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The economic contribution of the UK Life Sciences industry

Final report

March 2017

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Foreword
ABPI and other Industry Bodies

'We will identify the sectors of the economy that are of strategic importance to our economy, and do everything we can to encourage, develop and support them.'

Prime Minister Theresa May, 5 October 2016

With the publication of the Government's recent green paper, 'Building our Industrial Strategy', the Prime Minister has begun delivering on her commitment to have a 'proper industrial strategy'. For the Life Sciences sector, much of the detailed work is underway and clearly establishes the industry as being of critical strategic importance to the UK economy.

PwC's commissioned review of the sector demonstrates that almost half a million UK jobs are supported by the Life Sciences sector, with the average GVA per employee over twice the UK average at £104,000. The activities of our companies directly contributed £14.5bn to the UK economy in 2015, with an additional £15.9bn provided through the Life Sciences supply chain and employee spending.

By coming together as the Life Sciences sector, for the first time we have a collaborative report to determine our economic impact in the UK. This report reinforces the great value that our sector, and members, bring at a crucial time of change and opportunity.

Mike Thompson
ABPI

Doris-Ann Williams MBE
BIVDA

Peter Ellingworth
ABHI

Steve Bates OBE
BIA

Foreword

Jo Pisani, Partner, PwC

We are pleased to support the ABPI and other industry bodies on this important piece of work and we thank the companies and industry bodies who have contributed and helped make this work possible.

Life Sciences is a critical industry for the UK. We have a strong scientific community and a proven track-record of developing innovative new treatments and medical technologies. We have all the ingredients needed for a thriving Life Sciences ecosystem.

The diversity of the UK Life Sciences sector makes it difficult to identify its economic contribution using existing government statistics. By conducting company-level analysis, our research sheds new light on UK Life Sciences. The company level database we have created also presents a new research resource that the ABPI can use to enhance understanding of the sector.

This summary report shows that Life Sciences is a major contributor to employment, taxes and GDP – providing high skilled and highly productive jobs.

These are by no means the only benefits the sector confers on the UK. As well as contributing to the economy, a vibrant UK Life Sciences sector is delivering life-saving and life-enhancing medical technologies to patients.

We hope this research will prove to be valuable in the development of the UK Life Sciences industrial strategy. The UK has the chance to grasp the opportunities presented through EU transition to reinvigorate the UK industry and maintain our world leading position.

Jo Pisani

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Executive summary

The Life Sciences sector makes a significant contribution to the UK's strength in innovation, which is a critical success factor for modern economies. The largest pipeline of biotech products in Europe is under development in the UK. Pharmaceutical R&D and products for diseases such as dementia and oncology support the Government's drive to improve UK healthcare outcomes. They also underpin its commitment to address global health challenges such as antimicrobial resistance (AMR), HIV/AIDS, and malaria.

Medical technologies, including emerging digital technologies and devices, are creating substantial opportunities to improve NHS efficiency and deliver improved UK healthcare. Life Sciences are driving a medical revolution, as the scientific discoveries of recent years are translated into patient treatments and products. The next wave of medical technologies creates the opportunity to bring further investment, new highly skilled jobs, and improved healthcare to the UK. The UK is already a global leader in Life Sciences which is why it should be at the heart of the government's Industrial Strategy.

In support of developing a Life Sciences sector strategy at this key juncture for the UK, the Association of the British Pharmaceutical Industry (ABPI) commissioned PwC, with the participation of the BioIndustries Association (BIA), the Association of the British Healthcare Industry (ABHI) and the British In Vitro Diagnostics Association (BIVDA), to generate a new estimate of the economic contribution of the Life Sciences sector to the UK economy. This evidence is offered to provide key insights to the government and other interested parties.

We believe this will prove to be a valuable resource at a time of significant change and opportunity for the sector. In particular, it will help inform the development of a new UK Life Sciences industrial strategy.

The key findings of this study are:

UK Life Sciences contributed £30.4bn to the economy in 2015

This contribution arises from the activities of pharmaceutical, medical technology and biotechnology research companies. We estimate that the direct contribution of the sector was £14.5bn. A further £7.8bn was contributed through indirect effects from the Life Sciences supply chain and £8.1bn arose from induced effects related to employee spending.

Life Sciences supported almost half a million UK jobs

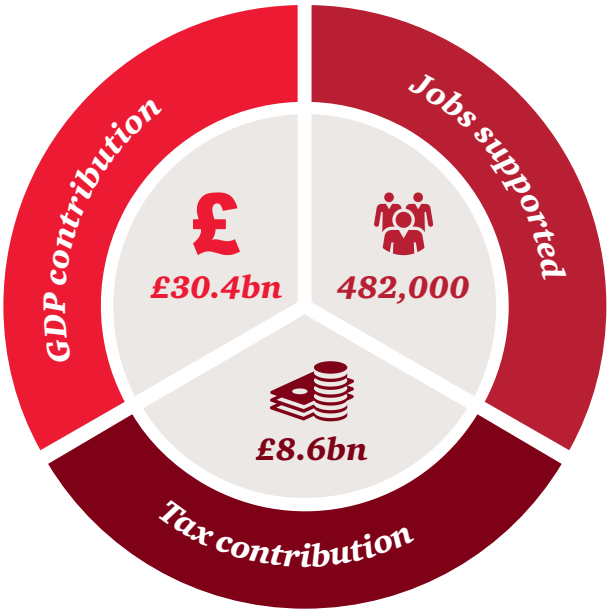
In 2015, we estimate that 482,000 UK jobs were supported by the Life Sciences industry. These comprise of 140,000 direct employees of Life Sciences firms, 196,000 jobs in the supply chain and 146,000 supported through induced effects.

Life Sciences were an important contributor to the Exchequer

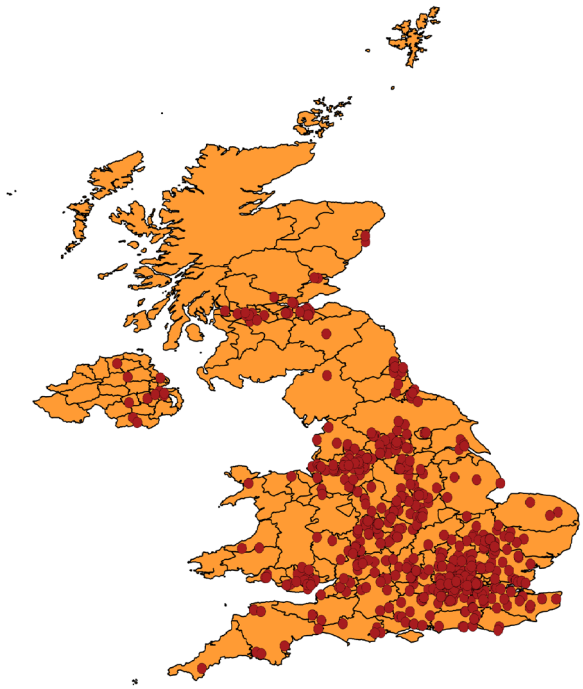
In 2015, we estimate that the UK Life Sciences industry made a tax contribution of £8.6bn across major tax groups such as Income Tax, National Insurance Contributions and Corporation Tax.

Summary of the contribution of UK Life Sciences

In 2015 the UK Life Sciences contributed £30.4 billion in UK GDP, supported 482,000 jobs and contributed £8.6 billion in taxes.



Life Sciences companies operate across the UK: every region contains a UK head office of a Life Sciences firm. Firms also have wider activities, such as R&D and manufacturing, spread across the UK.



Labour productivity is higher than other major European countries.

The average direct GVA per employee in UK Life Sciences is over twice the UK average.

Sources: PwC analysis, Office for National Statistics, Eurostat

1 Introduction

Objectives of this study

The Life Sciences sector makes a significant contribution to the UK's strength in innovation, which is a critical success factor for modern economies. The largest pipeline of biotech products in Europe is under development in the UK. Pharmaceutical R&D and products for diseases such as dementia and oncology support the Government's drive to improve UK healthcare outcomes. They also underpin its commitment to address global health challenges such as antimicrobial resistance (AMR), HIV/AIDS, and malaria.

Medical technologies, including emerging digital technologies and devices, are creating substantial opportunities to improve NHS efficiency and deliver improved UK healthcare. Life Sciences are driving a medical revolution, as the scientific discoveries of recent years are translated into patient treatments and products. The next wave of medical technologies creates the opportunity to bring further investment, new highly skilled jobs, and improved healthcare to the UK. The UK is already a global leader in Life Sciences which is why it should be at the heart of the government's Industrial Strategy.

Figures from the Office for National Statistics do not provide a clear picture as Life Sciences companies are spread across numerous industry sectors where they are mixed with non-Life Sciences companies.

The other key source of information on UK Life Sciences firms comes from the Office for Life Sciences whose 'Strength and Opportunity' database lists UK Life Sciences firms and estimates their turnover and direct employment[1]. As we describe in more detail later in this chapter, this source does not measure economic contribution, nor does it capture the impact the Life Sciences sector has on other sectors of the UK economy.

In support of developing a Life Sciences sector strategy at this key juncture for the UK, the ABPI commissioned PwC, with the participation of the BioIndustries Association (BIA), the Association of the British Healthcare Industry (ABHI) and the British In Vitro Diagnostics Association (BIVDA), to generate a new estimate of the economic contribution of the Life Sciences sector to the UK economy. This evidence is offered to provide key insights to the government and other interested parties.

We believe this will prove to be a valuable resource at a time of significant change and opportunity for the sector. In particular, it will help inform the development of a new UK Life Sciences industrial strategy.

Scope

The UK Life Sciences sector plays an important role in both the UK and wider global healthcare markets in helping to tackle long-term health challenges. It has been at the forefront of research and development in human medicines, advances in biotechnology and manufacturing of medical technologies.

