



Fraser of Allander Institute
The Economic Contribution of the
Pharmaceuticals Sector in Scotland
January 2021

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The Fraser of Allander Institute

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Appendix

ABPI Scotland would like to dedicate this report to their colleague, Neil Jarvis, who died shortly before publication of this report to which he had contributed.

Disclaimer

The analysis in this report has been conducted by the Fraser of Allander Institute (FAI) at the University of Strathclyde. The FAI is a leading academic research centre focused on the Scottish economy.

The report was commissioned in February 2020 by The Association of the British Pharmaceutical Industry (ABPI) Scotland.

The analysis and writing-up of the results was undertaken independently by the FAI. The FAI is committed to providing the highest quality analytical advice and analysis. We are therefore happy to respond to requests for technical advice and analysis. Any technical errors or omissions are those of the FAI.

Executive Summary

The pharmaceutical sector plays an important role in the Scottish economy.

Our findings in the accompanying report show that the industry has grown since our previous economic analysis in 2018 and 2017. The number of direct jobs in the sector has increased, as has Gross Value Added (GVA), Gross Value Added per head (GVA per head) and the total value of exports.

In National Accounts, the statistical classification of the pharmaceutical industry narrowly defines the sector as the manufacturing of pharmaceuticals. However, whilst manufacturing is an important part of the pharmaceutical sector, it is not the only component.

A more comprehensive definition, which we refer to as the 'Wider Pharmaceutical sector', includes:

- The manufacturing of pharmaceuticals;
- Pharmaceutical research and development; and,
- Other activities including medical sales, medical science liaison, management, etc.

The wider pharmaceutical sector itself employs 5,600 full-time equivalent (FTE) jobs and, once spill over effects are accounted for, generates £1.8bn of Gross Value Added in Scotland.

On its own, the manufacturing of pharmaceuticals employs around 4,000 people, with significant employment in rural areas. Additionally, it employs a large number of people in places such as North Ayrshire where income and employment deprivation are higher than in most parts of the country. All of which makes the pharmaceutical sector an important contributor to inclusive growth in Scotland.

The sector has complex supply chains and every pound of value created by the pharmaceutical sector, in turn, generates further value and jobs. For every 10 jobs in the wider pharmaceutical industry a further 17 are supported in the wider economy.

Moreover, the pharmaceutical industry, which makes up a significant part of the Life Sciences sector, has been identified by the Scottish Government as a key 'Growth Sector' in which they believe Scotland has a distinctive comparative advantage.

In this report, we assess both the economic impact of the wider pharmaceutical sector and the impact of manufacturing pharmaceutical products. This analysis allows us to estimate both the direct contribution of these sectors to the Scottish economy and the wider spill-over effects across the whole economy.

We estimate that, once wider spill-over factors are accounted for, the wider pharmaceuticals industry:

- Directly employs 5,600 FTE jobs in Scotland;
- Supports a total of 15,250 FTE jobs in Scotland;
- Supports a total of £2.5bn in Scottish output; and,
- Supports Scottish GVA worth £1.8bn.

Additionally, we find that the manufacturing of pharmaceuticals industry:

- Directly employs 3,850 FTE jobs in Scotland;
- Supports a total of 11,350 FTE jobs in Scotland;
- Supports a total of £2.1bn in Scottish output; and,
- Supports Scottish GVA worth £1.5bn.

Later in the report, we discuss the significant contribution of pharmaceuticals to life sciences and its role in promoting inclusive growth in Scotland through wider impacts that are not typically accounted for in economic models.

SUMMARY

Contribution of the pharmaceutical sector to Scotland's economy

Wider pharmaceutical industry



15,250
FTE jobs supported

Over £1.8 billion
in GVA supported



Manufacturing of pharmaceuticals industry



11,350
FTE jobs supported

£1.5 billion
in GVA supported



Introduction

The pharmaceutical sector is an important, and growing, component of the Scottish economy. In addition to the obvious employment and economic benefits the sector also contributes positively to the inclusive growth agenda.

