Life Sciences Superpower

Growing the leading global hub in the UK

June 2022

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In collaboration with

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Bringing medicines to *life*

Foreword from ABPI

Dr Richard Torbett
ABPI Chief Executive

When the Government published the Life Sciences Vision a year ago, the task was clear. How can we make the UK the best place in the world for life sciences companies to discover the medicines and vaccines of the future and make sure NHS patients are amongst the very first to benefit from them?

The Life Sciences Vision provided a compelling blueprint in answering this question. And impressively, figures from across Government and industry rapidly agreed with the ambition and started immediately on delivering against this plan. The life sciences sector will be at the forefront of driving growth in the twenty-first century and as global competition increases, this united action will be crucial in the UK's success.

The focus on creating an 'outstanding environment for life sciences businesses to start, grow and invest' was central to the ambition of the Life Sciences Vision, which is why this report has focused on the whole ecosystem to determine just what this outstanding environment should look like. The size of the prize on offer to the UK is significant – over 30 years, there is almost £70bn in additional GDP to be gained from increased R&D investment.

But it's also apparent that we need to take concrete, targeted action to address relative declines we are seeing in the UK's clinical trial activity, pharmaceutical manufacturing and R&D investment compared to our global competitors. This report sets out key performance indicators where the UK's competitiveness can be measured and helps tell a story about where our strengths lie and where we must focus our attention.

The ABPI is determined to work with our members, the Government, the NHS and everyone in the life sciences community across all nations of the UK to deliver against the opportunity we have to become the best place in the world to research, develop and manufacture the medicines and vaccines of the future. A year into the delivery of the Life Sciences Vision, this report provides a snapshot of where we are today and where we must work together over the coming decade.

We thank ABPI members and stakeholders for their involvement in interviews and workshops to support the development of this report. PwC interviewed and surveyed over 30 industry respondents across 13 ABPI member companies and the ABPI itself. Respondents held a variety of roles at their respective organisations, including UK Managing Directors and General Managers and decision-makers across value and access, R&D, commercial and medical teams.

The findings in this report reflect to the best of PwC's ability the sentiment and recommendations made by the following contributors:

- Alexion
- Amgen
- AstraZeneca
- Boehringer Ingelheim
- Bristol Myers Squibb
- GlaxoSmithKline
- Janssen
- Merck
- MSD
- Novartis
- Pfizer
- Roche
- Sanofi

Foreword from PwC

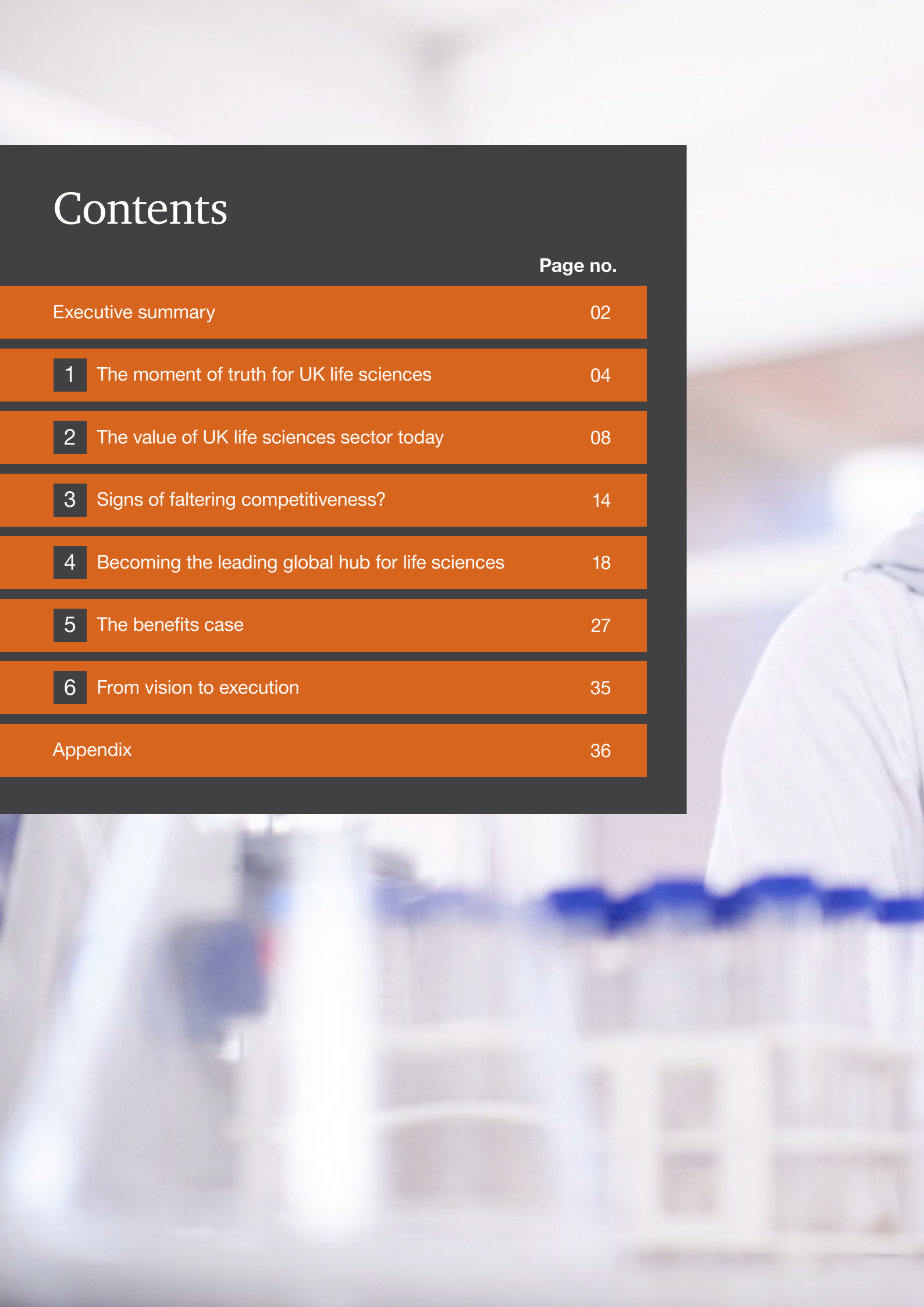
Thalita Marinho
PwC Strategy&,
Pharmaceuticals Partner

At PwC, we believe in creating a common purpose to help tackle the biggest issues facing the world today, in a manner which builds trust in societies. The UK Government created a common purpose to stimulate a thriving UK life sciences sector with the publication of the Life Sciences Vision. As we emerge from the COVID-19 pandemic, it is important to reinforce the resilience of life sciences so that we can solve some of the biggest healthcare problems of our generation.

This report looks at the value of the UK life sciences sector. Our findings, which were informed by independent desk-based research and interviews, look at the economic impact of the life sciences sector and its component parts in the context of the Life Sciences Vision. It also compares the UK against comparator countries and quantifies the potential benefits if the UK were to become the leading global hub for life sciences. We hope our findings support the ongoing dialogue on the importance of the sector.

My thanks to the Association of the British Pharmaceutical Industry for funding this report.

Contents



Executive summary

Last year the UK Government published its Life Sciences Vision, which set out an ambition to 'regain [its] status as a Science Superpower by [becoming] the leading global hub for life sciences'.[1] The UK now faces a moment of truth. It has the potential to become the leading global hub for life sciences. However, to do so, the UK will need to move quickly to fend off international competition. It will also need to implement the Government's Life Sciences Vision fully and at pace across all aspects of the ecosystem.

The life sciences ecosystem is highly interconnected and needs to operate as a virtuous cycle, with generation, production, and investment in, access to, and uptake of innovation as the key driving forces. Weaknesses in any one part may be felt across the entire ecosystem. It also means investments in one area may have outsized effects elsewhere. Achieving the Government's ambition to become 'the global hub for life sciences' requires each component to be firing on all cylinders.

Life sciences is already a major economic driver for the UK. This report analyses the sector's contribution to the UK in an average year using 2019 as its reference to avoid the distortions created by the COVID-19 pandemic in 2020. Where 2020 data is available as part of a time series, 2020 data points are included in the analysis. We find that, in 2019:

Life sciences contributed **£36.9 billion to UK gross domestic product (GDP)** and **584,000 jobs to the UK economy** through direct, indirect and induced effects.[2]

The sector's direct GDP contribution of **£16.9 billion** supports **patient outcomes** and NHS productivity through scalable interventions such as innovative medicines and medical devices as well as cutting-edge scientific research.

Spending on pharmaceutical research and development (R&D) totalled over **£4.7 billion**, which was **18 per cent of all commercial R&D** investment across the UK economy.[3]

The sector's clinical research studies supported by the National Institute for Health Research Clinical Research Network (NIHR CRN) generated **£2.7 billion of GDP** and supported **over 47,400 jobs** in the UK in 2018/2019.[6]

This single year's[4] pharmaceutical manufacturing R&D investment is expected to raise **all-economy productivity**[5] by **£45.0 billion** over the next 30 years.

However, there are some weaknesses in the UK's position which need to be addressed. While the UK's biotech sector has attracted greater volumes of investment in recent years, the country's overall share of global R&D spend is falling, and its once-leading position on clinical trials is in relative decline. The UK's pharmaceutical manufacturing presence (the largest segment of the UK life sciences sector) is shrinking in real terms. The UK is also perceived by global boardrooms to have a challenging access and uptake environment, which has impacted its attractiveness for product launches.

[1] HM Government (2021). Life Sciences Vision, 2021, p. 3.
[2] This includes spending on direct business activities, supply chain spending and employee spending.
[3] ONS (2021). 'Business enterprise research and development', 19 November 2021.
[4] 2019.
[5] Discounted to net present value at 3.5% nominal discount rate as per Green Book (2022) guidance with 2019 as base year.
[6] National Institute for Health Research (NIHR) and KPMG (2019). 'Impact and value of the NIHR Clinical Research Network', July 2019.

Becoming the leading global hub for life sciences would be transformative for the health and wealth of the UK.

This report quantifies the benefits case for the UK from life sciences growth by analysing certain key performance indicators for the sector's performance, drawing upon the latest available evidence. It finds that the UK could realise a number of benefits across health, GDP and employment, as well as NHS revenues and cost savings, including:

A **40 percent** decrease in total attributable burden of disease.

£68.1 billion in additional GDP over 30 years resulting from increased R&D investment.

17,500 jobs created from greater volumes of UK life sciences IPOs sustained each year.

£16.3 billion additional GDP and **85,000 additional** jobs in total from increased pharmaceutical exports.

£1.2 billion additional GDP and **7,230 additional jobs** annually from greater foreign direct investment to life sciences each year.

£165 million additional revenues and **£32 million** cost savings annually to the NHS from greater UK share of global commercial clinical trial enrolment each year.

Reduction in wide variation in time to patient access of innovative medicines so that all new medicines are made available within **3 months** of licensing and a **36 percentage point improvement** in patient uptake of innovative medicines.

Flawless execution and partnership by the UK and devolved nation governments, the NHS, the pharmaceutical sector and other stakeholders across the entire ecosystem will be required to make it a reality.

The purpose of this report

This report has been produced to provide an evidence base that demonstrates the scale of the opportunity for the UK in life sciences and accelerates the implementation of the Government's ambition to become the global hub for life sciences. Specifically, it:

1. **Sets out the opportunity for UK life sciences (Section 1)**
2. **Estimates the current economic impact of the life sciences sector on the UK (Section 2)**
3. **Explores how the UK can transform itself into the leading global hub for life sciences (Section 3)**
4. **Quantifies the potential benefits case for the UK if this ambition is realised (Section 4)**
5. **Sets out what is needed to get from vision to execution (Section 5)**

1. The moment of truth for UK life sciences

The UK has an unprecedented opportunity to become the leading global hub for life sciences. The UK Government has published an ambitious Vision, and the sector is supportive. But, with international competition mounting, there is a need to move quickly.

In July 2021, the UK Government set out in its Life Sciences Vision a commitment to transform the UK into the leading global hub for life sciences. The Life Sciences Vision recognises that a holistic approach is needed and that success means creating an ecosystem in which each component is firing on all cylinders. This is focused on four themes in particular:

Business environment
Creating a business environment in which small companies can access finance to grow, are regulated in an agile and efficient way, and can manufacture and commercialise their products in the UK.

Research infrastructure
Building on the UK's science and clinical research infrastructure and harnessing its unique genomic and health data.

Innovation, access and uptake
Helping the NHS test, purchase and spread innovative technologies more effectively, so that cutting-edge innovation can be embedded widely and early in the UK.

Healthcare challenges
Building on the new ways of working developed during the COVID-19 pandemic to tackle future healthcare challenges.

Figure 1: Enabling themes of the Life Sciences Vision

Source: PwC

Why a strong ecosystem matters

Becoming the world-leading hub for life sciences will boost both the health and the wealth of the nation, providing benefits to every person who lives in the UK. However, in implementing the Government's Life Sciences Vision, it is important to recognise that life sciences does not have a simple, linear value chain. Rather, it is made up of many distinct components, all of which operate together in an interconnected ecosystem (see Figure 2).

This interconnectedness creates a series of reinforcing loops, amplifying the overall value the ecosystem can deliver. For example, a key stimulant for investment in life sciences is investment in, access to, and uptake of innovative medicines. When access and uptake is strong, individual patients are more able to benefit from new treatment options. Use of real-world evidence on patient pathways then informs R&D, reinforcing the cyclical nature and patient-focussed drug development process. Life sciences goods and services directly impact patient outcomes, lives and livelihoods. However, this is only a proportion of the total system-wide value created. Healthier patients are more able to contribute to society and are more economically productive. Furthermore, innovators receive a return on their investment, which stimulates each next wave of investment and innovation in a virtuous cycle.

The downside of this interconnectedness is that weaknesses in any one part of the ecosystem can create a drag elsewhere. When access and uptake is weaker, for example, fewer benefits accrue to patients, which then limits the information on patient pathways or the relevant standard of care that informs future R&D. Uncertainty in innovators' returns on investment may also limit the appetite and opportunity for future investment. This, for example, has been seen in recent years in antibiotic development globally, which has triggered the establishment of the AMR Action Fund.[7,8]

This is all the more important given the sums involved. The UK spends, on average, about 10 per cent of GDP on healthcare, but only 0.9 per cent on pharmaceuticals.[9,10] In 2020, total global pharmaceutical R&D spending was over £154 billion,[11] of which the UK's share was £5 billion.[12] This represents just over 3.2 per cent of global pharmaceutical R&D, up 0.7 percentage points from 2019 which is likely driven from additional pandemic-related R&D investment. In the UK, the sources of this funding are varied, including venture capital, private equity and listed markets, plus major pharmaceutical companies themselves who typically reinvest around 20 percent of their revenue back into R&D activities.[13] It also includes £12 million (about 0.24 per cent) of pharmaceutical R&D funding to UK businesses by governments.[14]

[7] Roope et al. (2019). 'The challenge of antimicrobial resistance: What economics can contribute', Science, Vol. 364, No. 6435.

[8] Evaluate Pharma (2021). 'World Preview 2021 Outlook to 2026…', July 2021, p. 13.

[9] OECD Main Science and Technology Indicators

[10] IQVIA (2021). 'Drug Expenditure Dynamics 1995–2020: Understanding medicine spending in context', October 2021, Exhibit 1.

[11] Evaluate Pharma (2021). 'World Preview 2021 Outlook to 2026…', July 2021.

[12] ONS (2021). 'Business enterprise research and development, UK: 2020', 19 November 2021.

[13] PhRMA (2020). '2020 PhRMA Annual Membership Survey', 2020.

[14] ONS (2021). 'Business enterprise research and development', 19 November 2021, Worksheet 12: Sources of funds for R&D performed in UK businesses: Detailed product groups, 2020.

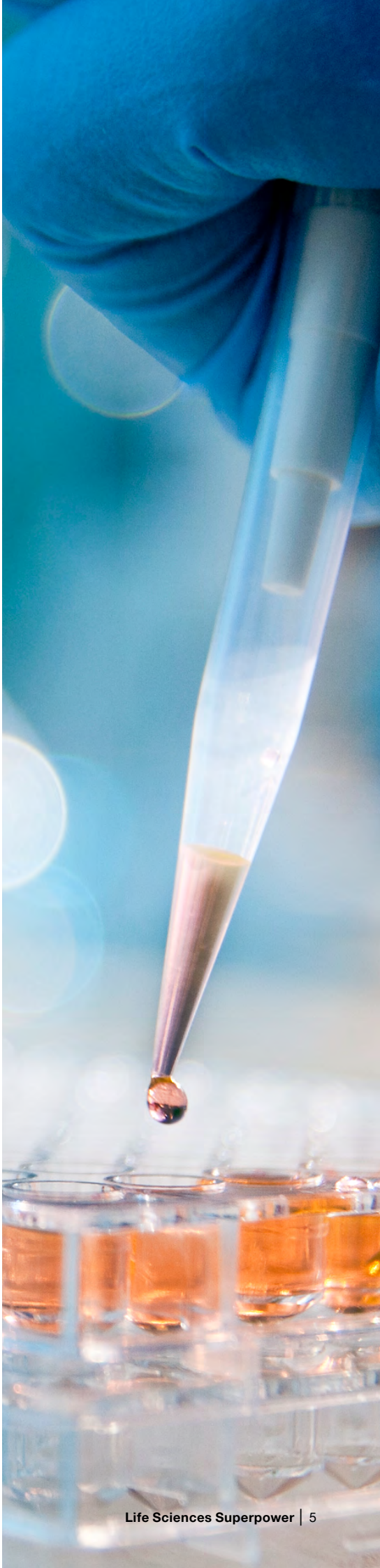
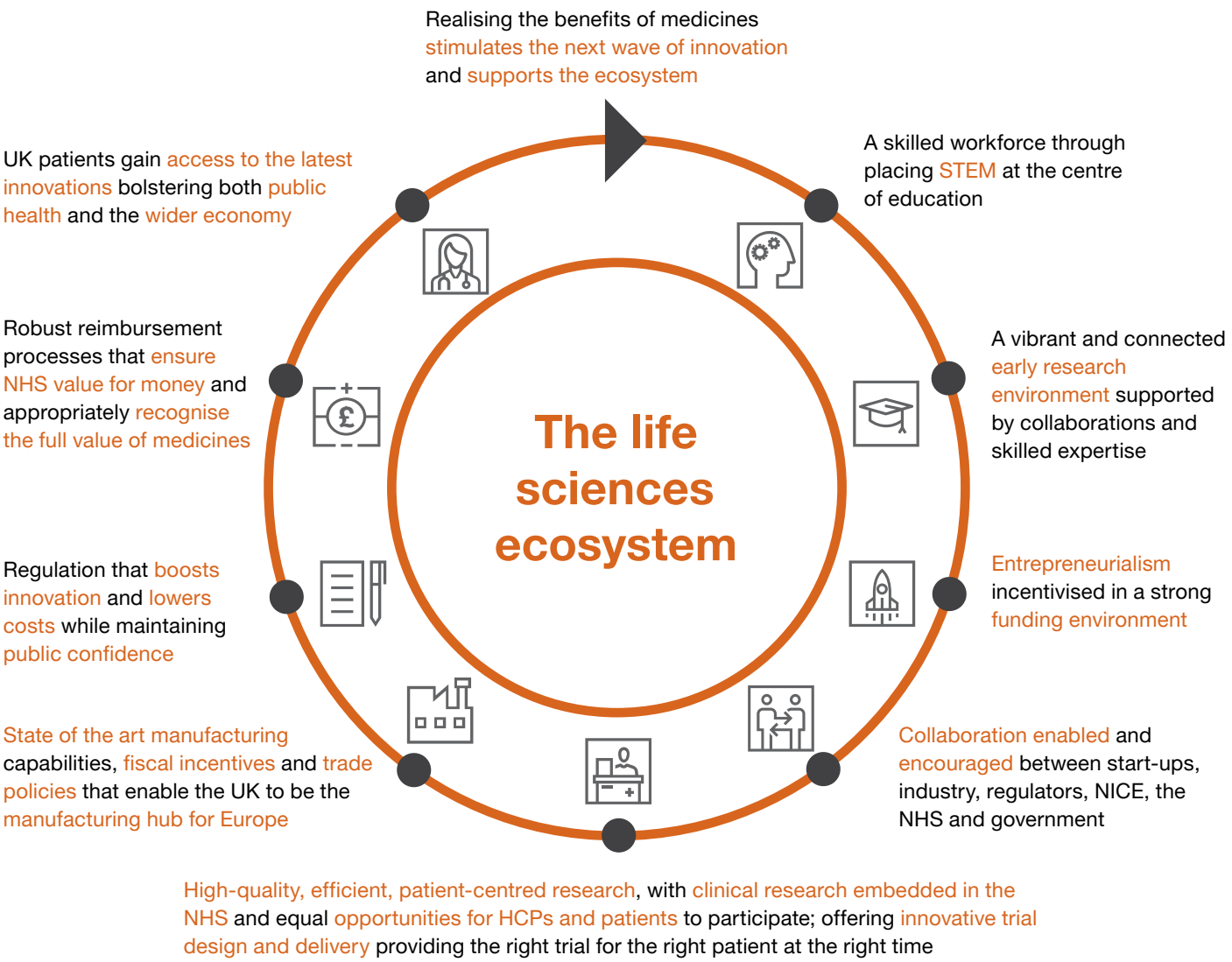


Figure 2: Key components in the life sciences ecosystem



Source: PwC

Better investment in, access to, and uptake of innovative medicines creates a virtuous cycle:

- A thriving commercial environment which values innovative medicines sends a signal to global boardrooms, positioning a country as a priority launch market.
- Greater access and uptake supports investment in the next wave of innovation. This is true whether it comes from pharmaceutical companies or from other sources such as venture capital, private equity, initial public offerings, or government and philanthropic funding. While R&D is conducted globally and is based on global return on investments, the literature and industry indicate there are mechanisms through which local commercial attractiveness can impact local R&D investment.
- Increased funding stimulates and sustains early research activities by academic researchers, discovery scientists in large pharmaceutical companies, pre-revenue biotechs and contract research organisations. Scientific breakthroughs from this research can generate new pharmaceutical assets that can progress to clinical development and provide broader economic and social benefits to the UK.
- Clinical development, in which medicines are trialled for safety and efficacy in humans, relies on numerous other stakeholders in the ecosystem, including clinical investigators, healthcare professionals and statisticians, who themselves then contribute to the economy.