For the purposes of this study, we have defined Life Sciences firms into three segments based upon the Standard Industrial Classification (SIC) system used by the UK Office for National Statistics and equivalent bodies around the world. Segmenting companies in this way allows us to draw upon existing data to identify Life Sciences firms. Further details on these segments can be found in Annex B.

Our categorisation of companies is based on how they describe their main activities in their annual returns filed at Companies House. In practice, the activities of some firms span more than one segment.

[1]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf

The three segments are:

- **Development and manufacture of Pharmaceuticals**: companies who focus on the development, manufacturing and sales of pharmaceutical products (e.g. GlaxoSmithKline, Roche, AstraZeneca);
- **Development and manufacture of Medical technology**: companies who develop, manufacture and market medical technology devices (e.g. Beckton Dickinson, Olympus Keymed); and
- **Life Sciences research**: companies primarily engaged in conducting Life Sciences research and experimental development within fields such as biotechnology, medicines and medical diagnostics and devices. These firms will often operate at the early pre-commercialisation stage (e.g. Amgen).

The analysis we undertake also captures the economic activity of the suppliers of these Life Sciences companies, (known as indirect effects) and wider economic effects arising from spending by employees (known as induced effects). We describe these measures in more detail in Annex A.

The scope of the study incorporates the UK activities of private sector companies only. We exclude Life Sciences activities undertaken by the other organisations such as charities and universities. The coverage is aligned to the membership of the ABPI and the other industry bodies that have participated in our study:

- The Association of British Healthcare Industries (ABHI) – the industry association for the medical technology sector in the UK;
- The UK BioIndustry Association (BIA) – the trade association for companies involved in the UK bioscience sector many of which focus on research into new medicines; and
- The British In-Vitro Diagnostics Association (BIVDA) – the industry association for the manufacturers and distributors of in-vitro diagnostic products in the UK.

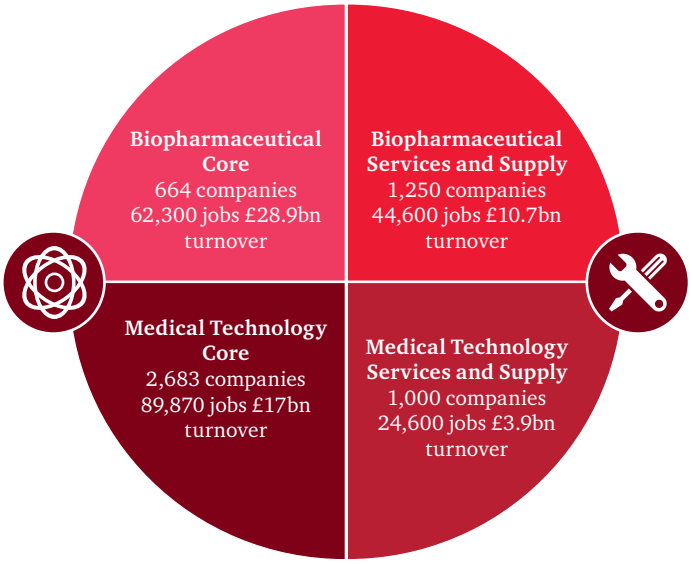
Context: the Life Sciences industry

Whilst there is a lack of a comprehensive assessment of the economic contribution of Life Sciences, existing research highlights the overall importance of the sector. A recent study by the German Life Sciences research organisation Wirtschaftsforschung (WiFor), estimated that the 40 largest pharmaceutical firms contributed €34.6bn to the European economy with an additional €43.3bn in 'spillover' effects[2].

In the UK, a 2015 study published by the Office for Life Sciences (OLS – part of the Department of Health and Department of Business, Energy & Industrial Strategy), identified 5,633 companies related to Life Sciences with a combined annual turnover of £60.7bn and employment of 222,000 in 2015. The results of the OLS study are summarised in Figure 1.1 below.

It is important to highlight that the turnover figures estimated by the OLS do not constitute Life Science's economic contribution. Turnover should not be compared with measures of economic contribution like Gross Domestic Product (GDP) or Gross Value Added (GVA). Turnover will always be higher than GDP and GVA as both net-off certain costs of production when calculating value. In some cases, companies with hundreds of millions of pounds of turnover make a small economic contribution, some companies have a negative contribution to GDP or GVA if their cost of brought in goods and services exceeds their turnover.

Fig 1.1: Key findings of the Office for Life Sciences 'Strength and Opportunity 2015'



Total turnover: £60.7bn **Total direct employment: 222,000**

Source: Office for Life Sciences

As we describe in the approach section in Annex A, we start with the company list developed by the OLS in our work. Our analysis then builds upon it by:

- Estimating the economic contribution (value added) of Life Sciences, rather than turnover;
- Capturing the tax contribution of the sector; and
- Using multipliers to value the broader economic and employment contribution of Life Sciences in other parts of the economy.

[2]Study Available at: http://eng.wifor.de/

[3]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf

Shaping the future of UK Life Sciences

Since launching the Life Sciences Strategy in 2011, the Government policy agenda has continued to evolve. Life Sciences is now within the portfolio of two ministers in the Department for Health: Lord O'Shaughnessy, Parliamentary Under Secretary of State for Health and Nicola Blackwood, Parliamentary Under Secretary of State for Public Health and Innovation. Within the Department for Business, Energy, and Industrial Strategy, Lord Prior of Brampton, has responsibility for Life Sciences and industrial strategy and Jo Johnson, Minister of State for Universities and Science, has responsibility for industrial strategy, universities and higher education reform and innovation.

Together, these ministers are leading on a number of key initiatives which we hope this study will help inform. These include:

1. **Industrial Strategy**: The sector is collaborating to develop a new Life Sciences industrial strategy that will help to strengthen the UK's role as a global leader in research and innovation for Life Sciences[4].
2. **How the UK leaves the European Union**: The UK's vote to leave the European Union has the potential to have a significant impact on the UK Life Sciences industry. The key issues that need to be considered include: regulation, medicines approval, trade and single market access, pan-EU research, labour market access and intellectual property rights.
3. **Accelerated Access review**: This review, published in October 2016[5], seeks to improve patient access to innovative medicines and medical technologies and improve outcomes for patients as well as enabling the UK Life Sciences sector to increase its competitiveness in the global arena.

The remainder of this report is structured in the following three chapters:

- Chapter two details our results on the UK contribution of Life Sciences;
- Chapter three includes national and international comparisons; and
- Chapter four contains our conclusions.

A set of Annexes describes our methodology along with additional detailed information relating to the study.

[4]https://beisgovuk.citizenspace.com/strategy/industrial-strategy/supporting_documents/buildingourindustrialstrategygreenpaper.pdf

[5]Available at https://www.gov.uk/government/publications/accelerated-access-review-final-report

2 The economic contribution of UK Life Sciences

This chapter contains the key findings from our assessment of the economic contribution of the UK Life Sciences sector. We begin by describing its aggregate contribution to the UK economy, employment and tax. We then describe geographical and segment level results for UK Life Sciences.

We show that:

- UK Life Sciences is a major contributor to the economy: in 2015, we estimate that it supported £30.4bn in GVA[6], 482,000 jobs and £8.6bn in tax payments.
- Within Life Sciences, the greatest contribution to GVA came from pharmaceutical development and manufacturing companies. We estimate they account for 52% of total Life Sciences GVA.
- The Life sciences industry provides high value jobs across the whole of the UK. Major clusters can be found in East Anglia, Wales and the South East of England[7].

GVA contribution of the UK Life Sciences industry

The Life Sciences industry's contribution to the UK economy is measured by the GVA it generates. Our GVA estimates incorporate three separate components:

- **The direct contribution** – the economic value generated by Life Sciences firms themselves;
- **The indirect contribution** – the economic contribution from the supply-chain which arises as Life Sciences companies purchase goods and services from UK-based suppliers which generates further GVA and employment amongst these suppliers;
- **The induced contribution** – results from spending by employees of Life Sciences companies and their suppliers on goods and services for their own consumption. For example, this captures the effect of Life Sciences companies' employees' spending their wages at restaurants in the UK.

Our key results are shown in Figure 2.1. We estimate that the UK Life Sciences industry contributed £30.4bn to the UK economy in 2015 with just under half the total (£14.5bn) being accounted for by direct GVA.

UK Life Sciences contributed £30.4bn to the UK economy in 2015

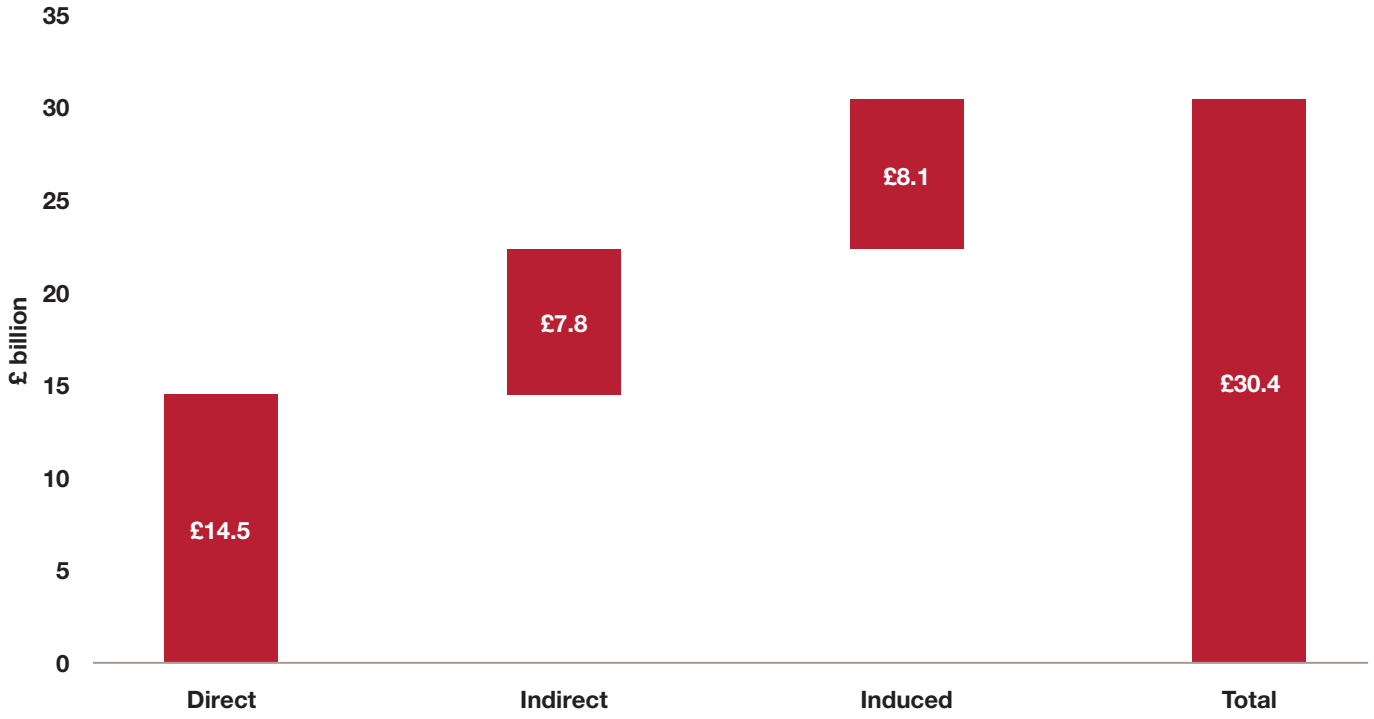
The indirect GVA contribution arising from the Life Sciences supply chain added a further £7.8bn. The induced effects of employee spending result in an additional contribution of £8.1bn to the economy.