This report assesses the economic impact and wider spill-over effects of the pharmaceutical manufacturing sector and also a broader group of pharmaceutical contributions which we call the 'wider pharmaceutical sector'.

To support our analysis, we spoke with several stakeholders who provided insights into the pharmaceutical sector including the risks and opportunities which lie ahead. Whilst the immediate outlook for the Scottish economy is dominated by the ongoing Coronavirus pandemic, the need to continue collaborating, as experienced at unprecedented scale during the pandemic, emerged as a key lesson for the future.

Additionally, the Association of the British Pharmaceutical Industry (Scotland) provided the institute with a range of case studies which highlighted the role of the pharmaceutical industry within R&D, NHS and academic collaboration and clinical trials.

This report is structured as follows –

- Section 1 assesses the wider impacts of the pharmaceutical sector and evaluates its contribution to inclusive growth in Scotland;
- Section 2 outlines the economic impact of the pharmaceutical manufacturing sector and the wider sector in terms of economic output, Gross Value Added (GVA) and employment;
- Section 3 covers pharmaceutical investment through research and development and discusses the increased collaboration seen in the pharmaceutical sector as a result of COVID-19;
- Section 4 includes case studies from Bristol Myers Squibb (BMS) and GlaxoSmithKline (GSK) on the importance of industry and academic collaboration in clinical trials and research; and,
- Section 5 includes joint working case studies provided by ABPI Scotland, highlighting the role that collaboration has to play in pharmaceutical research and other areas; and,
- Section 6 concludes this report.

1. The wider contribution of the Pharmaceuticals sector in Scotland

When evaluating the contribution of a sector it is important to look beyond traditional metrics and consider the wider impacts that economic models do not capture.

As this report will show, the pharmaceutical industry is far wider than just manufacturing and encompasses the impact of both commercial roles and research and development. However, in order to make comparisons over time, and across regions, we will use the narrow standard industrial classification - (SIC) 21.

Whilst we know that growing GDP is closely correlated with improved living standards in the long run, it does not capture how these improvements are spread across the economy. Therefore, in the latter half of this section, we investigate how the pharmaceutical industry contributes to inclusive growth in order to improve wellbeing.

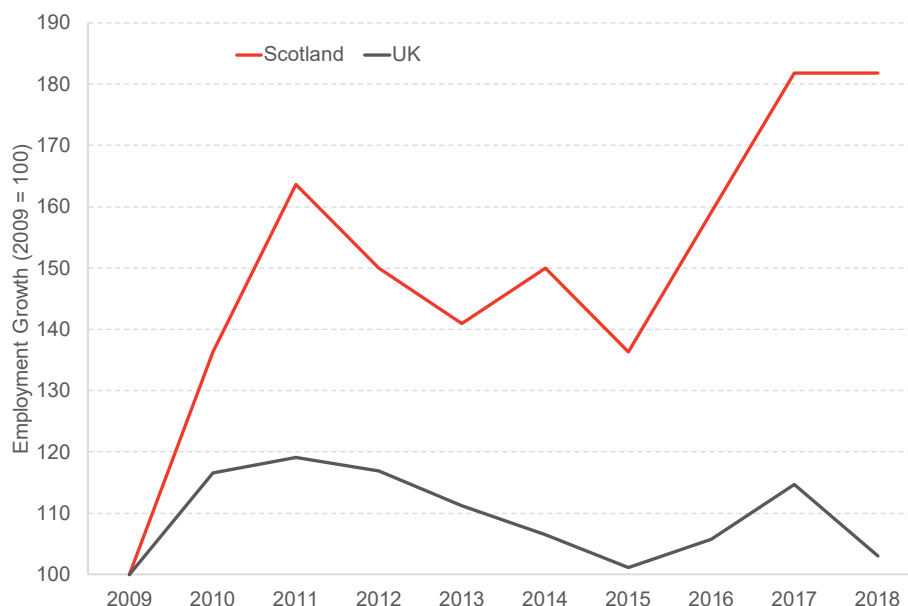
Economic indicators

Employment, economic activity & productivity

In 2018, around 4,000 people were employed within the manufacturing of pharmaceutical products in Scotland.

