical products and textiles stand out on trademark intensity, and software, databases and computer games are notable on copyright intensity.[41]

While these are broadly the same sectors that contribute the lion's share of IP in other countries, Switzerland shows a comparatively higher patent intensity than the UK in the medical technology, pharmaceutical, measurement, and biotechnology sectors, with 29% of all patents filed in these sectors in 2019, while the UK's share is 19%.[42] Moreover, only 8% of the UK's patent filings come from the computer technology sector and digital communications, compared to 12% in Korea and 18% in the US.[43]

This sectoral difference across both the UK regions and their IP intensity can help to explain the regional variation observed in **Exhibit 4**. The strong performance on patents in the West Midlands, for example, can be explained by its relatively high concentration of economic activity in the manufacturing of transport equipment (more than four times more concentrated than nationally) and other machinery and equipment (twice as concentrated as nationally), the two industries most likely to file patents. Similarly, the North West has the highest concentration of activity in the manufacturing of pharmaceutical products (more than three times the UK average), which is the most prominent sector for trademarks, helping to explain the North West's strength in trademarks.

While there is clearly variation across UK regions in IP intensity, comparing the intensity of the UK's highest performing regions to the benchmark countries demonstrates that even in the strongest regions, the UK underperforms on IP internationally. For example, the UK's most patent-intensive region, the East of England, filed over 60% more patents per £ billion of GDP in 2018 than the UK average, placing the East of England on a similar footing on patent intensity to the Netherlands, but still lagging behind the other benchmark countries. This is also the case for trademarks where London saw 30% more trademarks per £ billion of GDP filed than the average region, behind the highest international standards.

This evidence suggests that while some regions show a greater concentration in certain types of IP than others, all UK regions have untapped potential to increase IP intensity to levels seen in some of the benchmark countries. At the same time, the traditional IP intensive sectors perform better on IP intensity in the benchmark countries than in the UK. As significant contributors to the UK economy (industries with an above average use of IP rights in the UK accounted for 27% (£298.5 billion) of UK non-financial GVA, 15.5% (4.5 million) of total UK employment and 52.1% (£159.7 billion) of goods exported),[44] there is therefore a large gain to be realised.

Each UK region therefore has the potential to benefit from building on their existing strengths, particularly where there is an existing competitive advantage. But it will also be important to support regions across the board in some sectors. For example, as digital technologies play an increasing role in driving productivity,[45] there is a case for policy to place particular emphasis on incentivising IP within the digital sector at a national level.

IP rights are concentrated within larger businesses and high-growth SMEs in the UK, with the success of these SMEs driven by their ability to develop internationally.

As well as regional variations, there are also variations by business size. When looking at the greatest contributors to IP registrations, a clear gap emerges between the propensity to file IP amongst SMEs compared to large corporations. The evidence shows that only 9% of SMEs have registered IP rights, compared with 40% of large companies.[46]

In some countries the number of IP applications is driven by a small number of large firms. For example, in Sweden, Korea, and Switzerland, the top ten applicants make up 60%, 42%, and 32% respectively of total PCT applications originating from these countries. The UK, on the other hand, has a wider distribution of applications across firms, with only 18% of all applications driven by the top ten, similar to the US.[47] While this suggests that the UK's patent applications originate from across a wider business population, this is not necessarily an indication of a higher share of SME applicants relative to total applicants.[48]

Firm-level evidence in EU countries finds that the comparatively lower IP intensity amongst SMEs is due to a general lack of awareness and the ability to exploit IP rights.[49] Evidence also suggests that smaller firms are on average typically less inclined towards spending on R&D and innovation, and therefore are less likely to reach the commercialisation stage of innovation than larger firms.[50]

There are many factors that could explain this. One of the most cited barriers to innovation for SMEs is the accessibility of capital and finance, which is less of a barrier for larger firms. This, amongst other factors, increases the risk and uncertainty associated with this type of investment. Unlike other types of investment, the risk cannot easily be diversified away or insured against. As a result, this feature of innovation tends to lead to high costs of financing for start-up firms and SMEs which can lead to valuable innovations not going ahead.

At the same time, the SMEs more likely to own IP rights represent a segment of more innovative SMEs, typically defined as 'high-growth' or 'innovation-driven' enterprises, and the success of high-growth firms is often driven by their ability to develop internationally. In 2007-08, up to 26% of internationally active SMEs introduced products or services that were new for their sector in their country, compared to only 8% for other SMEs. These internationally active SMEs are also found to develop process innovations (11% vs 3% for SMEs without international activities).[51] However, these firms represent only around 6% of all SMEs, explaining the lower share of SMEs relative to large businesses with registered IP rights.

While this is a trend observed across many countries, the gap in the UK appears much starker. Approximately two thirds of high-growth EU SMEs who have IP rights are concentrated in six member states (Germany, the UK, Spain, France, Italy and Poland), but the UK's share of high-growth firms relative to all SMEs is only 7%, compared to 12% in the Netherlands and 9% in Denmark.[52] Furthermore, evidence from a firm-level study finds that the UK has a lower share of SMEs which own IP rights (10%) compared to other EU countries – such as Portugal (14%), Cyprus (13%), Denmark (12%), or France (11%) –, suggesting that UK SMEs are less likely to patent than international counterparts.[53]

UK evidence points to structural barriers in the market for SME finance, which could help to explain this as this was identified as a key barrier to many potential 'high-growth' SMEs starting out,[54] and led to the introduction of the British Business Bank in 2014. Since then, the Bank of England's Credit Conditions Survey has nevertheless continued to report that, while households and large corporates have been indicating an easing in credit availability, SMEs continued to report at the end of 2019 that the availability of credit remains 'poor' or 'very poor'.[55]

This suggests there is not only scope to both increase the share of high-growth SMEs to total SMEs as a way of increasing innovation, and to support high-growth SMEs in realising their potential, but the UK also stands to benefit by closing this gap with other countries. Fostering a propensity to file IP rights amongst SMEs will unlock significant boosts to innovation and drive further advancements and improvements in technology and processes, with the wider economic and societal benefits that this knowledge spillover brings.

Learning lessons from international counterparts

Countries with support at all stages of the R&D process are more successful than others at driving the commercialisation of ideas.

It is clear from the evidence that there are different ways to be successful innovators as countries have different strengths: some, in the creation of knowledge through academic excellence, and others in the transfer of knowledge or the adoption and development of ideas in commercial contexts. But the evidence also indicates that successful economies typically have an innovation ecosystem that fosters innovation at all stages of the R&D process.[56] Much of this can be explained by the wider environment for doing business, from infrastructure, skills, and access to finance to regulation, as well as the policy environment that supports this.

As a result, governments around the world that are successful in creating a thriving innovation ecosystem tend to be those that provide policy support for innovation at all stages.[57, 58] One study found that where the policy objective was one focused around the later stages in the R&D process, targeted support was only successful if coupled with support that addressed underperformance in the earlier stages of innovation.[59] This includes support at the pre-innovation stage that provides businesses with the environment to develop ideas, the R&D stage which enables businesses to develop their ideas, and the commercialisation stage where ideas are turned into new products and services. **Exhibit 5** summarises the different types of support governments provide at the different stages of R&D.

Exhibit 5 Government support at different stages of innovation

Source: CBI Economics analysis

While this wrap-around support requires significant investment by government, the evidence shows that government spending on R&D realises huge returns by leveraging private sector investment in R&D (a recent study showed that £1 of public R&D investment leverages between £1.96 and £2.34 of private R&D in the long-run),[60] attracting FDI and high-value skills, and boosting long-term productivity. Furthermore, the evidence indicates that successful innovators, who have the highest spend on R&D relative to their GDP, as well as the highest ratio of business-to-public sector spend are typically the most productive countries.[61]

The choice of policy instrument depends on the stage of the R&D process, with the commercialisation of ideas better supported through market-driven tax incentives.