This impact is significant. As we present in the following chapter, the scale of the Life Sciences Sector is comparable to other major UK production industries like oil and gas and aerospace. It is also important to be aware of the differences between this economic measure and turnover based measures. This is explained in more detail in Box 1 on page 12.

[6]Gross Value Added a linked measure to Gross Domestic Product (GDP) and is commonly used to measure the contribution of an individual company or sector. It is equivalent to GDP excluding taxes and subsidies on products.

[7]Based on registered office location.

Fig 2.1: Contribution of UK Life Sciences to GVA, 2015, £ billion



Sources: PwC analysis, FAME, Companies House.

Employment in the UK Life Sciences industry

The economic contribution of the UK Life Sciences industry can also be expressed in terms of the number of jobs the industry supports in the UK. We estimate that Life Sciences supported 482,000 jobs in 2015.

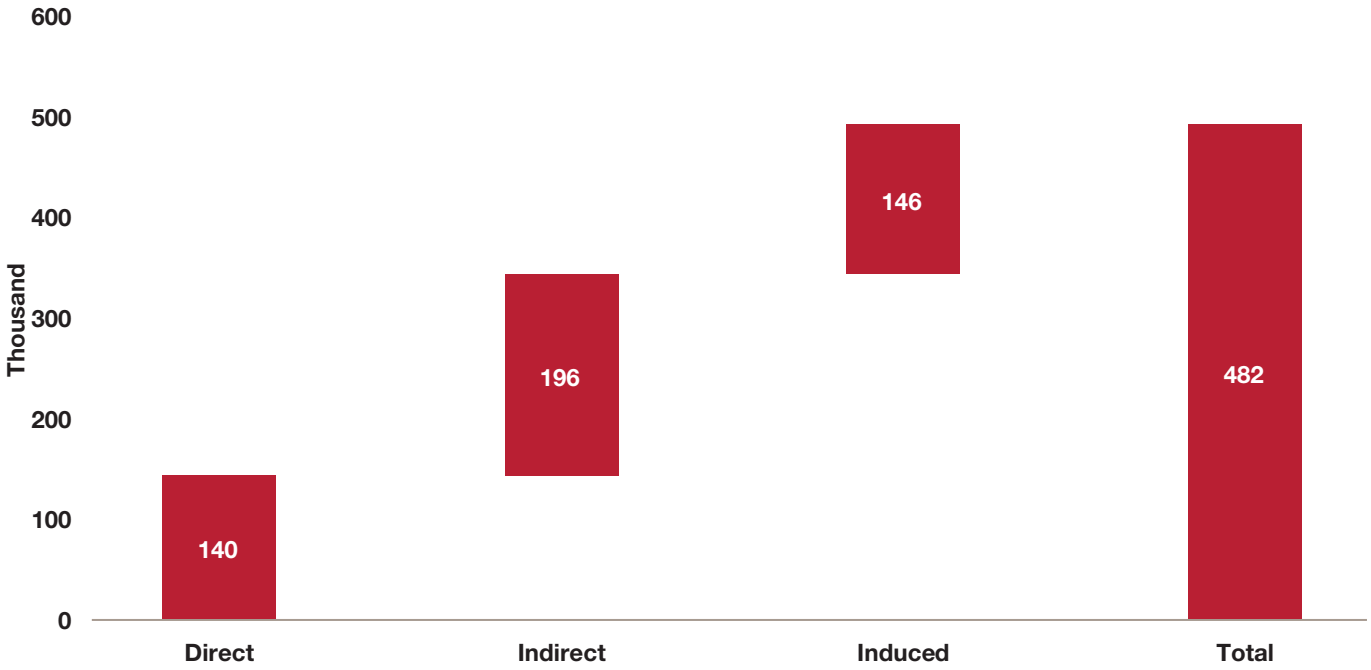
This comprised of 140,000 direct jobs, 196,000 indirect jobs in companies in the Life Sciences supply chain and 146,000 jobs through induced effects.

UK Life Sciences supported 482,000 jobs in 2015

The contribution of Life Sciences in the broader economy is greater for employment than GVA. Each direct Life Sciences job supports 2.5 jobs elsewhere in the UK economy, whilst each £1.00 of direct Life Sciences GVA supports £1.10 elsewhere in the economy. This difference is because Life Sciences jobs have high labour productivity that is more than twice the UK average. As a result, they have a disproportionate impact on jobs through the multiplier effect[8].

[8]We include productivity figures in the next chapter.

Fig 2.2: Contribution of UK Life Sciences to employment, 2015, thousand



Sources: PwC analysis, FAME, Companies House.

Box 1

Differences with the Office for Life Sciences turnover estimates

The economic measures we present in this chapter are not directly comparable with the OLS figures described in the introduction. The OLS estimated that there are 222,000 Life Sciences jobs in the UK across firms with a combined turnover of £60.7bn.

These figures are produced using a different methodology to our own. So the two measures cannot be compared on a life-for-like basis. Below we highlight the two key differences, more details on our approach can be found in Annex A:

1. 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.
2. Use of GVA rather than turnover: We estimate GVA whereas the OLS estimate turnover. GVA is a better measure of economic contribution than turnover because it takes account of the costs of the goods and services needed to generate turnover. The two measures should not be compared, turnover is likely to exceed GVA although, in some cases, research intensive businesses can have a negative GVA because they are not yet earning sufficient revenue from their products.

Tax contributions of the UK Life Sciences industry

A third measure of the economic contribution of the Life Sciences industry is the contribution to taxes in the UK. We have estimated this contribution across three types of taxes:

- **Product taxes** – are linked directly to the sale of a good or service. Examples include excise on alcohol and tobacco, insurance taxes and Value Added Tax;
- **People taxes** – include payroll taxes such as Income Tax and National Insurance Contributions; and
- **Other taxes** – we have grouped other taxes together as these are smaller in terms of their revenue. This category 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.

We estimate that the UK Life Sciences industry made a tax contribution of £8.6bn in 2015 across these categories. This comprised of a direct tax contribution of £3.7bn and a combined indirect and induced tax contributions of £4.9bn. The largest contribution came from people taxes that account for over half of the total.

UK Life Sciences contributed £8.6bn to the exchequer in 2015

It is important to highlight that GVA is based on pre-tax financial measures such as operating profit and total employee costs. The tax contribution is, therefore, largely captured in our £30.4bn measure of GVA contribution and the £8.4bn tax contribution should not be considered as additional.

Fig 2.3: Tax contribution of UK Life Sciences, 2015, £ billion

Sources: PwC analysis, FAME, Companies House

Different segments within the Life Sciences industry

Recognising that the UK Life Science industry is diverse, We also present our results across three broad segments. We examine:

- Development and manufacture of pharmaceutical products;
- Development and manufacture of medical devices; and
- Life Sciences research.

These categories are based on the Standard Industrial Classifications (SIC) system used by the ONS and equivalent statistical bodies around the world. Further details on each of the segments can be found in Annex B.

The majority of ABPI members are contained within the development and manufacture of pharmaceutical products category. ABHI members are mostly part of the development and manufacture of medical devices segment. Most BIVDA members are in the Life Sciences research category and BIA members are spread across Life Sciences research and the development and manufacturing of pharmaceutical products.

Figure 2.4 shows the relative importance of each of these segments in terms of their GVA, employment and tax contributions.

The biggest economic contribution comes from pharmaceutical companies. Together they contribute 52% of total Life Sciences GVA (£15.7bn). However, pharmaceuticals have a bigger impact on jobs, contributing 65% of the total (312,000). The next biggest contribution comes from medical device manufacturers who contribute 38% of GVA (£11.5bn) and 30% of jobs (144,000).

Pharmaceutical companies are the largest segment within UK Life Sciences

Pharmaceutical companies have a greater impact on jobs than GVA because of the high employment multiplier: we estimate that each job generates 3.4 additional jobs elsewhere in the economy. We estimate that the equivalent multiplier for medical technology firms is 1.6 jobs.