  Patients also benefit from early access to innovative (and potentially lifesaving) treatments, improved patient outcomes and improved patient confidence in the care they are receiving.
- As a medicine progresses through clinical trials to launch, greater volumes must be manufactured, creating further economic stimulus both directly, in supporting manufacturing jobs, as well as indirectly, through suppliers and service providers.
- When an innovative medicine is approved, a market's priority for future early launches is reinforced. Patients, carers, families and the NHS gain from the health, productivity and wider benefits of these medicines.

The need for speed

In a survey of 30 members of the Association of the British Pharmaceutical Industry (ABPI), the majority of respondents (around 80 per cent) agreed the UK has the potential to become the leading global hub for life sciences.[15]

Interviewees believed that timely and flawless execution of the Government's Life Science Vision would be critical given how many countries are also now prioritising life sciences.[16] The UK will need to move quickly to compete against these other markets or risk potentially missing out on industry investment.

Timing is important in life sciences, where investment decisions typically have extended lifespans. Significant investments tend to persist over the long term, often for ten years or more, due to the costs and complexities involved, particularly in manufacturing and R&D.

This means that decisions taken today may take time to bear fruit, whilst the benefits will be sustained into the future. The UK must act in a timely manner if it wants to realise its vision for life sciences. To do so, it will need to address the entire life sciences ecosystem holistically and support a virtuous cycle of innovation.

[15] PwC interviews with ABPI member companies
[16] PwC interviews with ABPI member companies

2. The value of the UK life sciences sector today

The UK's life sciences ecosystem is mature, successful and of critical importance to the nation's economy.

Measuring the true value of UK life sciences

The life sciences ecosystem cuts across many other sectors in the UK economy, including manufacturing, scientific research and development, administrative and support services and human health services.[17] This interconnectedness means the sector does not easily fit within the Standard Industrial Classifications (SIC), used by the UK Office for National Statistics and equivalent bodies globally. It also means that current official records do not fully reflect the full impact of the sector in the UK.

To provide a more accurate picture of the sector's value, this report estimates the combined effect of its direct, indirect and induced contribution to the economy in terms of both gross value added (GVA) and employment across the pharmaceutical manufacturing, medical technology and research segments of the life sciences sector:

- **The direct contribution** is the economic value generated by life sciences companies from their direct business activities.
- **The indirect contribution** is the economic contribution of the life sciences supply chain, as companies purchase goods and services from UK-based suppliers.
- **The induced contribution** is the economic contribution that arises from spending by employees of life sciences companies and employees of their suppliers on goods and services for their own consumption (i.e. on groceries, eating out, entertainment, and so on).

The analysis uses 2019 as its reference year to avoid the distortions created by the COVID-19 pandemic in 2020. It also divides the sector into three segments – pharmaceutical manufacturing, medical technology, and life sciences research – to show the relative performance of each. Further details on the methodology used, including the calculation of GVA and the composition of the three sector segments, are provided in the Appendix A.1.

Beyond GVA and jobs, the sector also contributes to the UK economy in other ways, with annual tax revenues, clinical trial revenues, cost savings to the NHS, and increased productivity via the spill-over effects of R&D investment. These effects are also considered on the following pages.

A £36.9 billion annual GVA contribution

Our analysis estimates that the life sciences sector contributed a total of £36.9 billion in GVA to the UK in 2019, as shown in Figure 3. Of this, £16.9 billion (46 per cent) was directly contributed by life sciences companies themselves, £7.7 billion (21 per cent) was from indirect contributions and £12.3 billion (33 per cent) was from induced contributions.

The direct GVA contribution of the sector includes the latest medicines that science has to offer, lifesaving medical devices and cutting-edge research which underpins these innovations. These goods and services directly impact patient outcomes and lives. For example, by consistently pushing the frontier of clinical effectiveness of innovative medicines, the sector improves both the quality and length of patients' lives.

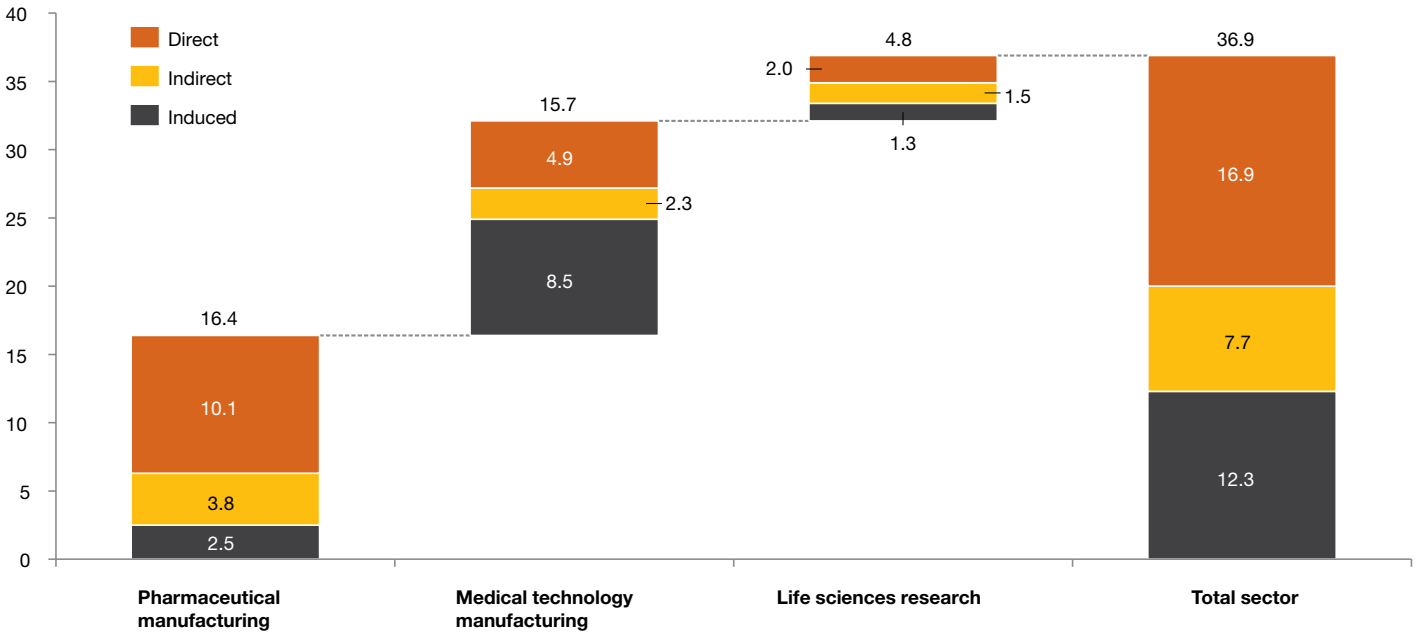
They also serve the NHS by providing scalable improvements to diagnosis and care in the form of innovative medicines and digital solutions. This is evidenced, for example, in the NHS England Long Term Plan, which highlights the efficiency and productivity gains to be achieved from consistent access to and best practice uptake of clinically effective interventions.[18] Medicines, diagnostics and other medical technology produced in the sector enables healthcare systems to reach more patients and communities, and advance more disease areas, with the finite time and staff at hand.

In 2019, pharmaceutical manufacturing was responsible for the majority of the sector's GVA contribution (£16.4 billion in total), closely followed by medical technology manufacturing (£15.7 billion). life sciences research was responsible for £4.8 billion.

[17] Sector groups as defined by the ONS

[18] NHS (2019). 'Online version of the NHS Long Term Plan', Chapter 6: Taxpayers' investment will be used to maximum effect, Test 2: The NHS will achieve cash-releasing productivity growth of at least 1.1% per year, 2019.

Figure 3: Contribution of UK life sciences to GVA (2019, £ billion)



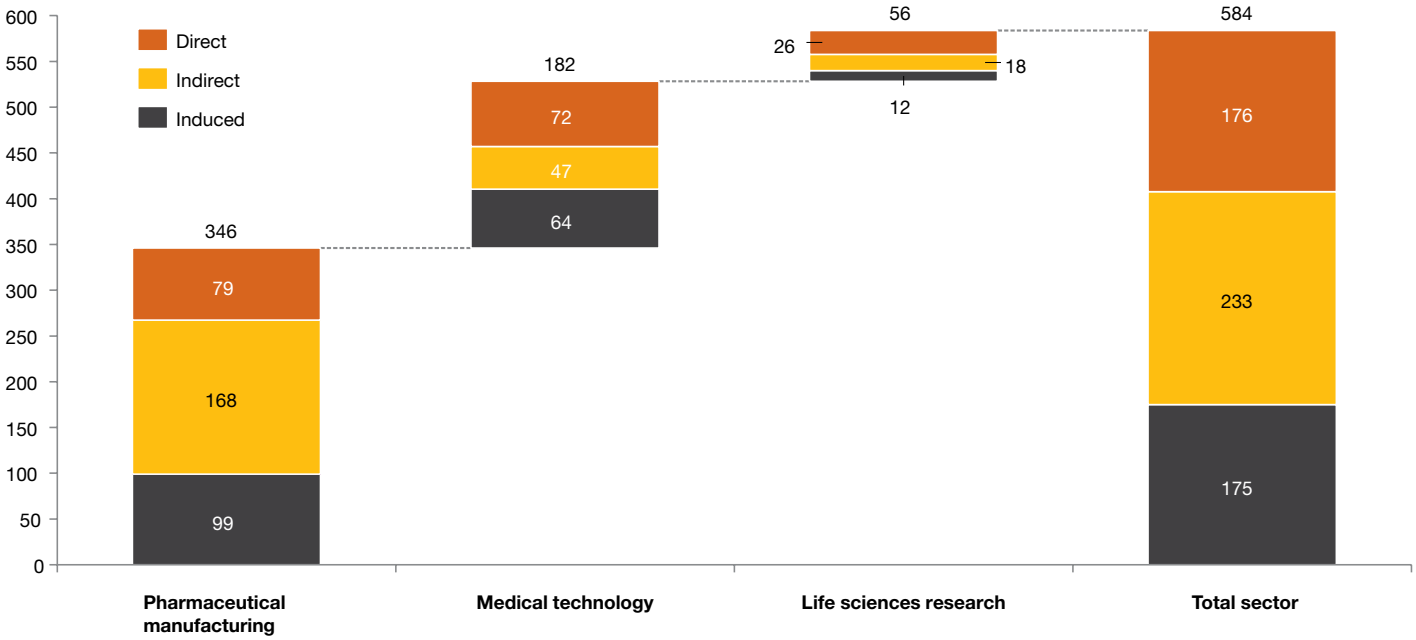
Source: PwC analysis, FAME, Companies House

584,000 jobs supported each year

The sector also plays a significant role in supporting employment in the UK. In total, we estimate that it contributed 584,000 jobs to the UK economy in 2019, as shown in Figure 4. This breaks down as follows:

- 176,000 jobs directly contributed by life sciences companies themselves (at their headquarters, manufacturing plants, research facilities, and so on)
- 233,000 jobs indirectly supported by supply chain spending
- 175,000 jobs supported through induced consumer spending by employees of life sciences companies and employees of their suppliers

Figure 4: Contribution of UK life sciences to employment (2019, thousand jobs)



Source: PwC analysis, FAME, Companies House

Consistent with the sector's GVA contribution, this represents a 21 per cent increase in the number of jobs contributed to the UK economy by life sciences since 2015.[19] The pharmaceutical development and manufacturing segment continues to provide the greatest contribution to UK employment (346,000 jobs), followed by medical technology manufacturers (182,000 jobs) and life sciences research (56,000 jobs).

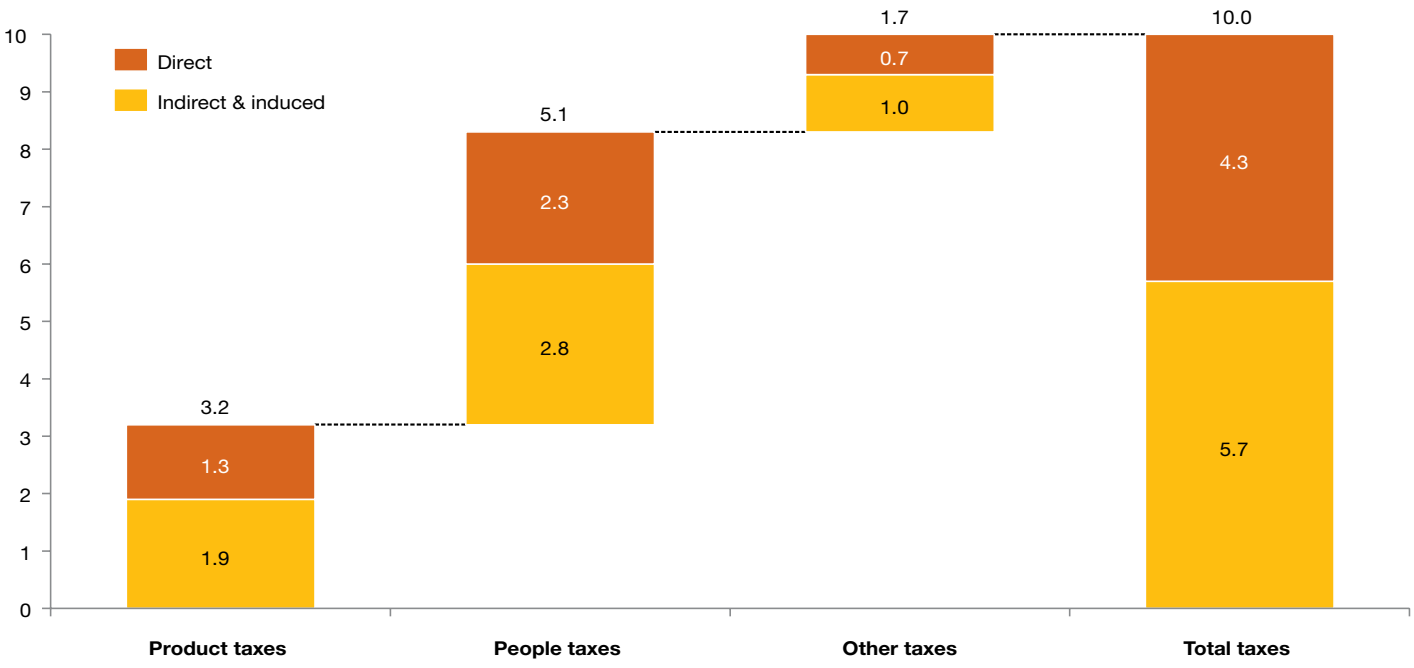
These jobs are of high value, with the pharmaceutical manufacturing, medical technology and life sciences research segments ranking in the 86th, 71st and 87th percentiles, respectively, for median annual gross pay for all jobs.[20] This means that the average life sciences employee in the UK has an annual gross pay greater than at least 71 per cent of UK employees. The sector not only supports the nation's economic wealth, but also individual livelihoods.

The life sciences sector is also a notable contributor to the UK Exchequer. The sector is estimated to have made a tax contribution of about £10 billion in 2019, as shown in Figure 5. Of this, about £4.3 billion was a direct tax contribution and about £5.7 billion resulted from a combination of indirect and induced tax contributions. The largest contribution came from payroll-related taxes such as income tax and national insurance contributions.

The sector's total fiscal contribution each year is roughly equal to the UK Chancellor's commitment to greater capital investment in the NHS over the next three years (by April 2025), announced in the Autumn 2021 Budget.[21] Therefore, the annual taxes contributed by the sector through its direct, indirect and induced activities are equivalent to an amount that could support the costs of improvements in NHS hospital and mental health facility capacity, diagnostic services and digital transformation over the current spending review period.

Because GVA is calculated on pre-tax financial measures, this £10 billion figure is largely captured within the £36.9 billion measure of GVA contribution set out above.

Figure 5: Contribution of UK life sciences to the Exchequer (2019, £ billion)



Source: PwC analysis

[19] PwC (2017). 'The economic contribution of the UK life sciences industry', March 2017, p. 11, Figure 2.1.
[20] PwC analysis of ONS (2021). 'Earnings and hours worked, UK region by industry by two-digit SIC: ASHE Table 5', 3 November 2021.
[21] The King's Fund (2021). 'The Autumn Budget and Spending Review 2021: what was announced and what does it mean for health and care spending?', 1 November 2021.

£355 million revenue contribution and £28.6 million cost savings to the NHS through commercial clinical trials

Commercial clinical trials create a number of important financial and non-financial benefits for healthcare providers, the NHS and patients. These include enabling patients to receive early access to innovation, supporting jobs in the NHS, improving job satisfaction among healthcare professionals, and enhancing the UK's reputation as an innovation pioneer.[22] For example, it is estimated that clinical research studies supported by the NIHR CRN generated £2.7 billion of GVA and supported over 47,400 jobs in the UK in 2018/2019.[23] It is estimated that over 28,000 participants received early access to innovative medicines through commercial clinical trials in England in 2019/20, and over 35,000 patients in 2020/21 – the third highest number on record despite the negative impact of the pandemic on clinical trials.[24,25] This includes patients who might not have otherwise received the life-saving treatment.

Clinical trials can be particularly important for patients living with rare and ultra-rare diseases, offering a beacon of hope.

Patients can also benefit from study-related treatment and medical tests provided free of charge by the industry sponsor. Life sciences companies are also developing decentralised trials to improve access and reach more patients with these diseases.[26]

It has been estimated that, in the 2018/19 financial year, the NHS received around £355 million in revenues for delivering clinical research and around £28.6 million in pharmaceutical product cost savings from commercial clinical trials supported by the NIHR CRN.[27]

Specifically, for each patient recruited to a commercial clinical trial (a clinical trial sponsored by life sciences companies), the NHS in England received an average of £9,189 in clinical research revenues and £5,813 in pharmaceutical cost savings where a trial drug replaced the standard of care treatment.[28] For some therapeutic areas, such as oncology, the average figures are higher, with the NHS receiving £13,143 in revenues and cost savings of £17,971 per patient.[29]

£45 billion long-term spill-over effects of R&D

According to Office for National Statistics figures, industry spent over £4.7 billion on pharmaceutical R&D in 2019, which represents nearly a fifth (18 per cent) of all R&D spending by industry across the UK economy.[30] The efforts by industry during the pandemic saw this figure increased to £5 billion in 2020.[31] Still, these figures may be underestimations, given that the underlying dataset is organised by product groups and the figures presented capture R&D spend on the primary product group, rather than the full sector segment.[32]

R&D investment by industry also brings broader economic benefits to the UK economy. Existing literature suggests that every £1 invested in private R&D today leads to a 'stream of future benefits to the economy as a whole' equivalent to £0.50 per year in perpetuity.[33,34] This means there would be approximately £45.0 billion[35] in future economic benefits to the UK economy over the next 30 years from the £4.7 billion invested by the pharmaceutical manufacturing segment in 2019 alone.