Government therefore plays a key role in driving R&D and the commercialisation of ideas. As well as providing support at all stages of the R&D process, the choice of policy instrument is just as important. There are three main channels through which governments can intervene to support innovation:

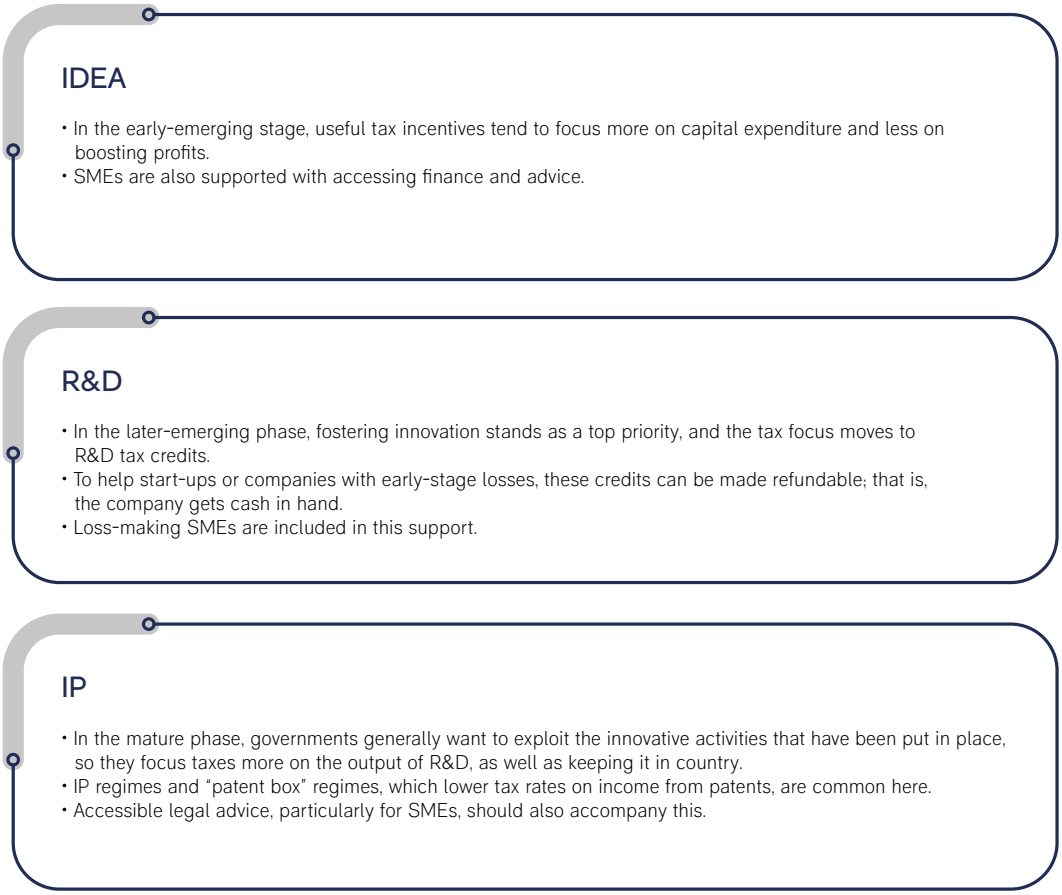
- **Direct and targeted funding** in the form of grants and subsidies support innovation in specific sectors, markets, or technologies, e.g., biotechnologies or low-carbon technologies, that help to address market failures where the risk profile would otherwise be too high. This type of support is important in developing the right conditions for earlier stages of innovation and collaborations, and for helping small businesses and start-ups in overcoming the initial barriers to innovation, such as access to capital.
- **Tax incentives, breaks, or deductions** lower the cost of innovation and encourage market-driven innovation across all sectors, markets, or technologies, helping to increase the commercial viability of certain investments. A competitive tax policy landscape is also an important factor in determining a country's attractiveness as a place to invest.
- **Regulation** sets the framework for businesses to operate in and therefore needs to strike the right balance between appropriate enforcement and over-regulation. Evidence shows that countries with weak enforcement of IP rights, or weaker institutions supporting patent protections and copyright laws tend to lag in innovation on the global competitive stage.[62]

The choice of policy instrument, however, depends on the policy objective, which is likely to differ according to the stage of the R&D process governments are seeking to support. Generally, to support businesses to innovate, governments can use a combination of direct spending and tax policy to achieve a desired policy outcome. Direct government funding allows governments to play a larger role in selecting the projects that will be funded and therefore in steering R&D in certain areas, whereas tax policy leaves the direction of innovation in the hand of the market.

While direct grant funding is shown to be more effective in promoting basic and applied research, tax incentives are more conducive of experimental development activities amongst businesses.[63] This is because tax incentives reward organisations for investing substantial resources into the development and commercialisation of new technologies, increasing the viability of those investments.[64] This complementarity between direct funding and tax incentives is therefore important in understanding how governments can successfully drive business behaviour at different stages of the innovation process.

Furthermore, the choice of tax incentive matters as some tax incentives can be more effective at particular stages of the R&D lifecycle, as illustrated by **Exhibit 6**.[65] While the earlier stages of R&D are best supported by policy targeted at supporting businesses (particularly SMEs) in acquiring the resources to take the first steps in developing and testing their ideas, businesses then require support with covering R&D expenditure, and finally support with protecting inventions and commercialising R&D outputs.

Exhibit 6 The effectiveness of tax incentives at different stages of innovation



Source: PWC (2010), Governments' Many Roles in Fostering Innovation

Despite offering a wide range of innovation related policy support, the UK underperforms international counterparts on the commercialisation of ideas.

The UK has one of the most varied systems of policy support for innovation, only rivalled by the Netherlands and Switzerland as set out in detail in **Table 3**.[66] As well as providing grants and subsidies, the UK operates several tax measures aimed at incentivising innovation and investment. Its R&D tax reliefs scheme is well-known as a successful example of tax policy which has helped to address some of the under-investment in R&D by UK businesses.[67] The UK also provides a patent box regime that aims to incentivise IP to be commercialised in the UK, encouraging both domestic and foreign investment, and spurring innovation through lower tax rates from patented innovations that have been developed in the UK.

Despite having this support in place, as demonstrated by **Table 3**, the UK underperforms all benchmark countries other than Singapore and the US on PCT patent intensity, a key measure of the commercialisation of ideas. Furthermore, it is clear from the analysis in the table that the level of policy support offered in the UK is not necessarily matched in the countries that outperform the UK on measures of the commercialisation of ideas, suggesting there are other factors to consider.

Taking a closer look at the policy environment in some of these countries helps to shed light on this. Korea, for example, has fewer policy support schemes in place than the UK but has consistently outperformed the UK on IP filings over the past decade, driving one of the largest growths in IP, exceeded only by China, and has the highest patent intensity in the world, alongside Switzerland. As well as differences in policy support, Korea's shift of economic strategy away from a reliance on imports of advanced technologies from abroad, to home-grown innovations is likely driving this picture.

Table 3 Policy support ranked by metrics on commercialisation of ideas[68]

Country	Innovation ranking	PCT patents ranking	Presence of policy ranking[69]	R&D tax credits and super-deductions?	IP box?
Switzerland	1 (1)	2	=1	✓	✓
Sweden	2 (2)	3	9		
US	3 (3)	6	7	✓	
UK	4 (4)	9	=1	✓	✓
Netherlands	5 (5)	5	3	✓	✓
Finland	6 (7)	4	6		
Singapore	7 (8)	8	4	✓	✓
Korea	8 (10)	1	7	✓	✓
China	9 (14)	7	5	✓	✓

Source: CBI Economics analysis based on World Intellectual Property Organisation (WIPO) Facts and Figures (2019), WIPO Global Innovation Index (2020) and Deloitte Survey of Global Investment and Innovation Incentives (2020)

Switzerland, on the other hand, performs strongly on most measures assessed, as well as having a similar level of policy support in place for innovation as the UK, including an IP box. Switzerland is renowned internationally for its focus on quality – from the quality of skills and education, research and academic outputs, through to the quality of its inventions and the strength of IP protection, which further attracts high-value investment and talent adding to its knowledge base.[70] Its wider environment for innovation is also a key aspect of its success, which has been supported again by successful policy and ranges from creating the quality infrastructure, education, training, and business support, through to supporting a high quality of life which attracts top talent.[71]

Finland is an interesting case as the review finds much less policy support compared to other countries, yet Finland performs well on measure of commercialisation, suggesting that the presence of an IP box is not necessarily a pre-requisite for being successful at commercialising ideas. Finland is the most successful of the benchmark countries at filing patents abroad, with 78% of Finnish patents filed with international administrations granted, compared to just 58% in the UK and 61% in Switzerland. This could be partly explained by its wider environment for doing business, with Finland ranking highly on innovation inputs such as the efficiency of its institutions, its high-quality education system, and its human capital, as well as its infrastructure.[72] This has helped create the foundation to enable Finnish businesses to spend on R&D and secure IP protection, particularly trademarks and PCT patents, highlighting the importance of creating an enabling business environment.