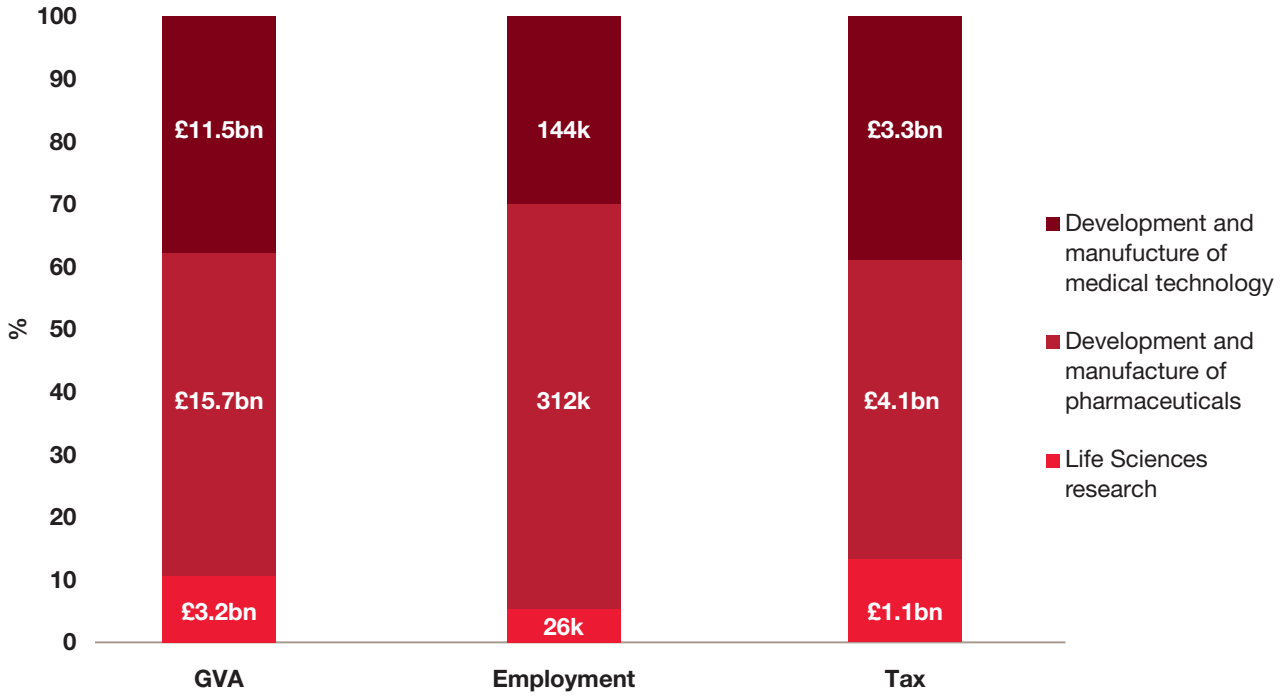
Medical technology firms will often operate in an industry structure that is similar to the automotive sector. The final company often acts as an integrator of components manufactured by suppliers who are high-tech manufacturers themselves with high labour productivity. This means that medical device firms can generate a large GVA contribution in the supply chain, but have a relatively smaller impact on jobs.

Life Sciences research companies represent the smallest of the three segments we assess. In 2015, they contributed £3.2bn in GVA, 26,000 jobs and £1.1bn in taxes. This only tells part of their story as a pre-commercialisation research company will often generate little or no revenue but accrue significant costs in the development of new treatments and medical technology. As a result, many will make a negative contribution to GDP when viewed through a single year's accounting figures[9].

However, through the successful development of new treatments and technology, these firms may drive a positive contribution in the future, when their developments reach the marketplace. In the same way, the contribution of pharmaceutical and medical manufacturers today reflects the research and development they have conducted in the past.

[9]This was the case for around 60 companies in our sample.

Fig 2.4: Share of Life Sciences GVA, employment and tax by segment, 2015, %



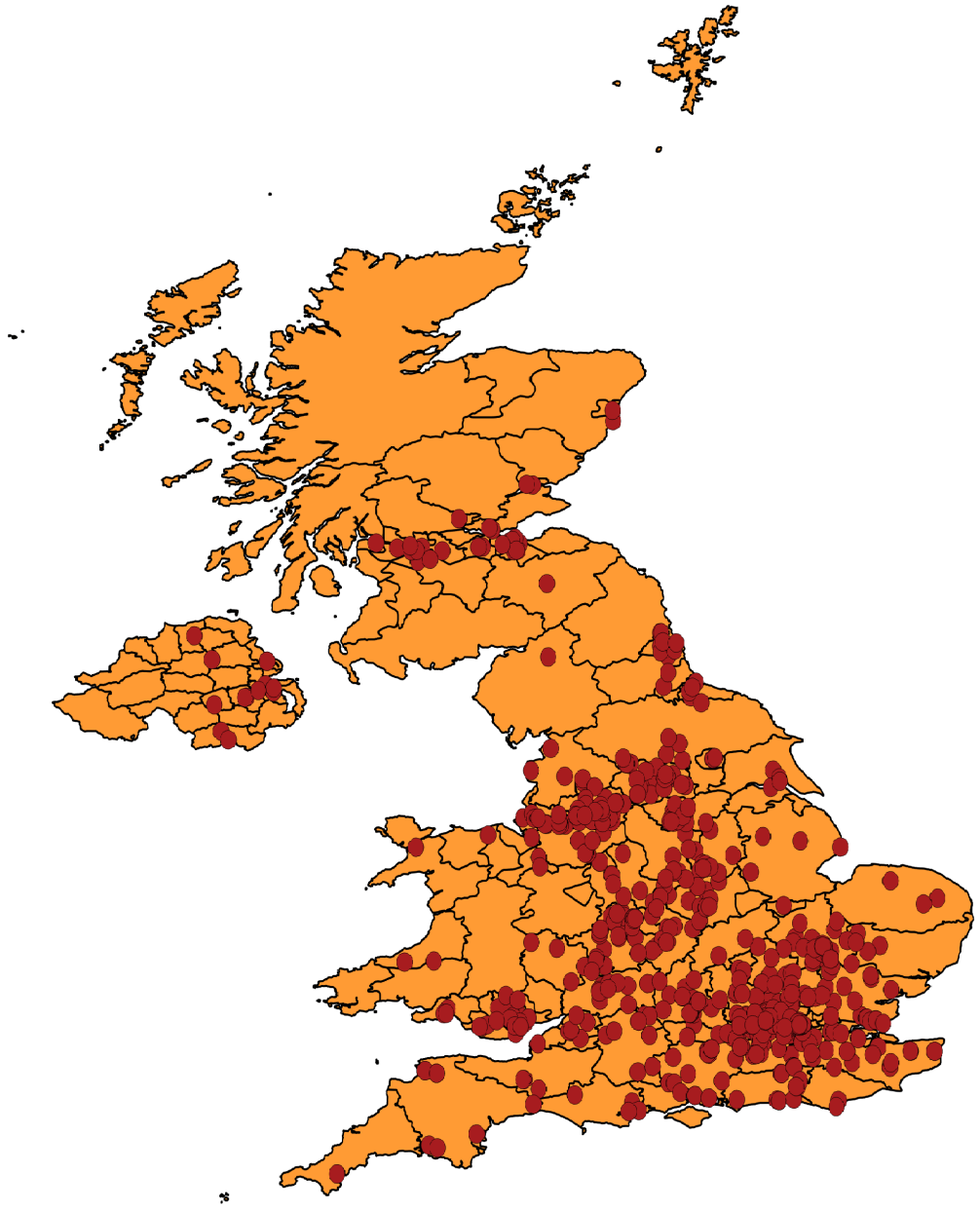
Sources: PwC analysis, FAME, Companies House.

The Life Sciences industry across the UK

Our data also allow us to illustrate where Life Sciences firms are based in the UK. Figure 2.5 shows the locations of the registered UK offices for all 1,700 Life Sciences entities included in our analysis[10].

This illustrates the depth and breadth of UK Life Sciences. Every region of the UK hosts Life Sciences companies.

Fig 2.5: Locations of registered offices of Life Sciences companies



Sources: PwC analysis, FAME, Companies House.

[10]UK registered offices listed in company returns. Because our analysis is conducted at the level of business entities we are only able to show the registered offices on this chart, so locations that are not the registered office will be omitted from this.

3 Comparisons with other industries

This chapter contains national and international comparisons. It demonstrates that UK Life Sciences:

- Makes a larger economic contribution than other major UK sectors such as aerospace and oil and gas;
- Provides highly skilled, high value jobs that have an average GVA per employee (a measure of labour productivity) that is over twice the UK average; and
- Is more productive than in any other major European economy: GVA per employee is 40% higher than in Italy and Germany, the next highest nations[11].