That represents an average social return of roughly £1.5 billion a year and is roughly equivalent to the amount of additional public health grant funding for local councils committed in the Chancellor's Autumn 2021 Budget.[36] This return may materialise, for example, in the form of efficiencies in the discovery of new medicines and vaccines through knowledge sharing within the life sciences research sector or improvements to social welfare through life sciences employment in regions with relatively high socioeconomic disparities.

In addition, R&D in pharmaceutical manufacturing contributed around 26,000 full-time equivalent jobs to the UK economy in 2019, including scientists, engineers, technicians, laboratory assistants, draughtsmen, and administrative and clerical workers.[37]

[22] ABPI (2021). 'Clinical research in the UK: an opportunity for growth', Autumn 2021.
[23] National Institute for Health Research (NIHR) and KPMG (2019). 'Impact and value of the NIHR Clinical Research Network', July 2019.
[24] NIHR (2020). Annual report 2019/2020.
[25] NIHR (2022). Annual statistics, 2022.
[26] Healey, N. (2021). 'How Covid-19 rocked rare disease communities', 22 November 2021.
[27] National Institute for Health Research (NIHR) and KPMG (2019). 'Impact and value of the NIHR Clinical Research Network', July 2019.
[28] National Institute for Health Research (NIHR) and KPMG (2019). 'Impact and value of the NIHR Clinical Research Network', July 2019.
[29] National Institute for Health Research (NIHR) and KPMG (2019). 'Impact and value of the NIHR Clinical Research Network', July 2019.
[30] ONS (2021). 'Business enterprise research and development', 19 November 2021.
[31] ONS (2021). 'Business enterprise research and development', 19 November 2021.
[32] The pharmaceuticals product group for pharmaceutical manufacturing; the precision instruments, optical products and photographic equipment product group for medical technology; and the research and development services product group for life sciences research.
[33] Office of Health Economics & RAND Europe (2010). 'Enhancing the benefits from biomedical and health research spillovers between public, private and charitable sectors in the UK', 2010.
[34] Sussex et al. (2016). 'Quantifying the economic impact of government and charity funding of medical research on private research and development funding in the United Kingdom', BMC Medicine, Vol. 14, Article no. 32 (2016). Doi: 10.1186/s12916-016-0564-z
[35] Discounted to net present value at 3.5% as per Green Book (2022) guidance with 2019 as base year
[36] Local Government Chronicle (2021). 'Councils to get biggest core funding rise for over a decade', 27 October 2021.
[37] ONS (2021). 'Business enterprise research and development', 19 November 2021.

An impact felt UK-wide

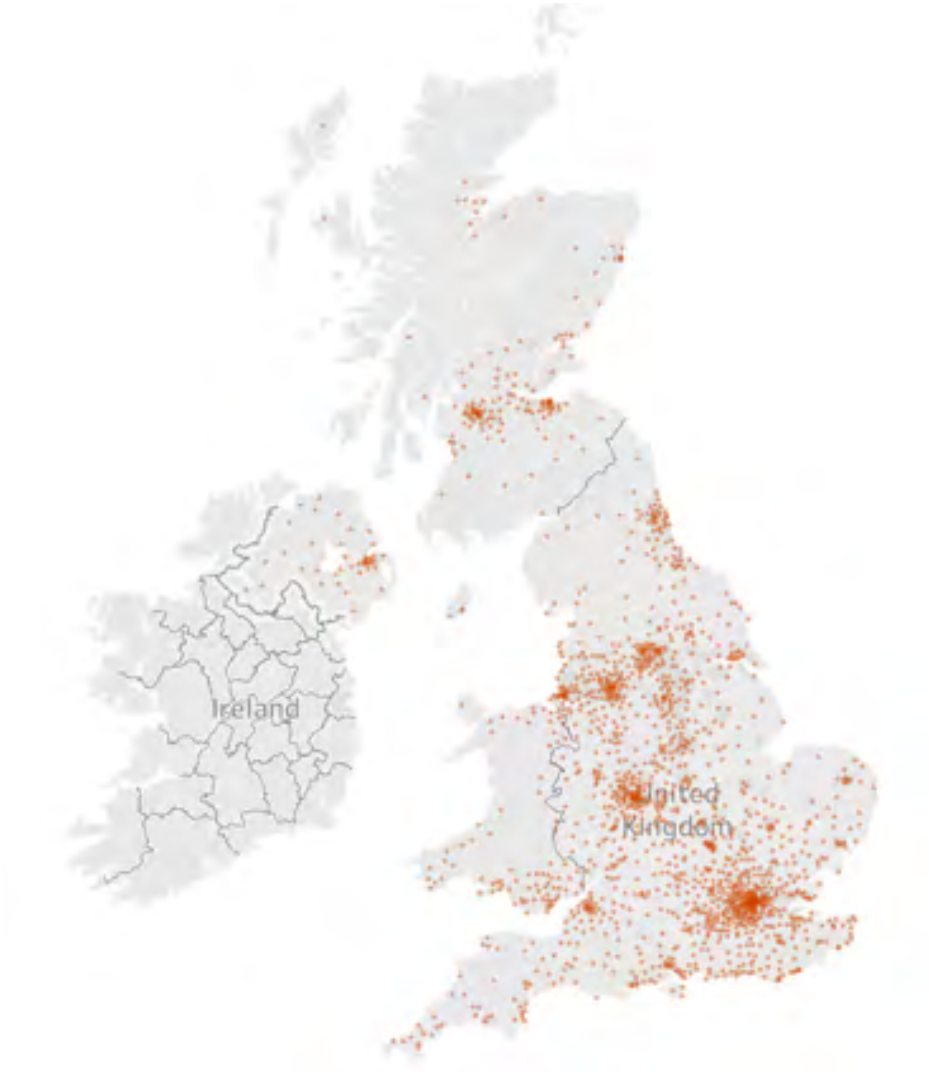
The life sciences sector also has a diverse geographic presence, as shown in Figure 6. The sector's contributions are distributed across the UK, supporting a wide range of local economies, health systems, businesses and residents.

We estimate that the sector contributes the most in GVA and employment to England, with £32 billion in GVA and 492,000 in jobs. This is followed by Scotland with £2.8 billion in GVA and 47,800 in jobs, and Northern Ireland, with £1.3 billion in GVA and 27,600 in jobs. The sector also contributes £800 million in GVA and 16,600 in jobs to Wales. Note, however, that these are indicative figures and that regional impacts have not been modelled. See Appendix A.1 for further detail.

One of the most valuable industries in the UK

The life sciences sector is one of the highest value-generating sectors in the UK. Taking its direct GVA and long-term R&D spill-over effects together,[38] pharmaceutical manufacturing (the largest segment of the sector) generated 1.25 times the economic value of the UK automotive sector and about 2.4 times that of the UK aerospace and oil and gas industries in 2019 (see Figure 7).

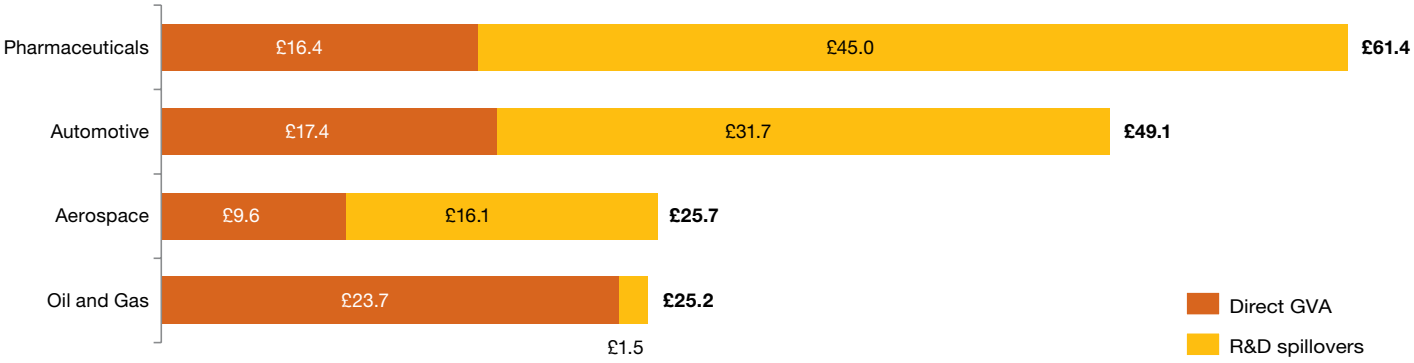
Figure 6: Geographical distribution of life sciences companies in the UK



Source: PwC analysis

[38] As above, the net present value of R&D spillover effects from R&D investment in 2019 is presented.

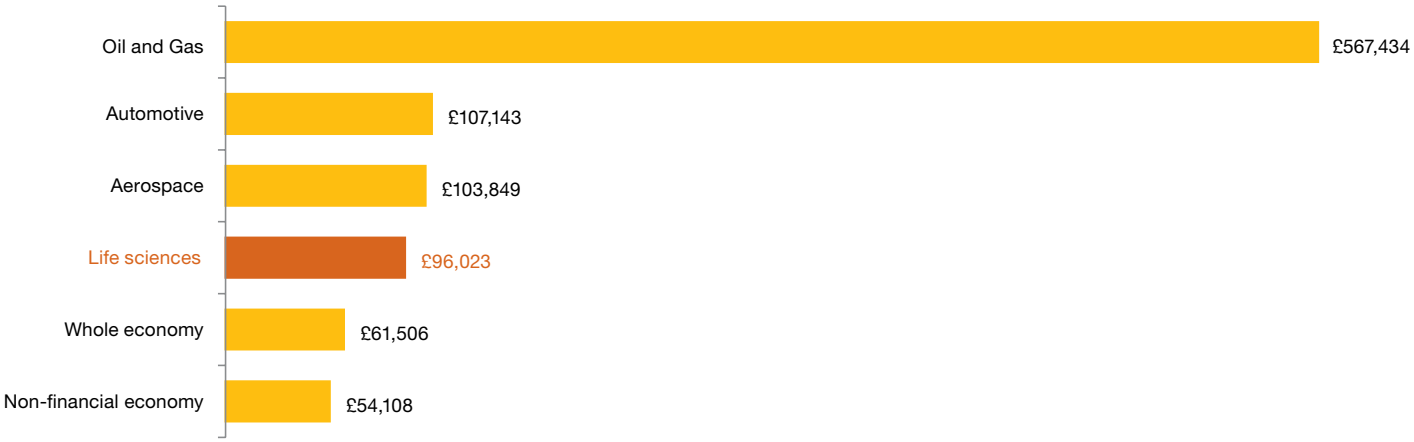
Figure 7: Economic contribution of selected sectors, current prices (2019, £ billion)[39,40]



Source: PwC analysis; ONS

Life sciences also has some of the most productive workforces in the UK labour market. On average, each life sciences employee contributes direct GVA of £96,023,[41] producing more than 1.5 times the output of the average UK employee across the whole economy and 1.7 times that of employees in the non-financial economy (see Figure 8). This makes the sector one of the most productive in the UK, comparable with automotive and aerospace (oil and gas can be considered an anomaly here due to its high capital intensity and relatively low number of employees).

Figure 8: Labour productivity (GVA per employee) of selected sectors, current prices (2019, £)[42]



Sources: PwC analysis of Evaluate Pharma and ONS data

These figures suggest the extent to which the UK economy relies on life sciences not only for the improved patient outcomes it delivers but also for the economic value it generates. It is important that the UK both protects and strengthens its life sciences ecosystem to ensure it can continue to improve the health and wealth of its population.

[39] PwC analysis of data from the ONS (2021). 'GDP output approach – low-level aggregates', 11 November 2021.

[40] Note that direct GVA data for other industries is not yet available at time of writing.

[41] PwC analysis of data from the ONS (2021). 'GDP output approach – low-level aggregates', 11 November 2021; and data from the ONS (2021). 'Industry (2, 3 and 5 – digit SIC) – Business Register and Employment Survey (BRES): Table 2 – 2019 (revised) edition of this dataset', 9 November 2021.

[42] PwC analysis of data from the ONS (2021). 'GDP output approach – low-level aggregates', 11 November 2021; ONS (2021). 'Industry (2, 3 and 5 – digit SIC) – Business Register and Employment Survey (BRES): Table 2 – 2019 (revised) edition of this dataset', 9 November 2021; and ONS (2021). 'Non-financial business economy, UK: Sections A to S', 24 June 2021.

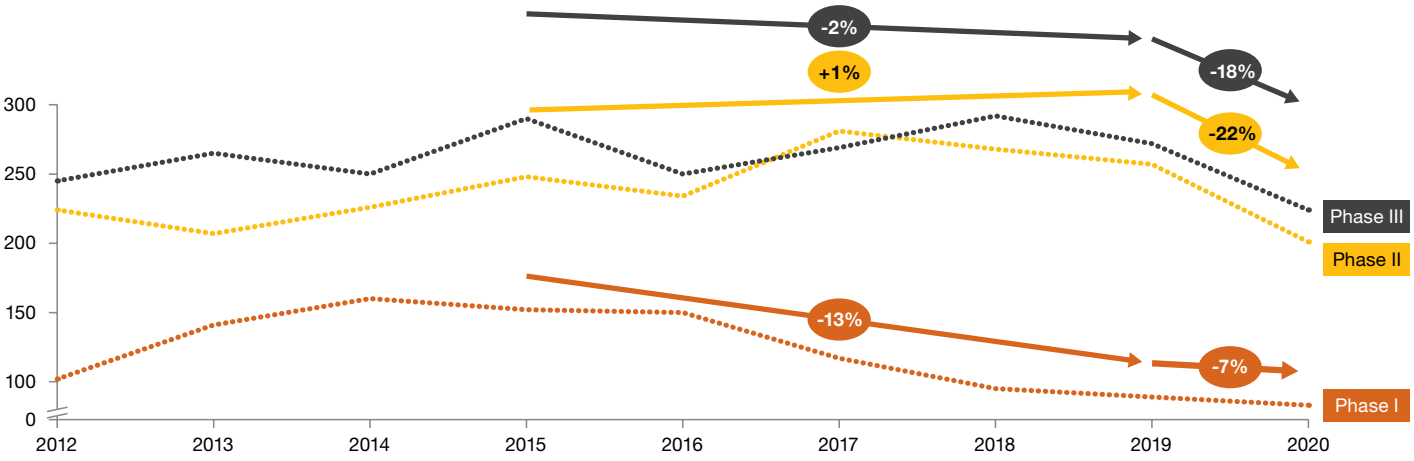
3. Signs of faltering competitiveness?

For all its many strengths, recent developments suggest areas of concern for the UK life sciences sector. The UK's clinical trial activity, pharmaceutical manufacturing, R&D investment and talent pool, have all declined relative to competitors in recent years and the UK may risk losing out on future investment to other markets.

While UK biotech investment is on the up, securing £4.5 billion from public and private financing in 2021 (a 60 per cent increase from the previous year),[43] other parts of the life sciences value chain appear less buoyant.

The UK's clinical trial activity, for example, has been declining across all phases over the past 5 years. Phase I clinical trials initiated in the UK have fallen by 13 per cent per annum from 2015 to 2019, as shown in Figure 9. The pandemic has exacerbated the downward trend in UK trials, with the number of Phase II and III trials falling by 18 per cent and 22 per cent in 2020, respectively.[44] This has impacted innovation in the sector, with the UK's number of global clinical trial firsts falling year on year, from 24 in 2017/18, to 15 in 2018/19, to 14 in 2019/20. This figure continued to fall to 8 in 2020/21, reflecting the pressures of the pandemic on clinical trials.

Figure 9: Average number of UK commercial clinical trials initiated by phase (2012-2020)

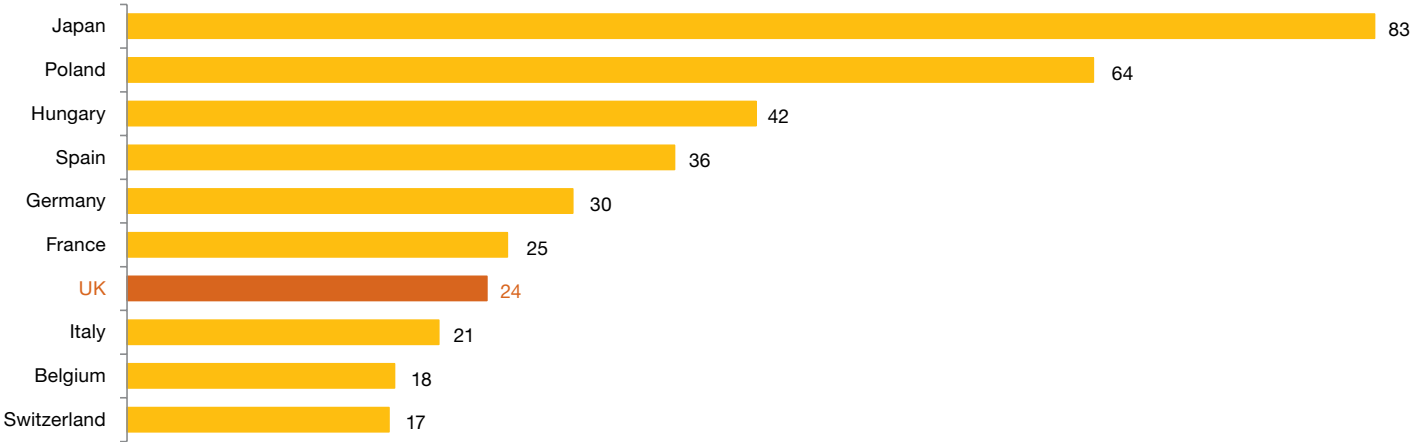


Source: PwC analysis of ABPI data

[43] BIA and Clarivate (2022). 'UK biotech financing in 2021', January 2022, p. 6.
[44] PwC analysis of ABPI (2021). 'Clinical research in the UK: an opportunity for growth', September 2021.
[45] OLS (2021). Life Sciences Competitiveness Indicators, Chart 4.
[46] PwC analysis of ABPI (2021). 'Clinical research in the UK: an opportunity for growth', September 2021.

