

Report for the

Chartered Institute of Patent Attorneys (CIPA)

and the IP Federation

The European Patent Convention

and its Impact on

the UK Economy and Innovation

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European Patent Convention (EPC) and its Impact on the UK Economy and Innovation

Executive Summary

An effective intellectual property system is vital for competitive, innovative, economies. The US and UK were among the earliest to create patent offices with clear rules on what constitutes an innovation, and legal rights to protect it.

The United Kingdom is a founder member of the European Patent Convention. Created in 1973 by EU and non-EU states, it set up:

- common criteria across countries of what can be patented
- the European Patent Office, to examine applications and grant patents, to avoid duplication of effort in each country
- rules on how successful applicants can validate EPO granted patents in EPC states they designate, in the form of a 'bundle' of national patent rights
- rights created by validated EPO grants regulated by national courts, not the CJEU

The economic benefits of the EPC to the UK include:

- much lower costs to business in establishing patent rights across contracting states
- consistency of patent rights, and of legal precedents for enforcement, with London IP courts playing a major international role
- creation of an international market in technical and legal businesses services in IP, in which the UK has a large and demonstrable competitive advantage, based on technical expertise and the English language.
- creation of a world class technical and legal skills base supporting international companies which choose the UK as a base for innovation because they can conduct research and create IP here, and manage its international exploitation in one place.

The European Patent Convention has 38 contracting member states, and its associated countries stretch from Morocco to Cambodia. It is vital to the innovation economy of Europe, and especially to the United Kingdom. Most English speaking firms around the world use UK IP professionals to secure patent protection across Europe using it.

UK and international firms overwhelmingly see the EPC / EPO as the most effective and efficient choice to secure patent protection in the UK. 90% of patent rights created in the UK between 2000 and 2018 were grants by the EPO, validated for UK. Less than 10% were granted by UK IPO. Of all EPO patents granted, inventors validate over 90% in UK.

If the UK were to lose its role in the EPC¹, the economic impacts would include:

- direct loss of UK patent attorney service exports to firms from around the world using the UK IP profession to file, prosecute and manage patents at the EPO, because UK attorneys would lose rights to do this work
- direct increase in UK imports of IP services by firms operating in UK, from patent attorneys in other EPC contracting states who would have sole rights to work with EPO

¹ UK negotiating objectives are to secure outcomes which 'are consistent with the UK's existing international obligations, including the European Patent Convention (EPC), to which the UK is party'. The analysis in this report aims to identify the economic benefits of achieving this objective.

- an immediate increase in business costs for UK based and international companies seeking to protect inventions in both UK and remaining EPC countries, having to file in both; US owned companies would carry the biggest extra costs
- Migration of most UK IP work to EPC countries, removing the income base on which the training and development of IP professionals by UK firms in the industry depends.

Indirect economic impacts would include:

- relocation of European innovation management by international firms in some sectors to EPC contracting countries within the EU single market (most probably to Germany, Netherlands, or elsewhere in the EU 27)
- risk to supply chains and potential diversion of R&D work by some international firms to EPC countries with a strong IP support service industry (Germany and Netherlands)
- weaker IP support in the UK, especially to young innovative firms, for which there is a significant growth premium linked to easy international patent protection through EPO.
- loss of influence for the London IP legal system, which today is the best followed judicial benchmark, setting standards across other European courts

In addition there would be simultaneously:

- a reduction in in the total number of patents created for the UK as some firms choose not to extend protection to this market
- a large increase in demand for patent grants by UK IPO, well beyond today's capacity for examination and grant, as many other companies use it to replace EPO protection.

These economic impacts can be estimated accurately in some areas. In others we can estimate it via feedback from patent managers in the UK on how they would react to change, or by studies which allow us to model effects of changed patenting behaviour.

Impacts can be summarised as follows:

Direct GDP Impacts	<i>Every year</i>
Loss of UK IP legal export services related to EPO links	£746 million
Increase in UK IP legal import services for EPO - UK firms	£35 million
Increase in UK IP legal import services with EPO - international	£56million
Total	£837 million loss
Direct Cost Impacts, to business	
Increase in business costs (mainly attorney fees) for innovators to secure UK patent rights of which:	£560 +/- £120 million
- Added costs to US owned businesses in UK	£170 million
- Added costs to Japanese/German owned businesses in UK	£204 million
- Added costs to UK owned businesses	£ 51 million
Direct costs to government	
Cost of extra patent examination and processing to retain control of patent decisions under UK jurisdiction	£640 +/- £110million

Estimates of cost to business due to additional patent filing and prosecution are based on costs of straightforward applications taken through to grant.

Additional costs to government would need to be recouped from businesses through patent filing, grant and renewal fees if UK IPO remained a self financing trading fund.

<p style="text-align: center;"><i>Loss of UK IP services capacity</i></p> <p>Loss of jobs in technical / legal business services</p> <p>Reduction in training for UK IP profession, and pro-bono help for new innovators</p>	<p style="text-align: center;"><i>Early years impacts</i></p> <p>3500 jobs including 1100 patent attorneys or more</p> <p>Profession unable to fund professional development, or support for SMEs</p>
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<p style="text-align: center;"><i>Indirect Impacts</i></p> <p>Relocation of UK IP management work in international firms</p> <p>Potential relocation of suppliers / R&D by international firms</p> <p>Loss of growth by ‘gazelles / unicorns’, worth at least £22 billion in recent market valuations, via weaker IP support</p> <p>Loss of growth in the wider economy through weaker innovation</p>	<p style="text-align: center;"><i>Medium Term</i></p> <p>Many Patent Attorney posts in UK branches of international firms (up to 150 jobs - est.)</p> <p>Engineering at risk Some Aerospace & Consumer products Threat to R&D surplus</p> <p>Risks to jobs growth Weaker IP will reduce venture finance.</p> <p>Productivity lower where R&D and value chains are cut.</p>
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This analysis does not quantify potential impacts on IP litigation services provided from the UK, for which London’s courts are a world centre. This would affect legal professionals well beyond patent attorneys, but who depend on the expertise of IP professionals to maintain London’s reputation.

Nor have we taken account of the probability that the many deals between international firms which involve Intellectual Property would be less likely to name London as the location for arbitration if the IP content were specified by patent attorneys outside the UK.

1. Background to the European Patent Convention

An effective intellectual property system has been vital for competitive, innovative economies for at least two centuries. The US and UK were among the earliest to create patent offices with clear rules on what constitutes an invention, and legal rights to protect it. Making the IP system work efficiently in a world with increasing international trade and investment has been a focus of policy for over a century.

The European Patent Convention (EPC), created in 1973 and including non-EU countries as contracting states from the start, set up:

- common criteria across member countries of what can be patented
- the European Patent Office (EPO), jointly governed by the Intellectual Property Offices from all contracting countries, to examine applications and grant patents, avoiding duplicated work in both patent offices and business
- rules on how successful applicants can validate granted patents, in EPC countries they designate, in the form of a 'bundle' of national patent rights
- a framework in which the national rights from EPO grants are regulated by national courts, not the CJEU

The economic benefits of the EPC include:

- much lower costs to business in establishing patent rights across as many contracting states as they wish
- consistency of patent rights, and of legal precedents for enforcement, with London IP courts playing a major international role
- creation of an international market in technical and legal businesses services in IP, in which the UK has a large and demonstrable competitive advantage, based on technical expertise and the English language.
- creation of a world class technical and legal skills base supporting international companies which choose the UK as a base for innovation because they can conduct research and create IP here, and manage its international exploitation.

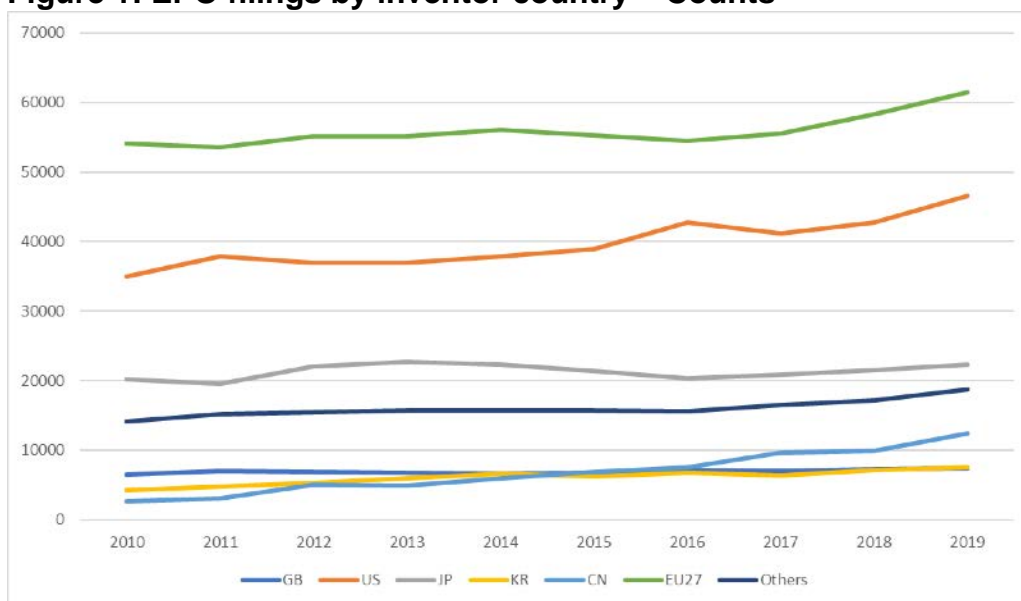
The European Patent Convention is not an EU institution, although 27 of its 38 member states now are EU members. The UK is a founder signatory of the international treaty setting it up, with non EU member Switzerland, alongside other EU Member States. The rules developed by the EPC are the outcome of a process to harmonise patent arrangements started by the Council of Europe in 1953. The Convention was ratified in 1973, came into force in 7 countries in 1977, and was updated in 2000 after 14 further members had joined. 18 more have since signed, and extension agreements which apply EPO systems without a say in governance have been made with countries such as Morocco, Moldova, Tunisia, and Cambodia.

The European Patent Office is one of the five largest IP offices in the world, which between them received 85% of total applications in 2018. China received the largest number (46%) following rapid growth, most from local applicants. The US (18%), Japan and Korea come next. The EPO receives over 5% of the world total, the rest coming to national patent offices. Around 37% of filings at EPO are from European companies².