Overall contribution to the economy

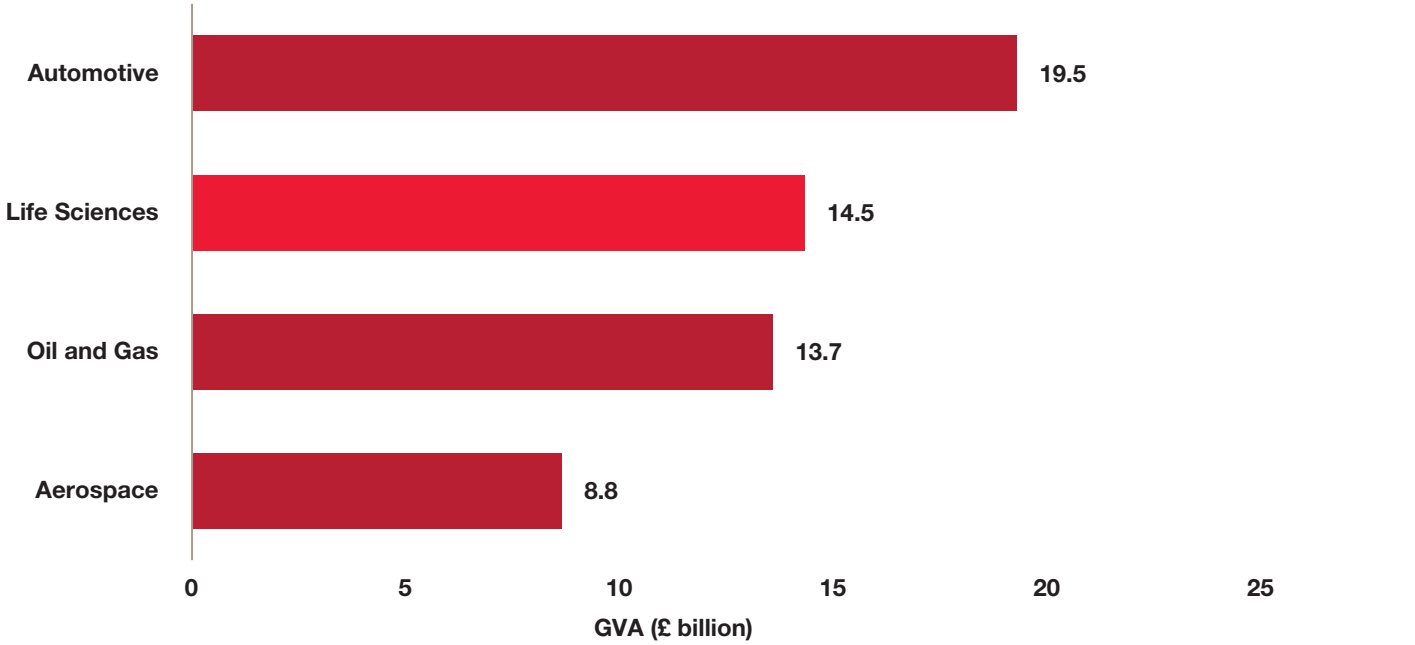
This chapter compares Life Sciences with other high-tech and innovative UK production industries: automotive, oil and gas and aerospace[12]. To compare these sectors with Life Sciences we only include the direct contribution, not the indirect and induced contribution.

Figure 3.1 compares the direct GVA contribution of the different industries. The Life Sciences sector is larger than aerospace (which includes major companies like BAE Systems) and slightly larger than the oil and gas industry (which includes the UK activities of major companies like BP). It is also three-quarters of the scale of the UK automotive industry.

[11] Based on Pharmaceutical manufacturing only

[12] We have chosen these industries, as they were also included in the Government's industrial strategy work, first published in 2013. https://www.gov.uk/government/collections/industrial-strategy-government-and-industry-in-partnership. Like Life Sciences, these comparators are also high-tech sectors which provide high value jobs.

Fig 3.1: Direct GVA of selected sectors, current prices, 2015, £ billion

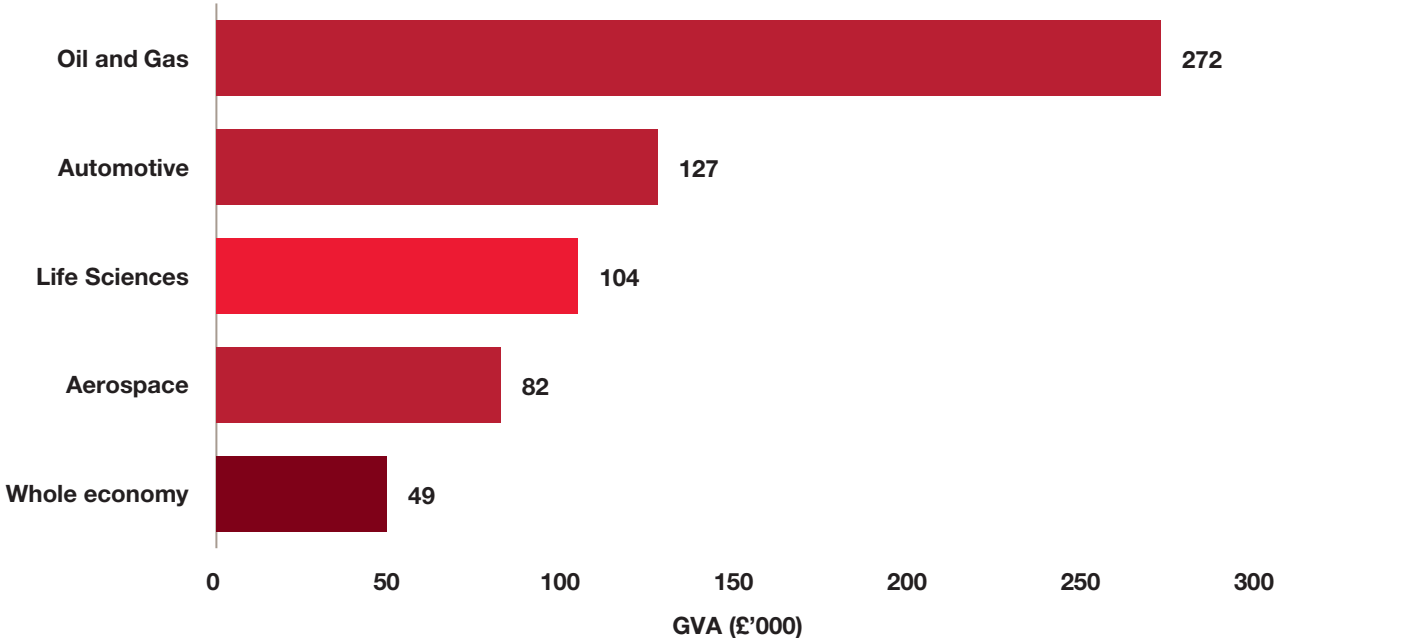


Sources: PwC analysis for Life Sciences, other sectors sourced from the Annual Business Survey.

Labour productivity

Another comparison is the direct GVA per employee, a measure of labour productivity. From this, we can determine how far an industry is producing high value, well-paid jobs. Figure 3.2 compares the GVA per employee of the Life Sciences sector with that of other industries.

Fig 3.2: Direct GVA per employee of selected sectors, current prices, 2015, £'000



Sources: PwC analysis for Life Sciences, other sectors sourced from the Annual Business Survey. Whole economy figure relates to the UK non-financial business economy.

We can see that the Life Sciences industry compares favourably to aerospace and is around 80% as productive as the automotive sector. The oil and gas sector, however, leads the way in terms of GVA per employee, with a value close to three times that of Life Sciences. Oil and gas is an exceptionally capital intensive sector with relatively few employees.

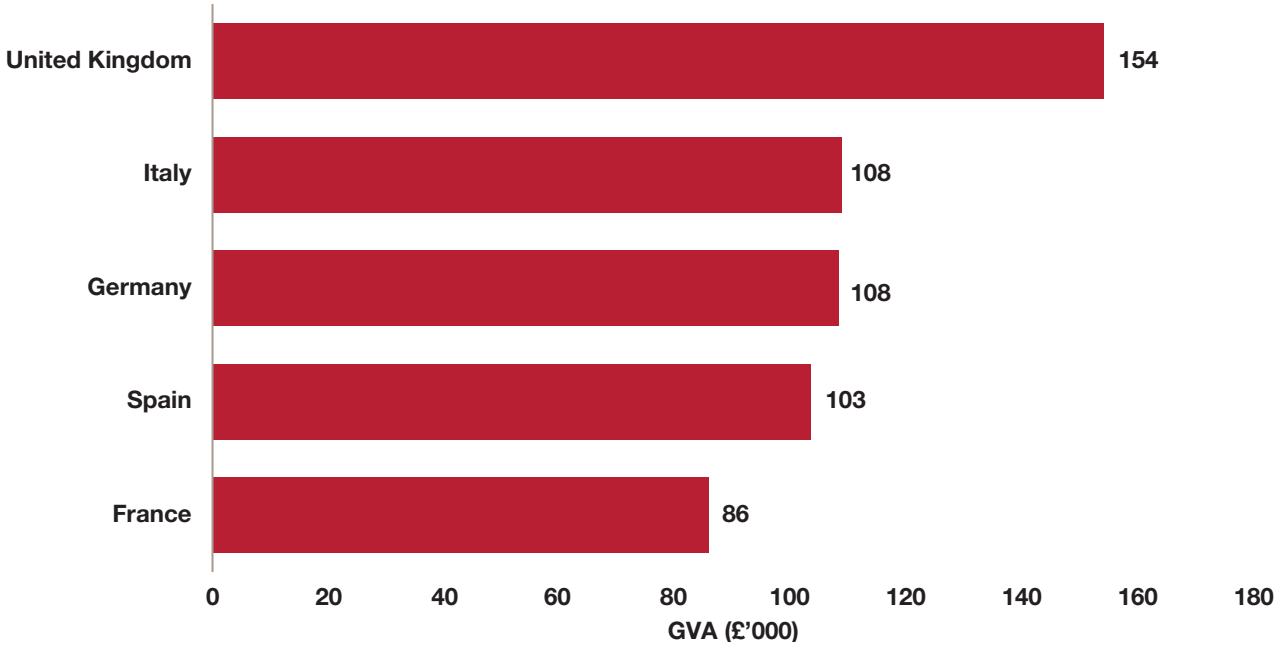
These industries are amongst the most productive in the UK. Comparisons to the UK average level of GVA per worker show that Life Sciences is twice as productive as the national average.

Comparison to other major European nations

Another way of contextualising the UK Life Sciences industry is to compare it to those elsewhere in Europe. Unfortunately, other EU countries do not measure Life Sciences in a comparable way, but we are able to assess the pharmaceutical manufacturing segment using data from Eurostat.

Figure 3.3 shows the GVA per employee in the manufacture of pharmaceutical products for the five largest European economies. It shows that the UK's pharmaceutical manufacturing sector boasts productivity levels that are 40% higher than Germany and Italy, 50% higher than Spain and almost twice the level achieved in France.