While this review demonstrates how the UK fares internationally, it does not provide definitive conclusions on the effectiveness of UK policy in driving new ideas to market. Therefore, to understand where UK policy could be improved requires a more detailed investigation into the different policy support available within this wider context. IP boxes have become increasingly popular as a policy tool to drive IP around the world, including in the UK, with the share of intangible assets growing. The design and effectiveness of these IP boxes is therefore crucial in understanding where UK policy could go further.

IP boxes are increasingly popular, but the presence of a patent box is not necessarily explanatory of high-IP intensity unless linked to earlier R&D spend.

Companies have increasingly been able to move these intangible assets to countries with lower taxes. The mobility of this IP income has resulted in competition between countries to attract and retain IP within their own jurisdictions. Countries around the world have therefore introduced IP boxes to address this behaviour, and encourage the retention of IP assets and IP creation in the domestic economy, which in turn helps to retain high-skilled jobs and R&D.

Governments around the world are also increasingly introducing IP boxes as a strategy to attract IP. To avoid tax competition between countries through differences in the design of IP boxes, these issues have led to the OECD introducing the Nexus principle of the Base Erosion and Profit Shifting (BEPS) rules.[73] The OECD's BEPS changes applied from 1 July 2016 and require businesses to demonstrate a nexus between the profits falling within the patent box and the underlying R&D activities behind the inventions. The "new" regime requires claimant businesses to track their R&D expenses and how they relate to specific patents, products, or product families, creating a clear link between R&D tax credits and the patent box.[74]

Nevertheless, R&D tax credits and super-deductions have a different aim to IP boxes – the former covers only R&D innovations, directly targeting an input to innovation that is under the control of the business; while the latter covers only patentable innovations, targeting innovation outputs which are largely driven by external causes. Lower taxes on patent income allow the business to re-invest in R&D, but evidence shows this is less effective than directly subsidising R&D and that these firms do not necessarily use these tax benefits to overcome the problem of financing further R&D investment.[75]

The UK introduced a patent box in 2012 that allows companies to apply a lower corporation tax rate of 10% to relevant profits from qualifying IP with the aim of incentivising IP to be commercialised in the UK, encouraging both domestic and foreign investment, and spurring innovation through lower tax rates from patented innovations developed in the UK.[76] It aims to do this by: 1) incentivising companies whose IP is already in the UK to invest in the commercialisation and undertake exploitation of that IP in the UK, 2) providing an incentive for companies whose IP is outside of the UK to develop it in the UK and then invest in commercialisation and undertake exploitation activities in the UK, and 3) reducing the risk that companies whose IP is in the UK shift this outside of the UK, investing in commercialisation in a foreign jurisdiction.

However, international studies show that IP tax incentives are not always as effective as they could be in delivering the desired economic outcome for the following reasons:

- **IP incentives have a small influence on the location of IP but are mostly used as a means within the overall tax-optimisation strategies of multi-national firms:** Cross-country firm-level evidence suggests that tax rates and the presence of a patent box can have a small influence on a company's decision of where to locate IP and can have a small effect on local R&D activity and the transfer of IP.[77] A recent HMRC study analysing the effectiveness of the UK patent box also demonstrated a small effect on investment in intangible assets.[78] However, the major criticism of patent boxes around the world is that patent boxes have become a means within the overall tax-optimisation strategies of multi-national firms.[79]
- **IP tax incentives tend to lead to tax competition between countries:** Patent box policies are implemented on the premise that firms move towards locations with lower corporate taxes. As the income derived from IP rights is highly mobile, international evidence suggests that multinational firms are increasingly choosing to hold IP (and the resulting revenue stream) in subsidiaries outside of the home country, often outside the country where the underlying research has taken place, and often in countries operating favourable tax regimes.[80] Therefore, while patent box policy can increase the level of commercial activity, it also potentially contributes to tax competition without attracting or mobilising additional innovation or production activity in the country of the Patent Box.
- **IP tax incentives reward existing innovations rather than incentivising new ones:** There is also a line of criticism that most patent box schemes award additional tax benefits to a successful innovation that already enjoys IP protection, providing limited economic benefit.[81] In particular, a 2015 European Commission study offers this as a potential explanation for weak effects on innovation.[82] Instead, evidence shows they can reduce the tax payable on the profits of already successful innovation (since the product has been patented and is generating sales) and which is already protected through a patent (and therefore restricts sales to the owning company, increasing profit).[83]

While internationally there are several criticisms of patent boxes, there is inconclusive evidence on whether these criticisms could be addressed through reform. Furthermore, there is also evidence to the contrary that demonstrates where patent box policies are effective in driving investment. For example, a UK study by HMRC found that, while patent boxes are generally found to have a small and weak effect on innovation, the UK patent box is found to have an impact on business investment.[84] Similarly, a Dutch study found that the Dutch patent box has an effect on local R&D investment decisions at the firm-level.[85] As many countries still have these policies in place, including the UK, it is therefore useful to explore these policies further to understand whether there is evidence to reform the UK's patent box.

Of the eight benchmark countries analysed, six have some form of IP box. Finland and the US are the two benchmark countries that do not currently have an IP box in place. An overview of the IP boxes in these five countries is presented in **Table 4**.

Table 4 IP box regimes in the benchmark countries

Country	Headline Corporation Tax (CT) Rate	Effective Tax rate (IP)	Nature of Incentive	Life cycle	Qualifying IP
United Kingdom	19%	10%	Reduced effective tax rate on profits arising from patents for companies owning or exclusively licensing patents.	Claim made in arrears	Granted Patents in any sector, or rights similar to patents for certain activities.
Switzerland	15%	8.8% - 12.6%	Taxpaying entities that hold Swiss or foreign patents, or patent-equivalent rights. Up to a 90% exemption from Swiss CIT for qualifying patent income.	Claim made in arrears	Registered patents and comparable rights, which the claimant company has developed within Switzerland under the OECD modified nexus approach.
Singapore	17%	5% - 10%	Reduced corporate tax rate for approved IP Development Incentive (IDI) companies on a percentage of qualifying IP income.	Claim made in advance	Patents and copyrights subsisting in software (must be approved IDI company).
Korea	10% -25%	5% - 18.75%	Tax exemption for SMEs that transfer or lease patent rights to a Korean party.	Claim made in arrears	Software protected by copyright, industrial patents, trademarks, designs and models, as well as processes, formulas and information relating to experience acquired in the industrial, commercial, or scientific field, capable of legal protection.
Netherlands	20%-25%	7%	Lower CT rate on profits from self-developed intangibles for which one or two entry tickets (including patents and other rights) have been obtained.	Claim made in arrears	The Dutch R&D statement (WBSO) outlines the 'entry tickets' without which one cannot access the regime.
China	25%	0% (tax holidays) – 15%	Tax holidays for qualifying businesses, and after tax holiday, certain enterprises qualify for ongoing reductions in CT rate to 15% or in some cases 10%.	Claim made in advance	Assessment by government as to whether the enterprise meets a qualifying designation. The precise criteria for each designation are not listed here.