² Filing and country data from two independent sources, Patstat and Questel, from independent analysts, have been used for the analyses in this section. Although data treatments differ, the main conclusions are consistent and underpin the arguments set out in the analysis

Next comes the US at 27%. China only entered the top five EPO filers in the last five years.

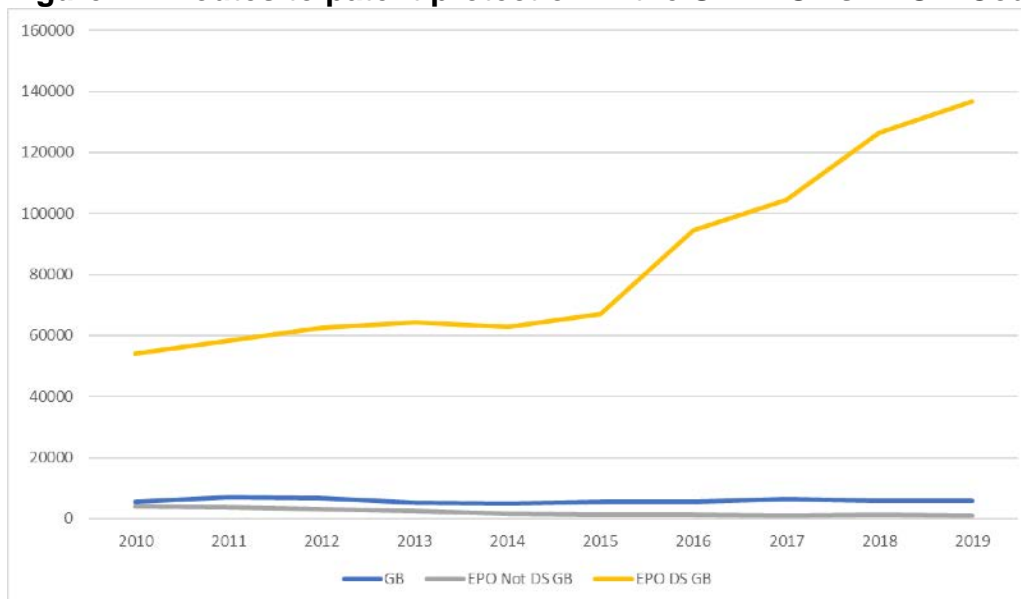
Figure 1: EPO filings by inventor country – Counts



Notes: The x-axis plots the publication year of EPO applications. The y-axis shows counts of EPO filings by country of residence of inventor (UK, US, Japan, Korea, China, EU countries excluding UK and other countries).

Over 90% of patents which have come into in force in the UK since 2000 came through the European system, as EPO grants designated for the UK. The proportion has risen steadily in recent years. The incentive for inventors to use the EPO is that it enables lower costs and less complexity in the application and prosecution process for inventors. It also gives inventors low cost options to choose national jurisdictions in which to maintain and enforce patent rights. Over 90% of the patents granted by the EPO are validated for the UK, which is one of the highest among leading European economies.

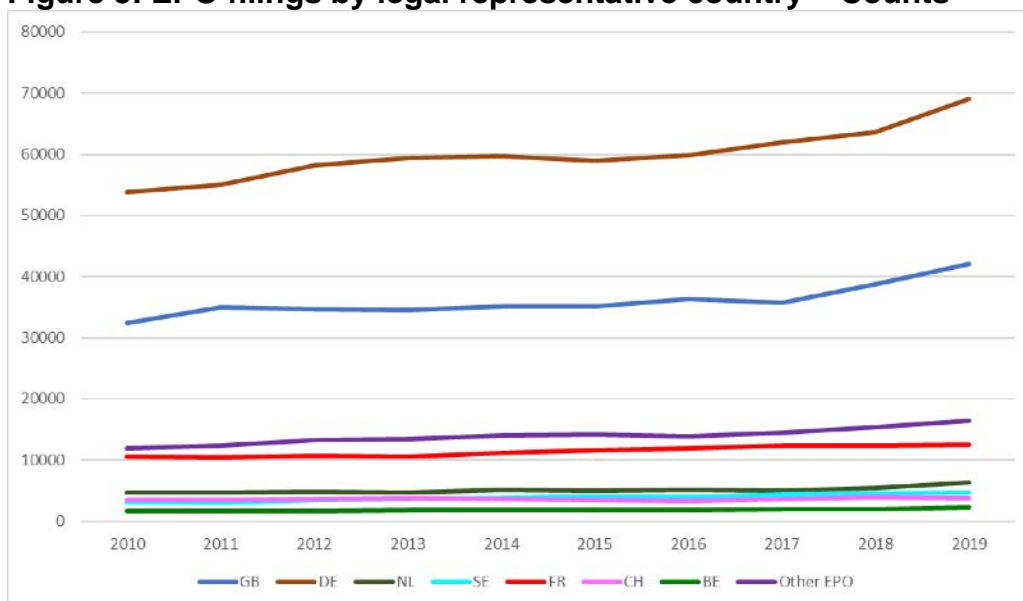
Figure 2 : Routes to patent protection in the UK: IPO vs EPO – Counts



Notes: The x-axis plots the publication year of the granted patent. The y-axis shows counts of patent grants of different routes to protection applicants may take. The yellow line corresponds to the number of EPO patents for which UK is a designated state. The orange line represents EPO grants that do not have UK as designated state as grant. The grey line shows the number of grants at the UK IPO.

A high proportion of all patent applications arrive at the EPO via UK professional service firms. German and UK patent attorneys dominate this process.

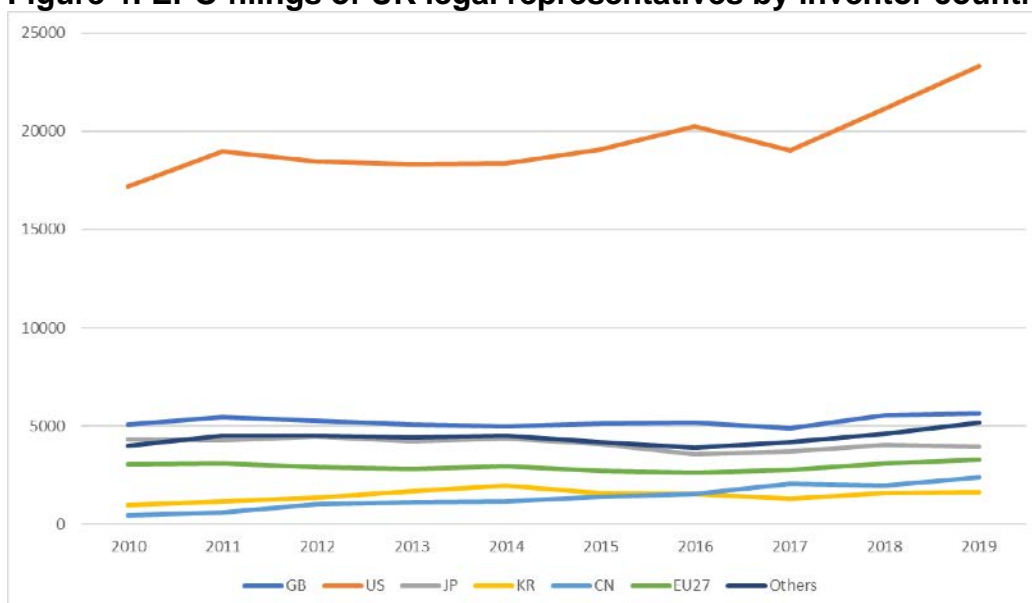
Figure 3: EPO filings by legal representative country – Counts



Notes: The x-axis plots the publication year of EPO applications. The y-axis shows counts of EPO filings by country of residence of the legal representative before the EPO.

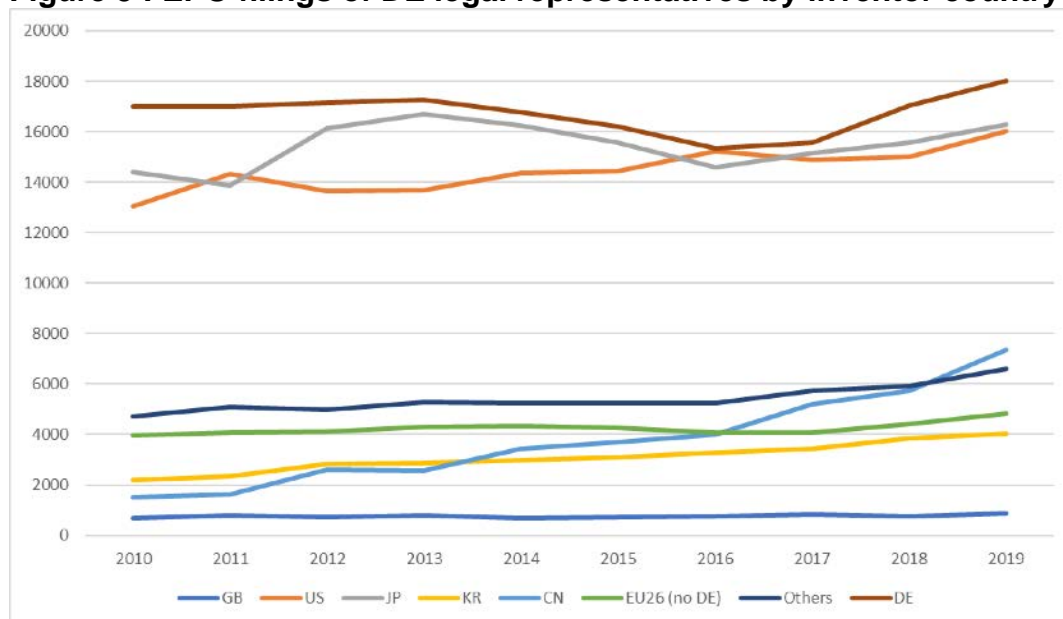
Data for filings by inventor country show that UK attorneys have a leading share of US applications, and of GB applications, and are in second place in Japanese applications.

Figure 4: EPO filings of UK legal representatives by inventor country – Counts



Notes: The x-axis plots the publication year of EPO applications. The y-axis shows counts of EPO filings with a UK legal representative by country of residence of the inventor (UK, US, Japan, Korea, China, EU countries excluding UK and other countries).

German patent attorneys handle a somewhat lower share of American applications at EPO, most of the applications by German inventors, a majority of Japanese applications, and a steadily increasing number of Chinese and Korean patents.