Pharmaceutical employment in Scotland grew consistently faster than the UK as a whole. Over time employment in the UK pharmaceutical sector remains steady at 2009 levels whilst Scotland's pharmaceutical sector has grown. Chart 1.

Chart 1: Pharmaceutical employment growth, Scotland and UK, 2009-2018

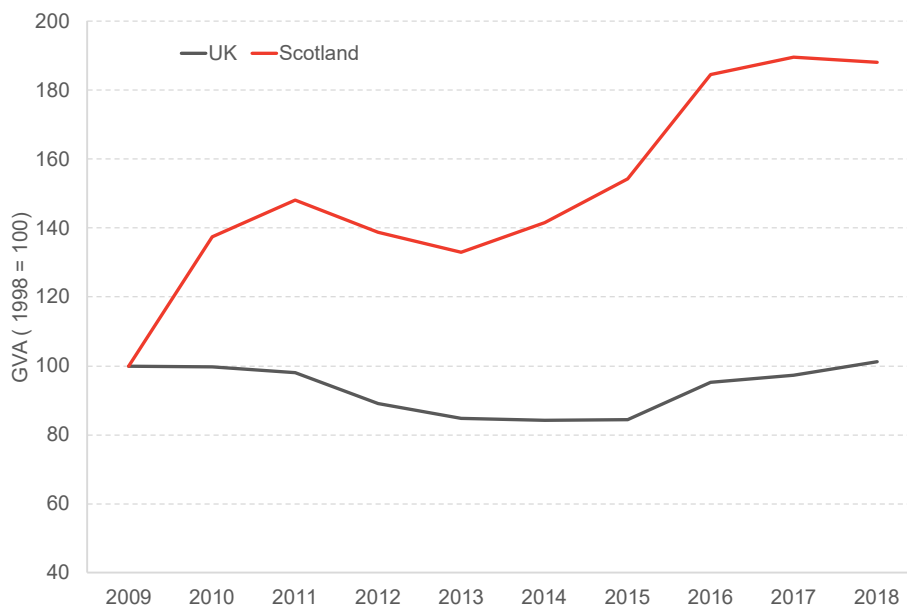


Source: Scottish Government, UK BRES

Employment is closely related to the amount of GVA¹ in an industry. Since 2009, GVA in Scotland's pharmaceutical industry has experienced significant growth, narrowing the gap between itself and the UK's pharmaceutical industry.

Scotland's pharmaceutical industry's GVA has almost doubled since 2009. Chart 2.

Chart 2: Gross value added at basic prices, pharmaceuticals, Scotland and UK, 2009-2018



Source: ABS

In our 2017 report we found that productivity was a strength of the pharmaceutical sector and this remains the case. GVA per head was almost £158,500 in 2018, and around £65,000 higher than its nominal value in 2008.

Furthermore, GVA per head in the manufacturing of pharmaceuticals is double that of the manufacturing sector as a whole.

¹ Gross Value Added (GVA) measures the total value of goods and services produced in a region or industry.

When compared more widely, productivity in the manufacturing of pharmaceuticals is almost three times the Scottish industry average. Chart 3.

Chart 3: Nominal GVA per head, Pharmaceuticals vs Scotland average, 2008, 2013 and 2018



Note: The denominator for both GVA per head calculations is employment count.