Source: CBI Economics analysis based on a review of IP boxes in the set of countries

The analysis in **Table 4** provides several key findings relating to the design of IP boxes across the benchmark countries:

- **The most prominent feature of IP Box regimes is the tax rate.** However, the countries with the lowest effective tax rates are not necessarily the countries with the highest IP performance. Two IP regimes which offer some of the lowest effective tax rates amongst the selected benchmark countries are that of Singapore and Korea (both as low as 5% compared to 10% in the UK) but, while the lower tax rate is reflected in Korea's IP performance, it is not reflected in Singapore's.
- **Many regimes are now subject to the OECD 'modified nexus' approach.** This broadly means that IP qualifying for a preferential regime should be linked with the claimant company's underlying R&D activity, significantly reducing (but not eliminating) the incentive and ability to locate patents purely based on tax rate.
- **There is significant heterogeneity in IP regimes.** For example, whilst some regimes such as China offer initial tax holidays, others focus on Corporate Income Tax (CIT) exemptions (Switzerland) and still others have entirely separate CIT rates for IP income (UK). This suggests both that there is not a common agreement on how to incentivise IP creation in the tax system, and that the heterogeneity of countries' broader IP environments may play into their IP tax regimes (including on how they may best compete with one another).
- **Despite this heterogeneity, nearly all the IP regimes reviewed focus on legally registered patents and similar rights.** It is striking that the regimes in this review, except for China, focus primarily on IP which is legally registered such as a patent (although they also exclude other legal rights such as trademarks and copyrights). While this is unsurprising, it leaves open the question of whether patent boxes could be made to work harder for their respective countries. For example, there is already a tie to R&D expenditure in most regimes due to the application of the 'modified nexus' approach. Taking this one step further, it could be possible to extend the patent box regime to apply to the commercialisation of any R&D, whether a legal patent was applied to it or not. This may be a missing link in the current R&D framework and bears further exploration.

- **The UK goes further than many of the benchmark countries in supporting SMEs to file for patents but could do more to simplify the IP process:** The UK's patent box acknowledges the barriers faced by SMEs by differentiating between SMEs and large firms in its patent incentives through preferential incentives and by accommodating loss-making firms. However, the UK's regime could go further in levelling the playing field for SMEs and large businesses by simplifying the IP process for SMEs. This could involve providing alternative models for obtaining IP rights (such as utility models) which are more accessible and act to support SMEs in obtaining short-term protection for their inventions. This would enable SMEs to draw out much-needed private investment (such as VC) and develop their inventions further, bringing them to a place where they can ultimately apply for longer-term IP protection.

In conclusion, the analysis suggests that the current patent box framework is not working to its full potential. The UK could therefore see positive gains from reviewing the regime and considering an expansion in its scope, while still operating within the constraints of relevant international norms such as the OECD modified nexus approach and potential Pillar 1 & 2 agreements.

Innovation related tax incentives seek to minimise the barriers for SMEs, which helps to drive the commercialisation of ideas.

Tax policy is an important, but not the sole, policy lever used by many countries to support innovation at all stages of the process, with many countries recognising both the value small firms play in spurring innovation and the significant barriers they face in bringing new ideas to market. Many governments seek to reduce these barriers through certain design features of their tax incentives, for example by providing preferential treatment to SMEs and/or support for loss-making SMEs, which help increase the commercial viability of an investment.

An approach taken by some countries is to provide tax incentives to private investors to help SMEs access the necessary funding required to commercialise an idea. This support enables Venture Capital (VC) investors, for example, to take on the higher risk associated with investing in new, small businesses with large sunk costs. The evidence demonstrates that the benefits resulting from these investments could be substantial, with VC-backed start-ups growing faster than their non-VC backed counterparts on every financial measure, as well as excelling against non-VC backed firms in terms of intangible assets growth, allowing them to improve further and faster than their peers.[86] There is therefore a clear argument for governments to support VC investors in order to realise the potential value they can bring to an economy.

However, of the countries considered for this study, only China provides clear support for VC investment through tax incentives. In China, a VC company or an individual investor may deduct 70% of the amount invested in a start-up technology company from the taxable income derived from such an investment if the investment has been held for at least two years. This could therefore partly explain why China has seen the highest growth in patents and other forms of IP of all countries considered for this study.

Furthermore, the evidence shows that businesses that engage with universities or research organisations are more likely to take new products or services to market and file for IP rights.[87] The most successful governments, such as Switzerland, place great emphasis on capitalising on the quality of their universities and research organisations. This makes the difference between producing high-quality publications which are internationally cited but are not translated into new products or services brought to market, such as in the case of the UK, and producing high-quality research which is applied and brought to market. Switzerland recognises this and has created the Swiss Innovation Agency Innosuisse with an annual budget of nearly 200 million Swiss francs specifically to promote cooperation between science and industry through networking, training, and coaching. This is a similar level of funding relative to GDP, at 0.29%, to the UK's funding for UKRI of 0.25% of GDP (or £7.1 billion).[88]

While the policy landscape for innovation plays a huge role in incentivising IP, the wider environment for doing business can further explain why some countries are more successful than others at driving quality inventions.

It is clear from the evidence that a successful innovation system balances the forces that push knowledge creation, exploration, and investments – the innovation inputs – with the forces that pull ideas and technologies towards application, exploitation, and impact – the innovation outputs. The availability and quality of innovation "inputs" within the wider ecosystem is important in driving successful innovation outcomes. While the policy and regulatory environment have been shown to play a significant role in spurring innovation and investment in IP, both amongst domestic firms and attracting investment from abroad, there are other factors within the wider environment for doing business which can act to enable or hinder innovation and IP.

For example, the IT infrastructure (such as high-speed broadband), physical space to enable collaboration between businesses, enable university-industry linkages or the co-location of supply chain with larger corporates, and the incubation of ideas, or easy access to major airports are key elements of physical infrastructure which enable ease of doing business. On its own, physical infrastructure is insufficient in encouraging smaller businesses, for example, to collaborate and innovate, and business support/ advisory services are also key in enabling them to reach their potential by helping them overcome administrative and financial difficulties.

Availability of skills is also critically important in driving innovation and productivity, and the education environment plays a role – from early years through to higher degrees and additional training provision. Access to finance (credit availability, but also government grants, access to venture capital or angel investment) can similarly be a key driver or a stumbling block in taking ideas forward and investing in R&D.

These are some of the many factors which affect the ease of doing business in a given country, but also the ease of starting a new business with disruptive new inventions which are important for driving innovation related activity and commercialising ideas. This is highlighted by the GII which shows that the top performers on innovative outputs also tend to be those ranked highest on inputs.[89] It is therefore crucial that government support not only seeks to increase the commercial viability of taking ideas to market through tax incentives or grants for example, but that it also creates an environment conducive to these types of investments by ensuring the policy environment encourages the skills and infrastructure that will anchor this investment into the UK.

Realising the UK's untapped potential to drive value from R&D

The UK stands to gain considerably from boosting investment in IP and R&D spending to levels observed in other countries.

Bringing the evidence together, there are several clear themes that emerge on where gaps currently exist in the UK's IP regime that help to identify where policy support could play a larger role in driving commercial value from R&D. The overarching finding driving this study is that while the UK is a world leader in innovation, driven by its academic outputs, the UK underperforms on the commercialisation of R&D. If the UK matched the IP intensity observed in other countries, these economic benefits could be realised.

However, as the evidence shows, there are structural issues at play that will be important to address to release this potential. Historically, the UK has underperformed on business investment, including on its share of IP assets relative to total business investment. This is reflected in both a lower business R&D spend, and a lower IP intensity compared to other countries. The pandemic has exacerbated this challenge, with evidence showing the UK has been harder hit than the benchmark countries. This, coupled with increased corporate debt and limited cash flow, reduces the ability for firms to invest in the near and medium term.

There is therefore a clear role for policy in creating the incentives that enable investment to take place. With innovation a clear driver of productivity, boosting innovation-related investment will drive a productivity-led recovery in the UK that creates sustainable economic growth and prosperity.

To realise the UK's untapped potential, there are three key areas where policy could play a key role in addressing gaps within the UK's innovation regime.

The evidence set out in this study shows that the UK's performance on IP is held back by an underspend on R&D by domestic business at the earlier stages of innovation and a lower propensity for domestic firms to seek IP rights (whether in the UK or abroad). This is not necessarily driven by barriers relating to the wider economic environment as the UK appears to be attractive to R&D spend from abroad and to IP filings from non-UK firms. Nevertheless, the success rate of IP filings of UK businesses both domestically and abroad is comparable to that of business in other comparator countries, suggesting that the quality of UK inventions is internationally competitive. This suggests therefore that the UK's main weakness lies in encouraging resident businesses to translate knowledge into commercial outputs.