Figure 5 : EPO filings of DE legal representatives by inventor country – Counts

Notes: The x-axis plots the publication year of EPO applications. The y-axis shows counts of EPO filings with a German legal representative by country of residence of the inventor (UK, US, Japan, Korea, China, EU countries excluding UK and other countries).

The UK has a relatively strong position in the international IP system - but not because of the number of patents claimed by UK inventors. Rather it is because its well qualified IP services industry allows English speaking inventors - UK and international - to establish rigorously tested European and UK rights at low marginal cost. This has a number of spin-off benefits for the UK innovation system:

- rights through the EPO are created at low cost to the UK and foreign inventors who use it, and to the UK Intellectual Property Office
- the UK IPO receives much of its income stream from renewal rights on patents granted by the EPO and maintained by their owners in the UK
- £48 million of UK IPO's total £65 million income relating to patents came from EPO patent renewals in 2018/9.

Table 1 : UK IPO Revenue from patent operations - year to March 2019

UK IPO Charges related to Patents	£million
Application, search and examination	4.2
Renewals of UK patents	11.8
Renewals of EPO patents	48.4
Other patent income	1.0
Total	65.4
Patenting Expenses	66.4

Income from renewals of EPO patents is important for the UK patent system, it supports activities across the process from initial search and examination through to enforcement.

The relationships between EPO, UK IPO and the UK IP profession have developed in response to the advantages that the EPC has given to the UK. UK IPO has made efficient use of its income stream, and established a good reputation for initial search and examination which allows firms to get a rapid first check on the quality of an application before taking it on to the more expensive stages of full examination and grant in the UK, or more often via a global PCT application at WIPO and through the EPO.

The UK patent attorney profession includes over 2,500 qualified attorneys, over 1,000 trainees, and 4,000 in supporting occupations³. Almost 2100 patent attorneys work in private practice, generating fees over £982 million a year, with 76% from international firms totalling £746 million. It is among UK's most export intensive technical / legal services. In addition 450 qualified patent attorneys in industry manage IP portfolios, design, file and prosecute patents via the EPO and UK systems for their companies.

This study uses a combination of company reports (via FAME) of firms which account for around 23% of UK patent attorneys, plus a confidential survey of firms (non-overlapping) which account for 21% of the profession. The survey asked about the structure of their professional and support staff, about the balance of their work between UK and international clients, about the proportion of their work directly linked to the EPO, and also the time their professionals spend helping new innovators and universities, and in pro-bono to support professional training. In addition we asked some supplementary questions about services which the fee income covers. Aggregated responses, the method for calculating value of IP services, and the rationale behind estimates for impact of losing EPC membership are set out in Annex A

The survey responses, and the company report data, indicate levels of fee income which are higher - even for that part relating to patent filing and prosecution - than costs in the online guide by Dehns, one of the large firms included in the survey. This guide https://www.dehns.com/cms/document/the_financial_realities_of_patent_protection.pdf. is a helpful reference point for professional and office fees. It quotes costs of securing a patent escalating as international coverage is sought:

UK IPO filing and prosecution	£3000 to £6,000, and up to £10,000 to full grant
PCT filing	£4,000 to £5,500
International search review	£600 to £1,500
EPO filing and prosecution	£6,000 to £10,000
US filing and protection	£6,000 to £14,000
Validation main EPC markets	£6,000 to £8,000

IP Office official fees are a relatively small part of these costs - typically 10% to 15%. Professional fees for drafting, negotiating, representation at hearings and dealing with oppositions make up most of them.

The Dehns guide suggests a typical route for UK firms as initial filing at UK IPO then, if initial search and examination are promising, filing a PCT application at WIPO to establish

³ Data in this section comes from a survey of UK patent attorney firms accounting for 429 patent attorneys, of incomes and exports. Data from an independent search of reports and accounts data on leading IP firms, with another 479 attorneys have been incorporated; see Annex A

international priority. After that follows an EPO filing for European coverage (perhaps dropping the UK application), USPTO for the US and so on. At present any EP qualified patent attorney can do all three of the first three steps, but if the UK were to leave the EPC, British attorneys would lose that right.

None of the patent attorney firms surveyed relies only on drafting, filing and prosecuting patents to grant. Other services they provide include:

- appeal hearings to challenge an initial assessment by the EPO (or sometimes UK IPO)
- opposition to other applicants' filings when clients see their own IP has already covered inventions claimed
- appeals where patents are refused altogether or in part
- 'freedom to operate' work to advise clients how to avoid infringing on other IP holders
- licensing deals and advice on licensing terms
- strategic advice on IP and commercial objectives.

For firms in our sample these additional services account for a minimum 20% of fee income, up to 55%. The data shows, not surprisingly, that on average the larger firms tend to deliver a wider range of 'value added' services, mostly related to patents they have helped draft and prosecute through the system. There are also smaller firms, not in our sample, which specialise in freedom to operate and other work, and who do less filing and prosecution.

This same group of people also deliver services which are not monetised. About 700 of them spend a significant amount of time in pro-bono activities in IP education, in support for SME innovators as part of government schemes or on their own account, or in support of university and other not for profit researchers. A significant minority work in science or business parks alongside inventors around the country.

Supported by its quality legal and IP system, and by the advantage of working in English, the UK patent profession has developed its role to become the point of entry for many international innovating companies from the US, other English speaking countries, and elsewhere into the European patent system. Only the German patent profession is bigger, and that supports a significantly larger domestic innovation stream.

This international role shows a UK patent system which is specialised and efficient, with;

- much of the IP office examination and grant work outsourced to EPO which achieves the largest economies of scale
- UK IPO performing rapid, high quality initial search and examinations in much greater numbers than the grants it makes
- the UK patent profession able to work across all technologies in close contact with local innovators and global companies, seen as the best advisers - certainly in English
- the UK IP courts seen as high quality decision makers whose judgements are likely to be taken as precedent in other EPC countries

This has led to the UK becoming an attractive home for international patent management teams in a range of industries, especially for US firms, and some European, Japanese and other multinationals. It has also created a strong profession, able to invest in its future, to support training and development, to help early stage innovators, universities and research institutes, as well as competing on a global scale. It employs about 7,500 people in private practice, who generate around £1 billion in gross value added, and approaching £750 million in exports. It is one of the most export intensive technical or legal service industries the UK has today.

These strengths depend on the UK's position in the European Patent Convention. The rest of this report addresses:

- direct impacts on the UK patent profession of losing rights to practice in Europe
- economic losses if the trade surplus in IP technical and legal services is reversed
- potential risks to the UK innovation system, and to Britain's role as a centre for internationally funded innovation work if the UK's role in EPC was limited.

2. IP, Research and Innovation

Investment in knowledge by business in the US, UK, and much of western Europe is at least as big as investment in tangible assets. A majority of new jobs are created in knowledge intensive firms. Intellectual property rights are the legal form of new ideas and technologies which allow inventors - firms or individuals - to secure the results of their investment through licensing, exploiting and sharing them.

The role of intellectual property in supporting innovation has been well documented in economic research and case studies. In the US Administration's approach to trade, the President has said "We recognise how integral intellectual property rights are to our Nation's economic competitiveness. Intellectual property rights support the arts, sciences, and technology. They also create the framework for a competitive market that leads to higher wages and more jobs for everyone".

In US trade negotiations for the last 20 years, that has meant treaty partners adapting their IP frameworks to look more like the US. But in one way the US has moved its position towards the rest of the world in that period, when it moved its patent system from one where the first to invent claimed a patent to one where first to file a claim held that right.

Differences between the US and EPC systems could create difficulties for a country aligned to the US system if it were in the EPC. One of these is allowing a 'grace period' - a limited time in which inventors can still file for a patent after disclosing the invention - by accident or otherwise. European rules do not currently allow this. In addition what can be patented between Europe and the US may differ, partly because US rules are shaped by US court decisions as well as by legislation.

Intellectual Property

The innovation capability of a country depends on much more than numbers of patents or the spend on R&D. As the World Intellectual Property Organisation's Innovation Scoreboard, published each year, makes clear reliable institutions, human capital, innovation infrastructure and effective markets are all important. The UK comes near the top of the Scoreboard - just behind Switzerland and the US and ahead of Singapore - because of its regulatory environment, its ability to act as home to international R&D companies, access to innovation finance, its knowledge intensive workers, university - industry collaboration, knowledge creation and trade in intellectual property.

Four examples below show the importance of international IP to innovators

- a) in development of new competitive positions by UK innovators
- b) in use of high quality UK IP advice by innovators based elsewhere
- c) how IP advice underpins the UK's balance of payment surplus in IP
- d) why the UK IP system provides a home for patent management by international firms, often accompanied by part of their global R&D

a) Creating new UK businesses

Insofar as they benefit innovating companies, most of these strengths depend on access to good, internationally competitive IP advice. Turning new ideas into sustainable and defensible businesses works best if they can be secured as intellectual property rights. Then they can secure investment, be developed in new markets, used to create strategic business partnerships and licensed without losing market advantage. **Wave Optics** is a

good UK case explaining the importance of protection in growing a new business, through strong patents in augmented reality, and creating a leading position in international markets. <https://www.cipa.org.uk/policy-and-news/case-studies/patent-strategy-protecting-ideas-at-home-and-abroad/>

Nexeon, a successful energy storage spin out from Imperial College, tells a similar story.

A strong IP strategy and identifiable intellectual property rights are essential elements in getting funding. The focus will change as the business and its competitive environment changes. For **Nexeon**, at spin out stage from Imperial in 2006, the most valuable IP was largely know-how and trade secrets. An early Imperial patent application may have been an initiator but it was really a stepping stone.

A major part of the IP strategy in the subsequent funding rounds was to strengthen our patent position, to ensure the business maintained freedom to operate, and to continue protecting its innovations as, inevitably, competition in such an exciting new technology space increased. Throughout, we needed a very good handle on identifying our core IP to evaluate its strengths and weaknesses. The high quality advice available from UK patent professionals which helped with this stems from a strong link through their training and career development with the approach of the EPO and the EPC system.

The EPO provides a more rigorous, consistent and predictable view of what should or should not be patentable compared to other major Offices. It provides a stronger level of confidence that the appeals/oppositions processes (and the European patent courts) can correct deficiencies when they occur; more so than the US system which can deliver unpredictable decisions. The EPC system gives clarity and a degree of certainty which is critical for new growth businesses.