Source: Scottish Government Growth Sectors database

Imports & exports

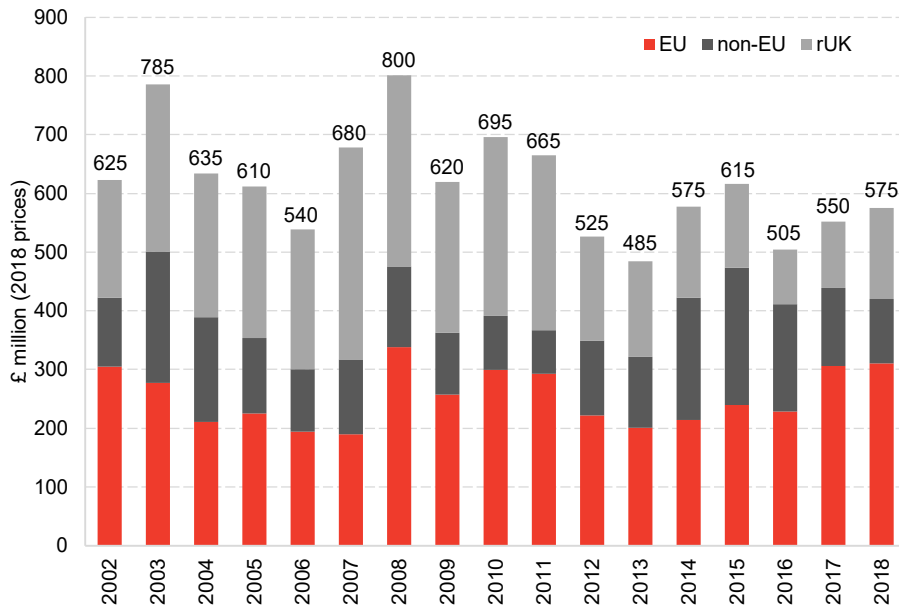
In terms of exports, the overall volume of Scottish pharmaceutical exports has fluctuated over time and decreased slightly in real terms since the 2008 financial crisis.

The pharmaceutical industry in Scotland exported £575m of goods and services in 2018, up almost 15% since 2016, which further demonstrates growth in the sector.

In 2018, over a half of all exports in the sector went to EU countries, just under 20% to non-EU countries, and over 25% to the rest of the UK. The UK's future relationship with the European Union and the impact of new regulatory, customs and border arrangements following the end of transition will result in significant changes in the way the industry operates. Between 2002 and 2018 the share of exports to the EU has grown relative to other export destinations. Chart 4.

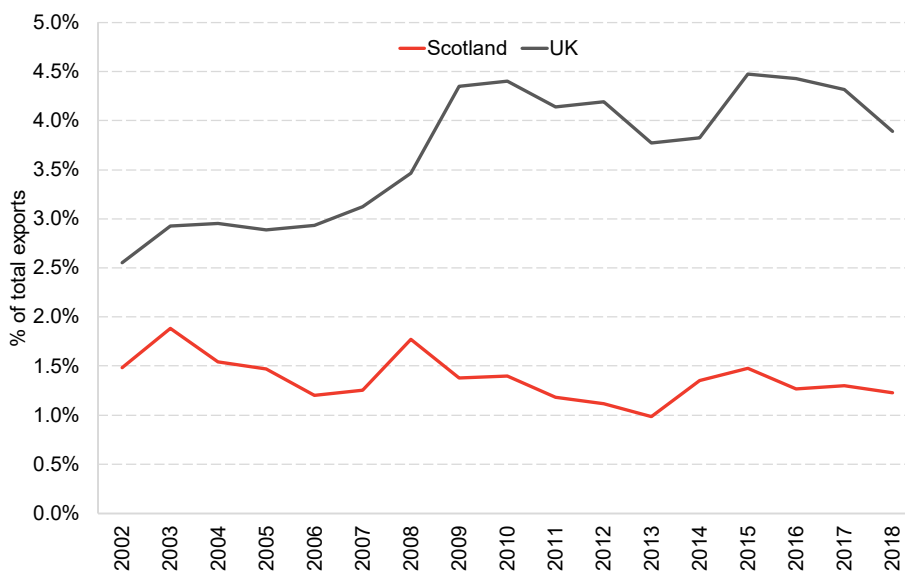
Export activity in the pharmaceutical sector has historically been stronger in the rest of the UK compared to Scotland. In the rest of the UK, exports of pharmaceutical products as a share of total exports rose from 2.6% in 2002 to 3.5% in 2018, whilst exports of pharmaceuticals in Scotland fell from 1.5% of total exports in 2002 to 1.2% in 2018.