It is therefore important that the policy environment seeks to address this underperformance by improving the existing policy offering through both an investigation into where existing policies can be reformed, as well as exploring where new policy may be needed to encourage businesses to commercialise their ideas. A crucial starting point to this investigation is to understand the gaps that currently exist in the UK's IP regime and the best practice evidence on how policy might help to address this, which has been collated as part of this study.

Drawing on the international evidence set out in this paper, this study identifies **areas of development** that help to understand the factors likely driving the UK's underperformance on the commercialisation of ideas, and therefore the specific areas where future policy should focus:

- **Encourage the commercialisation of ideas from the earlier stages of the R&D process, capitalising on academic success, encouraging collaborations, and incentivising IP:** The evidence in this paper showed that, while the UK features as one of the world leaders on innovation according to the WIPO Global Innovation Index and has one of the most effective environments for IP (as indicated by the International IP Index), its performance on the creation of IP does not match its success on academic publications, and indeed falls behind many international peers. Analysis into the factors behind this underperformance suggests that the UK could do more to incentivise domestic businesses to create IP. The international evidence on effective policy suggests several ways to achieve this:
    - **Policy that successfully incentivises IP creation by businesses includes support tailored to business needs at all stages of the R&D process.** Governments around the world that are successful in creating a thriving innovation ecosystem tend to be those that support innovation at all stages of the R&D lifecycle through different policy instruments – including direct funding and tax incentives. While direct grant funding is shown to be more effective in promoting basic and applied research, tax incentives are better targeted at closer-to-market R&D activities, such as experimental development and the creation of IP. Furthermore, the choice of tax incentive matters and must be tailored to business needs at different stages of R&D: in the earlier stages of R&D, businesses (particularly SMEs) need support in acquiring the resources to take the first steps in developing and testing their ideas. Access to innovation space and testing facilities, finance, expertise and advice are key at these stages. To support later stages businesses require support with covering R&D expenditure, and protecting inventions and commercialising R&D outputs.

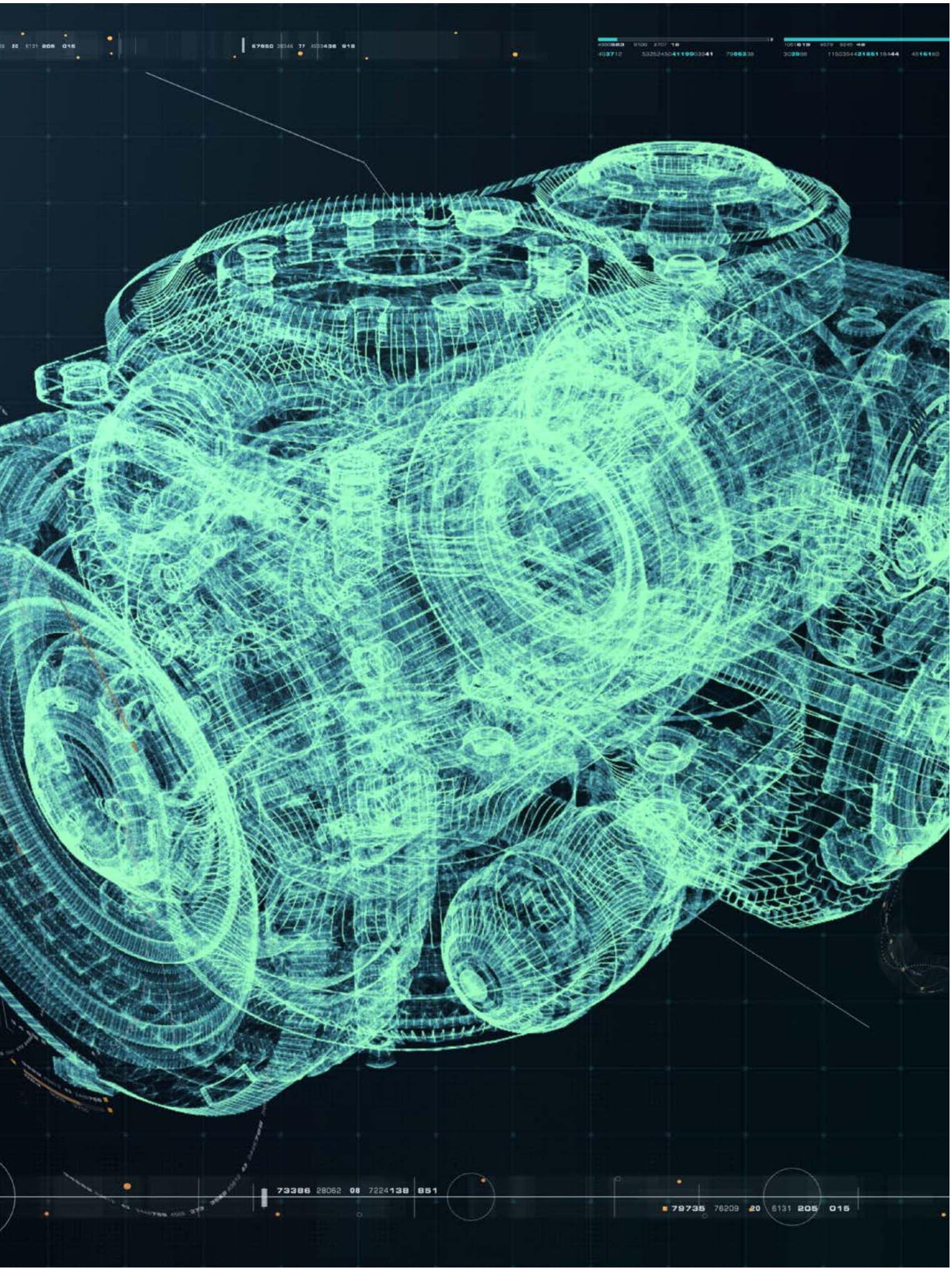
- **With R&D spend a driver of IP performance, achieving the government's 2.4% target could help to encourage R&D that translates into new products and services.** The analysis suggests that the UK's underperformance on IP is linked in part to its underperformance on R&D spend, particularly business R&D spend. Alongside policy support and incentives for business to develop and commercialise ideas, the evidence shows that governments can also leverage private sector R&D by spending more on R&D themselves. The evidence shows public sector R&D spend leverages significant private sector R&D spend, which subsequently results in higher IP performance. This suggests there is a clear role for government to play in boosting both its own R&D spend and that of others.
- **Encouraging greater collaboration between business and universities encourages the sharing of ideas and increases the likelihood that these ideas are commercialised.** As the evidence shows, the most successful governments, such as Switzerland, place great emphasis on capitalising on the quality of their universities and research organisations. This makes the difference between producing high-quality publications which are internationally cited but are not translated into new products or services brought to market, such as in the case of the UK, and producing high-quality research which is applied and brought to market.
- **The UK's underperformance on IP is reflected across all regions, but there is regional variation which points to potential strengths in different IP areas:** While some UK regions contribute more than others to the UK's overall IP picture, such as the East of England, when comparing the IP performance of the strongest UK regions to the strongest benchmark countries, these regions still lag behind international counterparts. And with the regional variation observed for performance of different types of IP, underinvestment in IP is evident across many of the UK's regions that if increased could realise a multitude of benefits for the UK economy. This suggests a need for policy to address a low propensity for IP across the board rather than addressing a regional imbalance. However, as different regions show different strengths across markets and technologies, there is a clear benefit for policy to look to encourage innovation at the national as well as the regional level and across key technologies and industries where there is an existing competitive advantage. Furthermore, the evidence points to a lower propensity to patent by UK digital firms and a weakness in the UK's enforcement of IP rights against software piracy. As the digital economy continues to play an increasing role in productivity-led growth, there is a case for policy and regulation to place a particular emphasis on enabling and attracting IP investment from digital firms.