The story of how the company is using its IP to develop new areas of battery technology, and grow international partnerships, is shown at <https://www.nexeon.co.uk> ”

Annex B sets out the role of IP advice in supporting the creation of UK based ‘unicorns’, new firms with valuations over £1billion. Of 24 current unicorns and 5 exited unicorns, 15 have patent filings that have been published (the others are generally in Fintech for which patents play a lesser role). Of these, all 15 (100%) have employed the services of UK patent attorneys to file their first patent applications. Also, in all cases, where subsequent filings have been made as PCT/EPO filings, all 15 (100%) have continued to use the services of UK patent attorneys.

These UK unicorns have together created business valuations of over £22 billion.

This case evidence is supported by statistics from a recent study showing that establishing an international IP right, especially a European patent, can double the likelihood of high growth performance in new businesses. [http://documents.epo.org/projects/babylon/eponet.nsf/0/F59459A1E64B62F3C12583FC002FBD93/\\$FILE/high_growth_firms_study_executive_summary_en.pdf](http://documents.epo.org/projects/babylon/eponet.nsf/0/F59459A1E64B62F3C12583FC002FBD93/$FILE/high_growth_firms_study_executive_summary_en.pdf)

b) Exporting IP advice to other innovators

The UK patent profession supports the innovation system internationally as well as in the UK. Its scale and expertise gives inventors choice of technical and legal specialists, in the English language which allows them to use the same expertise to protect in the UK, the US and the rest of Europe. The case of Norwegian medical technology company

ConceptoMed shows how this relationship works to create market advantage through patented syringe design <https://www.cipa.org.uk/policy-and-news/case-studies/the-international-advantage-using-a-uk-patent-attorney/> .

c) Supporting the UK's surplus in IP licensing

The UK is one of the few countries in the world which has a balance of payments surplus in Intellectual Property payments (about £3billion). This income depends on the effective protection for licensing deals, and clear strategies for the application of patents and other rights to attract and grow an international customer base. The case of leading UK design consultancy **Acumen** demonstrates how access to the best IP expertise makes this work for patented aircraft interior design. <https://www.cipa.org.uk/policy-and-news/case-studies/turning-ideas-into-profits-licensing-your-patents/>

Another case, **Contra Vision**, shows how well designed patent licensing can enable a small, inventive, UK firm to deal successfully with global market leaders, and so compete successfully across the world

Contra Vision Ltd was founded in 1985 to exploit a dominant patent in the field of one-way vision and see-through graphics. As an SME it was able, using UK IP and licensing advice, to license big multinationals in North America, Western Europe and Japan. In 1990, subsidiaries **Contra Vision North America, Inc.** and **Contra Vision Supplies Ltd** took over the licences in the west, sub-licensing printers to make **Contra Vision** products. Additional licenses followed, including **3M**, **Avery Dennison** and specialists in substrates to manufacture **Perforated Window Films** for sale to large format commercial graphics printers making wraps for buses, buildings, retail windows - or any see-through structure.

Over 30 patented inventions later, **Contra Vision** still lead this field in terms of technology, now selling their own range of films in all continents, and licensing others, recently including French glass multi-national, **Saint Gobain**, for ceramic ink printing of glass. It is changing the look of towns and cities across the world from its base in Stockport, Cheshire.

d) Hosting IP management by international firms

The UK comes in the top 10 countries as a base for global R&D performing companies, and also as a base for patent management, especially for US and Japanese firms, and also a number of EU producers. International companies which have built capability to manage - or part manage - IP from the UK include **IBM**, **Caterpillar**, **Babcock**, **AGCO**, **P&G (US)**; **Pilkington / Nippon Sheet Glass (Japan)** ; **Ericsson (Sweden)** and **Syngenta (Switzerland)**.

Some of these are accompanied by research and development facilities in the UK, or are involved in licensing and collaboration with development partners

Most UK multinationals manage all or most of their IP from here. However many of them also have IP functions in the US or elsewhere in Europe, alongside development activity. **GSK**, **Shell**, **Unilever**, **BAE Systems**, **Dyson**, **Arm**, **BT**, **BAT**, **Centrica**, **Ocado**, **Rolls-Royce**, **Johnson Matthey** work like this. Some have all their internal patent attorneys in the UK, and outsource international work, others have IP management split across major markets.

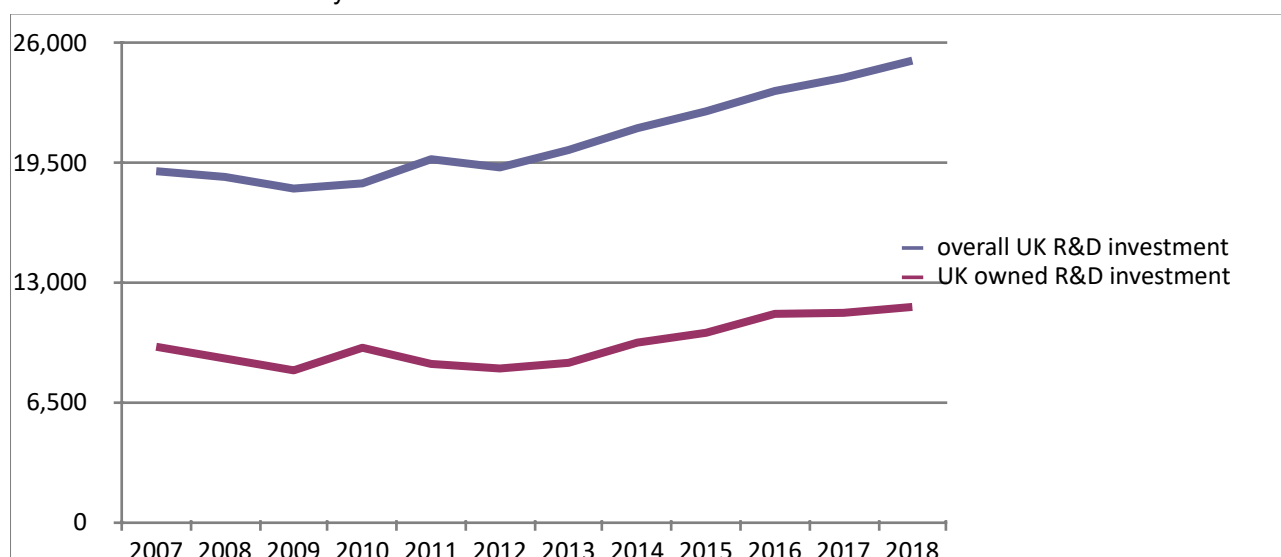
Many multinationals maintain IP teams in the UK because they can manage IP efficiently across Europe and coordinate with the US from one office, usually with their own patent attorneys supported by strong private practitioners. Their UK teams' ability to operate across Europe is valuable to them, especially those which have substantial research and development in the UK. The UK's EPC membership is important for all those who need high quality IP advice co-located with development work.

Research & Development

After stalling in the wake of the financial crisis, UK business R&D growth has recovered strongly, reaching £25 billion in 2018. This may owe something to introduction of the patent box tax incentive, which offers firms a reduced rate of corporation tax on income from patented products and services, backed by UK based R&D. Most of the growth has come in R&D of foreign owned firms, in part resulting from acquisitions by US, Indian, Japanese and other international companies. R&D by UK owned firms was 60% of the total in 2007 and by 2018 had fallen to 47%.

Figure 6 : UK Business R&D Chart - Total, and by UK owned firms

£ million. ONS R&D Survey



In one sense this represents a vote of confidence by international business in UK research and innovation. But it means that UK innovation activity is increasingly internationally mobile. Its funders have other options. The UK has to compete for it at a global level with newly developing centres like Singapore

Singapore has a national target to be the regional innovation hub linking companies across the globe to innovation potential in its region, attracting research and innovation. To do this it has developed four key strengths;

- 1) political stability and trust in institutions, especially commercial courts
- 2) effective IP regime to protect new ideas and businesses
- 3) strong IP support and advice for businesses exploiting ideas via Singapore
- 4) access to innovation finance and high quality human capital.

This combination, together with IP collaboration with partners in ASEAN, has given Singapore the top position among Asian businesses in WPIO's Global Innovation Scoreboard, in 2019.

Singapore is a country which has set out to attract research, innovation and IP management as a hub for its region, and the wider world. This has been central to Singapore's development strategy. The country's progress in creating the key elements are set out in its 2017 Masterplan Update publication, https://www.ipos.gov.sg/docs/default-source/about-ipos-doc/full-report_update-to-ip-hub-master-plan_final.pdf.

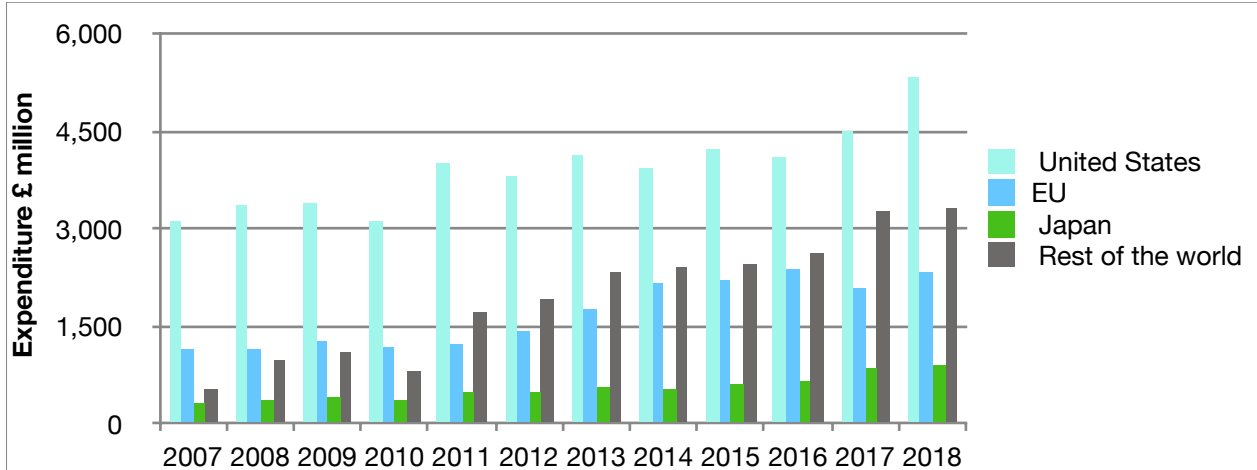
Some of the elements of the Singapore IP plan have been modelled on the UK, or have used British advice, as well as inputs from across its region. It has included a series of collaboration agreements with IP offices in ASEAN.