In parallel, the UK's share of global recruits has declined over recent years.[45] The country is recruiting significantly fewer participants for Phase II and III trials than its European counterparts (see Figure 10).[46]

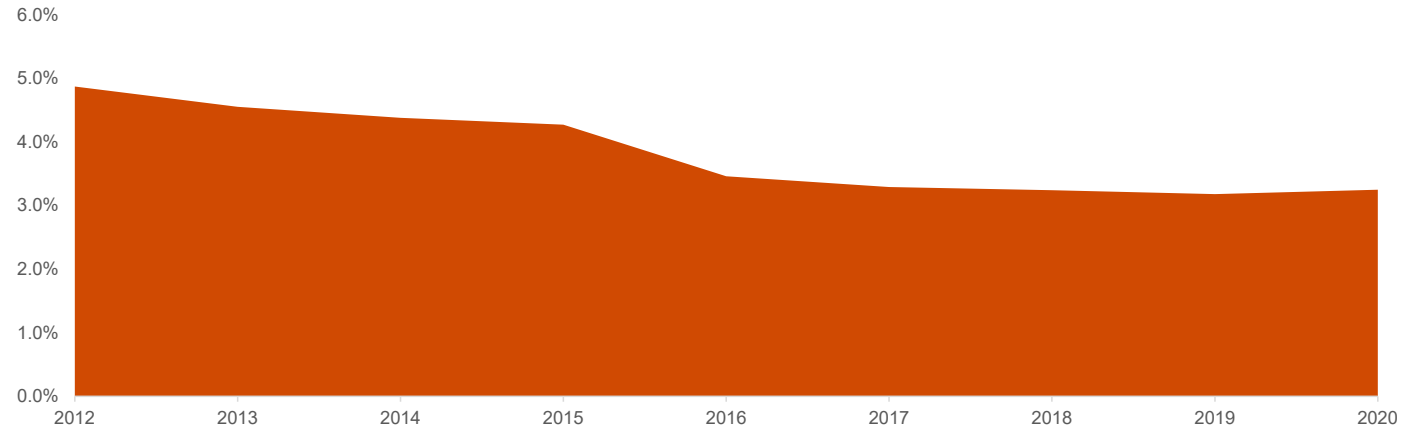
Figure 10: Average number of participants treated per Phase II-III commercial clinical trial (2017-2019)



Source: PwC analysis of ABPI data

The UK's share of global pharmaceutical R&D has also been declining over the past decade, falling from 4.9 per cent in 2012 to 3.2 per cent in 2019, with only a marginal increase to 3.3 per cent in 2020 (see Figure 11)[47]. This led to a loss of an average £1.5 billion in R&D spending per year for the past 8 years.[48]

Figure 11: UK share of global pharmaceutical investment (2012-2020)



Source: PwC analysis of Evaluate Pharma and ONS data

The country's pharmaceutical manufacturing presence has also been weakening in terms of its direct GVA and exports. The University of Cambridge found that, between 2009 and 2017, the GVA of the average UK pharmaceutical sector employee fell by 12.3 per cent.[49] This could be due to the faltering attractiveness of the UK for manufacturing which has seen a 31 per cent fall in production volume since 2008.[50]

[47] PwC analysis of data from Evaluate Pharma (May 2021) and ONS (2021). 'Business enterprise research and development', 19 November 2021, Worksheet 2.

[48] PwC analysis of data from ONS (2021). 'Business enterprise research and development', 19 November 2021, Worksheet 2.

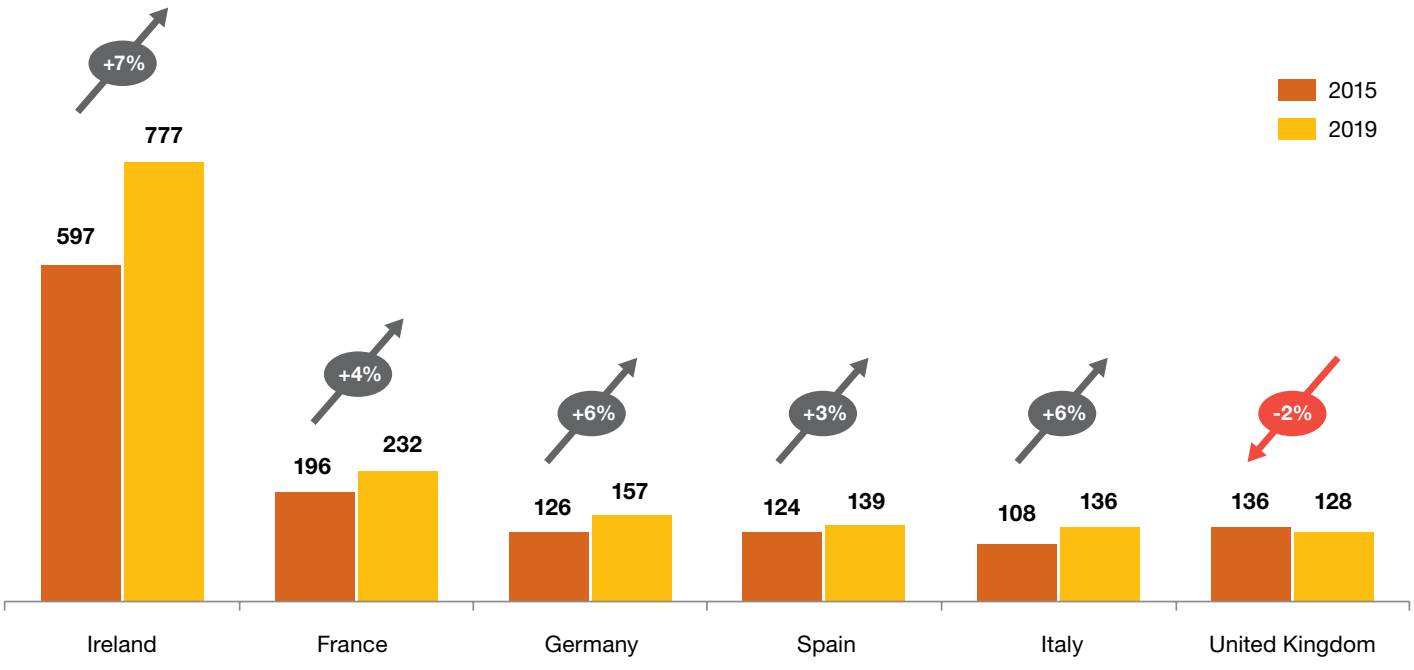
[49] University of Cambridge (2021). 'UK Innovation Report – Benchmarking the UK's industrial and innovation performance in a global context', February 2021, Chart 3.1.

[50] ONS (2021). 'Index of Production time series', 10 December 2021.

Meanwhile, other countries in Europe have increased their productivity (see Figure 12). In 2015, the UK's pharmaceutical manufacturing sector had a higher GVA per employee than that of Germany, Spain and Italy. In the subsequent years through to 2019, however, the UK's productivity has not kept pace with these other countries. Ireland, in particular, has had a strong performance, linked to its investment environment.

> **There will likely always be investment into the UK and something very adverse would need to happen to close that presence. However, maintaining the status quo isn't enough and that is the real concern.**
>
> UK General Manager, Large pharmaceutical company

Figure 12: Direct GVA per employee of pharmaceutical manufacturing, current prices (£ thousand)[51]

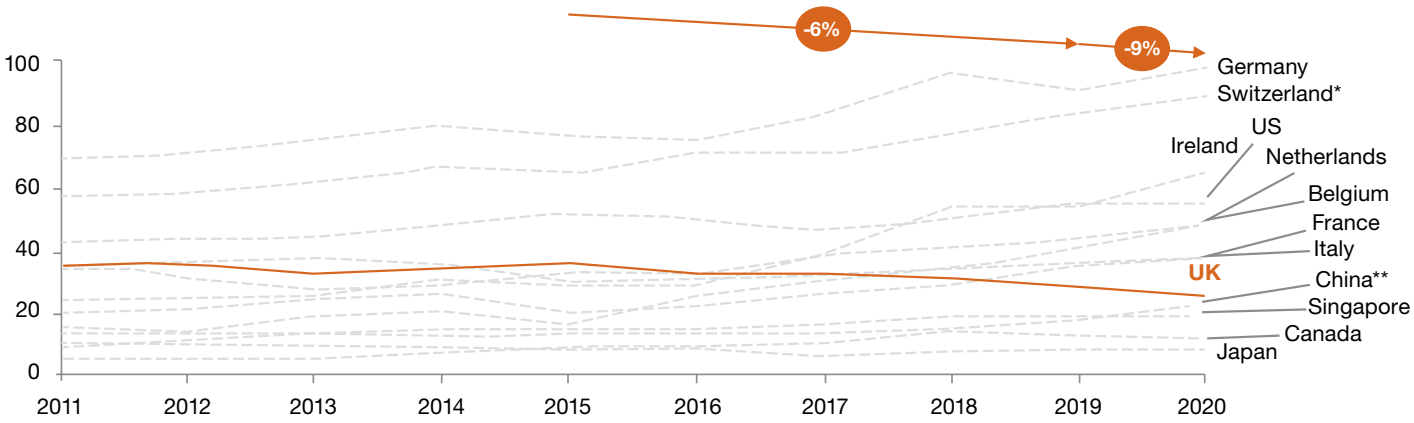


Source: PwC analysis of data from BvD FAME database, ONS, Eurostat and CSO. Note that we estimate Ireland's direct GVA per employee by extrapolating from 2014 data based on GVA and employment growth rates, as 2014 is the last available year for which this indicator has data.

[51] PwC analysis of data from BvD FAME database; Eurostat and PwC (2017). 'The economic contribution of the UK Life Sciences industry', March 2017.

When inflation is taken into account, the direct GVA impact of the pharmaceutical sector in the UK has decreased in real terms since 2015[52]. This is partly driven by the UK's stagnant volumes of gross pharmaceutical exports, relative to comparator countries since 2011 (as shown in Figure 13) and its 6 per cent average annual reduction in gross pharmaceutical exports from 2015 to 2019[53].

Figure 13: Gross pharmaceutical exports by country (2011-2020, US$ billion)[54]



Sources: PwC analysis, Office for Life Sciences; *Data for Switzerland includes Liechtenstein; **Data for China includes Hong Kong and Macau.

The UK Government has acknowledged a growing skills gap, with the Minister for Science, Research and Innovation stating that the UK's success in becoming the leading global hub for life sciences depends on its 'ability to attract, recruit, train and retain the skilled [life sciences] workforce that [it needs][55]. There remains considerable room for improvement across a number of areas particularly those with a strong crossover between digital skills and scientific experience, including chemometrics, physiological modelling and computational chemistry[56]. To remain competitive, the UK will need to consider how it grows its life sciences talent pool, with the right policy frameworks in place. This should include policy frameworks to grow the talent pool through the education pipeline, reskilling programmes, increasing access to global talent, and more.

These findings provide a warning signal that the UK's competitiveness may be faltering just as the global race for life sciences investment heats up. They are all the more important given the interconnectedness of the UK's life sciences ecosystem. While there has been some government-backed investment to support UK pharmaceutical manufacturing through catapults and other innovation groups, if these critical elements of the sector continue to wane, the effects may be felt in the direct loss of productivity and jobs, in willingness to invest and ultimately in patient access to innovation.

[52] PwC analysis using figures from PwC (2017), 'The economic impact of the UK life sciences industry', March 2017, assuming 2% per annum inflation.
[53] Office for Life Sciences (2021). 'Life Science Competitiveness Indicators 2021', Chart 9A: Global exports of pharmaceutical products.
[54] PwC analysis of data from the OLS (2021). 'Life Science Competitiveness Indicators 2021', 30 July 2021.
[55] ABPI (2022). 'Bridging the skills gap in the biopharmaceutical industry', January 2022, p. 3.
[56] ABPI (2022). 'Bridging the skills gap in the biopharmaceutical industry', January 2022. pp. 4-5.

4. Becoming the leading global hub for life sciences

The UK is well positioned to become the leading global hub for life sciences. But it will need to move at pace to capitalise on the opportunity. This includes creating an environment that supports greater access to and uptake of innovative medicines.

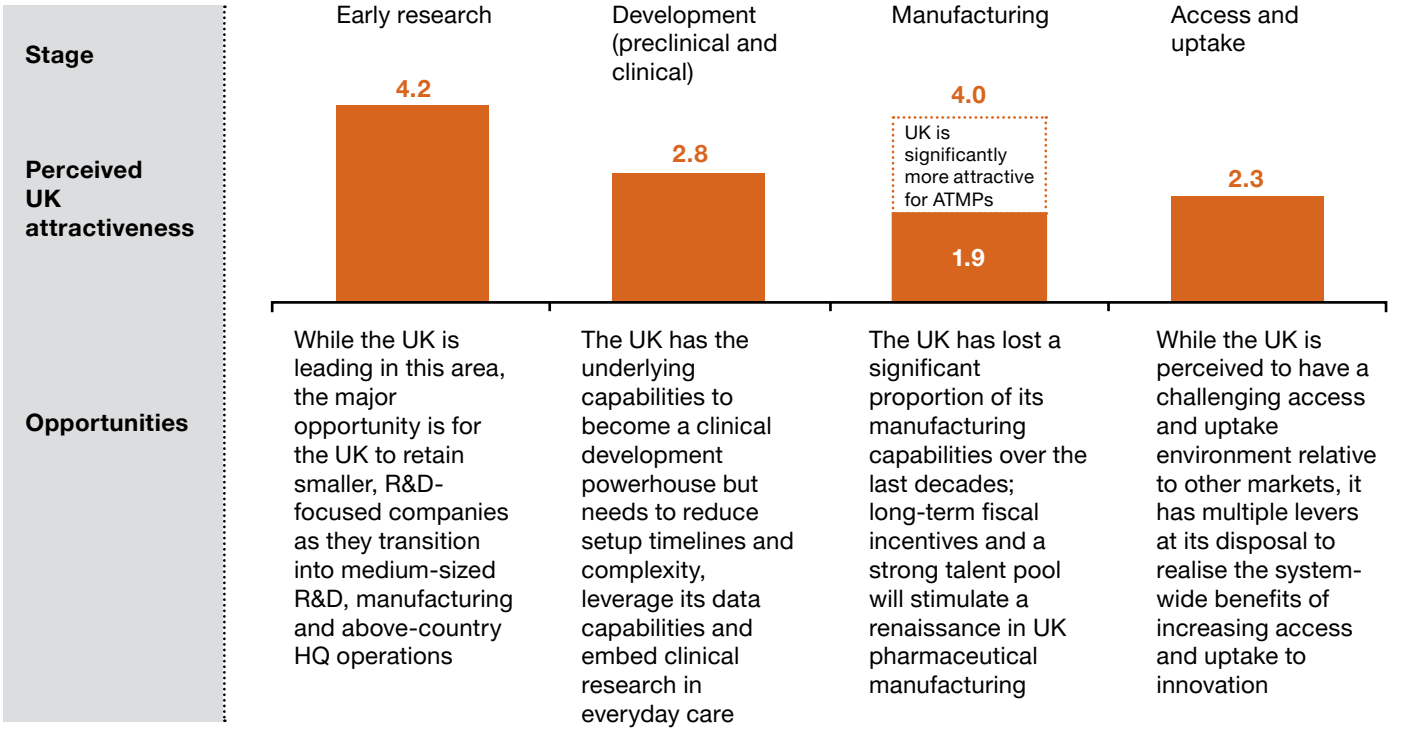
What are the priorities and opportunities for the UK?

As articulated in **Section 2**, the UK already has a mature life sciences ecosystem, with many of the underlying cross-ecosystem capabilities needed to become the leading global hub. The UK is, for example, a world leader in early research, especially in areas of basic science, translational science, and discovery of new medicines and vaccines. It is also perceived to be an attractive market for advanced therapy medicinal products (ATMPs), with a 12 per cent UK share of global ATMP clinical trials and 20 per cent growth in the number of ATMP trials in the UK in 2020, despite the COVID-19 pandemic.[57]

However, it currently punches below its weight in areas like clinical trials resource and capacity. It has a more challenging innovation access environment, slower and more variable uptake of innovation and poorer health outcomes, than many of its international competitors. There is also a disparity in how the sector itself perceives the UK's attractiveness across different parts of the ecosystem, including early research, preclinical and clinical development, manufacturing, and access and uptake (see Figure 14).

Combined, full implementation of the Life Sciences Vision could result in significant gains for the UK across health, GDP and employment, as well as NHS revenues and cost-savings.

Figure 14: Summary of perceived UK attractiveness for investment and opportunities by industry[58]



Source: PwC interviews of ABPI member companies. Interviewees were asked to rate each stage on a scale of 1 to 5, with 1 being the least attractive and 5 being the most attractive. Average aggregated scores for each stage are presented here.

[57] Catapult Cell and Gene Therapy (2021). 'Press release: 2020 clinical trials database report confirms the UK as an internationally attractive clinical space for the development of cell and gene therapies', 23 February 2021.

[58] Preclinical development refers to, for example, animal toxicology studies, while clinical development refers to, for example, clinical trials in humans.

How is the UK tracking against other countries?

Figure 15 below presents the UK performance on 13 key performance indicators (KPIs) across R&D, manufacturing and access and uptake capabilities. We rank the UK against the following comparator countries: Belgium, Canada, China, France, Germany, Italy, Japan, Norway, Singapore, Spain, Sweden, Switzerland and the US. While not an exhaustive list, comparator countries were chosen based on those which are also in the race to become the leading global hub for life sciences.[59]

Whilst there are accompanying visions to support some of these areas, such as **The Future of UK Clinical Research Delivery**,[61] there remains room for improvement in UK performance across these KPIs. We summarise some of the key challenges perceived by industry below.

R&D: Early research

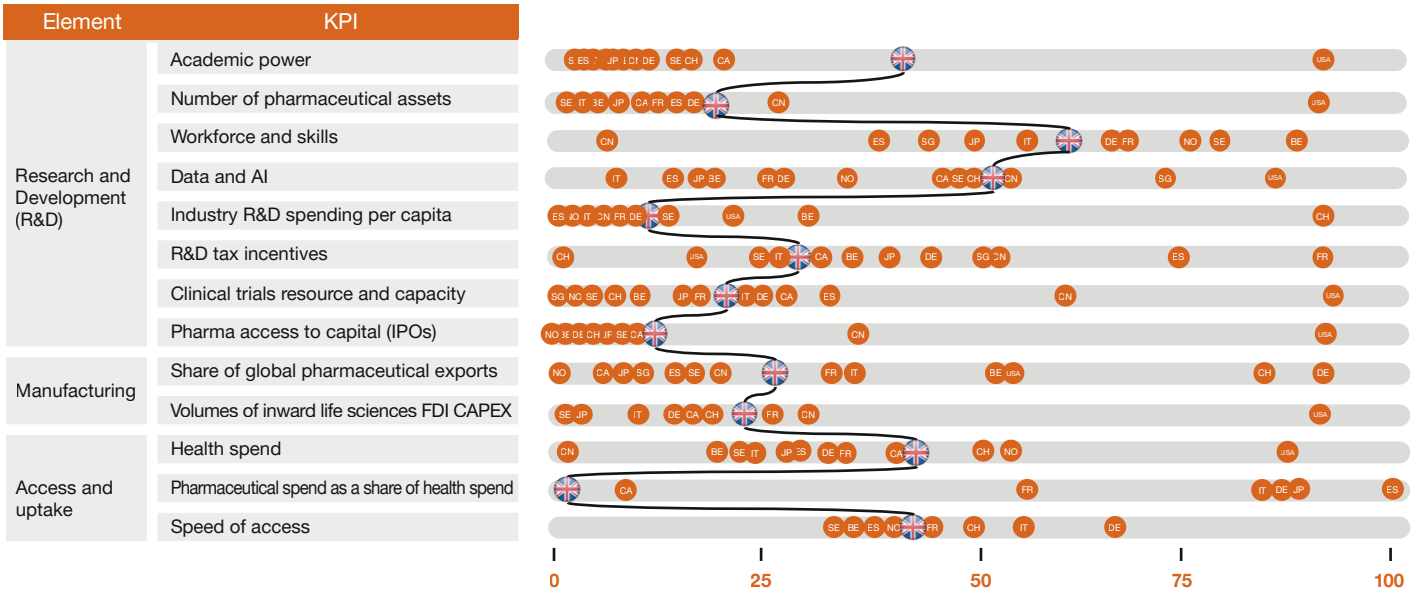
The industry sees the UK as a global leader in early-stage research, including basic science, translational science and the discovery of new medicines and vaccines.[62] This is reinforced by the fact that there has recently been significant growth in private financing of early-stage life sciences companies: 52 per cent increase between Q3 2021 (£4.25 billion) and 2020 (£2.8 billion).[63]

There is much to be proud of. The UK boasts key life sciences assets such as Genomics England, the UK Biobank, world-class scientists, robust intellectual property protection, and leading academic institutions. The NHS is also positioned well to potentially develop 'cradle to grave' data, given the single-payer system. The UK has 14 of the top 100 universities for life sciences.

> **"Genomics England's ability to do gene sequencing at scale is a very powerful way of discovering the impact of drugs and diseases. Stratifying patients based on risk and pinpointing the patient groups is a big strength of the UK's.**
>
> **UK Managing Director,** Large pharmaceutical company

And although much of the UK's academic strength is centred on the 'golden triangle' of Cambridge, London and Oxford, there are also significant R&D hubs in the North of England, Scotland, Wales and Northern Ireland. Continued growth of a Northern Life Sciences Supercluster has been estimated to generate an additional £16.5 billion in GVA to the UK economy.[64]

Figure 15: UK performance against comparator countries[60]



Source: PwC analysis of data from QS World Ranking, Pharmaprojects, OECD, IMD, NetBase Quid, EFPIA, ABPI, Trialtrove, OLS, S&P Capital IQ, WTO, and IQVIA

[59] PwC interviews with ABPI member companies
[60] See Appendix A.2 for further detail on the figures and data sources used in this benchmark exercise.
[61] UK Government (2021). 'The Future of UK Clinical Research Delivery: 2021 to 2022 implementation plan', 23 June 2021.
[62] PwC interviews with ABPI member companies
[63] JLL (2021). 'Venture Capital levels into Life Sciences hit record high', 22 September 2021.
[64] NHSA and NP11 (2021). 'A Northern Life Sciences Supercluster: The Economic Potential of a Systemwide Approach', September 2021.