- **Policy support needs to go beyond direct incentives, and support the wider business environment, including infrastructure and skills, as key enablers of IP.** While the level of overall policy support offered in the UK is one of the most generous, countries with less support in place are more successful than others at driving quality inventions both amongst domestic firms and attracting investment from abroad. This suggests that, while the policy landscape for innovation plays a huge role in incentivising IP, the wider environment for doing business can further explain why some countries are more successful than others at driving quality inventions both amongst domestic firms and attracting investment from abroad. It is therefore important that policy not only incentivises direct changes in business behaviour, but also promotes the wider environment for doing business as an enabler of innovation.

- **Address the barriers to R&D spend and IP investment faced by SMEs to unlock valuable and disruptive innovations and increase the share of high-growth SMEs:** Reducing the barriers for SMEs to commercialise R&D could unlock significant untapped potential for UK IP outputs and investment, as well as innovation more broadly. A particular area of improvement for the UK is in growing its share of high-growth SMEs, that are more outward-looking and innovation-active than the traditional SME. But these SMEs have high barriers to investment due to the risk profile and funding required for these types of investment. Addressing these early on could therefore unlock further improvements to the UK's IP performance. Many governments do this through certain design features of their tax incentives, for example by providing preferential treatment to SMEs and/or support for loss-making SMEs, which help to increase the commercial viability of an investment. Another approach is to provide tax incentives to private investors to help SMEs access the necessary funding required to commercialise an idea. This support enables VC investors, for example, to take on the higher risk associated with investing in new, small businesses with large sunk costs.

- **Review the effectiveness of the UK patent box and the possibility to extend its scope to encourage patents and other IP:** The presence of a patent box is not necessarily explanatory of high-IP intensity unless linked to earlier R&D spend, but international evidence suggests there is scope to improve the UK's patent box. The UK's suite of policy support includes a patent box, which are increasingly common around the world as countries look to support the last-mile stage of R&D and translate knowledge into closer-to-market inventions. International evidence on the effectiveness of patent boxes is mixed, with several lines of criticism pointing to areas for improvement. In addition, the IP box regimes reviewed mostly focus on IP which is legally registered, such as a patent, and therefore it is worth exploring whether the UK's regime could go further in encouraging other types of commercialisation of R&D. The UK's patent box acknowledges the barriers faced by SMEs both in spending on R&D and in filing for patents and differentiates accordingly between SMEs and large firms in its R&D and patent incentives. However, it could go further in simplifying the IP process for SMEs. This could involve providing alternative models for obtaining IP rights (such as utility models) which are more accessible and act to support SMEs in obtaining short-term protection for their inventions. This would enable them to draw out much-needed private investment (such as VC) and develop their inventions further, bringing them to a place where they can ultimately apply for longer-term IP protection.

This study demonstrates that while there are several gaps in the UK's IP landscape that, if addressed, could realise a multitude of benefits to the UK economy, there is no silver bullet. To close these gaps will require a package of policy support, as well as action from the business community. This study has identified the need for policy action. It provides an understanding of the broad areas where policy intervention could play a greater role in increasing the commercialisation of ideas in the UK. Further investigation and consultation is required to achieve consensus on the optimal blend of policy intervention to drive economic growth.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Appendix 1: Selection of benchmark countries

This paper presents evidence for the UK relative to a set of benchmark countries informed by research and selected according to the following two criteria:

1. **The country is a global leader on innovation -** this assessment is based on the GII 2020 rankings as an indicator of overall performance across countries. The countries in the top 10 on the GII index provide the starting point for our list of benchmark countries. These are: Switzerland, Sweden, the US, the Netherlands, Denmark, Finland, Singapore, Germany, and Korea.
2. **The country performs well on measures of IP creation and the commercialisation of R&D,** such as IP receipts and/or payments, and the number of patents, trademarks, or industrial designs per GDP. The countries that stand out on these measures are Switzerland, Korea, Japan, the Netherlands, Sweden, Austria, Finland, Israel, the US, Singapore, and Ireland.

This final list of countries was selected on the basis that they meet the criteria above, i.e., those countries that are global leaders on innovation, as well as strong performers on the commercialisation of R&D. This is because the objective of this study is to understand the factors that enable the successful commercialisation of ideas which is ultimately reflected in a high overall performance on innovation.

On this basis, the list of selected countries is as follows:

- Switzerland
- Sweden
- The Netherlands
- Finland
- USA
- Singapore
- Korea

This list also provides us with a mix of countries that are established and emerging leaders in innovation, a perspective on the innovation landscape across different continents, and countries with varying policy landscapes. Comparing these countries against each other will enable us to capture the various elements that drive innovation success across countries.

Evidence underpinning the criteria

Innovation performance can be measured in several different ways, capturing knowledge creation and knowledge diffusion by businesses, research institutions or universities, and other public sector or charity organisations. There are several data sources that provide information on metrics such as R&D expenditure as share of GDP, number of patents filed, or number of cited academic publications. In addition, there are also composite measures which draw on a few indicators aimed to provide an overall picture of innovation performance, such as an index of knowledge creation across business, academia, and the public sector, or an index of innovation 'inputs' and 'outputs', which distinguish between the ingredients needed to enable knowledge creation, and how that is translated into improved or new products or services for consumption.

The starting point for selecting the benchmark comparators was to draw on evidence compiled into a common index measure for innovation that allows for international comparison and is therefore a useful tool to identify the world leaders across a range of measures. The Global Innovation Index (GII 2020)[90] provides an average ranking of innovation capabilities, across roughly 80 indicators, grouped into innovation inputs and outputs, capturing the multi-dimensional facets of innovation.

These measures captured by the index are grouped into the following two sub-indexes:

- **An Input Sub-Index:** this captures performance across a number of different innovation 'inputs' or 'enablers', such as institutions, human capital, infrastructure, finance availability and accessibility, expenditure on R&D, or political and regulatory environment; and
- **An Output Sub-Index:** this measures the knowledge creation, diffusion, and impact across scientific and technological outputs, as well as creative outputs.

While the top 10 countries on the overall GII 2020 index were firstly considered, there was also a focus on the Output Sub-Index as this allows the identification of those countries performing well on innovation outputs to create, diffuse, and commercialise ideas to drive new products and services in the economy and improvements in technology and processes, which is the core focus of this study. This is particularly important as the initial research showed that countries that perform well on IP do not always feature in the top rankings of the GII on overall innovation, illustrating the diversity amongst countries in terms of their innovation ecosystem. Additional data sources that complement this index and help to provide a clearer picture of the IP landscape across different countries were also considered. Finally, the selection was further informed by additional measures of innovation outcomes in relation to trade and FDI.

Below is a summary of the additional set of metrics that were analysed to understand differences in performance across measures of commercialisation of R&D and inform the selection of benchmark countries in relation to the second criteria.

- The main performance measures we considered for capturing success in the commercialisation of IP are: the number of patents, utility models, trademarks, and industrial designs (the main type of IP) per GDP.
- IP payments[91] (absorption of IP regardless of country of origin) were also against IP receipts[92] (diffusion of IP by domestic firms, regardless of destination) to understand whether a country is more likely to have businesses which invest in IP, or simply more attractive to IP investment from foreign affiliates or through FDI.
- This was complemented by a measure of ownership of inventions from abroad in relation to all domestic patents, which gives a further indication of a country's attractiveness to investment in new technologies enabled by a favourable overall environment for IP.

Appendix 2: Data sources

The core data underpinning the analysis in this report is listed in **Table 5** below.