The European Patent Convention has enabled UK to develop a strong, influential, effective and internationally efficient patent regime, in a highly competitive international market, of just the type Singapore is seeking. The United Kingdom also has the other elements that Singapore is building. The opportunity now is to build on this foundation as the UK Government seeks to raise research and innovation as part of its economic strategy.

3. UK as an ‘Innovation gateway’

More than half of UK business R&D is performed in or for firms which are internationally owned. This is growing partly due to acquisition and part due to internal investment. US owned firms account for much of the growth, although the value and share of R&D from the rest of the world (India), Japan and EU countries apart from UK has risen too.

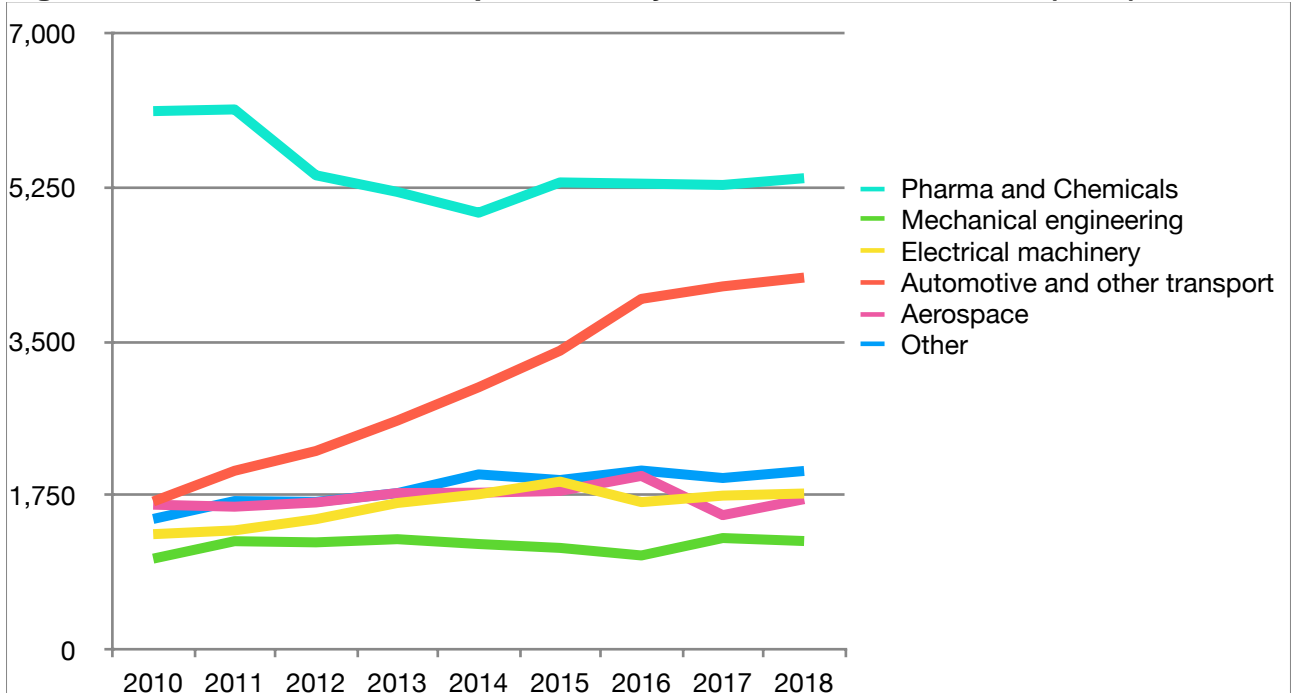
Figure 7: R&D in Foreign Owned UK Businesses: By Country of Ownership, £m



Source: ONS

The UK’s largest areas of R&D spend are pharmaceuticals, automotive, ICT and aerospace; all these sectors have seen spending growth by multinational research teams, and acquisitions of UK research intensive companies by US, Indian, Japanese and others.

Figure 8: UK Business R&D Expenditure By Sector, Constant Prices (2018), £m



Source: ONS

The UK now has a record employment of 250,000 R&D professionals (2018), who support a positive balance of trade in R&D services, with exports of £7.9 billion against imports of £6.7 billion. Both are growing strongly.

UK IP trade (2018) also has a positive balance. Overall professional, scientific & technical service exports, of which patent attorney services are part, are the second biggest service trade category with £54 billion in 2018, growing strongly from £36 billion in 2015, both roughly double the levels of imports.

This is an area of the UK economy which is highly international, with a strong positive contribution to GDP through balance of trade. The patent technical and legal services which patent attorneys and their associates provide are probably the most international of all, with between 75% and 80% of their total fees paid by overseas firms. The pattern of their filings on behalf of clients at EPO makes this clear.

Around 55% of UK patent attorney filings at EPO originate from inventors based in the US, 10% from UK inventors, around 9% from Japanese firms, 6% (and rising) from China and 7% from Korea. The UK is the main point of entry for English speaking countries into the European patent system including the US, Canada, Australia, New Zealand, and Ireland. It plays a similar role for Norway and some other smaller states. German IP attorneys have significantly higher shares of business from China, Japan, Korea, Russia and much of the rest of Europe.

While the UK IPO is a relatively small office in number of granted patents (around 6000 a year) the number of patent rights granted covering the UK via the EPO each year is around 136,000. This makes the UK jurisdiction 6th in the world for number of rights granted, behind China, the US, Japan, Germany and Korea, and equal with France.

Another measure of the UK's attractiveness to international companies as a place to design, obtain, defend and exploit patents comes from a regular survey by international IP lawyers Taylor Wessing. It brings together assessments of the IP system on a number of dimensions. Among the factors which influence performance are quality, predictability and speed of decisions, quality of professional advice, cost, speed, lack of bureaucracy and the probability that decisions in one national system will be precedent for another. The UK comes top in the most recent assessment, and has never been outside the top three.

This helps to explain why the UK is chosen as the entry point into the European system for so many patents - around 50,000 applications - for international innovators. These choices are not only based on cost (UK IPO filing and maintenance charges are relatively low but professional fees high) but on quality of specialised advice.

The availability of these advantages in English, within the European Patent Convention and with flexibility of ways to use it, explains why US companies are so keen to use both the UK and European systems in parallel. It enables them to use the UK IPO as a first filter, then to use EPO for cost effective international protection.

Caterpillar UK explains "The EPC has been a tremendously useful tool for Caterpillar patent activity for many years. Any moves to distance the UK from the EPC are likely to have a significant and adverse impact on our patenting activity, particularly in the UK"

Caterpillar UK Ltd first-files close to 100% of UK-origin applications in the UK; around 75% of these are subsequently filed at the EPO. Those of these that are granted in the EPO are then usually also validated in the UK.

If UK protection was not available from EPO filings, it is likely that our EPO filings would actually *increase* in order to retain filing strategy flexibility.

If UK protection were not available under EPC, we anticipate that our UK filings would actually *decrease* significantly as focus is likely to shift to the larger European market. Our limited IP budget is likely to shift to the EPO and away from the UK.

In managing supply chains this may mean a greater likelihood of using an EU supplier rather than a UK supplier if that means we are likely to have more IP to bargain with.

James Horgan, European head of patents for global healthcare company MSD says "It is true to say that the EPO has been the cornerstone of effective patent protection in Europe for over 40 years. The UK was a founding member and the vast majority of industry obtains patent protection through it for the UK without a second's thought. Being able to get protection in the UK via an office which is widely viewed as having the most thorough examination and consistent practices in the world provides reassurance to UK business and investors that EP(UK)s are likely to be regarded as valid."

The attractions that bring US companies here also benefit UK firms. A leading UK engineering and aerospace company makes a little under half its first filings in the UK with the rest going to EPO. The UK applications are withdrawn after applications have been made at EPO. If the EP route to UK protection were lost, then more UK patents would be filed and all of them would need to be prosecuted through to grant. Use of the EPO would be unchanged, so there would be considerable duplication of work and cost.

However, for any company (wherever its international base) whose in-house patent attorneys might lose the right to represent at EPO, European work would need to be outsourced to patent attorneys in Germany, Netherlands or elsewhere in Europe. Additional costs would be incurred from separate UK prosecution of all patents to grant, and from having to split work between UK and German attorneys. Over time some companies in this position would be likely to move some IP management to Germany or another EPC member state, so that they could attract and retain European patent attorneys to work within their operations. Supply chains dependent on close IP collaboration and support could then move with them.

4. Economic Impacts if UK were to leave the EPC

Impact on IP infrastructure

The UK IPO is relatively small by international standards - no 12 in the world in terms of applications and it processes fewer than 1% of global patents. Its quality is judged as good by users, and it has been a relatively fast producer of initial searches and examinations. It has influence in the world IP system from its quality of work, and a strong role in international bodies - including EPO.

UK IPO has relatively low search / examination / maintenance fees, partly thanks to its share of income from maintenance of UK rights granted by EPO, for which UK IPO does not have to incur costs to grant. This 'free' revenue, which would be lost if UK IPO was completely separate from the EPO, is around half of IPO's income. Without it, UK patenting fees would have to rise.

The other likely impacts of EPC withdrawal are:

- the number of patents for which businesses would need to seek grants direct from UK IPO would rise, from about 6,000 a year to at least ten times that - or more - as the only route to protection in the UK. To deliver the same patent protection for companies as today, UK IPO would need to process to grant over twenty times the number of patents that it did in 2019.
- Not all companies would seek patents in the UK if that required double filing, but UK IPO would need to increase patent examiners in proportion to the number of patents processed. The alternative, to avoid incurring extra costs, would be to accept EPO examination results without challenge.
- the use of UK IPO as an entry point, including initial search and examination, to Europe would fall away, because international companies, and new UK innovators looking for wider markets, would need to approach EPO direct.

In 2019, 142,000 new patent grants covered the United Kingdom. Of these:

- just under 6,000 were created by patent grants at the IPO
- over 136,000 were created by inventors validating European patent grants for the UK

If all firms chose to maintain UK patent cover now secured through EP rights with UK patents, and the UK government wanted to retain jurisdiction in the process, it would need to process 136,000 extra patents per year. At current patenting costs, assuming 50% of processing costs are variable this would add £750 million to IPO's operating costs.

If extra costs to firms drove down the rate of patent cover to reflect only those EP patents which are maintained at first renewal, UK IPO estimate that UK patent applications would only be around 65% of EP validations. At 88,000 UK applications, the extra processing costs would be around £528 million.