Additionally, the COVID-19 pandemic demonstrated the UK's prowess in early-stage R&D, both through the development of the Oxford/AstraZeneca vaccine, two billion doses of which have been supplied across the globe.[65] In the UK specifically, there were over 100 million doses of the Pfizer-BioNTech vaccine supplied over the course of 2020 to the end of 2021, with Pfizer's Sandwich site also playing a key role in designing, quality-testing and enabling the clinical trials involved in the development of the company's COVID-19 treatment.[66] The UK's response to the COVID-19 pandemic is a key example of its increasingly strong track record in collaborative research, with 55 per cent of recent UK research publications the result of an international collaboration.[67]

Internationally, however, the industry continues to view the United States as the world leader in early research and China has rapidly established itself as a major player in life sciences, with its share of global research publications by 15 per cent in just 10 years and now accounting for one in five research publications.[68] China's rise demonstrates that capabilities and reputation in this area can be built quickly.

The UK cannot afford to stand still if it wants to become a 'science superpower' and grow its attractiveness as a location for innovative research.

Key opportunities for the UK:

- Create an environment that enables more homegrown innovative companies to stay and expand in the UK and connects emerging innovators with pharmaceutical companies.

> **"In cancer, the academic network is really quite strong and I don't think [the UK has] really tapped into that. The UK could streamline the ethics process and drive recruitment that way. Our company just ran a 900-patient Phase III kidney cancer trial. This was a tremendous effort supported by the academic community that gathered around it. Strengthening the capability of the UK cooperative group structure is key.**
>
> **VP and Regional Franchise Lead in Oncology,** Large pharmaceutical company

- Expand the UK's international research collaborations, by establishing multilateral and bilateral platforms, efficient and collaborative research administration, flexible and transparent funding mechanisms and enabling cross-border flows of talent, data and goods.

R&D: Clinical development

The UK has many underpinning capabilities that should enable it to be a powerhouse for clinical trials. The UK boasts a population of 67 million people and is becoming increasingly diverse with 20 per cent of the population of a minority ethnic background, presenting the opportunity to reach a large and diverse set of people through clinical trials.[69] It has advanced capabilities in genomics and leading investigators across disease areas.

Additionally, NICE is a global leader in application of cost-effectiveness-driven health technology assessments (HTAs), referenced and followed by many HTA bodies globally. Similarly, MHRA has demonstrated its ability to respond to extreme pressures by building resilience into clinical trial design and conduct during the pandemic.[70]

While historically the UK has been on par with leading countries in the number of Phase I commercial clinical trials it attracts, the UK is now lagging internationally in terms of the number of Phase II-III clinical trials it attracts. The UK's number of Phase I clinical trials has declined in recent years, falling 13 per cent per annum from 2015 to 2019.[71] Industry believes that the relatively low numbers of clinical trials across all phases is primarily due to the complexity, expense, and lack of speed in trial approvals, setup (costing and contracting) and recruitment.[72] Low uptake of innovative medicines in the UK is also a hindering factor.

[65] AstraZeneca. COVID-19 vaccine supply news release, 16 November 2021.
[66] DHSC. UK secures extra 60 million Pfizer/BioNTech COVID-19 vaccines – GOV.UK (www.gov.uk).
[67] ABPI (2022). 'Life Sciences R&D: Building the UK's global research collaborations', February 2022.
[68] ABPI (2022). 'Life Sciences R&D: Building the UK's global research collaborations', February 2022.
[69] IFS (2022). 'Race and ethnicity'.
[70] MHRA Inspectorate (2020). 'Building resilience into clinical trial design and conduct during the pandemic', 11 November 2020.
[71] PwC analysis of ABPI (2021). 'Clinical research in the UK: an opportunity for growth', September 2021.
[72] PwC interviews with ABPI member companies

Clinical trials create significant value for the UK, both in terms of additional revenues for NHS Trusts and savings from trial sponsors covering medicine costs.[73] Clinical trials also boost the UK's reputation as a place where medical innovation happens, and improve job satisfaction for healthcare professionals. This is on top of the common clinical benefits that come from giving patients access to new medicines, with better patient outcomes seen at research-active NHS Trusts.[74]

> **The standard of academia in Bulgaria and Hungary is great and the data is spot-on, even with patient tracking. Five years ago, they were doing things that [the UK is not] even doing now. They are small countries, but they are going for niches.**
>
> **UK General Manager,** Large pharmaceutical company

The potential of the UK's clinical trial infrastructure was demonstrated during the COVID-19 pandemic, with just under 1.5 million participants successfully enrolled in COVID-19 studies.[75] However, beyond trials of COVID-19 vaccines and treatments, the UK was in fact one of the countries where non-COVID-19 trials were most negatively impacted. Over 40 per cent of non-COVID-19 study site research activity across the NIHR CRN was paused during the first wave of the pandemic. Oncology, for example, which comprises the majority of the UK's research portfolio, saw enrolment in May 2020 down 88 per cent compared with May 2019.

Internationally, the industry views the United States as the leading country for clinical trials. However, some European countries also outperform the UK in certain respects, including Germany and Spain on share of participants recruited to global commercial clinical trials.[76] Eastern European countries are also increasingly seen as attractive locations thanks to their ability to set up late-stage trials and enrol patients quickly at a lower cost than in the UK.[77]

Additionally, industry respondents have highlighted that it is becoming increasingly common for trial sponsors to place later stage trials in markets that are more likely to grant reimbursement for a new agent.[78]

Key opportunities for the UK:

- Streamline trial setup by centralising and standardising costing and contracting processes. This will help improve set-up and recruitment timelines for commercial research studies.
- Enhance the speed and reach of trial enrolment, by embedding clinical research across primary, secondary and tertiary care settings, making it routine to offer the opportunity to participate in clinical trials to all patients across disease areas, and using electronic health records to find the right participant at the right time for the right trial. This will enable the recruitment and enrolment of a larger and more diverse set of patients.
- Update the standard of care, increasing patient access to innovative medicines, and ensuring suitable comparators can be used for clinical trials. This will ensure the UK remains at the cutting-edge of innovative clinical research and healthcare.

> **Ireland has understood their niche, invested heavily, educated their populace (with manufacturing plants connected to universities). By contrast, it is non-strategic in the UK.**
>
> **UK Managing Director,** Large pharmaceutical company

[73] NIHR and KPMG (2019). 'Impact and value of the NIHR Clinical Research Network', July 2019.
[74] ABPI (2021). 'Briefing paper: Embedding Research in the NHS – Cross sector Health and Care Bill briefing', 22 November 2021.
[75] ABPI (2021). 'Use lessons from COVID-19 to revitalise post-pandemic clinical research environment, says ABPI', 29 September 2021.
[76] Note that, in contrast to the US or China, these EU countries are considered to be comparator countries to the UK given similar population sizes
[77] PwC interviews with ABPI member companies
[78] PwC interviews with ABPI member companies

Manufacturing

Pharmaceutical manufacturing may be perceived to be the weakest part of the UK life sciences ecosystem. Although the UK has a significant manufacturing base, including 2,000 manufacturing plants,[79] since 2009, it has seen production volumes fall by 29 per cent and over 7,000 jobs lost.[80] This is especially damaging as pharmaceutical manufacturing jobs are high quality and well-paid and have a direct GVA contribution of around £128,000 per employee.

The UK's shrinking pharmaceutical manufacturing presence contrasts with other major markets. Ireland, in particular, has seen a strong rise in pharmaceutical manufacturing investment in recent years (see Box 1 for more detail on this trend).

Addressing the UK's manufacturing presence requires a multi-dimensional effort that will need to be sustained over the long term. The costs and complexities of moving operations mean that capital investments in manufacturing facilities are significant multi-year commitments, often lasting a decade or more.

Pharmaceutical manufacturing also has a potentially significant role to play in the UK government's levelling up agenda, if further investment can be attracted. There are already significant manufacturing hubs outside of the South East, such as in Macclesfield in the North West of England. With the right conditions, a similar transformation to that seen in San Diego could be seen in the UK (see Box 2).

Box 1: Ireland – a leading pharmaceutical manufacturing hub

Ireland is one of the leading locations for pharmaceutical production in Europe. Its life sciences sector accounts for 39 percent of national exports (~€60 billion, CSO 2020), it is the largest net exporter of pharmaceuticals in the European Union[86] and the third largest exporter of pharmaceuticals globally.[87] Around 120 overseas companies have a manufacturing presence in the country, including nine of the largest ten pharmaceuticals companies globally.[88]

Over the past decade, Ireland has seen around €10 billion invested in new biopharmaceutical production facilities thanks to its strong talent pool, regulatory environment, government support, and track record in clinical and academic R&D (particularly in nanotechnology and immunology).[89] The country also has a historically low corporation tax rate of 12.5 per cent.[90]

Ireland's ability to attract foreign direct investment is supported by various initiatives that help promote the growth of its knowledge economy, such as the national network of technical training institutes developed in the 1970s.[91]

Originally, Ireland's life sciences sector was largely limited to producing active ingredients for export for final processing and refinement. Since the 1960s, however, it has grown to support more processing of final products and companies have now started to set up R&D centres and joint research projects with academic institutions.

Notable recent developments include:

- Pfizer's 2020 announcement of a €300m investment in Irish manufacturing sites.[92]
- AstraZeneca's 2021 announcement of plans to establish a $360 million next-generation active pharmaceutical ingredient (API) manufacturing facility for small molecules.

Key opportunities for the UK:

- Address the UK's fiscal incentives – the key driver of increased investment – and international competitiveness by extending in timeframe and scope the recently introduced Super Deduction.[81] The UK might also consider an expanded capital grant facility for investments in new manufacturing facilities.[82]
- Enhance the quality and accessibility of the UK life sciences talent pool to improve competitiveness against countries, such as Ireland.[83]
- Future-proof the UK's transport and digital infrastructure, with a particular focus on spreading the benefits across the UK to support the levelling up agenda.[84,85]

[79] Office for Life Sciences, (2020). Bioscience and Health Technology Sector Statistics
[80] Clarke (2021). 'UK life sciences sector: do you have the Vision for innovation?', European Pharmaceutical Review, 30 August 2021.
[81] ABPI (2021). 'Autumn Budget and Spending Review 2021: Invest and Innovate', 24 September 2021.
[82] ABPI. 'Manufacturing 5: Investing in advanced manufacturing is investing in levelling up', 2021
[83] PwC interviews with ABPI member companies
[84] ABPI Manufacturing report (see above)
[85] ABPI Manufacturing report (see above)
[86] Irish Pharmaceutical Healthcare Association (IPHA). Contribution to the Irish Economy, accessed 09 December 2021
[87] IDA Ireland (2022). 'Bio-Pharmaceutical Industry Ireland', 2022.
[88] Irish Pharmaceutical Healthcare Association (IPHA). (see above)
[89] Pharmaceutical Technology. 'Why Ireland for BioPharma Manufacturing?', 17 April 2018
[90] The Irish Times. 'Ireland has changed position on 12.5% tax rate', 5 October 2021
[91] Burton, P.. Pharma Boardroom article: 'A Resurgence in Irish Pharma', 27 July 2016
[92] Pharmafile article

Access to and uptake of innovative medicines in the UK[96]

The UK and devolved nations have made steps to improve their access to and uptake of innovative medicines through a number of targeted interventions, including the Early Access to Medicines Scheme (2014), the Accelerated Access Collaborative (2016), the Voluntary Scheme for Branded Medicines Pricing and Access (2019), the Welsh Government's New Treatment Fund (2020), the introduction of the Innovative Licensing and Access Pathway (2021) and Innovative Medicines Fund (2022).

Nonetheless, access to and uptake of innovation, either across or within the UK's four devolved nations, has been variable. There remains a strong view among life sciences companies that the UK places a lower value on innovative medicines, provides slower access, and has less extensive uptake than other major markets.[97] This is borne out of access and uptake challenges across multiple disease areas:

- **Breadth of access.** In the last three years, 54 per cent of the positive recommendations NICE has made have been for a narrower patient population than that approved by the EMA or MHRA.[98] A recent study shows in about two-thirds (65 per cent) of optimised recommendations, NICE recommended use for less than half of eligible patients, and around a third (35 per cent) recommended use in less than a quarter of patients.[99]
- **Speed of access.** In terms of average time between the approval and reimbursement of a new medicine, England's 335 days ranks seventh in Europe, significantly slower than the leader, Germany, at 120 days.[100] While the UK's European counterparts operate different health systems and the UK has made improvements[101] continued focus is needed on supporting early patient access and providing sufficient flexibilities in the system in line with NICE's strategic plan.
- **Extent and rate of uptake.** In an Office for Life Sciences study of the uptake of new medicines in the first five years after launch, the UK was found to have a per-capita utilisation almost a third lower than in comparable countries (69 per cent of the average uptake in 15 comparator countries for 76 innovative medicines recommended by NICE and launched between 2015 and 2019).[102] Similarly, patients in England are also missing out on the medicines they need, with 6 out of 12 medicines not achieving the England benchmarks for recommended, cost-effective use, published in the NH Estimates Report.[103]

Box 2: San Diego's thriving life sciences ecosystem

San Diego has become a leading national centre of biotechnological and pharmaceutical R&D.[93] Originally a 'geographically isolated' city with limited resources and slow population growth, it developed over the years into a thriving life sciences ecosystem, with significant investment from industry and government.[94]

That included the establishment of several research institutions in the middle of the previous century, including the Scripps Research Institute, the Salk Institute, and University of California San Diego (UCSD), which brought more innovation and R&D funding into the region. Some of the first nationally successful biotechnology firms (such as Hybritech) were also based in San Diego, influencing future waves of biotechnological and pharmaceutical innovation in the area. By the 1980s, further research centres, including the Burnham Institute, were established and began working with private sector entrepreneurs.

San Diego's life sciences sector has seen steady employment growth in recent years, and by 2019, it was supporting over 175,000 jobs (including indirect and induced as well as direct employment).[95] In particular, the proportion of biochemists and biophysicists was almost five times higher than the US national average. Additionally, total foreign exports from life sciences products and services amounted to around $24 billion.

The growth of the San Diego Life Sciences hub was enabled by several key factors, including its ability to attract world-class academic research centres, the availability of government R&D funding, the 'positive signal' given to the rest of the industry by the past successes of entrepreneurial firms, and a history of close partnership between academic institutions and tech firms.

[93] Porter, E. M.. 'San Diego: Clusters of Innovation Initiative', Harvard University, 2001
[94] The Royal Society (2020). 'Research and innovation clusters', July 2020.
[95] Biocom. 'California Economic Impact Report databook', 2020
[96] Note that NICE decisions are adopted in England, Wales and Northern Ireland while Scotland has its own HTA body, the Scottish Medicines Consortium (SMC).
[97] PwC interviews with ABPI member companies
[98] ABPI analysis of NICE recommendations 2019-2021
[99] Office of Health Economics (2020). 'NICE 'Optimised' Recommendations: What Do They Mean for Patient Access?', 30 July 2020.
[100] EFPIA, 'EFPIA Patients W.A.I.T. Indicator 2020 Survey', April 2021.
[101] Office for Life Sciences (2021). 'Life Science Competitiveness Indicators 2021', 30 July 2021, p. 17.
[102] Office for Life Sciences (2021). 'Life Science Competitiveness Indicators 2021', 30 July 2021, p. 32.
[103] NHS Digital (2021). 'NICE Technology Appraisals in the NHS in England (Innovation Scorecard) To June 2021', 28 October 2021.

> **We have had several medicines now that we have not been able to launch in the UK despite having the lowest prices. That means when we look to launch other therapies, the UK is already being left out of the equation.**
>
> **UK Value and Access Director,** Large pharmaceutical company

Investment in, access to, and uptake of innovative medicines is arguably a critical part of the life sciences ecosystem. Not only does it benefit patients themselves, but there are also significant social and ecosystem benefits, which are explored in our recent report, **'Transforming lives, raising productivity: Is the UK missing out on the full potential of innovative medicines?'**. Access and uptake also allow innovators to see a return on their investment, stimulating further innovation across the ecosystem.

The link between access and uptake and the rest of the life sciences ecosystem has also been acknowledged by competitor countries. France, for example, is investing to increase access and uptake along with a broader strategy for life sciences (see Box 3).[104]

Industry respondents rank Germany second behind the US in terms of access environment and have noted an upward movement of Germany in global launch sequences as a result.

By contrast, companies believe the UK's weak access and uptake environment is harming its attractiveness for investment. In response to changes to the regulatory approval process following Brexit, industry respondents stated that the UK is already 'struggling to maintain its priority status and it is unlikely whether globally minded businesses would see it as a viable option to make [an] investment for a UK-only market authorisation'.[105] This has also been seen in the literature, with academics identifying the relevance of commercial environments to some forms of investment: Koenig and MacGarvie (2011) shows that within Europe, life sciences investors invest more in R&D in countries with fewer price controls, and that countries with more stringent price controls tend to lose ground.[106] The raison d'être of the industry is to bring medicines to patients, where the health and broader social benefits accrue. The likely extent of access and uptake in a market may therefore influence a decision about where to invest.

Another consideration is that if access and uptake in the UK is perceived to be low in a therapeutic area, a company may perceive the risk of a negative NICE appraisal to be high due to the perception that a negative NICE appraisal in the UK can impact access in other countries, given NICE's strong influence and credibility globally.[107] This may create a reputational disincentive for innovators to bring their medicine to the UK. Additionally, if reimbursement is not granted, patients who were involved in clinical trials can only continue to have access under a compassionate use scheme, where the company provides the medicine free of charge. This can create a further financial disincentive for companies to launch their medicines in the UK.

To deliver against the UK's ambition set out in the Life Sciences Vision and to become the global hub for life sciences, investment in the infrastructure that underpins the UK's life sciences ecosystem is needed. As the UK seeks to take advantage of regulatory freedoms possible as a result of leaving the EU and demonstrate global healthcare leadership, agencies such as the MHRA and NICE need to be resourced sufficiently in order to deliver their work programmes and ensure they can sufficiently evolve to meet the needs of the changing pharmaceutical pipeline.

> **There is also an ethical dilemma, where we bring our trials to the UK, but cannot deploy our medicines at scale. I do not think it is right to trial medicines on UK patients if they cannot actually get access to the medicine. At the end of the day, why would we invest if we do not get the return and, more importantly, if there isn't an impact on patients?**
>
> **UK Managing Director,** Large pharmaceutical company

[104] French Government (2021). 'Healthcare innovation 2030', 29 June 2021.

[105] House of Commons (2017). 'The impact of Brexit on the pharmaceutical sector', Business, Energy and Industrial Strategy Committee, Ninth report of session 2017-19, p. 17, paragraph 33.

[106] Koenig and MacGarvie (2011). 'Regulatory policy and the location of bio-pharmaceutical foreign direct investment in Europe', Journal of Health Economics, 2011, Vol. 30, Issue 5, pp. 950-965.

[107] Wijnands et al. (2016). 'Nice Collateral Effect: What Is The Influence Of Nice On Other Hta Bodies?', Value in Health, 2016.

Key opportunities for the UK:

- Maximise uptake of innovative medicines so that the UK maintains its international attractiveness as a location for clinical development (by, for example, ensuring there are more patients on the current standard of care, a relevant comparator to be included in clinical studies). An outdated standard of care risks there being fewer people on appropriate comparator medicines for clinical trials, which can have negative knock-on impacts on trial revenues and investment in the UK.
- Consider and address the risks for innovators of a new medicine having restricted access or limited uptake, particularly for companies with limited capital that need to make trade-off decisions about where to invest from a global perspective. Limited access and uptake minimise the return on investment for innovators, which can create a disincentive for global boardrooms to provide additional investment for the next wave of innovation to be developed in the UK. See Figure 16 for more detail.