Fig 3.3: Direct GVA per employee of manufacture of pharmaceutical products, current prices, 2014, £'000



Sources: PwC analysis, Eurostat. Note this data is also presented in Figure 3.10 of the ABPI UK Biopharma R&D Sourcebook 2016, it has been converted from euros to pounds. http://www.abpi.org.uk/our-work/library/industry/Pages/Open-for-Innovation-ABPI-Sourcebook-2016.aspx


MP70
Anesthesia
12-2005
EXTREME BRADY
49
100
30
4.0
0.0
SHOULD THE TOUCH SCREEN MALFUNCTION
USE THE SPEED POINT KNOB
WMID NHS 2138
Vol %
Push On
Sevoflurane
Use Only Isoflurane

4 Conclusions

Our study provides evidence of the significant economic contribution that the Life Sciences industry makes to the UK economy. We estimate that in 2015 it generated £30.4bn in GVA once indirect and induced effects are included, it employed 482,000 people and contributed £8.6bn in taxes.

The largest economic contribution comes from companies that develop and manufacture pharmaceutical products. We estimate that they contributed 52% of total Life Sciences GVA (£15.7bn) and 65% of jobs (312,000).

Companies that develop and manufacture medical devices are estimated to contribute 38% of Life Sciences GVA (£11.5bn) and 30% of jobs (144,000).

Life Sciences research companies represent the smallest of the three segments we assess. In 2015, they contributed £3.2bn in GVA, 26,000 jobs and £1.1bn in taxes. This does not, however, reflect their potential longer term economic value. A pre-commercialisation research company will often generate little or no immediate revenue but accrue significant costs in the development of new treatments and medical technology. As a result, many will make a negative contribution to GDP when viewed through a single year snapshot – but they will make a positive economic contribution in the future, as developments reach the marketplace.

The sector provides highly skilled, high value jobs with more than twice the average level of UK labour productivity. The companies and jobs are located in all regions of the UK.

The UK Life Sciences industry also compares favourably against its European counterparts. UK pharmaceutical manufacturing is the most productive of any of the major European nations. GVA per employee in 2014 was 40% higher than in Germany and Italy, and almost twice the level in France.

The UK has the unique chance to grab the opportunities presented through EU transition to reinvigorate the industry.

We believe our work can help achieve this goal through:

- Helping to understand the geographical and sectoral make-up of UK Life Sciences;
- Identifying the linkages in the Life Sciences supply chain; and
- Understanding the areas of Life Sciences that are thriving, and which are not.

Our database provides a valuable new resource for further work.

Replicating this study in the future would add to its value by allowing company level and aggregate trends to be tracked and assessed over time.

Annexes

Annexes

The Annexes provide further details of our method. They are structured as follows:

- Annex A: Approach
- Annex B: Definition of Life Sciences segments based on the Standard Industrial Classification
- Annex C: Treatment of companies with multiple UK entities
- Annex D: Small company archetypes
- Annex E: Company surveys and Life Sciences specific multipliers

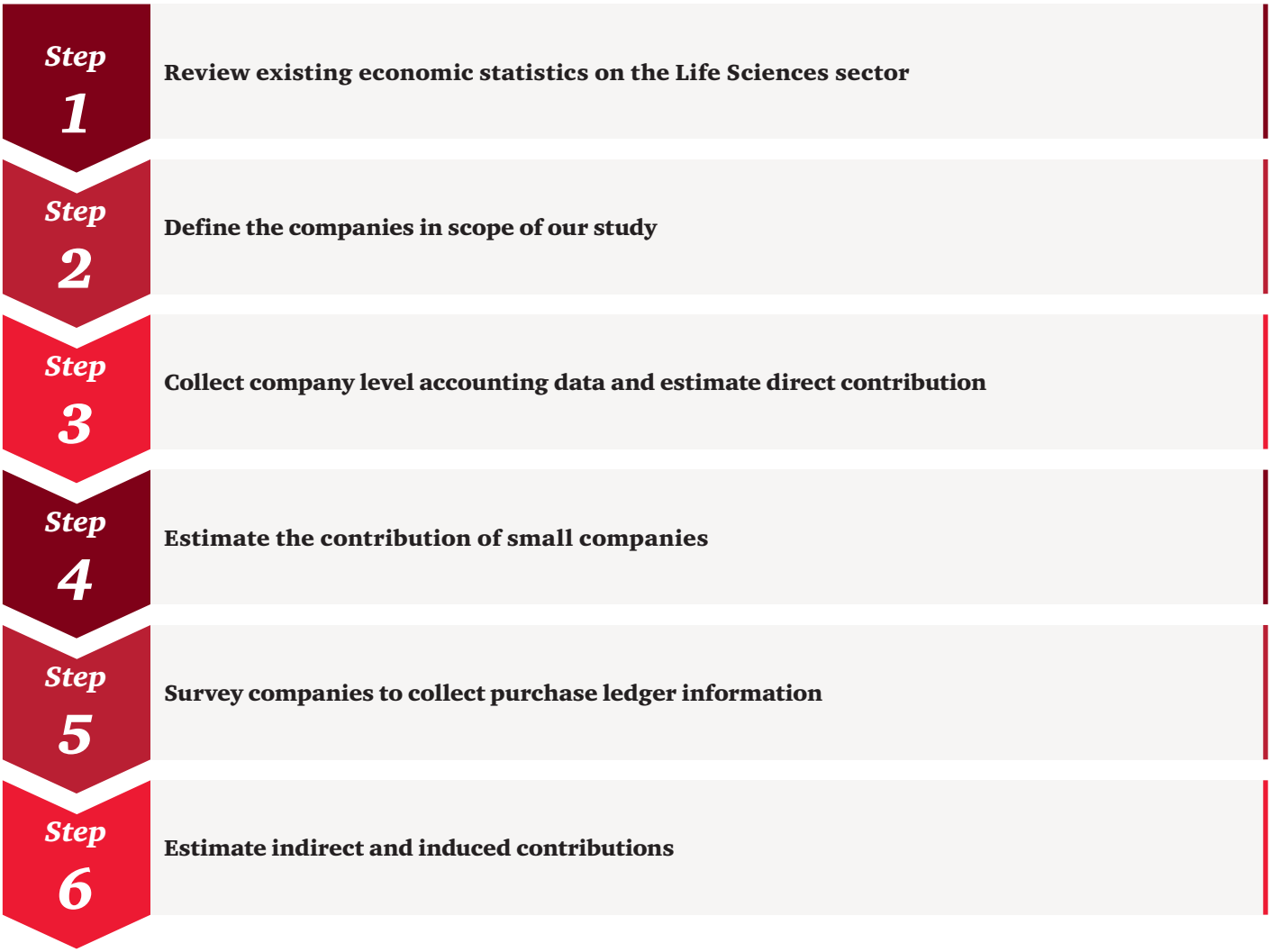
Annex A: Approach

This Annex explains our approach to estimating the economic contribution of the Life Sciences industry. We measure this contribution in terms of Gross Value Added (GVA)[13], the number of jobs supported and the sector's tax contribution.

Our broad approach has been to collate financial data at company level and estimate their GVA and employment. These data are then combined to estimate the overall economic contribution of the industry.

We then use economic and employment multipliers to estimate the additional contribution that arises from the spending on suppliers and by employees in the wider economy. These are commonly referred to as indirect and induced effects. Figure A.1 below provides an overview of the six key steps in our approach.

Fig A.1: Outline of our approach



Source: PwC

[13] Gross Value Added a linked measure to Gross Domestic Product (GDP) and is commonly used to measure the contribution of an individual company or sector. It is equivalent to GDP excluding taxes and subsidies on products.

Step 1: Review existing economic statistics on the Life Sciences sector

Our starting point was to assess the economic data currently available on UK Life Sciences. The two key sources are the Annual Business Survey (ABS) and the 'Strength and Opportunity Database' produced by the Office for Life Sciences (OLS).

The ABS is the main business survey conducted by the Office for National Statistics (ONS). It collects financial information for non-financial private sector firms that represent around two-thirds of the UK economy.

The ABS segments companies into broad industry groups (using the Standard Industrial Classification (SIC)). However, Life Sciences companies are found in a wide range of SIC groups and, they only account for a small part of the SIC group to which they are assigned. Given this, the data published by the ABS cannot be used to assess the economic contribution of Life Sciences firms reliably.

The OLS produces an annual database of 5,633 firms that operate in the UK Life Sciences sector. This is a valuable resource, which also includes data on total turnover and employment related to Life Sciences activities, but not the contribution to GVA, tax or multiplier effects.

Figure A.2 summarises the key differences between the analysis that we undertake in this study and the existing data.

Fig A.2: Key differences in scope between PwC analysis and other studies

Metric	PwC analysis	ABS	OLS
Turnover	✓	✓	✓
Employment	✓	✓	✓
GVA	✓	✓	✗
Indirect and induced multipliers	✓	✗	✗
Life Sciences specific estimates	✓	✗	✓

Source: PwC

[14] Part of the Department for Business, Energy and Industrial Strategy

Step 2: Define the companies in scope of our study

Our analysis was conducted at company level so we collated a list of relevant companies to include in the data collection process. These companies were used to estimate the direct economic contribution. The principles behind assembling this list were that:

- We used a definition of Life Sciences activities centred on research, pharmaceuticals and medical technology. We excluded downstream activities such as retail, wholesale and the provision of healthcare (i.e. activities relating to hospitals or GPs).
- Because our multiplier analysis captures economic contributions in the supply chain, we excluded companies who supply the research, pharmaceuticals and medical technology firms described above to avoid double counting their contributions.

To develop the company list for our data collection process we used the OLS database as our starting point. We distinguished between companies identified as 'Core' and 'Service and Supply' in the OLS database. All 'Service and Supply' companies were excluded on the grounds that their operations should be captured in our multiplier analysis.