In practice the outcome would be between the two. Patent applications purchase a valuable option for future protection. The fact that some are allowed to lapse after 5 years does not mean they should not have been bought. Whether firms would choose to buy options will depend most of all on whether the UK market becomes a more or less attractive market for innovation. A rational estimate of extra costs can therefore be taken as £640 million plus or minus £110 million.

If UK IPO were to remain a breakeven trading fund operation, these extra costs would need to be passed on to businesses seeking protection to operate in the UK. The only alternative would be for the UK IPO to accept foreign patent grant judgements from EPO or elsewhere without having any say in how they were determined.

EPO is much larger, accounting for 5% of global applications, and ranks in the IP5 - China, US, Japan Korea and EPO - which between them handle 85% of global applications. UK withdrawal would leave EPO as the main route for firms seeking to protect innovations across most European markets, but those seeking UK rights would have to make separate or additional applications. For the 20% of EPO applications from SMEs, this would represent a significant cost and administrative burden.

EPO would lose part of the income stream from renewal of the 90% patents it grants which are validated in the UK. Long term it would probably have to raise overall charges a little to make up for this, as its costs would be unchanged.

The **UK Patent Attorney** system is unlike much of the rest of Europe. The majority of IP professionals work in specialist firms, and almost 80% of their work is for international clients. Most UK patent attorneys are qualified to work with EPO, which makes them ideally suited to work with inventors who prefer English, and who want access to all EPC markets - including UK - through a single representative.

In Europe, only Germany has more patent attorneys than the UK and almost half of them are based in industry. This reflects the different legal system in Germany which incentivises invention within individual businesses and means that firms need to manage their internal relationships with inventors, as well as with the wider IP system.

Table 2 Estimated number of Patent Attorneys and where they work

Country	UK	Germany	France	Italy	Switzerland
Private practice	2085	2645	777	465	256
Industry	459	2040	427	70	338
Total	2544	4685	1204	535	594

CIPA sources

If the UK left EPC membership, UK nationals, whether in private practice or industry, would lose the right to represent clients from any country before the EPO, to pursue an application or to oppose one by their clients' competitors. All the EP related export income from international clients would be lost. In addition, any work for UK inventors seeking protection in remaining EPC countries, or trying to defend their patents from challenge, would have to be done by attorneys there, mostly German but some in Netherlands, Sweden or elsewhere. Fees for this work would become service imports for the UK.

The loss of EPO work would reduce fee income for UK patent attorney firms by at least 75% to 80%. Some of the UK filing work (which would increase) would go with it because the UK market for IP services is open for overseas nationals, and it would be more economic for many companies to prepare both filings (for EPO and for UK IPO) in the

same place. Most inventors could use German or other EPC country patent attorney firms to complete the whole process, and under current rules file directly in the UK

There may be some offset in patent work with UK IPO, but there would be competition for it from patent attorneys based across Europe, who could file in the UK as an 'add on' to an EPO filing. It is likely that only companies based in the UK (and certainly not all of them) would continue to use UK patent attorneys for the whole process of designing, drafting, filing and prosecuting patents to grant.

UK based patent attorney firms say that they have limited capacity in their German or Netherlands offices (where partners and staff could retain the rights to work with EPO) to file patents at EPO for which the detailed work has been done in the UK. Their UK offices, where most of their expertise is, would lose the right to negotiate directly with EPO patent examiners, which is an important part of the process. Satellite offices of UK firms across the rest of Europe would be an inadequate substitute.

Loss of most of their income would leave IP professional firms in the UK in a weaker position than their equivalents in Germany, France or Italy, with a much reduced ability to attract or train new entrants. The UK would then become a difficult place for international firms to attract or retain patent attorney teams which could manage their IP here, because the pool of local talent would be in long term decline. Every incentive would be there to relocate IP management to a base within the EPC member states.

UK IP courts tend to attract higher value work than other national jurisdictions (mainly Germany, Netherlands, France and Sweden) for major cases. A comparative study by UK, German, US and Belgian academics shows that UK courts have a low volume share of international litigation, and so this accounts for relatively little work by patent attorneys. The UK courts specialise in high value cases with higher legal fees than others <https://openaccess.city.ac.uk/id/eprint/16392/8/Published%20article.pdf> UK courts are seen as fair, predictable, reliable and more likely to be taken as precedent in other jurisdictions. This makes the additional costs worthwhile in cases with high commercial value.

If the UK were to diverge from the EPC, two outcomes are likely. First, the courts would carry less weight in setting precedents for other jurisdictions in Europe, including Germany and other EPC jurisdictions. Second, the pool of IP legal talent which the courts currently draw on would diminish, diluting their reputation.

Economic Impacts

Direct impact on UK GDP - assuming no change in patent coverage by companies

Immediate - on IP service earnings

If UK patent attorneys were no longer able to file, manage negotiations or represent on patents at EPO, then all IP export services to international firms associated with EPO would disappear. Based on survey responses covering private firms with 21% of the 2084 patent attorneys in private practice this would cut export earnings by around £746 million per year. This represents about 75% of the UK profession's total earnings.

If UK based inventors seeking patent protection in EPC countries had to buy IP services from Germany or Netherlands, in order to lodge an application at EPO, the number of

patents affected would be around 5,000 per year, at an average cost for drafting, application and negotiation of an average of £7,000, depending on the sector. The additional service imports would be £35 million pa. If they went to the same patent attorneys for associated PCT and other filings the additional service imports would double.

There are also many international businesses with IP management teams in the UK, and they too would have to buy IP services from Germany, Netherlands or Sweden. These teams deal with applications whose inventors may be in the US, Japan, the EU, Korea or China, but the firms have IP teams, or at least patent managers, in the UK. Some of these may already be counted by UK patent attorneys as 'international sales' if the payments for services are made by overseas parents.

But some must be seen by patent attorneys as UK firms because there is not enough patent activity by UK applicants (11% of applications) to account for 25% of fee income ascribed to UK companies. We cannot know which of these companies would continue to purchase services through teams in UK, further increasing imports, and which would relocate the entire function to an EPC country. But if they all stayed in UK, and kept their European patent coverage as today, at 8,000 patents a year, additional imports at £7,000 each would be another £56 million - more if PCT work went to Europe as well.

The overall direct negative impact on UK GDP - £746 million lost exports plus £91 million additional imports - would be £837 million pa. If other services - freedom operate work, licensing services - went to EP practitioners the lost exports would be greater.

Costs to business for owners of UK IP

Likely impact on company patent behaviour

Feedback from a wide range of companies, from multinational operators owned in the UK, US, Japan and the rest of Europe, to SME innovators, shows a range of potential responses if loss of direct access from the UK IP profession to the EPO were to occur.

At one extreme are most pharmaceutical and some other health care producers, who have limited scale economies in production, high gross margins and the very real risk that generic producers can enter individual national markets, even small nations, if their inventions are not protected. They have to secure patents in every country in order to protect their markets. For them an EPO patent, validated in every EPC territory, is currently the best approach. If the UK were to leave EPC, they would have to duplicate every EPO patent application with a UK application to secure cover.

At the other extreme are one or two ICT innovators who are able, because of steep economies of scale, relatively low gross margins on sales and very large existing IP portfolios, to achieve European protection of most new inventions by patenting in as few as two or three countries. For the one firm which reports this behaviour, the least cost choice is to patent via national offices (usually Germany, UK and perhaps one other) and not to use the EPO. It would be unaffected if the UK left EPC. Its patenting activity via UK IPO is already included in its grant statistics, and not in new EPO grants.

Between these two extremes, companies foresee a wide range of behaviours which depend on technology, on size of firm, on commercial strategy and on the economics on protection. However, none of the 20 companies approached for this study, whether based in the UK, US or elsewhere, has said that it would reduce its filings at the EPO. The choice facing all of them would be how much to file in the UK.

For some, this is determined by national security. One aerospace innovator has to file its defence related inventions first in the UK, before approval by government to file and publish elsewhere. This would not change except that it would have to find additional patent attorneys able to represent at EPO. However its US subsidiary, which is required to file first at the US patent office for similar security reasons, after clearance would file directly with PCT, for global coverage, and then at EPO. To secure European patents it would require patent attorneys based inside an EPC state. Additional costs for securing separate patent grants for the UK would therefore apply to most of its portfolio

Another aerospace firm, uses the UK IPO to establish priority on some of its patents, then takes these and more through to grant at EPO, without using the UK grant process. It would need to take many through both processes. The increase in patenting costs would be significant, and decisions would need to be taken as to how important it would be to secure patent protection in the UK on a case by case basis. An internal UK IP team would be maintained to support the large number of UK inventors. However, needing to deal with attorneys based outside the UK would further increase costs, and the ability to recruit internationally qualified IP attorneys in the UK would decline. This would make it attractive to relocate some activity.

Responses from other engineering firms also indicate that losing access from a UK IP team to the EPO has costs beyond those directly related to costs of filing and prosecuting patents. The loss of IP expertise and the decline in patent cover for technologies in the UK would affect the ability to share technology with partners in the supply chain, and to structure licensing deals. This would affect joint development programmes, for which the UK would be a less attractive environment to work in. Incentives to develop elsewhere, and to procure elsewhere, in bigger markets with a common IP system, would increase.

Energy companies identify increased costs due to dual filing and prosecution through to grant, and to having to deal through more than one patent system. They would file more at UK IPO, but cannot yet judge how far extra costs might lead them to reduce patent coverage in the UK. It would not affect coverage needed elsewhere. Some of these firms are investing in new technologies to achieve the zero carbon imperative for their industry, often developed by new innovators for which IP is the principal asset. The companies themselves need good internal IP capability to assess the value of technology as investors. Also the innovators they are looking to invest in need good local IP advice to make sure their technology has the IP protection to make it worth acquiring. The energy innovation field is intensely competitive internationally, with strong rivals in the EU and Asia, so a strong and stable IP system in the UK with international expertise is essential.

Consumer product firms among respondents use EPO for most of their protection, across Europe and in the UK. For some, having to file additionally in the UK and prosecute to grant would increase direct costs. In some it could lead to IP management being transferred out of the UK which would significantly weaken the IP profession. Even more seriously, some of these firms consider that if the scope of patents in the UK were to diverge from the rest of Europe that could lead to problems in supply chain management and to difficulty in establishing freedom to operate with a single product across the whole of Europe. Some report that in the extreme, the UK could lose production to other locations within both the EPC and the European single market.