> **"Government will really need to properly make some changes to send a signal around the world that this is a place to do business. The gun has already gone. This race has started over the last 12 months, so we really need to start making progress.**
>
> **UK Managing Director,** Large pharmaceutical company

Figure 16: How the access and uptake environment can influence investment decisions across the life sciences ecosystem

Source: PwC

Box 3: France's Healthcare Innovation 2030

France's Healthcare Innovation 2030 strategy aims to shape the country into 'the leading European nation in innovation and sovereignty in healthcare'.[108] The plan calls for collaboration between academic institutions, R&D hubs, hospitals, healthcare workers, and life sciences manufacturers to 'innovate, invent, produce and sell' healthcare solutions.

The strategy involves a significant funding target of €7 billion which will be used to:

- Strengthen France's biomedical research capacity and accelerate the innovation that will ultimately benefit patients.
- Enhance strategies for biotherapies and biomanufacturing, digital health, and emerging infectious diseases and chemical, biological, radiological and nuclear (CBRN) threats.
- Support France's role as the leading European country for clinical research by increasing the number of clinical trials and enrolled patients.
- Create a more predictable operating environment by supporting R&D and production investments, while improving budgetary objectives and regulation within the public health insurance system.
- Build out France's healthcare manufacturing footprint, including 123 supported projects as part of the COVID-19 Recovery Plan.

To realise its ambitions, and in close collaboration with industry following sustained engagement over recent years, France is changing its market access process, creating a system similar to that used in Germany. This involves providing market access immediately after approval by the French National Health Authority (the Haute Autorité de Santé) for all products assessed to have an 'improvement in actual medical benefit'.[109]

Additionally, the 2030 strategy outlines plans to establish an Agency for Healthcare Innovation, which will be responsible for coordinating healthcare innovation in France and 'guaranteeing the vision and the roadmap of the state'.

France may have already started to see the fruits of its strategy, with Pfizer recently announcing a €520 million investment in the country over the next five years to support manufacturing and research in France, including the production of its oral antiviral COVID-19 treatment.[110] This reflects concerted action by policymakers to recognise and encourage healthcare innovation. Overall, however, the success of Healthcare Innovation 2030 will rest on numerous life sciences stakeholders continuing to work together to deliver a sustainable and inclusive ecosystem.

[108] Strategic Council for the Healthcare Industries (CSIS). 'Healthcare innovation 2030' report, 2021

[109] This is for all products assessed with an IAMB/ASMR ranked I to IV, with a 2-years test period for the new procedure

[110] Reuters (2022). 'Pfizer to boost COVID-19 pill production with French deal', 17 January 2022.

5. The benefits case

Realising the ambition of the UK becoming the leading global hub for life sciences could be transformative for the health and wealth of the country.

A multi-billion-pound opportunity for a healthier and wealthier nation

The UK's Life Sciences Vision recognises that becoming the leading global hub for life sciences relies on having a holistic approach that addresses all parts of the ecosystem. Our analysis suggests the results could be genuinely transformative in terms of gains in employment, productivity, and population health and quality of life (see Figure 17).

Figure 17: Potential incremental impact of achievement of the UK life sciences Vision

40% reduction

in the burden of disease in the UK from prioritising future healthcare challenges

£68.1 billion

in GDP over 30 years from increased total R&D investment by industry

17,500 jobs

created from increased volumes of UK life sciences IPOs each year

£16.3 billion

additional GDP and

85,000 jobs

in total from increased pharmaceutical exports

£1.2 billion

in GDP and

7,230 jobs

annually from increased foreign direct investment to UK life sciences companies each year

£165 million

additional revenues to providers and

£32 million

additional cost savings annually to the NHS from a greater UK share of global commercial clinical trial enrolment each year

Reduction in wide variation in time to patient access of innovative medicines so that all new medicines are made available within **3 months** of licensing and

36 percentage point

improvement in patient uptake of innovative medicines

Source: PwC analysis

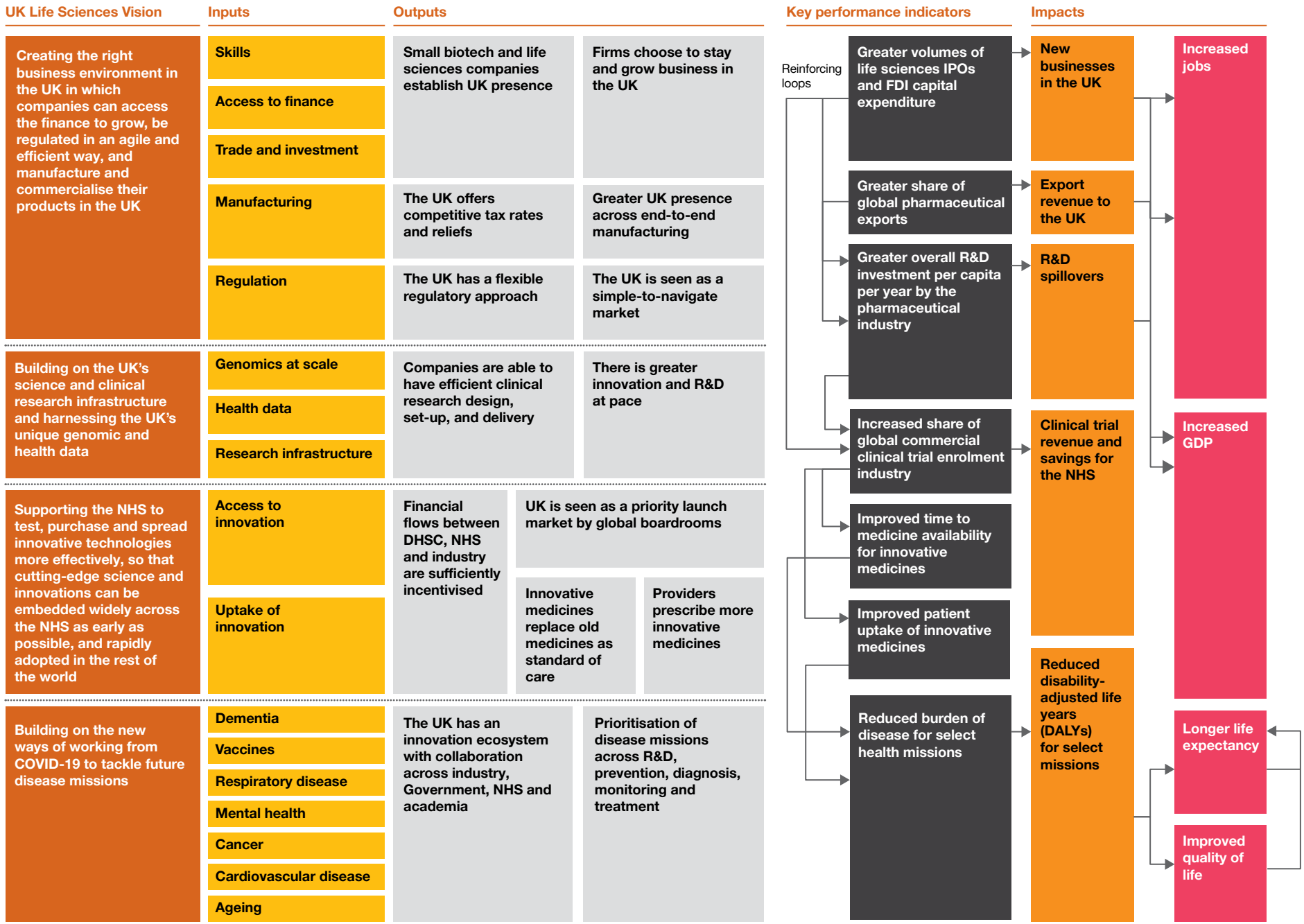
To quantify these benefits, this report analyses the impact of improving a series of key performance indicators, or KPIs, to a level that can reasonably be described as world-leading (see Figure 18). We draw upon the latest available evidence to estimate the current state of the UK across these KPIs.

These KPIs, agreed across PwC and the ABPI, have been selected on the basis of what can be reasonably improved and measured should the UK fully implement the Life Sciences Vision. They are also aligned with the four key themes set out in the Life Sciences Vision. However, we note they are not exhaustive of all the impacts that could materialise as a result of achieving its ambition to become the leading global hub for life sciences as we have not explored all relevant levers that could be pulled to support the growth of UK life sciences, for example institutional investment. Additionally, these impacts may be realised at different points in time over the short, medium and long-term, depending on the nature of individual KPIs and the pace at which the UK seizes the opportunities set out above that could support the UK becoming the leading global hub for life sciences. As such, we have not specified the timeline of when these impacts would be achieved. In performing this analysis, we compared progress against suitable comparator countries, considering what a country with a population and economy the size of the UK's can reasonably achieve (see Figure 19).[111]

In the following pages, we examine each of the four themes and their associated KPIs in detail. It should be noted that because our analysis considers each KPI in isolation, there are likely to be further benefits that come from the reinforcement loops throughout the life sciences ecosystem, where improvements in one part benefit other parts in a virtuous cycle. The benefits quantified may, in other words, only be the tip of the iceberg of the potential for the UK.

[111] Note that the comparator countries differ depending on the KPI.

Figure 18: Life Sciences Vision potential impact pathway[112]



Source: PwC analysis. Note that this impact pathway is non-exhaustive

Key: Intermediate impacts Final impacts

[112] See Figure 19 for further information on the comparator countries used to quantify the impacts presented in this impact pathway.

Figure 19: Summary of the impact of becoming the leading global hub for life sciences

Life Sciences Vision Theme	KPI	UK's current status	Comparator or frontier	KPI target	Potential additional benefit
Creating the right business environment	Volumes of life sciences IPOs	4 life sciences IPOs per year	Double the UK's current performance	8 life sciences IPOs per year	£17,500 new jobs and £1.6 billion of additional capital each year
		£12 in life sciences IPO value per capita	75% of US performance	£17.50 in life sciences IPO value per capita	
	Volumes of inward life sciences FDI	£898 million in inward life sciences FDI capex per year	Ireland performance	£1.89 billion in inward life sciences FDI capex per year	£1.2 billion in GDP and 7,230 jobs each year
	Share of global pharmaceutical exports	4.3% of global pharmaceutical exports per year	Belgium	8.3% of global pharmaceutical exports per year	£16.3 billion in GDP and 85,000 jobs each year
Building on the UK's science and clinical research infrastructure	Overall R&D investment per capita per year by the pharmaceutical industry	£5.0 billion spent by pharmaceutical industry on R&D per year	US levels on a per capita basis	£12.2 billion pharmaceutical industry R&D per year	£68.1 billion additional in GDP over next 30 years
	Share of global commercial clinical trial enrolment	2.4% of global recruits per year	Spain	3.9% of global recruits per year (a +1.5 percentage point improvement)	£165 million in additional revenues to clinical research providers and £32 million in cost savings to the NHS each year
Supporting access and uptake to innovative technologies across the NHS	Time to availability for innovative medicines	335 days (about 11 months)	Leading EU markets and NICE's KPI	All medicines approved 3 months after licensing (in line with NICE's KPI) and improving UK position vs. leading EU markets (up to 120 days, on average)	Reduction in wide variation in time to patient access of innovative medicines and knock-on benefits for patients
	Extent of patient uptake of innovative medicines	64% of median comparator market uptake	Median comparator market uptake	100% of median comparator market uptake (a +36 percentage point improvement)	Improved health of eligible patients and freed up NHS resource
Tackling major health missions	Disability-adjusted life years (DALYs)	647 million DALYs across five of the seven health missions	Singapore, Norway and Switzerland	389 million DALYs	40% reduction in burden of disease for selected health missions

Source: PwC analysis

Theme 1: Creating the right business environment

A business environment in which companies are able to grow, are regulated in an agile and efficient way, and can manufacture and commercialise their products in the UK needs the right balance of skills, access to finance, trade and investment, manufacturing and regulation.

We have identified three KPIs to measure this: the volume and value of initial public offerings (IPOs) in life sciences; foreign direct investment in capital expenditure (FDI capex) on life sciences; and pharmaceutical export value.

IPO volume and value.

When the business environment and financing conditions are right, the number and value of IPOs in the UK will rise. Put simply, a company is more likely to establish and grow its business in the country in which it lists on public markets. Therefore, attracting greater numbers of IPOs is an important step in growing the UK life sciences sector and scaling its economic and social benefits.

Today, the United States is the most attractive market for IPOs, followed by China. HMT's Patient Capital Review found that 'the UK performs well in financing start-up firms but young, innovative UK firms that are growing are less likely to receive the investment they need to scale up than businesses based in the US.[113]

Over the past three years, the UK has averaged around four life sciences IPOs per year[114] worth about £195 million each. If, however, the UK were to achieve life sciences IPO investment closer to that achieved in the US, on a per capita basis, the sector would unlock significant growth. Scaling the UK's life sciences IPO investment to 75 per cent of US levels would generate nearly £100 million more per IPO. At the same time, if the UK were to also attract double the number of life sciences IPOs it achieves each year and sustain this level of new business creation each year, the sector could raise nearly £1.6 billion of additional capital and create around 17,500 new jobs every year.[115] This represents a two-fold increase in the number of jobs supported annually by the current level of life sciences IPO investment in the UK.

There's no doubt this would represent a step change in the UK's current performance. But it illustrates the scale of what's needed for the UK to become the leading global hub for life sciences.

FDI capex.

Having the right business environment attracts greater levels of FDI capex making this another suitable measure of the UK's performance. More FDI capex can, in turn, lead to greater GDP and job creation in the UK.[116]

In 2020, the UK received £898 million in life sciences inward FDI capex. While the US and China receive the highest levels in life sciences globally, a more suitable comparator for the UK is probably Ireland, which performs disproportionately well given its location and population size.

If the UK could attract annual inward life sciences FDI capex comparable to that of Ireland (£1.89 billion in 2020), it could see an additional £1.2 billion in GDP and an additional 7,230 jobs created or safeguarded in the UK economy each year.

Pharmaceutical export value.

With the right business environment for manufacturing, the UK's pharmaceutical exports could be increased, leading to greater export revenue and, ultimately, more jobs and higher GDP.

Today, Germany and Switzerland are the global leaders in pharmaceutical export value, with a share of the global market of 13.7 per cent and 12.7 per cent respectively.[117] However, more suitable comparators for the UK (ranked 9th) are perhaps the United States, Belgium and Ireland (ranked 3rd, 4th and 5th, respectively), which each account for just over 8 per cent of global pharmaceutical exports.[118]

In 2019, the UK accounted for £20.8 billion in pharmaceutical exports, contributing 4.3 per cent of the global total.[119] If the UK were to increase that share by 4 percentage points, to a level comparable with the United States, Belgium or Ireland, it would gain about £19.5 billion in export revenues. This would result in an additional £16.3 billion in GDP and could support an additional 85,000 jobs in total. While such an expansion in exports may appear to be a dramatic increase from the UK's current performance, it is less than the 5.85 percentage point expansion achieved by Germany between 2002 and 2008, the 5.1 percentage point expansion achieved by Ireland between 2000 and 2020 and the 4.3 percentage point expansion achieved by Switzerland between 2003 and 2016.[120]

[113] House of Lords (2017). 'Life Sciences Industrial Strategy: Who's driving the bus? Oral and Written evidence', 25 August 2017, p. 534.

[114] PwC analysis of S&P Capital IQ data from 2018-2020. Figures include IPOs by pharmaceutical, biotechnology and life sciences tools and services companies.

[115] PwC analysis using findings from Butler et al. (2019). 'Local Economic Spillover Effects of Stock Market Listings', **Journal of Financial and Quantitative Analysis**, Vol. 54, No. 3, June 2019, pp. 1025–1050 doi: 10.1017/S0022109019000188

[116] The EIB finds that a 1 percentage point increase of FDI to GDP ratio leads to a 0.014 increase in GDP growth per capita for high-income countries, with statistical significance of $p<0.01$.

[117] PwC analysis of WTO, Time Series on International Trade Database, https://stats.wto.org/

[118] PwC analysis of WTO, Time Series on International Trade Database, https://stats.wto.org/

[119] PwC analysis of WTO, Time Series on International Trade Database, https://stats.wto.org/

[120] PwC analysis of WTO, Time Series on International Trade Database, https://stats.wto.org/

Theme 2: Building on the UK's science and clinical research infrastructure

Maximising the UK's science and clinical research infrastructure and harnessing its unique genomic and health data within the life sciences ecosystem will enable faster innovation along the entire value chain. There are two KPIs to measure this: overall R&D investment and clinical trial recruitment.

R&D investment.

The latest Office for National Statistics figures indicate that the sector spent over £5 billion in pharmaceutical R&D in 2020.[121] If the UK were to raise its spending to a per-capita level comparable with that of the United States, an additional £7.2 billion of investment would be channelled to its life sciences sector each year.

While this achievement would still position the UK behind Switzerland, Denmark and Belgium as shown in Figure 20 above, it would have numerous long-term beneficial spill-over effects. The literature[122,123] suggests an economy gains a stream of future benefits equivalent to £0.50 per year in perpetuity from every £1 invested in private R&D today. An additional £7.2 billion of investment in one year would therefore equate to £68.1 billion in R&D spill-overs over the subsequent 30-year period. What's more, given the rate of return on R&D investment is cumulative, the impact of higher pharmaceutical R&D spending would in fact be far greater if maintained.

Of course, this additional investment will not materialise overnight. However, nurturing the right business environment can help catalyse it. In particular, public spending on health R&D can be a powerful tool in stimulating private sector investment and social returns to the wider UK economy as measured by GDP.[124]

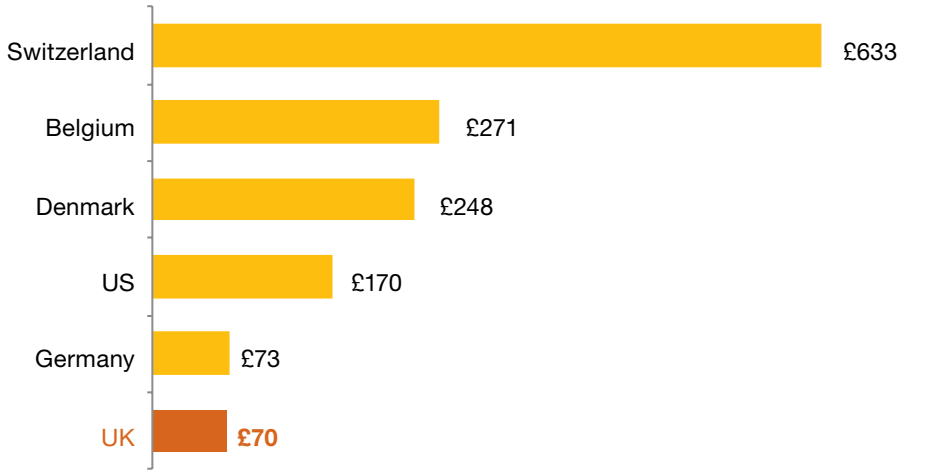
Clinical trial enrolment.

The United States currently leads the way in the share of participants recruited to global commercial clinical trials. Peer countries like Germany, Canada and Spain are perhaps more relevant comparators for the UK given their population size. In 2019, the UK was responsible for 2.4 per cent of global recruits to commercial clinical trials. This means it ranks 7th against its peer markets for global commercial clinical trial enrolment.[125,126]

If the UK were to increase its annual global commercial clinical trial enrolment to levels consistent with Spain, our analysis suggests healthcare providers could generate around £165 million in additional revenues and the NHS could see £32 million in additional savings each year.[127] This would represent about one fifth of the £1 billion NHS long-term plan target for industry contract and R&D collaborative research in the NHS.[128]

These additional revenues and savings would not only alleviate short-term financial pressures on the system, but also prepare the UK to be more 'research-ready', with further knock-on benefits in terms of enhanced job satisfaction and employee retention in the NHS.[129]

Figure 20: Country ranking by pharmaceutical industry R&D expenditure per capita (£m, 2017)



Source: PwC analysis of EFPIA and OECD data

[121] ONS (2021). 'Business enterprise research and development', 19 November 2021.
[122] Office of Health Economics & RAND Europe (2010). 'Enhancing the benefits from biomedical and health research spillovers between public, private and charitable sectors in the UK', 2010.
[123] Sussex et al. (2016). 'Quantifying the economic impact of government and charity funding of medical research on private research and development funding in the United Kingdom', BMC Medicine, Vol. 14, Article no. 32 (2016). Doi: 10.1186/s12916-016-0564-z
[124] Sussex et al. (2016). 'Quantifying the economic impact of government and charity funding of medical research on private research and development funding in the United Kingdom', BMC Medicine, Vol. 14, Article no. 32 (2016)
[125] Patients enrolled multiplied by number of clinical trials
[126] ABPI (2021). 'Clinical research in the UK: an opportunity for growth', September 2021.
[127] PwC analysis using data from KPMG (2019). 'Impact and value of the NIHR Clinical Research Network', July 2019.
[128] NHS Long-term Plan, 'Research and innovation to drive future outcomes improvement'.
[129] NHS England (2021). Blog: 'What does the new clinical research vision mean for NHS patients and health professionals?', 23 March 2021.