Following a review of the companies within the database, we selected only those SIC groups that were aligned to our definition of Life Sciences. These are firms engaged in:

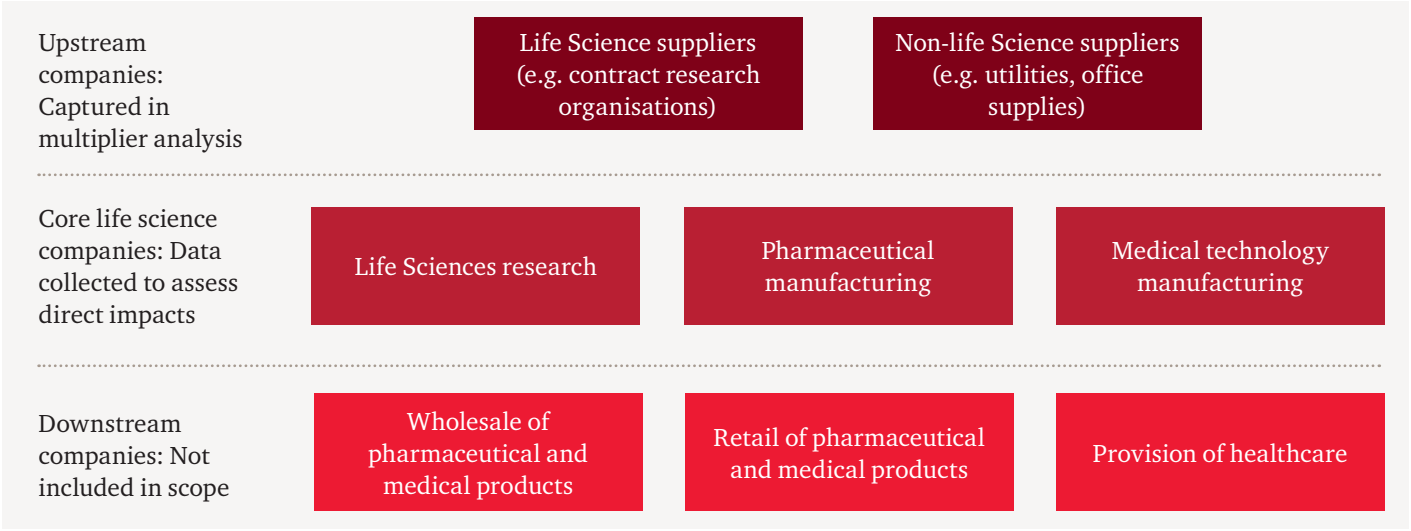
- Development and manufacture of pharmaceutical products;
- Development and manufacture of medical devices; and
- Conducting Life Sciences research and experimental development within fields such as biotechnology, medicines and medical diagnostics and devices: these firms often operate at the early pre-commercialisation stage.

In total, we include 27 different SIC groups within the company list. A full list of the SIC groups that we include under each of these categories can be found in Annex B.

Our final step in assembling the company list was to compare it to the current membership lists of the ABPI, ABHI, BIVDA and BIA. Any companies that were not in the OLS database but met our criteria were added. Because the most recent published OLS database uses 2015 data, this allowed us to capture companies that have recently joined the organisations as well as recent start-ups.

Overall, this approach resulted in an initial selection of around 1,700 companies for our data collection process.

Fig A.3: Scope of our study



Source: PwC

Step 3: Collect company level accounting data and estimate contribution

To estimate the direct value added of the companies identified in Step 2, we extracted data from the accounts of over 550 large companies from the sample selected in Step 2.

We used two principal sources to collect the financial data for each company:

- The FAME company database (produced by Bureau Van Dijk); and
- Companies House.

We used the financial data collected to calculate the direct GVA of each company (i.e. its contribution to the UK economy). GVA was calculated by combining operating profit, employee costs, depreciation and amortisation and impairment. This is consistent with the national accounting methods used by the ONS and in previous publications such as the Value Added Scorecard[15]. Figure A.4 outlines the components of GVA.

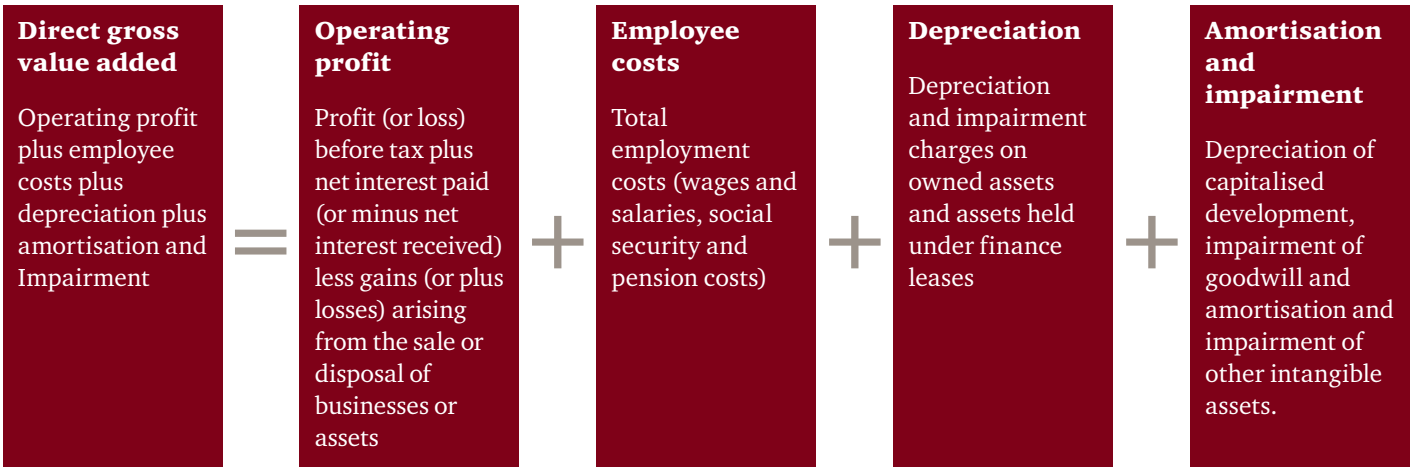
Data were collected on companies for 2015[16].

A number of Life Sciences companies, typically larger companies and those with operations in multiple countries, have multiple UK business entities. Where this was the case, we examined each active UK entity and included only those that met our criteria[17].

A small number of UK based multinationals also incorporate value generated in other countries in their UK accounts. Where this was the case, we adjusted their direct GVA and employment based on the share of non-UK based employment. Employment data were obtained from FAME and Companies House for most companies.

Our study also includes the tax contributions of the industry. Because companies do not report all their tax payments in their statutory accounts, we used data from the Office for National Statistics on typical ratios between GVA and tax to estimate these values[18].

Figure A.4: Components of gross value added



Source: PwC

[15] http://webarchive.nationalarchives.gov.uk/20100908131539/http:/innovation.gov.uk/value_added/downloads/2009_ValueAdded_Analysis.pdf

[16] In practice, companies have different financial years so the data may cover all or only part of 2015. No adjustments were made to account for this. The only adjustments made to the base data was in cases where accounting figures did not apply to a 12-month period. In these cases the results were pro-rated.

[17] As set out in Step 2, only those entities which operate in Life Sciences activities, or are directly supporting Life Sciences activities were included.

[18] Based on data from UK input-output tables.

Step 4: Estimate the contribution of small companies

Small companies (defined as those with an annual turnover below £6.5m, and assets worth less than £3.26m) are not required to provide a profit and loss account to Companies House. Whilst some small companies voluntarily do so, the majority do not. Given the data we need to calculate GVA are contained in the profit and loss account, we needed to estimate the economic contribution of small companies in our study.

We used the following approach for small companies:

- We randomly selected a sample of small firms across the three main segments (research, pharmaceutical manufacturing and medical technology manufacturing) from the list assembled in Step 2.
- We collected financial and employment data for these companies. As few companies with turnover below £6.5m publish this data, we used a turnover definition of up to £15m to obtain a larger data set. We collected data for 107 companies within this turnover threshold[19].
- We used this company data to define 'archetype' characteristics for each of the three segments. These characteristics represented the median ratios of turnover to GVA, employment and employee compensation.
- The archetype ratios were used to estimate the employment and GVA of small firms using their reported turnover from the OLS database[20]. Further details on the ratios used can be found in Annex D.

Step 5: Survey companies to collect purchase ledger information

We have an in-house model that estimates multipliers based on the supply and use tables published by the ONS.

However, Life Sciences firms do not fit within the ONS's Standard Industrial Classifications so we estimated bespoke multipliers as part of this study. To do this, we collected data on the external purchases made from suppliers and their employee compensation payments.

We worked with the ABPI, BIA, ABHI and BIVDA to survey members. We received 34 responses from companies that account for over £10bn in revenue in the sector[21]. We used these data to estimate multipliers for the Life Sciences research, pharmaceutical manufacturing and medical technology segments.

Further details on the survey can be found in Annex E.

Step 6: Estimate indirect and induced contributions

The final step in our approach was to use the multipliers developed in Step 5 to estimate the wider contribution of the Life Sciences sector. This was done by combining the multipliers with the estimates of direct economic and employment contribution.

There are two types of multiplier:

- ***The indirect multiplier:*** this measures the economic contribution in the supply-chain that would be expected from Life Sciences companies' purchases of goods and services from UK based suppliers.
- ***The induced multiplier:*** this captures the economic contribution of spending by employees of the companies and their suppliers on goods and services for their own consumption. For example, this would include the effect of ABPI members' employees' spending their wages at restaurants in the UK.

Annex E contains the estimated multiplier values that we use.

[19] Because of the lack of data available for the smallest companies (less than £5m revenue), this approach assumes that their characteristics are the same as those of slightly larger companies (up to £15m in revenue). This may increase the margin of error for the estimates of smaller companies, but with 90% of our estimated GVA coming from companies with £5m turnover and above, we believe the impact on the overall results is likely to be immaterial.

[20] The OLS database only provides turnover ranges so we take the mid-point of the range.

[21] The survey response rate was approximately 10%.

Definition of Life Sciences segments based on the Standard Industrial Classification

Below, we show the SIC groups included in our three segments. Companies in these SIC groups were extracted from the OLS Strength and Opportunity database and formed our initial company list for the analysis.