Most of our direct responses on estimates of additional cost to firms come from multinationals, based in a half a dozen countries and in the UK. They indicate a range of

extra direct costs for dual filing and prosecution, from £3,000 up to £6,000, plus internal organisational costs to deal with multiple patent attorneys in different countries.

For large firms, extra organisational effort can be spread over management costs of large existing portfolios. But for SMEs life is very different. Most do not have internal IP expertise, and have to buy it in for each decision on how to protect their new ideas, or how to share it. This is costly in management time and in professional costs. The chairman of three successful UK knowledge - based SMEs reinforces this point;

"If the European Patent were not available to small companies we would still need both UK and European protection. This would add between 150% and 175% to our IP costs, which is significant for SMEs. We don't have in-house IP management, and our admin costs would also be affected by having to deal with IP attorneys in an EPC country.

More serious is the risk to high quality UK based IP legal advice, which we rely on heavily. If this were weakened, because UK patent attorneys were only able to work with IPO, then we would have to carry out some of this work outside the UK."

The UK Federation of Small Businesses, representing many SME innovators, is clear;

"Small UK innovators need IP to support their exploitation of new ideas in their markets, Unlike larger businesses they don't have the resources to manage IP inside the firm.

All the costs associated with regulation bear much harder on SMEs, including the legal cost of IP. That is why access to an effective UK IP system linked to their main markets is vitally important. They need:

- access to good IP advice delivered locally at reasonable cost
- a system of IP regulation which is low cost, as straightforward as possible, and consistent across the areas they work in
- certainty over how the rules for IP will develop over time.

The EPO gives SMEs access to European protection at more affordable cost than the alternatives, and it is helpful and important that we have British IP support for EU applications and that the expertise in UK IP courts has an influence across Europe to help sustain a viable innovation system.

We should be helping our smaller innovators to develop and build to grow the UK economy, and must avoid anything which might adversely affect their ability to do so."

Cost to business

In 2019, an estimated 142,000 new patent grants covered the United Kingdom. Of these:

- just under 6,000 were created by patent grants at the IPO
- over 136,000 were created by inventors choosing to validate European patent grants for the UK.

If all of the 136,000 EPO patents had to be separately filed at UK IPO, and taken through to grant, there would be costs associated with drafting, filing, amending and negotiating through to grant which would fall on the inventors. Company estimates for these costs vary widely between sectors and technologies, and depend as well on the familiarity the businesses have in dealing with national IP offices rather than EPO.

The range quoted by responding companies, for costs from filing at UK IPO through to grant, including internal, professional and office fees, is £3,000 to £6,000 per case or family. Taking a figure of £5,000 (half the Dehns benchmark in Section 1, allowing a margin for negotiations) to maintain the same level of patent cover sought in 2019 would be £680 million per year.

The numbers of EPO patent grants, and designations for the UK, have almost doubled over the last ten years. Although there may be a pause in growth for the economic crisis cause by today's pandemic - as there was after the financial crisis - growth will most likely be resumed in a year or two, So the estimated costs to business will rise too, so long as the UK remains an attractive economy in which to innovate.

As noted earlier, UK IPO suggests that only 65% of EP patents validated for UK would actually be submitted as UK applications. This would mean only 88,000 additional applications, with fee costs of £440 million per year.

As the UK IPO's report 'Building the evidence Base; Performance of the UK's IP System' says "International companies patenting decisions are driven primarily by where they are economically active". We argue that government should be concerned with all costs to business in the UK. But we can split additional business costs by country of ownership.

US owned businesses account for around 25% of the UK designations of EPO patents. The costs to US owned businesses to maintain the current level of IP protection they need in the UK will therefore be around £170 million per year. Japanese and German owned businesses each account for around 15% of EPO patents designated for the UK; for each of these, costs would rise by £102 million. Additional UK business costs come next, £51 million.

In all of these calculations, firms have assumed that filing, search and processing charges from UK IPO would be unchanged. However we have seen (Table 1) that these charges account for less than 10 % of the costs of operation of the search examination and grant process, and without a significant increase in the fees the UK patent office would be unable to fund the extra grant activity. The alternative would be for these costs to be funded out of taxation.

All of our cost estimates have come from multinational firms, with established processes for securing patents in multiple jurisdictions. For SMEs which patent infrequently, the additional cost, especially in management time, is likely to be higher - at or above the levels quoted by multinationals. According to EPO statistics, 20% of patents granted are to SMEs. Taking account of this, and of the growth in overall patent activity, the range of overall costs to business quoted here are likely to be conservative estimates.

Immediate Impact - on UK IP profession

If half the replacement work on patent applications for UK rights went to Germany / Netherlands attorneys, along with all the work associated with EP applications, the impact on income of UK attorney firms would be over 50% - with a proportional loss of jobs in the UK patent profession and industry - about 1100 patent attorneys plus 2400 associated staff. It would shrink to the size of France or Italy, or smaller because it could effectively only practice in UK. It would be at a big competitive disadvantage. It is difficult to see how it could survive as a worthwhile economic contributor.

The negative impact on capacity to subsidise pro-bono work for new innovators, and IP training would be substantial. Today around 700 qualified patent attorneys are actively engaged in this work, supported by the income from international clients. It would depend in part on how much fee income in the profession would be depressed not just by loss of EPO related work, but by the loss of access to more sophisticated international work. If work for international inventors were lost, UK patent design, application and prosecution skills would become less valuable to clients.

Impact on the UK IP system

The scale of impact on UK IPO is highlighted by the income figures related to patents in its financial report to 2019, shown earlier in Table 1, and by the fact that it currently grants fewer than 10% of the rights created for the UK market. It is clear that the patent operation - and the wider office - is largely paid for by patent renewal fees granted by the EPO, for which UK IPO has incurred little or no cost to grant. Assuming that a negotiated EPC withdrawal would give UK a breathing space, and a limited period in which it could replace these renewal fees as EPO granted patents run out, UK IPO would need to scale up the number of UK patent grants by between 1000 and 2000 percent

To manage anything like the volume of patent applications to maintain UK rights, UK IPO would need a huge increase in the number of patent examiners. Examiners take time to train and occupy some of the best paid jobs in UK IPO. Costs of fully staffing up would run into hundreds of millions.

These additional costs would need to be carried by UK IPO without any additional short term income apart from fees for filing, search and examination, which are significantly less than cost. It would take several years for renewal fees for new UK patents to kick in and provide the subsidy. The alternative to scaling up the UK's patent capacity would be to accept EPO grants as evidence to grant in the UK. This could avoid tying up thousands of British science PhDs to carry out work duplicating examinations done at EPO, and adding cost to businesses without adding any real value.

Indirect impacts

Changed patenting behaviour by international firms deciding not to patent in UK

Having spoken to over a dozen patent managers in leading UK based firms' patent teams it is clear that they are as heterogeneous as the patent attorney firms. Their reactions to a change in the UK's position in EPC would cover a very wide range.

First, it is clear that pharmaceutical firms, wherever based, would continue to seek patent cover in every territory. They would mostly pay the increased cost of business, because they need patents to cover the whole of the markets they serve.

Some ICT firms take a similar approach, willing to pay the additional costs of patenting most of their inventions across most of Europe and in the UK. They would generate additional patent applications for UK IPO, but the work to do this may not be based in the UK. Others take a different approach, reasoning that it is possible, on low margin high volume products to protect their European market sales by patenting in a few key markets (which to date usually include Germany, UK and France). National patent applications could be the preferred route to this type of coverage. If the UK was not in the

EPC, the UK market may not always be one of those selected for patenting some new inventions. UK IP teams would have a weaker role in future plans for IP management.

Engineering and consumer goods have the most diverse responses. Some were keen to stay using the UK IPO as the first place to file, then approach the EPO via PCT applications at WIPO. Those which already have research centres in UK or elsewhere in EPC countries, would be able to manage their IP work between them and patent as appropriate. However, their overall number of patents - especially in UK - would reduce to stay within IP management cost limits.

But others were concerned that exposing their innovation and their supply chains to a situation where IP regimes could deteriorate or diverge under them has real risks. Joint development with suppliers was one concern, especially where collaboration requires sharing IP across borders. There could be pressure to develop new activities, and new European supply relationships, within the EPC countries. For companies which can make choices between international partners the costs of doing this could be lower than the risks of continuing 'business as usual' in a country where their IP position is more risky.

Relocating IP management

Patent managers in UK based IP teams would lose their rights to file or represent at EPO, and so changes would be immediate. The number of companies which would consider moving their IP management away from the UK may initially be small - but they would be significant international players. Several have indicated that they would need to move at least some of their internal patent attorney work, in addition to having to buy more external IP services from European attorneys.

This would further reduce the demand for IP services in Britain, weakening the profession in a downward spiral. The economic impact of a 20% relocation in industry patent attorneys would be small, but if development work and value added in sourcing for supply chains followed, the impact on GDP would run into billions. The most vulnerable areas appear to be transport, engineering and consumer products, where there is significant international ownership of IP creating firms. Loss of new development projects here would impact those sectors which have achieved significant recent growth. Their current R&D spend is over £5 billion a year.

Impact on growth SMEs

Assessing the impact of a weaker IP legal advice system for smaller businesses on future growth is inevitably speculative. But there is evidence that smaller high growth firms do gain from getting the right international IP protection at an early stage, helping subsequent growth performance. A recent study for EPO shows that prior filing of at least one international patent increases the probability that an SME will achieve a sustained period of high growth by 25%. This evidence ([http://documents.epo.org/projects/babylon/eponet.nsf/0/F59459A1E64B62F3C12583FC002FBD93/\\$FILE/high_growth_firms_study_en.pdf](http://documents.epo.org/projects/babylon/eponet.nsf/0/F59459A1E64B62F3C12583FC002FBD93/$FILE/high_growth_firms_study_en.pdf)) covers SMEs across six countries - including the UK.

The UK is currently the most successful European generator of high growth firms which make the transition from small / medium to capitalisation approaching £1 billion. So far there have been 29 UK based 'unicorns', which is a good track record, but well behind the US and China. As summarised in Annex B, half of them have patent based IP, and have used UK patent advice to secure EPO and wider patent protection to generate £22billion in market value. Any change in the IP regime which reduces the probability that

a new business with good technology will succeed and make it into this group will limit GDP growth, and probably productivity too.