Theme 3: Supporting access to, and uptake of innovative technologies across the NHS

Aside from the clinical benefits for patients, greater access to and uptake of innovation across the NHS would help to position the UK as a priority launch market among global pharmaceutical boardrooms. Access refers to the availability of innovative medicines on the NHS, e.g. the medicines are licensed for use and have received a positive recommendation by a health technology appraisal body for the NHS to prescribe them to patients. The UK's access and uptake environment can be improved, including by increasing speed (where there are unnecessary barriers) and breadth of access, and extent of uptake of innovative medicines. In this scenario, we explore two of those KPIs: speed of access and extent of uptake.

Speed of access.

Greater access to innovative medicines is linked with positive health outcomes. However, the UK sees wide variation in speed of access to medicines. This is demonstrated when comparing the average time to access in England and Scotland with other countries. Between 2016 and 2019, its median time to availability was 335 days, or around 11 months.[130] This compares with leading EU countries like Germany (120 days), Switzerland (166 days) and Denmark (169 days), and England is ranked 7th in Europe.[131]

If the UK were to achieve NICE's KPI of all new medicines being approved within 3 months of licensing nationwide, this would rival the leading EU country's time to availability and reduce wide variation in time to patient access in the UK. This could have beneficial knock-on effects on uptake as well, enabling patients to benefit from these technologies sooner. In the case of patients with critical conditions, like some cancers or rare diseases, this greater speed could be lifesaving.

Extent of uptake.

Over the past eight years, the UK has had a consistently low uptake of NICE-approved medicines relative to the median in comparator countries.[132] Uptake has been, on average, 36 percentage points below the median in the 1-5 years following launch.[133] The UK's below average performance on this KPI has an impact on patient outcomes. It means patients have not been receiving the latest medicines, despite them being readily available to the NHS. This represents a forgone opportunity to improve patient outcomes and lives.

If the UK could achieve at least the median level of uptake it would not only benefit patient health, but also free up resources across the NHS. For example, it could help the NHS to circumvent some of its current constraints (including ongoing staff shortages) and deliver improved patient outcomes by switching patients to medicines that avoid hospitalisations or require less intensive monitoring by healthcare professionals. For example, Asthma UK has found that the treatment of severe asthma with biologics has led to a 43 per cent reduction in hospital admissions.[134]

[130] EFPIA (2021). 'EFPIA Patients W.A.I.T. Indicator 2020 Survey', April 2021.
[131] EFPIA (2021). 'EFPIA Patients W.A.I.T. Indicator 2020 Survey', April 2021.
[132] Comparator countries include Australia, Austria, Belgium, Canada, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Spain, Switzerland, Sweden, USA. UK uptake has been, on average, 64% of median comparator country uptake.
[133] Shows UK median uptake as a percentage of average uptake in the comparator countries for medicines launched during 2015-2019. Source: ABPI analysis of IQVIA data, from Life Sciences Competitiveness Indicator Report 2021.
[134] Asthma UK. 'Do no harm – safer and better treatment options for people with asthma', p. 10.

Theme 4: Tackling future healthcare challenges

The Life Sciences Vision emphasises the need to build on the new ways of working developed during the COVID-19 pandemic to improve overall population health and tackle a series of healthcare challenges, such as dementia, vaccines, respiratory disease, mental health, cancer, cardiovascular disease, and ageing.

The most suitable KPI of the UK's progress against international comparators for which there is sufficient data available is its burden of disease, as measured by disability-adjusted life years (DALYs). This is a time-based measure that considers the overall burden of disease by assessing the years of life either lost due to premature mortality or lived in less than full health.[135] For example, 1 DALY represents the loss of the equivalent of one year of full health (e.g. loss of one year of full health or the loss of two years of health at 50 per cent capacity).

Disability-adjusted life years.

If the UK were to raise its performance in its most pressing disease areas to the levels of the best-performing comparable country (that is, developed countries with a significant pharmaceutical ecosystem), it could realise a 40 per cent reduction in the aggregate burden of disease for five out of the seven priority healthcare challenges set out in the Life Sciences Vision.[136,137]

For example, across dementia, cancer, cardiovascular, respiratory diseases and mental health, the UK had an attributed burden of disease (i.e. DALYs known to be caused by a specific disease) totalling around 6,471,000 DALYs in 2019.[138,139] Our analysis suggests that if it were to match the performance of Singapore for dementia, pancreatic cancer, brain cancer, cardiovascular disease and respiratory disease, Norway for liver cancer, and Switzerland for mental health, the UK could reduce this burden by about 2,577,500 DALYs in total.[140]

The reductions in cardiovascular disease (41 per cent) and respiratory disease (71 per cent) are both particularly significant, with these two disease areas accounting for over 80 per cent of the total DALY reduction opportunity identified.

We note, however, that there are an additional 8.3 million DALYs unattributed to a specific disease area estimated in England alone.[141] Therefore, while the Life Sciences Vision prioritises the seven disease areas set out above, there are many more improvements to be made – and patient outcomes to be raised – across wider healthcare challenges following further scientific research.

[135] WHO, Disability-adjusted life years (DALYs) information page.

[136] Country comparison pool includes the following countries where data is available: Belgium, Canada, China, France, Germany, Italy, Japan, Norway, Singapore, Spain, Sweden, Switzerland, UK, USA

[137] These include dementia, cancer, cardiovascular, respiratory diseases and mental health. We have not completed this analysis for ageing and vaccines due to a lack of comparable international data.

[138] The burden of disease from cancer has only been considered for three cancers with low survival rates (pancreatic, brain, and liver cancers). This suggests that there is a significantly larger opportunity if progress is made across more/all cancers.

[139] Global Burden of Disease (On GBD, filters used are cause (disease area), DALYS, select KPI countries, all ages, both sexes, rate unit), Our World in Data

[140] PwC analysis.

[141] Public Health England (2020). 'The Burden of Disease in England compared with 22 peer countries A report for NHS England', January 2020, p. 20, Figure 12.

6. From vision to execution

Flawless execution and extensive collaboration will be required if the UK is to seize the opportunity and fully implement the Life Sciences Vision to become the leading global hub for life sciences.

The UK faces a moment of truth. With a more attractive business environment, a stronger manufacturing and research infrastructure, better investment in, access to, and uptake of innovative medicines, and a renewed approach to its priority healthcare challenges, it has the potential to become the leading global hub for life sciences.

The UK stands to make major quantifiable gains if it does so. What is more, given the reinforcement loops built into the life sciences ecosystem, these gains may only represent a proportion of the total potential value to the UK, which could be much larger.

However, realising them is not guaranteed. Without intervention, UK life sciences risks missing out on future investment to other markets and faces a future of stagnation or decline. This is why recognising the sector as an interconnected ecosystem is critical to the UK becoming the leading global hub for life sciences. In doing so, we can build a thriving ecosystem in which each individual component contributes to a whole that is greater than the sum of its parts.

Co-delivery and partnership by the UK and devolved nation governments, the NHS, the life sciences sector and other stakeholders will be required to make the Life Sciences Vision a reality. Mutually beneficial solutions will need to be found that properly account for the value that each part of the ecosystem provides.

This execution will need to be considered across all stakeholders, from the highest levels of government, NHS and industry right down to the individuals working on the front line.

The result will be a healthier, happier, longer-living population, and a wealthier and more prosperous nation.

Appendix

A.1. Economic impact methodology

Overview

The economic measures presented in this report are calculated through a different approach to the one taken by the Office for Life Sciences (OLS) in its bioscience and health technology sector statistics.[142]

The OLS estimates that the UK life sciences sector employed 256,100 people in 6,300 businesses in 2019, with turnover of £80.7 billion.[143] These figures include core life sciences companies as well as service and supply companies associated with the sector. These figures are produced using a different methodology to our own, so the two measures cannot be compared on a like-for-like basis.

Below we highlight the two key differences:

- **Scope of the analysis:** Our analysis captures the impact of life sciences firms in the broader economy. For example, the economic contribution and employment generated when a life sciences firm purchases office equipment from a UK based supplier. This is not captured in the OLS estimates, which only considers the impact of those suppliers who are themselves life sciences firms. We are, therefore, able to capture a broader measure of the sector's contribution in this report.
- **Use of GVA rather than turnover:** We estimate gross value added (GVA) whereas the OLS estimate turnover. We consider GVA to be a more suitable measure of economic contribution than turnover because it takes account of the costs of the goods and services needed to generate turnover. Therefore the two measures do not measure the same thing and should not be compared. Turnover is likely to exceed GVA as it does not capture leakage effects (revenue lost to other countries, for example through imported goods from foreign suppliers), which are found in most non-closed economies.

Constructing a company-level sample

To calculate the direct economic impact of the sector, we apply a bottom-up approach using company-level data. To assemble a representative and complete life sciences company sample, we use the Bioscience and Health Technology Sector Statistics 2019 by the OLS as a starting point.

We make the following adjustments to our sample:

- We exclude downstream activities such as retail, wholesale and the provision of healthcare (i.e. activities relating to hospitals or GPs).
- We exclude companies who supply life sciences companies to avoid double counting their contributions, as these are captured in our economic multiplier analysis.
- Where a company has multiple UK entities and there are no non-UK entities included in its Group accounts, we include their Group accounts within our analysis.
- Where a company has multiple UK entities and non-UK entities included in their Group accounts, we include each active UK entity that met our life sciences criteria.
- Finally, we include any ABPI member companies that are not already within the OLS Database.

This leads to a sample of 2,780 core life sciences companies (e.g. non service and supply companies).

We then construct a subsample of 515 medium to large companies by filtering for companies with turnover greater than £5 million. We correct for the omission of small companies (most of which do not choose to publish profit and loss information) by scaling the results of the direct GVA and employment calculations (set out below) by the turnover to be representative of the sector, calculated from the Bioscience and Health Technology Sector Statistics 2019 (large companies account for 91 per cent of core life sciences turnover).

We draw upon information available on Companies House and the FAME database by Bureau van Dijk to populate any gaps in the companies' profit and loss information and employment information.

We break down the subsample into three segments: pharmaceutical manufacturing, medical technology manufacturing and life sciences research. This enables us to provide more granular analysis on different sector segments and assess how the sector has evolved in composition. Table 1 shows the criteria we use to define these sector segments.

These segments are not always mutually exclusive. For example, a large company within the life sciences sector will likely have activity across two or three of the segments. Where we quantify the economic contribution of the sector, we have assigned the companies to the segment to which the majority of their activity contributes.

[142] OLS, Bioscience and health technology sector statistics.
[143] Office for Life Sciences (2020). 'Bioscience and health technology sector statistics 2019', August 2020, p. 4.

Table 1: Sectors included within the UK life sciences sector

Life sciences sector segment	Standard Industrial Classification (SIC) components
Pharmaceutical development and manufacture	• **SIC 20590:** Manufacture of other chemical products n.e.c. • **SIC 20130:** Manufacture of other inorganic basic chemicals • **SIC 20140:** Manufacture of other organic basic chemicals • **SIC 21100:** Manufacture of basic pharmaceutical products • **SIC 21200:** Manufacture of pharmaceutical preparations • **SIC 46460:** Wholesale of pharmaceutical products[144]
Medical technology manufacture	• **SIC 32500:** Manufacture of medical and dental instruments and supplies • **SIC 26600:** Manufacture of irradiation, electromedical and electrotherapeutic equipment • **SIC 32990:** Other manufacturing n.e.c. • **SIC 26110:** Manufacture of electronic components • **SIC 26512:** Manufacture of electronic industrial process control equipment • **SIC 26513:** Manufacture of non-electronic instruments and appliances for measuring, testing and navigation, except industrial process control equipment • **SIC 28410:** Manufacture of metal forming machinery • **SIC 26701:** Manufacture of optical precision instruments • **SIC 27900:** Manufacture of other electrical equipment • **SIC 25990:** Manufacture of other fabricated metal products n.e.c. • **SIC 28290:** Manufacture of other general-purpose machinery n.e.c. • **SIC 22290:** Manufacture of other plastic products • **SIC 28990:** Manufacture of other special-purpose machinery n.e.c. • **SIC 82990:** Other business support service activities n.e.c. • **SIC 33130:** Repair of electrical equipment • **SIC 33140:** Repair of electronic and optical equipment
Life sciences research	• **SIC 72110:** Research and experimental development on biotechnology • **SIC 72190:** Other research and experimental development on natural sciences and engineering • **SIC 74909:** Other professional, scientific and technical activities n.e.c. • **SIC 86900:** Other human health activities

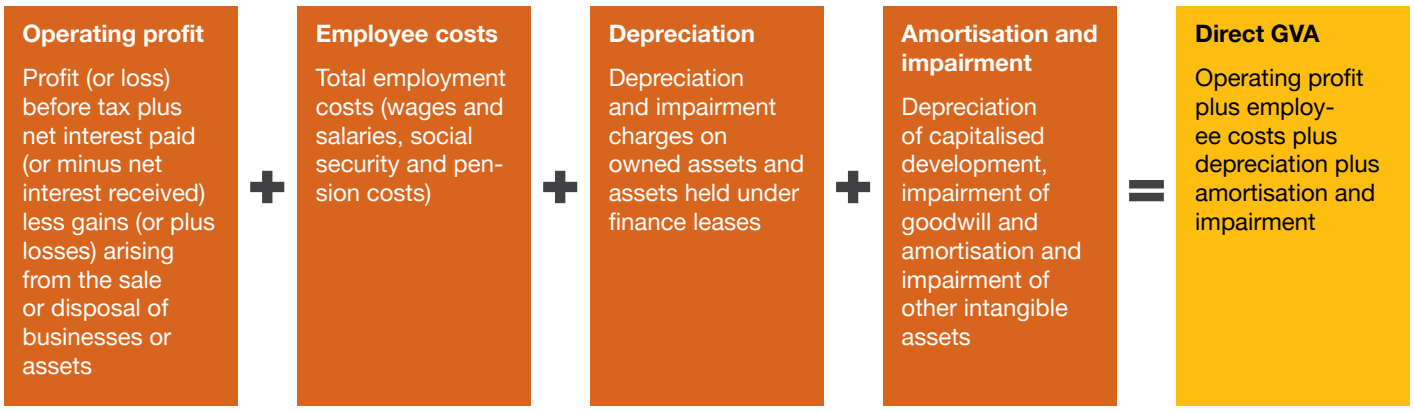
Source: PwC

Estimating the sector's GVA and employment contributions

To estimate the direct GVA of the sector, we add operating profit, employee costs, depreciation and amortisation and impairment, as shown in Figure 21. This is consistent with the national accounting methods used by the ONS and equivalent bodies in other markets.

[144] Some life sciences companies are classified as wholesalers when their business operations also include development and manufacturing. Therefore we have included wholesale of pharmaceutical products within our criteria and filtered out companies which appeared to be pure wholesalers.

Figure 21: Direct GVA calculation



Source: PwC

To estimate the direct employment of the sector, we used headcount employment figures, as full-time equivalent employment figures are not widely available.

To calculate the indirect and induced contributions, we multiply the direct impacts by the economic multipliers set out in Table 2. These multipliers are derived from a bespoke input-output modelling exercise of the UK life sciences sector conducted in PwC (2017).[145] We take confidence in using these multipliers for this analysis as sector multipliers are unlikely to change significantly from year to year.

Table 2: PwC multipliers for the UK life sciences sector

Industrial classification group	Type I GVA (supply chain effect)	Type II GVA (employee spending effect)	Type I Employment (supply chain effect)	Type II Employment (employee spending effect)
Pharmaceutical development and manufacture	1.38	1.63	3.14	4.40
Medical technology manufacture	1.88	3.22	1.65	2.55
Life sciences research	1.77	2.44	1.68	2.12

Source: PwC

In Figure 22 below we provide an indicative breakdown of how the sector's GVA and employment contributions may be spread across England, Northern Ireland, Scotland and Wales. We use each nation's proportion of UK GVA and population to apportion the sector's GVA and employment contributions, respectively.

Our findings indicate that the sector contributes the most to England, with £32 billion in GVA and 492,000 in jobs. This is followed by Scotland with £2.8 billion in GVA and 47,800 in jobs, and Northern Ireland, with £1.3 billion in GVA and 27,600 in jobs. The sector also contributes £800 million in GVA and 16,600 in jobs to Wales. Note that these are indicative figures and that regional impacts have not been modelled.

[145] PwC (2017). 'The economic contribution of the UK life sciences industry', March 2017.

Estimating the sector's tax contribution

We estimate the sector's tax contribution by applying a taxation multiplier to the GVA contribution of the sector. We use the tax-to-GVA ratios for the life sciences sector found in PwC (2017), which is 27% for life sciences.[146]

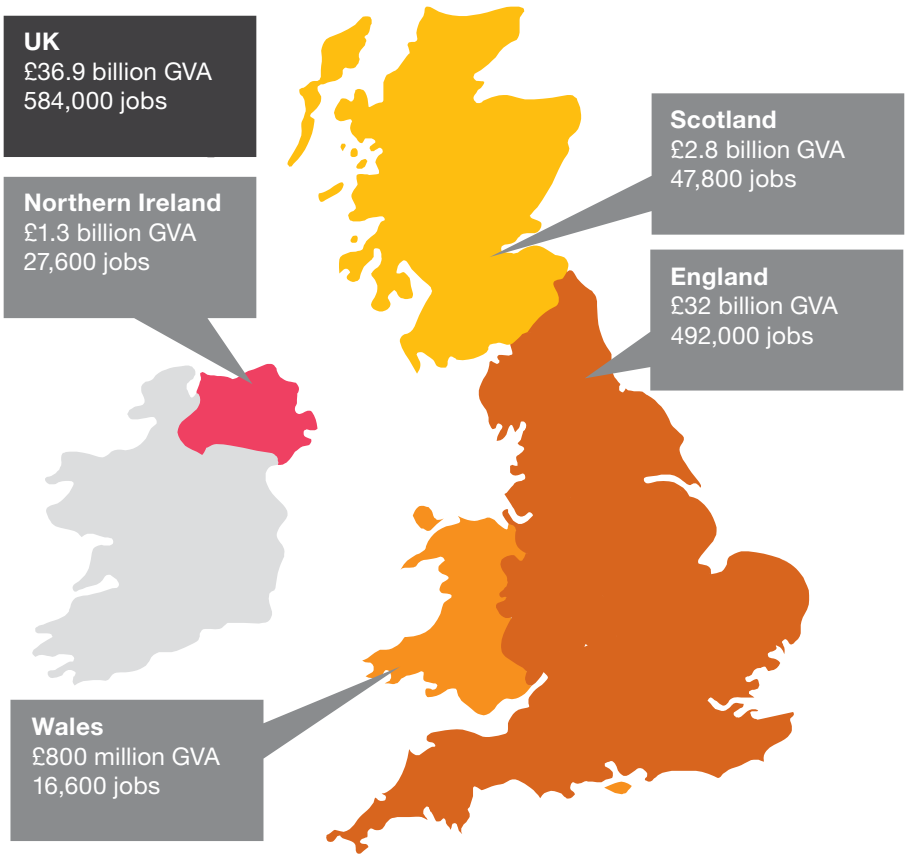
As R&D and intellectual property (IP) are highly valuable elements of a flourishing economy, the UK applies a relatively lower tax rate to profits made on these activities. The life sciences sector involves high levels of R&D and IP through medicines and medical technology; as such, the sector's tax-to-GVA ratio is lower relative to the UK's 33% national average for 2019.[147]

While, at the time of writing, the UK corporation tax main rate has decreased by 1 percentage point since the period reviewed in PwC (2017), we do not consider this to have a significant impact due to the lower effective tax rate through exemptions, R&D credits and Patent Box protection. Similarly, while the UK personal income tax allowance and higher rate threshold have increased since the period reviewed in PwC (2017), we do not consider this to have significant impact given they have largely risen with inflation.