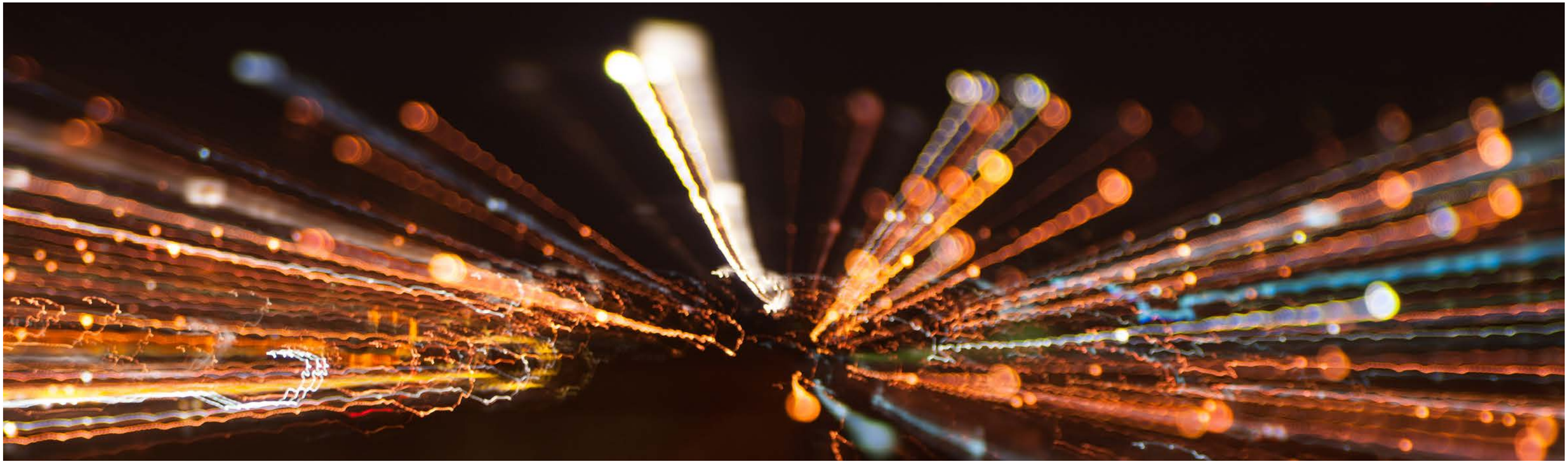
Table 5 Data sources

Metric	Data Source
Business investment – total, and by asset	ONS (2020), Business Investment by Asset
Business investment – total, and by asset	OECD (2020), National Accounts at a Glance, Investment by Asset
Business investment as a % of GDP	Oxford Economics Global Forecasting Model, 2020
Innovation index	World Intellectual Property Office (WIPO), Global Innovation Index 2020
IP Index	US Chamber of Commerce (2021), International IP Index 2021 (9th Edition)
R&D expenditure (% of GDP) Business-funded R&D expenditure (% of GDP) R&D expenditure from RoW (% of GDP) R&D expenditure by type of R&D (% of total R&D expenditure)	OECD Science & Technology Indicators, 2020
Patent filings per billion $ GDP PCT patent filings per billion $ GDP Trademark filings per billion $ GDP Design filings per billion $ GDP % of PCT filings that went to national phase entry (% of all PCT filings) Success rate of patents abroad (% of filings granted)	WIPO (2021), IP Facts and Figures 2020
IP (patents, trademarks, and designs) filings per billion £ GDP by UK region	UK Intellectual Property Office (2020), Facts and Figures 2019; ONS (2020), Regional Gross Value Added (balanced) 2019
IP use (IP rights per 1,000 employees) by industry	UK Intellectual Property Office (2020), Use of Intellectual Property Rights across UK Industries
Patent filings by sector (% of all patent filings)	WIPO (2021), IP Facts and Figures 2020
PCT patent filings top 10 applicants as a % of all PCT patent filings	WIPO (2021), IP Facts and Figures 2020
IP ownership – SMEs v. large firms High-growth firms as a % of all SMEs, EU countries	European Patent Office (2021), Intellectual property rights and firm performance in the European Union
Credit availability reported by SMEs	Bank of England (2021), Credit Conditions Survey Q4 2020

Appendix 3: International review of IP performance and policy

The following table provides an overview of how each comparator country performs on different measures of IP outputs, and what type of policy incentives they have in place to support IP.

Country	**GII 2020 ranking**	Gross expenditure on R&D, % of GDP	Business expenditure on R&D, % of GDP	Patent filings per bn $ GDP	PCT patent filings per bn $ GDP	Trademark filings per bn $ GDP	Design filings per bn $ GDP	Success rate of businesses filing patents abroad (% of filings granted)	Headline CT Rate	Does it have an IP box	Does it have R&D tax credits and super-deductions
United Kingdom	**4**	**1.7%**	**0.9%**	**18**	**1.8**	**401**	**62**	**58%**	19%	✓	✓
Switzerland	1	3.3%	2.3%	78	7.9	902	253	61%	15%	✓	✓
Sweden	2	3.4%	2.0%	43	7.6	612	84	65%	21%		
United States	3	2.8%	1.8%	25	2.8	91	19	60%	27%		✓
The Netherlands	5	2.0%	1.0%	36	4.0	551	129	71%	25%	✓	✓
Finland	7	2.7%	1.6%	43	6.0	612	84	78%	20%		
Singapore	8	1.9%	1.0%	13	2.0	135	9	59%	17%	✓	✓
Korea	10	4.3%	3.3%	113	9.0	172	72	61%	25%	✓	✓
China	14	2.1%	1.6%	59	2.6	382	50	46%	25%	✓	✓



References

1. European Patent Office (2021), Intellectual Property rights and firm performance in the European Union
2. Bank of England (2021), Credit Conditions Survey Q4 2020
3. A measure of IP filings per billion $ of GDP
4. OECD (2015), Enquiries into Intellectual Property's Economic Impact
5. National Institute of Economic and Social Research (2019), Tax Policy for Innovation
6. OECD (2016), Fiscal incentives for R&D and innovation in a diverse world
7. European Patent Office (2017), Patents, trade and foreign direct investment in the European Union
8. ONS (2020), Business Investment by Asset
9. Ibid.
10. Ibid.
11. OECD (2020), Investment by Asset - National Accounts
12. Oxford Economics Global Forecasting Model, 2020
13. Ibid.
14. LSE Growth Commission, Centre for Economic Performance (2018), UK Growth: A New Chapter
15. See, for example: Centre for Economic Performance (2015), *Productivity and Business Policies* or McKinsey Global Institute (2018), *Solving the United Kingdom's Productivity Puzzle in a Digital Age*; Goldman Sachs & British Business Bank (2016), *Unlocking UK productivity: Internationalisation and Innovation in SMEs*
16. Goodridge et. al (2020), Can Intangible Investment Explain the UK's Productivity Puzzle?, National Institute Economic Review
17. CBI (2018), **Catching the Peloton**
18. WIPO (2020), **Global Innovation Index**
19. Ibid.
20. The comparison is based on a set of criteria, which takes the top 15 innovation leaders on the GII 2020 and narrows this down to the countries which simultaneously perform well on overall innovation and on measures of commercialisation as measured by IP intensity or high growth. The list of countries selected is: The US, Switzerland, Sweden, Finland, Netherlands, Korea, Singapore, and China.
21. BEIS & Cambridge Econometrics (2020), Macroeconomic modelling of the 2.4% R&D target
22. Hillman, N. (2010), From T to R revisited: Cross-subsidies from teaching to research after Augar and the 2.4% R&D target, Higher Education Policy Institute Report 127
23. The metrics summarised here refer to: the WIPO Global Innovation Index overall innovation rankings in 2020, where the countries are ranked highest on an index of approximately 80 innovation input and output measures, with 1 = highest, 131 = lowest; and a range of R&D expenditure measures as a percentage of GDP, or subsets of R&D spending by type of research as a share of total R&D spending sourced from the OECD 2020 Science & Technology Indicators.
24. Kamath et al (2017), Correlating R&D Expenditure and Scholarly Publication Output Using K-Means Clustering, International Journal of Information Technology, Modelling and Computing, vol. 5, no. 1
25. Das, R. (2020), Interplays among R&D spending, patent and income growth: new empirical evidence from the panel of countries and groups, Journal of Innovation and Entrepreneurship