Pharmaceutical development and manufacture

- Manufacture of basic pharmaceutical products
- Manufacture of pharmaceutical preparations
- Wholesale of pharmaceutical products
- Manufacture of other chemical products not elsewhere classified
- Manufacture of other inorganic basic chemicals
- Manufacture of other organic basic chemicals

Medical technology manufacture

- Manufacture of medical and dental instruments
- Manufacture of irradiation, electromedical and electrotherapeutic equipment
- Other manufacturing n.e.c.
- Manufacture of electronic components
- Manufacture of electronic industrial process control equipment
- Manufacture of electronic instruments and appliances for measuring, testing, and navigation, except industrial process control equipment
- Manufacture of medical and dental instruments and supplies
- Manufacture of metal forming machinery
- Manufacture of optical precision instruments
- Manufacture of other electrical equipment
- Manufacture of other fabricated metal products not elsewhere classified
- Manufacture of other general-purpose machinery not elsewhere classified
- Manufacture of other plastic products
- Manufacture of other special-purpose machinery not elsewhere classified
- Other business support service activities not elsewhere classified
- Repair of electrical equipment
- Repair of electronic and optical equipment

Life Sciences research

- Research and experimental development in biotechnology
- Other research and experimental development on natural sciences and engineering
- Other professional, scientific and technical activities (not including environmental consultancy or quantity surveying) not elsewhere classified
- Other human health activities

[22] Some companies list more than one SIC code in their annual accounts, in particular we note that some of the companies we define as pharmaceutical manufacturers (e.g. Pfizer) also list wholesale of pharmaceutical products as their SIC group and are classified as wholesalers in the OLS database. As a result, we individually reviewed the companies classified as a pharmaceutical wholesaler and re-classified them where their main activities appeared to be non-wholesale.

Annex C: Treatment of companies with multiple UK entities

Some of the companies in our analysis have multiple UK business entities. These were examined in detail to ensure that we captured only the parts of the company that met our Life Sciences criteria.

Our first preference was to use consolidated group accounts when available, however, these were not used where either:

- The group accounts included the financial results of non-UK subsidiaries; or
- The group accounts included non-Life Sciences activities.

When consolidated group accounts were not used, we examined the data on each UK entity listed in Companies House. We included those meeting the following criteria:

- The activity of the entity related only to the UK;
- The economic activity fell within the SIC groupings that we have defined as being Life Sciences related for this study or directly support activities that fell within these SIC groups.
- The entity is listed as active rather than dissolved or dormant;
- The entity had available profit and loss accounts; and
- The entity was material, (i.e. above £5m turnover or operating profit).

This resulted in the inclusions of some entities that provide back office functions that are directly supporting other entities within the organisation that satisfy our Life Sciences definition. We also include entities that receive intellectual property licencing fees.

Table A.5 provides a list of the main entities included in the analysis for selected major companies.

Table A.5: Multiple entities included in our database

Company name	UK entities included in the analysis
Abbott Diabetes Care	Abbott Diabetes Care Limited
	Abbott Laboratories Limited
	Abbott Healthcare Products
	Murex Biotech Limited
Actavis	Actavis Holding UK Limited
	Actavis Holding VericUK II Limited
	Auden McKenzie Holdings Limited
	Warner Chilcott UK Limited
Advanced Medical Solutions Group	Advanced Medical Solutions Group Plc
Alere	Alere UK Holdings Limited
	Alere Connected Health Limited
	Alere Limited
	Alere Toxicology Plc
	Alere Healthcare Connections Limited
	Alere UK Subco Limited
AstraZeneca	Medimmune UK Limited
	Medimmune Limited
	AstraZeneca UK Limited
	Archigen Biotech Limited
	AstraZeneca Insurance Company Limited
	Kudos Pharmaceuticals Limited

Company name	UK entities included in the analysis
Baxter Healthcare	Baxter Healthcare Limited
Biocompatibles	Provensis Limited
	Biocompatibles UK Limited
	BTG Management Services Limited
	Protherics Medicines Development Limited
	BTG International Healthcare Limited
	BTG International Limited
Boehringer Ingelheim	Boehringer Ingelheim Limited
Consort Medical	Consort Medical Plc
Coopervision	Coopervision Limited
	Coopervision Manufacturing Limited
Eli Lilly and Company	Eli Lilly and Company Limited
Elekta	Elekta Limited
Frontier Medical Group	Frontier Medical Group Limited
GE Healthcare	GE Medical Systems Limited
	GE Healthcare UK Limited
	GE Healthcare Limited
GlaxoSmithKline	GlaxoSmithKline Finance plc
	Domantis Limited
	Glaxo Operations UK Limited
	GlaxoSmithKline Export Limited
	GlaxoSmithKline Intellectual Property Limited
	GlaxoSmithKline Research & Development Limited
	GlaxoSmithKline UK Limited
	GlaxoSmithKline IHC Limited
	GlaxoChem (UK) Unlimited
	GlaxoSmithKline Consumer Healthcare (overseas) Limited
	GlaxoSmithKline Consumer Healthcare (UK) Trading Limited
	GlaxoSmithKline Consumer Healthcare Finance Limited
	GlaxoSmithKline Consumer Trading Services Limited
	SmithKline Beecham Research Limited
	SmithKline Beecham Limited
	Dealcyber limited
	GlaxoSmithKline Caribbean limited
	ViiV Healthcare limited
	GlaxoSmithKline Services Unlimited
	Novartis Consumer Health UK Limited (acquired by GsK)

Company name	UK entities included in the analysis
Johnson & Johnson Medical	Johnson & Johnson Consumer Services EAME ltd
	Johnson & Johnson Finance Limited
	Johnson & Johnson Innovation Limited
	Johnson & Johnson Limited
	Johnson & Johnson Medical Limited
	Depuy International Limited
MacFarlan Smith	MacFarlan Smith Limited
Martindale Pharmaceuticals	Bolt Equity Limited
	Nut Bond Limited
	Bolt Mezzanine Limited
	Martindale Pharma Holdings Limited
	McCarthys Laboratories Limited
Mercury Pharmaceuticals	Mercury Pharma Group Limited
	Concordia International RX (UK) Limited
	Focus Pharmaceuticals Limited
	Mercury Pharma (Generics) Limited
	Mercury Pharmaceuticals Limited
	Primegen Limited
Molnycke Health Care	MHC UK Limited
	Medlock Medical Limited
	Regent Medical Limited
	Molnycke Health Care Limited
NAPP Pharmaceuticals	NAPP Pharmaceutical Holdings Limited
Norbrook Laboratories	Norbrook Laboratories Limited
Novartis	Novartis Pharmaceuticals UK Limited
	Novartis UK Limited
	Novartis Grimsby Limited
	Alcon Laboratories (U.K.) Limited
	Sandoz Limited
	Vivacta Limited
Olympus Keymed	Olympus Keymed Group Limited
	Keymed (Medical and Industrial Equipment) Limited
Penn Pharmaceuticals	PCI Pharma Holdings Limited
Pfizer	Pfizer Limited
	John Wyeth & Brother Limited
	Neusentis Limited
	Pfizer Consumer Healthcare Limited

Company name	UK entities included in the analysis
Pharmaserve	Pharmaserve (North West) Limited
Roche	Roche Products Limited
	Roche Diagnostics Limited
	Roche Diabetes Care
Sanofi-Synthelabo	Rhone-Poulenc Rorer limited
	Aventis Pharma Limited
	Genzyme Therapeutics Limited
	May & Baker Limited
	Sanofi-Synthelabo Limited
	Fisons Limited
Shire Pharmaceuticals	Shire Pharmaceuticals Group
	Shire Pharmaceuticals Services Limited
	Shire Holdings UK Limited
	Shire Global Finance
	Shire Pharmaceuticals Limited
	Viropharma Limited
Synergy	Synergy Health Holdings Limited
Teva	Norton Healthcare Limited
	Teva UK Limited
Thornton & Ross	Thornton & Ross Limited
	Internis Pharmaceuticals Limited
	Zeroderma Limited

Source: PwC

Annex D: Small company archetypes

Table A.6 below outlines the values that were calculated for each of our three archetypes and used to estimate the economic value and employment for the small companies where we did not directly collect financial information. The values are based on the median figures obtained in order to minimise the impact of outliers.

These results are based on data for a sample of 107 smaller firms out of the population of around 1,400.

Table A.6: Small company archetype values

	Turnover to GVA ratio	Turnover per employee (£'000)	GVA per employee (£'000)	Compensation per employee (£'000)
Life Sciences research	1.1	105	60	52
Pharmaceutical development and manufacture	2.5	152	81	60
Medical technology manufacture	2.6	134	65	43

Source: PwC analysis, Companies House

Annex E: Company surveys and Life Sciences specific multipliers

Our survey of ABPI, BIA, ABHI and BIVDA members asked companies to provide data on their procurement spending in a range of industries and on their employee compensation.

In total, we received 34 responses to the survey from companies that account for over £10bn of turnover in the Life Sciences industry.

We asked firms to provide their procurement in the following categories:

- Basic pharmaceutical products and pharmaceutical preparations;
- All other manufactured products;
- Utilities and waste removal;
- Transport services;
- Postal and courier services;
- Accommodation and food services;
- Information and Communication services;
- Financial and insurance Services;
- Real estate services;
- Scientific research and development;
- Training and education services;
- Other business services;
- Contractor services; and
- Any other goods and services not covered above.

Table A.7: PwC multipliers for the UK Life Sciences

Industrial Classification Group	Type I GVA	Type II GVA	Type I Employment	Type II Employment
Life Sciences research	1.77	2.44	1.68	2.12
Pharmaceutical development and manufacture	1.38	1.63	3.14	4.40
Medical technology manufacture	1.88	3.22	1.65	2.55

Source: PwC analysis.


NHS

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A company limited by guarantee registered in England and Wales (number: 09826787)

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170217-160555-RS-OS