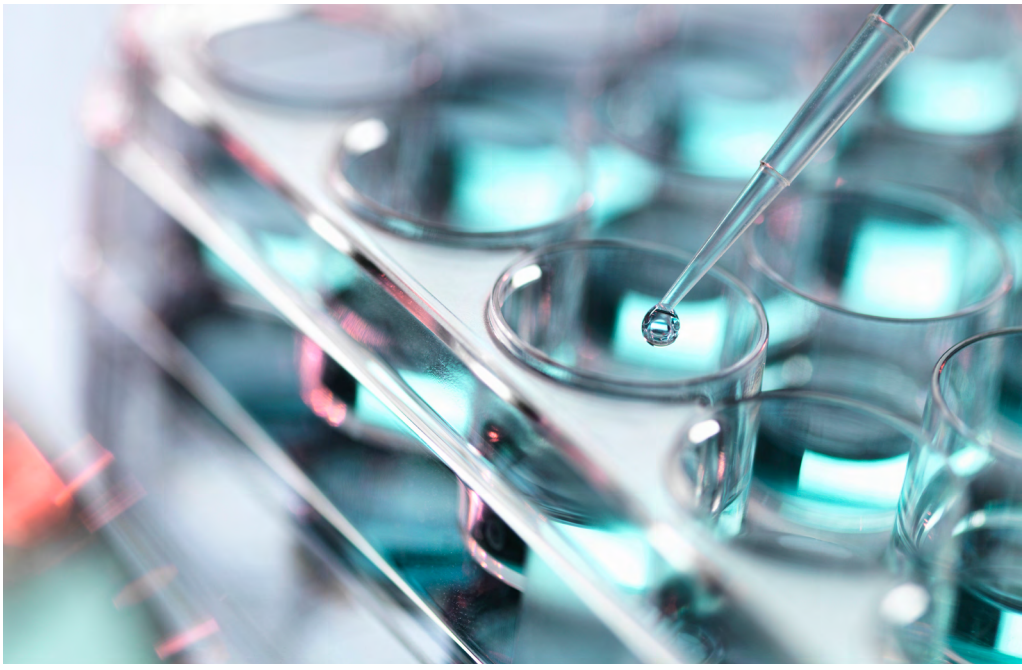
The tax contribution of the sector reflects the following taxes paid:

- **Product taxes** – includes taxes linked directly to the sale of a good or service, such as insurance taxes and Value Added Tax.
- **People taxes** – includes payroll taxes such as Income Tax and National Insurance Contributions.
- **Other taxes** – includes property taxes, which relate to the ownership, sale, transfer or occupation of property, environmental taxes which are applied to the supply, use or consumption of goods and services that are considered to be harmful to the environment and profit taxes such as Corporation Tax.

Figure 22: Indicative national split of life sciences sector GVA and employment contribution



Sources: PwC analysis of ONS and OLS data



[146] PwC (2017). 'The economic contribution of the UK Life Sciences industry', March 2017.
[147] OECD, 'Revenue Statistics 2020 – the United Kingdom'.

A.2. KPI methodology

In Table 3 below, we set out detailed breakdowns of the key performance indicators presented in Figure 15 above, both in absolute and indexed values, across early to late-stage R&D, manufacturing, and access and uptake. Figure 15 presents the PwC-calculated average metric for each KPI.

We rank the UK against the following comparator markets: Belgium, Canada, China, France, Germany, Italy, Japan, Norway, Singapore, Spain, Sweden, Switzerland and the US. While not an exhaustive list, comparator markets were chosen based on findings from interviews which indicated that these markets are also in the race to become the leading global hub for life sciences.

Table 3: Detailed breakdown of KPIs

KPI	Academic power		Number of pharma assets		Workforce and skills		Digital and artificial intelligence				
Metric	Number of top universities for Life Sciences & Medicine degrees		Number of medicines for each HQ country		Total R&D personnel per thousand total employment		Digital competitiveness ranking		Investment in AI as a % of GDP		Data and AI average
Year	2021		2021		2018		2021		2020		2020/21
Source	QS World Rankings[148]		Pharmaprojects[149]		OECD[150]		IMD[151]		NetBase Quid[152]		PwC[153]
Type	Absolute	Indexed	Absolute	Indexed	Absolute	Indexed	Absolute	Indexed	Absolute	Indexed	Indexed
Belgium	2	6.8	562	7.5	19.1	87.8	75.3	36.8	0.00%	2.6	19.7
Canada	7	21.3	770	12.5	-	-	87.3	58.7	0.04%	33.8	46.3
China	2	6.8	1,390	27.5	6.2	5.0	84.4	53.5	-	-	53.5
France	2	6.8	702	10.9	16.3	69.8	75.7	37.5	0.02%	12.6	25.1
Germany	3	9.7	869	14.9	16.3	69.4	79.3	44.2	0.01%	9.3	26.7
Italy	2	6.8	547	7.1	14.0	54.8	61.8	12.2	0.00%	1.2	6.7
Japan	2	6.8	621	8.9	13.0	48.9	73.0	32.7	0.01%	4.9	18.8
Norway	-	-	-	-	17.2	75.3	91.3	66.0	0.00%	2.0	34.0
Singapore	1	3.9	-	-	12.1	42.6	95.1	73.0	-	-	73.0
Spain	1	3.9	792	13.0	11.4	38.5	68.2	24.0	0.00%	3.0	13.5
Sweden	4	12.6	325	1.8	17.8	79.2	95.2	73.1	0.03%	20.3	46.7
Switzerland	5	15.5	n/a	-	-	-	94.9	72.6	0.03%	23.0	47.8
UK	14	41.6	1,077	19.9	14.8	60.2	85.8	56.0	0.06%	47.3	51.6
US	31	91.0	3,998	90.4	-	-	100.0	81.8	0.11%	90.8	86.3

[148] QS World University Rankings by Subject 2021: Life Sciences & Medicine.
[149] Pharmaprojects.
[150] OECD Main Science and Technology Indicators.
[151] IMD World Digital Competitiveness Ranking 2021.
[152] Stanford University (2021). 'Artificial Intelligence Index Report 2021', November 2021.
[153] PwC analysis (average of indexed values).

Table 3: Detailed breakdown of KPIs (cont'd)

KPI	Industry R&D spending		R&D tax incentives		Clinical trials resource and capacity								
Metric	Pharmaceutical sector R&D spending per capita		Implied tax subsidy rates on R&D expenditure		Share of global recruits per year		Total clinical trials initiated per year		Number of CGT trials conducted		Number of days from core package received to first patient enrolled		Clinical trials infra-structure average
Year	2016		2020		2019		2020		2021		2019		2019-21
Source	EFPIA and OECD[154]		OECD[155]		ABPI[156]		ABPI[157]		Trialtrove[158]		OLS[159]		PwC[160]
Type	Absolute	Indexed	Absolute	Indexed	Absolute	Indexed	Absolute	Indexed	Absolute	Indexed	Absolute	Indexed	Indexed
Belgium	€209	29.2	15%	35.2	-	-	290	10.0	86	8.0	-	-	9.0
Canada	-	-	13%	30.9	3.1%	10.5	418	16.0	123	11.5	190.0	61.9	25.8
China	€46	5.2	23%	52.4	-	-	945	40.8	823	78.2	-	-	59.5
France	€55	6.6	41%	91.2	2.8%	9.5	439	17.0	147	13.8	242.0	30.5	17.7
Germany	€62	7.6	19%	43.8	3.8%	12.8	543	21.9	134	12.6	214.0	47.4	23.7
Italy	€20	1.4	11%	26.6	2.8%	9.5	381	14.3	110	10.3	201.5	55.0	22.3
Japan	-	-	17%	39.5	-	-	465	18.2	138	12.9	-	-	15.6
Norway	€20	1.4	22%	50.3	-	-	-	-	22	1.0	-	-	1.9
Singapore	-	-	-	-	-	-	-	-	14	1.1	-	-	1.1
Spain	€19	1.3	33%	74.0	3.9%	13.1	549	22.2	128	12.9	163.5	77.9	31.5
Sweden	€91	11.9	11%	26.6	-	-	-	-	39	3.5	-	-	3.5
Switzerland	€628	90.8	0%	0.8	0.2%	1.0	110	1.5	39	3.5	264.5	17.0	5.7
UK	€71	8.9	12%	28.8	2.4%	8.2	508	20.3	150	14.1	218.0	45.0	21.9
US	€159	21.9	7%	18.0	30.4%	100.0	2,002	90.6	956	90.9	141.0	91.5	93.2

[154] EFPIA, Pharmaceutical industry research and development in Europe. OECD, Population.
[155] OECD Main Science and Technology Indicators.
[156] ABPI (2021). 'Clinical research in the UK: an opportunity for growth', Autumn 2021.
[157] ABPI (2021). 'Clinical research in the UK: an opportunity for growth', Autumn 2021.
[158] PharmaIntelligence, Trialtrove.
[159] OLS (2021). 'Life science sector data, 2021'.
[160] PwC analysis (average of indexed values).

Table 3: Detailed breakdown of KPIs (cont'd)

KPI	Pharma access to capital (IPOs)					Share of global pharmaceutical exports		Volumes of inward life sciences FDI CAPEX	
Metric	Number of IPOs		Value of IPOs		Pharma access to capital average	Share of global pharmaceutical exports		Pharma industry foreign direct investment, capital expenditure	
Year	2020		2020		2020	2019		2020	
Source	S&P Capital IQ[161]		S&P Capital IQ[162]		PwC[163]	WTO[164]		OLS[165]	
Type	Absolute	Indexed	Absolute	Indexed	Indexed	Absolute	Indexed	Absolute	Indexed
Belgium	1	1.1	£56.2m	1.3	1.2	8%	52.4	-	-
Canada	6	7.1	£717.6m	6.5	6.8	1%	7.4	£647	16.4
China	32	38.2	£4,186m	33.5	35.9	3%	20.3	£1,158	29.5
France	-	-	-	-	-	5%	33.1	£1,011	25.7
Germany	1	1.1	£99.6m	1.7	1.4	14%	91.0	£681	17.2
Italy	-	-	-	-	-	5%	33.1	£375	9.4
Japan	3	3.5	£40.2m	1.2	2.4	1%	7.4	£153	3.7
Norway	1	1.1	£13.2m	1.0	1.1	-	1.0	-	-
Singapore	-	-	-	-	-	1%	7.4	-	-
Spain	-	-	-	-	-	2%	13.9	-	-
Sweden	5	5.9	£13.8m	1.0	3.5	2%	13.9	£52	1.1
Switzerland	1	1.1	£190.8m	2.4	1.8	13%	84.6	£713	18.1
UK	5	5.9	£1,968.6m	16.3	11.1	4%	26.7	£898	22.8
US	76	90.9	£11,558.3m	91.0	90.9	8%	52.4	£3,556	90.9

[161] S&P Capital IQ.
[162] S&P Capital IQ.
[163] PwC analysis (average of indexed values).
[164] World Trade Organisation.
[165] OLS (2021). 'Life science sector data, 2021'.

Table 3: Detailed breakdown of KPIs (cont'd)

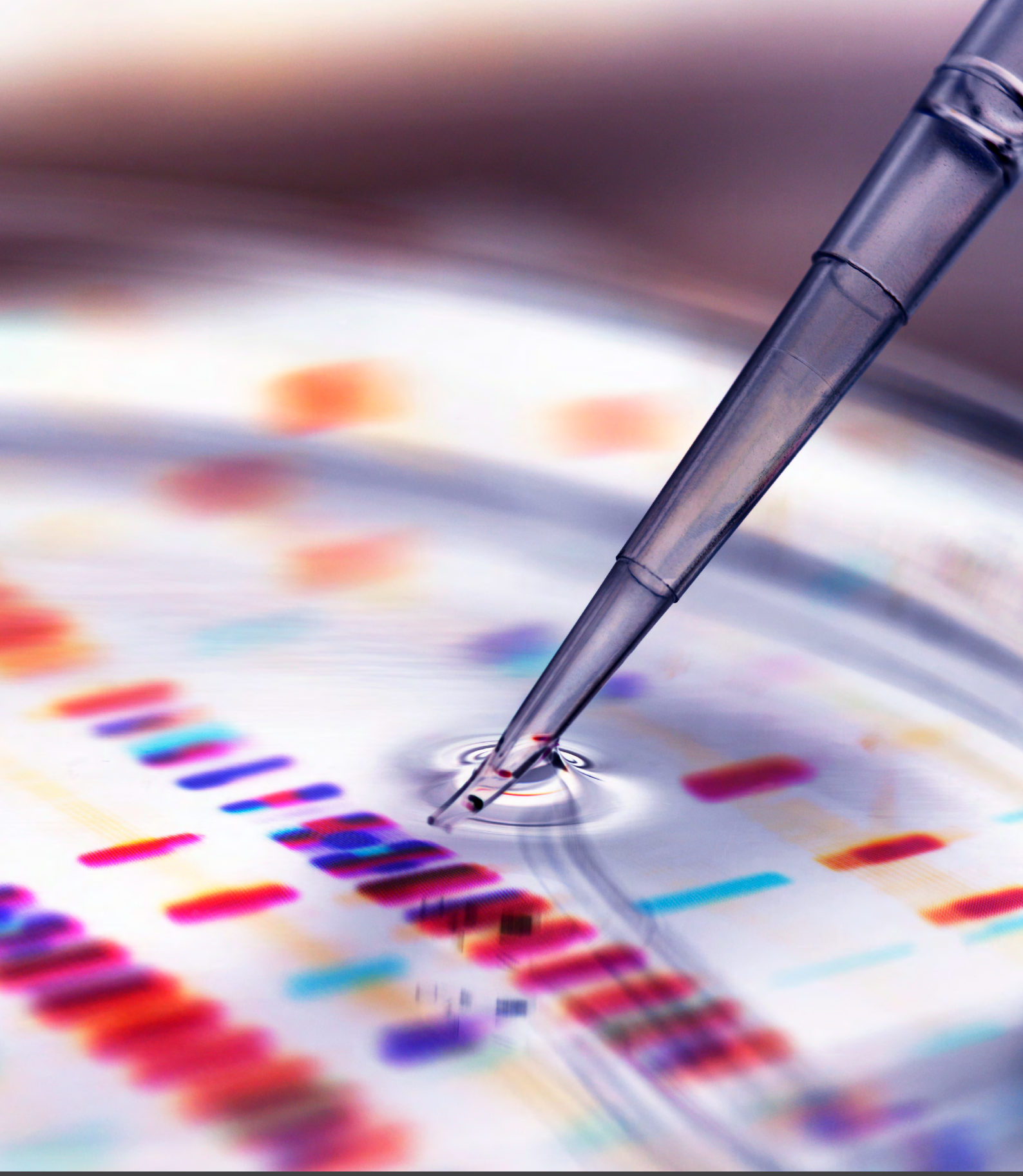
KPI	Health spending										
Metric	Spend on health R&D as a % of total gov't R&D		Spend on health R&D per capita (PPP)		Average health R&D	Total healthcare spend per capita (PPP)		Total healthcare spend as a % of GDP		Average total health spend	Average health spend
Year	2019		2019		2019	2019		2019		2019	2019
Source	OECD[166]		OECD[167]		PwC[168]	OECD[169]		OECD[170]		PwC[171]	PwC[172]
Type	Absolute	Indexed	Absolute	Indexed	Indexed	Absolute	Indexed	Absolute	Indexed	Indexed	Indexed
Belgium	1.6	1.5	$6.20	1.4	1.5	$5,458.40	41.6	10.7%	41.2	41.4	21.5
Canada	-	-	-	-	-	$5,370.40	40.9	10.8%	42.6	41.7	41.7
China	-	-	-	-	-	$969.20	1.9	5.9%	5.5	3.7	3.7
France	11.3	33.7	£35.30	22.4	28.0	$5,274.30	40.0	11.1%	44.6	42.3	35.2
Germany	5.1	13.2	£28.30	17.3	15.3	$6,518.00	51.0	11.7%	49.0	50.0	32.7
Italy	10.4	30.8	£25.30	15.2	23.0	$3,653.40	25.6	8.7%	26.2	25.9	24.5
Japan	6.1	16.5	£19.80	11.2	13.9	$4,691.50	34.8	11.0%	44.1	39.5	26.7
Norway	15.6	47.9	£109.10	75.5	61.7	$6,744.60	53.0	10.5%	40.2	46.6	54.2
Singapore	-	-	-	-	-	-	-	-	-	-	-
Spain	12.6	38.2	£28.00	17.1	27.6	$3,600.30	25.2	9.1%	29.7	27.4	27.5
Sweden	2.4	4.1	£9.80	4.1	4.1	$,551.90	42.5	10.9%	43.2	42.8	23.5
Switzerland	-	-	-	-	-	$7,138.10	56.5	11.3%	46.0	51.3	51.3
UK	20.6	64.7	£56.10	37.3	51.0	$4,500.10	33.2	10.2%	37.4	35.3	43.2
US	28.4	90.6	£130.10	90.6	90.6	$10,948.50	90.3	16.8%	87.3	88.8	89.7

[166] OECD Main Science and Technology Indicators.
[167] OECD Main Science and Technology Indicators.
[168] PwC analysis (average of indexed values).
[169] OECD Main Science and Technology Indicators.
[170] OECD Main Science and Technology Indicators.
[171] PwC analysis (average of indexed values).
[172] PwC analysis (average of indexed values).

Table 3: Detailed breakdown of KPIs (cont'd)

KPI	Pharma spending		Speed of access								
Metric	Net pharma spend as a % of healthcare spend		Time to availability (days)		Number of innovative medicines available annually		Rate of full public available medicines out of measured basket		Average days between marketing authorisation and medicine availability		Average speed of access
Year	2018		2016-19		2020		2020		2020		2016-20
Source	IQVIA[173]		EFPIA[174]		EFPIA[175]		EFPIA[176]		EFPIA[177]		PwC[178]
Type	Absolute	Indexed	Absolute	Indexed	Absolute	Indexed	Absolute	Indexed	Absolute	Indexed	Indexed
Belgium	-	-	440	70.7	75.0	10.4	49%	30.4	440	30.3	35.5
Canada	10%	11.1	-	-	-	-	-	-	-	-	-
China	-	-	-	-	-	-	-	-	-	-	-
France	15%	66.7	527	88.9	96.0	36.8	57%	42.1	527	12.1	45.0
Germany	17%	88.9	120	3.5	133.0	83.3	88%	87.2	120	97.5	67.9
Italy	17%	88.9	418	66.1	114.0	59.4	70%	61.0	418	34.9	55.4
Japan	17%	88.9	-	-	-	-	-	-	-	-	-
Norway	-	-	434	69.4	84.0	21.7	55%	39.1	434	31.6	40.5
Singapore	-	-	-	-	-	-	-	-	-	-	-
Spain	18%	100.0	453	73.4	82.0	19.2	51%	33.3	453	27.6	38.4
Sweden	-	-	262	33.3	90.0	29.3	32%	5.7	262	67.7	34.0
Switzerland	-	-	166	13.2	115.0	60.7	52%	34.8	166	87.8	49.1
UK	9%	0	334	48.6	110.0	54.5	43%	21.7	335	52.4	44.3
US	-	-	-	-	-	-	-	-	-	-	-

[173] IQVIA (2021). 'Drug Expenditure Dynamics 1995–2020: Understanding medicine spending in context', October 2021, Exhibit 1.
[174] EFPIA (2021). 'EFPIA Patients W.A.I.T. Indicator 2020 Survey', April 2021.
[175] EFPIA (2021). 'EFPIA Patients W.A.I.T. Indicator 2020 Survey', April 2021.
[176] EFPIA (2021). 'EFPIA Patients W.A.I.T. Indicator 2020 Survey', April 2021.
[177] EFPIA (2021). 'EFPIA Patients W.A.I.T. Indicator 2020 Survey', April 2021.
[178] PwC analysis (average of indexed values).



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