26. The metrics summarised here refer to: the WIPO Global Innovation Index overall innovation rankings in 2020, where the countries are ranked highest on an index of approximately 80 innovation input and output measures, with 1 = highest, 131 = lowest; and a range of IP concentration (or intensity) measures relative to $ billion of GDP.
27. WIPO (2021), Facts and Figures 2020
28. WIPO (2020), Protecting your inventions abroad: Frequently asked questions about the Patent Cooperation Treaty (PCT)
29. The application process up to this stage, which includes detailed search and examination at an international level, provides some information to businesses regarding the prospects of obtaining patents and the scope for protection.
30. WIPO (2018), The Patent Cooperation Treaty at 40, WIPO Magazine
31. The system enables them to better manage risk and withdraw their application if found unpatentable before incurring the national phase filing costs. This is because their application signals that a patent is pending and allows them to enter the competition of filing simultaneously across most countries around the world at a lower cost than direct entry to separate patent offices.
32. This is estimated as the number of resident patent filings in each benchmark country relative to the number of non-resident patent filings.
33. It is important to note that there are differences in the patent process and legal enforcement of patents across countries, which potentially make a cross-country comparison difficult. The differences in success rates amongst businesses in obtaining patent rights domestically, compared to abroad, could therefore simply be attributed to these differences.
34. It is important to note that there are differences in the patent process and legal enforcement of patents across countries, which potentially make a cross-country comparison difficult. The differences in success rates amongst businesses in obtaining patent rights domestically, compared to abroad, could therefore simply be attributed to these differences.
35. This refers to the number of patents granted to UK businesses (whether in the UK or abroad) as opposed to patents granted in the UK (whether to UK businesses or foreign businesses). The number of patent filings has grown at a slower pace than the number of patents granted, and the number of patents of UK origin has grown faster than the number of patents in the UK (regardless of origin). The figures in the UK IPO report related to patents filed and granted with the UK IPO, whereas this talks about patents granted to UK businesses at any IP office anywhere in the world.
36. US Chamber of Commerce (2021), International IP Index, 9th Edition
37. Where 1st = highest effectiveness, 53 = lowest effectiveness.
38. US Chamber of Commerce (2021), International IP Index, 9th Edition
39. UK Intellectual Property Office (2020), Use of Intellectual Property rights across UK industries
40. Not elsewhere classified, i.e. excluding transport manufacturing, chemicals and pharmaceuticals, electrical equipment and computers, paper, wood or leather products, food, drink and tobacco manufacturing, textile and wearing apparel, machinery and equipment, fabricated metals, or furniture.
41. UK Intellectual Property Office, Facts and Figures 2019
42. WIPO (2021), IP Facts and Figures 2020
43. Ibid.
44. UK Intellectual Property Office (2020), Use of Intellectual Property rights across UK industries
45. DCMS analysis suggests the UK tech sector to have contributed £149 billion to the UK's economy in 2018 (7.7% of all UK GVA), a contribution which has grown 43% since 2010. See: **https://www.gov.uk/government/statistics/dcms-sectors-economic-estimates-2018-gva**
46. European Patent Office (2021), Intellectual property rights and firm performance in the European Union
47. WIPO (2021), Facts and Figures 2020
48. Note that an analysis of IP applications by firm size is not possible given a lack of IP data published in this way.
49. European Patent Office (2019), High-growth firms and intellectual property rights: IPR profile of high-potential SMEs in Europe
50. Ibid.

51. Ibid
52. Ibid
53. European Patent Office (2021), Intellectual Property rights and firm performance in the European Union
54. Goldman Sachs & British Business Bank (2016), Unlocking UK productivity: Internationalisation and Innovation in SMEs
55. Bank of England (2021), Credit Conditions Survey Q4 2020
56. PWC (2018), Innovation: Government's Many Roles in Fostering Innovation
57. NIESR (2019), **Tax Policy for Innovation**
58. OECD (2020), R&D Tax Incentives Database
59. Grant Thornton (2019), International Business Report – R&D: The right incentives to grow
60. **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/897470/relationship-between-public-private-r-and-d-funding.pdf**
61. Rogers, M. (2010), R&D and productivity: using UK firm-level data to inform policy, Empirica, 37, 329-359
62. PWC (2010), Innovation: Government's many roles in fostering innovation
63. OECD (2020), The Effects of R&D Tax Incentives and their Role in the Innovation Policy Mix: Findings from the OECD MicroBERD project, 2016 – 2019, OECD Science, Technology and Industry Policy Papers
64. Atun, R. (2007), Innovation, Patents and Economic Growth, International Journal of Innovation Management
65. Ibid.
66. The rankings are based on performance on a number of IP intensity measures, including patents, trademarks, and designs per billion $ of GDP, but also PCT patent-intensity as an indicator of propensity to file patents internationally, the success rate on patent filings, i.e. % of filings granted. It also ranks the selected benchmark countries on their global standing on the 2020 WIPO Global Innovation Index and on the number of policy measures they offer for R&D and IP.
67. Evaluation of Research and Development Tax Credit, HMRC Working Paper 17: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/413629/HMRC_WorkingP aper_17_R_D_Evaluation_Final.pdf
68. The table provides a summary of performance across a number of metrics aimed at capturing performance on innovation and patents, as well as the availability of policy supportive of innovation and patents. The innovation ranking is based on the countries' position on the 2020 WIPO Global Innovation Index (which ranks countries on a number of measures of innovation inputs and outputs, with 1 = highest to 131 = lowest), re-positioning their performance within the set of benchmark countries (ranking 1 = lowest/ best ranking on the GII to 9 = highest/ poorest ranking on the GII). The second metric ranks 1 = highest concentration of PCT patents per $ billion of GDP to 9 = lowest concentration.
69. This is a measure which ranks the benchmark countries on the basis of the availability (rather than the effectiveness) of a number of policies. This is based on a total of 17 policy tools or characteristics, with a ranking of 1 representing the highest presence of policy support, while a ranking of 9 indicates the lowest presence of policy support. The policy tools included are: R&D tax credits, R&D cash grants, R&D loans, accelerated depreciation on R&D assets, tax deductions (including an R&D super-deduction), tax exemptions, income tax withholding incentives, patent-related incentives, financial support, tax holiday, VAT reimbursement, Horizon 2020 funding. The main characteristics included in this measure of policy presence are linked to the evidence presented in Figure 9, and include: capital expenditure credits, Venture Capital incentives, SME support, and support for loss-making firms.
70. WIPO (2020), **Global Innovation Index**

71. Switzerland Global Enterprise (2020), **Enabling new business: Swiss Innovation**
72. WIPO (2020), **Global Innovation Index**
73. OECD (2013), **Action Plan on Base Erosion and Profit Shifting**, OECD Publishing
74. Ibid.
75. NIESR (2019), **Tax Policy for Innovation**
76. HM Revenues & Customs (2017), **Government Guidance: Use the Patent Box to reduce your Corporation Tax on profits**
77. European Commission (2015), **Patent Boxes Design, Patents Location, and Local R&D**
78. HM Revenue & Customs (2020), **Patent Box Evaluation**
79. OECD (2017), **Innovation, Patent Location and Tax Planning by Multinationals**, Economics Departments Working Papers, No. 1360
80. OECD (2017), **Tax Planning by Multinational Firms: Firm-level Evidence from a Cross-Country Database**, Economics Departments Working Papers, No. 1355
81. Alstadsæter, A. et al., 2018. Patent boxes design, patents location, and local R&D. Economic Policy, 33(93), p. 131–177.
82. Ibid.
83. HM Revenue & Customs (2020), **Patent Box Evaluation**
84. Ibid.
85. Mohnen et. Al (2017), Evaluating the innovation box tax policy instrument in the Netherlands, 2007 – 13, Oxford Review of Economic Policy, vol. 33, issue 1, pp. 141-156
86. Invest Europe (2019), **The VC Factor: Data-driven insights about VC-backed start-ups in Europe**
87. PWC (2010), Innovation: Government's many roles in fostering innovation
88. Department for Business, Energy & Industrial Strategy (2018), **The allocation of funding for research and innovation: 2017 to 2021**
89. WIPO (2020), **Global Innovation Index**
90. World Intellectual Property Organisation (WIPO), Global Innovation Index 2020
91. Charges for use of intellectual property, payments (% of total trade, 3-year average). Receipts are between residents and non-residents for the use of proprietary rights (such as patents, trademarks, copyrights, industrial processes and designs including trade secrets, franchises), and for licenses to reproduce or distribute (or both) intellectual property embodied in produced originals or prototypes (such as copyrights on books and manuscripts, computer software, cinematographic works, and sound recordings) and related rights (such as for live performances and television, cable, or satellite broadcast).
92. Charges for use of intellectual property, receipts (% of trade, 3-year average).

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