One of the patent managers responding to the survey, from the energy sector, who works (in a large company) with a range of smaller innovative ICT and engineering enterprises identifies this a key risk. As an investor himself, his company is well aware that “the investor and financial services community is increasingly aware of the value of IP and are looking to determine opportunities to invest in companies with quality IP supporting their proposition. Loss of a supportive IP profession will damage investment opportunities in this sector. “

Productivity Impacts

Two important drivers of productivity growth in any national economy are investment in R&D, and the amount of inward investment by international businesses. Numerous macro and micro economic studies have demonstrated this in general, and specifically for the UK economy. Any reduction in the amount of investment in innovation in the UK, or in the innovation activity by international firms will reduce the rate of growth of labour productivity for the future. Empirical evidence on the ‘spillovers’ which R&D and other innovation activities cause across the economy show that productivity losses would not only affect the businesses investing less, but would also slow down growth of other UK business with which they compete.

Annex A

Value of UK Patent Attorney Profession, and sales to International Firms

Patent Attorney firms are not separately identified in official statistics. The value of their output has been measured for this study from two sources.

- 1) data gathered by Belmana, using FAME company data together with CIPA membership data by Patent Attorney firm to establish gross fee income per qualified Attorney for the firms (7) whose reports are covered by FAME. 479 patent attorneys work in these firms. They tend to be medium / large firms with between 50 and 100 patent attorneys,⁴
- 2) a confidential survey of Managing Partners coordinated by CIPA, to establish numbers of Patent Attorneys, gross fee income, business with international firms, proportion of fees directly related to EPO work, pro-bono activity and work with universities. Responses to this survey cover 9 firms ranging from 5 to 75 patent attorneys. In total they contain 429 patent attorneys. Two firms have fewer than 10 attorneys, four are between 20 and 40, five between 45 and 75.⁵

These two quite different samples have very similar values for GVA, or gross fee income, per patent attorney - £460,000 and £480,000 respectively. Their total GVA is £427 million, generated by 908 patent attorneys, 44% of the UK profession working in private practice.

Scaling up to the UK professional total of 2085 patent attorneys gives a GVA total for the sector of £982 million.

For firms reporting fees charged to international firms the overall estimate of international sales comes to 76% of fees, with several medium sized and larger firms over 80%. Work related to EPO activity on behalf of clients accounts for 65% of fee income across this sample.

In addition, one third of patent attorneys within these firms provide pro-bono services in training for the profession, and to support fledgling inventors. Slightly over one third work with university researchers, usually at reduced fee rates.

Drafting, filing and prosecuting patents is the largest part of fee earning work. Other important contributors include hearings, appeals and oppositions, mostly at EPO, licensing transactions, patent transactions, strategic advice on patent portfolios and - importantly - freedom to operate work which innovators need to establish where they can exercise their rights without being sued for infringement. The percentage of non-filing income varies, with some larger firms reporting over 50%. There are some small specialist firms (non respondents) where the proportion is known to be higher.

Estimates of what would happen to fee income if the UK were no longer an EPC member require assumptions. One certain result would be that UK nationals, based in the UK, would lose the right to represent clients at EPO. The incentive for international firms to use their services would vanish. They would still be able to file and represent at UK IPO, and in the PCT system. But most clients would prefer to use attorneys able to undertake the whole process, and not have to deal with multiple service providers.

It is unlikely that international innovators would come to UK patent attorneys for advice on freedom to operate, licensing or strategy if the attorneys were not active practitioners in the international system. These areas of work require up to date practical knowledge of the international patent landscape, and of the clients portfolio and commercial objectives.

Work for UK based firms involving the EPO would also move to mainland Europe. Given that foreign attorneys have rights to represent at UK IPO, UK innovators' UK filings could be transferred as well, avoiding the need to deal with multiple providers.

⁴ Marks & Clerk, HGF, Mewburn Ellis, Boulton Wade Tennant, Mathys & Squire, Haseltine Lake Kempner, Kilburn & Strode, D Young & Co

⁵ J. Spaargaren, Abel & Imray, Forrsters, Wynne Jones, J.A.Kemp, GJE, P Clarkson, Symbiosis, Carpmael, M Jenkins, Dehns.

Annex B

UK Unicorns in 2020 and their IP - Analysis by Scott Roberts, BT.

The list of current UK businesses qualifying as "unicorns" and also some businesses that have exited "unicorn" status by way of acquisition, merger or business reshaping includes 24 current firms, and 5 which have changed.

Using publicly available patent publication information (Espacenet), we can identify:

- patent applications filed by these businesses
- in which jurisdiction the applications were filed
- who filed them (i.e. which patent attorney firms); and also
- an inference as to sequence of patent filing by IP office.

Not all patent applications that are filed are published, so these findings constitute a minimum number

It is reasonable to identify the patent attorney firm engaged for the earliest patent applications for a unicorn as most likely to be the first primary patent advisor for the unicorn during its start-up. Thus we can infer the source of patent (and IP) advice for a unicorn based on the earliest patent filings. For the unicorns reviewed, there was consistency of firms employed across patent applications.

The firms, and their patent activities, are set out in the spreadsheet below. Of the 24 current unicorns and 5 exited unicorns, 15 had patent filings that could be located publicly (the others generally relating to Fintech for which patents play a lesser role). Of these, all 15 (100%) have employed the services of UK patent attorneys to file their first patent applications. Also, in all cases, where subsequent filings have been made as PCT/EPO filings, all 15 (100%) have continued to use the services of UK patent attorneys.

Company	Patent First Filing Jurisdiction	Inferred Patent Filing Strategy	Likely first patent service firm(s) based on agent for first filings	~Valuation (£bn)	Business Areas	Investors
CURRENT UNICORNS						
Global Switch	<i>no patents/applications identified</i>			\$11.08	Hardware	Aviation Industry Corporation of China, Essence Financial, Jiangsu Sha Steel Group
Revolut	<i>no patents/applications identified</i>			\$5.50	Fintech	index Ventures, DST Global, Ribbit Capital
Arrival	United Kingdom (>36 filings)	GB then WO then EP/US/ors	UK Firm Venner Shipley LLP	\$3.91	Auto & transportation	Kia Motors Company, Hyundai Motor Company
Greensill	<i>no patents/applications identified</i>			\$3.50	Fintech	SoftBank Group, General Atlantic
TransferWise	<i>no patents/applications identified</i>			\$3.50	Fintech	IA Ventures, Index, Ventures, SV Angel

The Hut Group	<i>no patents/applications identified</i>			\$3.25	E-commerce & direct-to-consumer	KKR, Old Mutual Global Investors, Artemis Investment Management
BGL Group	United Kingdom (at least 1 filing)		Waterfront Solicitors LLP	\$3.00	Fintech	CPP Investment Board
Monzo	<i>no patents/applications identified</i>			\$2.55	Fintech	Passion Capital, Thrive Capital, Orange Digital Ventures
OakNorth	<i>no patents/applications identified</i>			\$2.30	Fintech	Clermont Group, Coltrane Asset Management, Toscafund Asset Management
Benevolent AI	United Kingdom (>22 filings)	GB then WO then EP/US/ors	Appleyard Lees; AA Thornton; GJE; Bridle IP; Dentons; Reddie & Grose	\$2.10	Artificial intelligence	Woodford Investment Management
Deliveroo	<i>no patents/applications identified</i>			\$2.00	Supply chain, logistics, & delivery	Accel Partners, General Catalyst, Index Ventures
Improbable	PCT (United Kingdom) (>3 filings)	WO then EP/US/ors	Boult Wade Tennant	\$2.00	Other	Andreessen Horowitz, SoftBank Group, Temasek Holdings
Checkout.com	<i>no patents/applications identified</i>			\$2.00	Fintech	Insight Partners, DST Global
Babylon Health	United Kingdom (>5 filings)	GB then WO then EP/US/ors	Marks & Clerk	\$2.00	Artificial intelligence	Kinnevik, Vostok New Ventures, Public Investment Fund of Saudi Arabia
Oxford Nanopore Technologies	United Kingdom (>88 filings)	GB then WO then EP/US/ors	J A Kemp	\$1.96	Health	Illumina, Invesco Perpetual, IP Group
Graphcore	United Kingdom (>22 filings)	GB then US and WO then EP/US/ors	Page White & Farrer	\$1.95	Artificial intelligence	Dell Technologies Capital, Pitango Venture Capital, Amadeus Capital Partners
Darktrace	United Kingdom (>7 filings)	GB then WO then EP/US/ors	Kilburn & Strode	\$1.65	Artificial intelligence	KKR, Ten Eleven Ventures, Summit Partners
Ovo Energy	<i>no patents/applications identified</i>			\$1.28	Other	Mitsubishi Corporation, Mayfair Equity Partners
Atom Bank	United Kingdom (>6 filings)	GB then some WO then EP/US/ors	Secerna LLP	\$1.25	Fintech	Toscafund Asset Management, Woodford Investment Management, BBVA
Rapyd	<i>no patents/applications identified</i>			\$1.20	Fintech	Target Global, General Catalyst, Durable Capital Partners
BrewDog	United Kingdom (>6 filings)	GB then some WO then EP/US/ors	HGF; Lawrie IP Ltd	\$1.15	Consumer & retail	TSG Consumer Partners, Crowdcube
Radius Payment Solutions	<i>no patents/applications identified</i>			\$1.07	Fintech	Inflexion Private Equity
CMR Surgical	United Kingdom (>50 filings)	GB then US and WO then EP/US/ors	Slingsby Partners LLP	\$1.00	Health	Cambridge Innovation Capital, LGT Capital Partners, Escala Capital
Snyk	<i>no patents/applications identified</i>			\$1.00	Cybersecurity	BOLDstart Ventures, Google Ventures, Accel

EXITED UNICORNS						
Just Eat	United Kingdom (>7 filings)	GB then WO then EP/US/ors	Mathys & Squire		e-Commerce	Sure, Flyt, Practi, City Pantry, Canary Flash
Zoopla	<i>no patents/applications identified</i>				Other	Bricklane, Hometrack, Trussle, Money.co.uk , The Plum Guide
Skyscanner	United Kingdom (>7 filings)	GB then WO then EP/US/ors	Origin Limited		Other	Baillie & Gifford, Artemis, Khazanah, Oxford Capital, Scottish Equity
Farfetch	United Kingdom (2 filings)	GB then WO then EP/US/ors	Keltie LLP		e-Commerce	BrandOff, My-wardrobe
Funding Circle	<i>no patents/applications identified</i>				Fintech	Prosper Marketplace, Lending Club