Chart 4: Exports from the Scottish pharmaceutical sector by destination, 2002 – 2018



Source: Scottish Government

Chart 5: Exports from the pharmaceutical sector as a share of total exports, Scotland and UK, 2002 – 2018



Source: Scottish Government

Of 96 Scottish industries, the pharmaceutical industry is the 23rd most dependent on imports from the rest of world with over a fifth of pharmaceutical inputs come from outside of the UK.

Links to other sectors – what other sectors of the economy benefit from pharmaceuticals in Scotland?

In addition to contributing to Scottish exports, the pharmaceutical industry also supports a significant number of other Scottish industries.

Table 1 shows the links between the pharmaceutical sector and other industries in Scotland and outlines the main industries which benefit from purchases made by the pharmaceutical industry. The industry purchases most from financial services (15%), wholesale (13%) and itself (10%). These purchases indirectly support employment in other sectors of the economy, as below.

Table 1: Main industrial purchases made by the manufacturing of pharmaceuticals sector, 2017

Financial services	14.5%
Wholesale - excl vehicles	12.7%
Pharmaceuticals	10.3%
Electricity	7.7%
Retail - excl vehicles	5.1%
Post & courier	3.4%
Public administration & defence	3.2%
Other land transport	2.1%
Employment services	2.1%
Other	38.9%

Source: Scottish Government Input-Output Tables (2017)

However, the industry also contributes towards reducing inequality and its activities help support inclusive growth.

Pharmaceuticals and Inclusive Growth

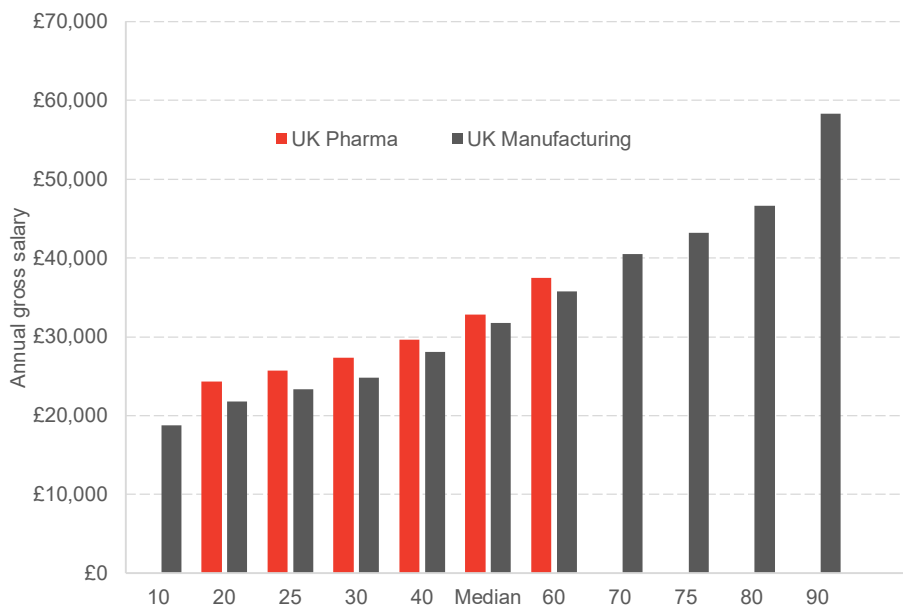
In recent years, governments and policymakers have recognised that traditional measures of economic performance such as GDP do not capture the full picture of economic prosperity. As a result, there has been a shift towards promoting growth that is inclusive. Put simply, this is the idea that the benefits of growth should be distributed fairly to everyone in society.

It is therefore important to understand the contribution of the pharmaceutical industry to inclusive growth in Scotland.

Higher than average salaries

Data from the Annual Survey of Hours and Earnings (ASHE) shows that earnings in the UK's manufacturing of pharmaceuticals industry are typically greater than earnings for the manufacturing sector as a whole. Chart 6.

Chart 6: Gross annual salary, Full-time employees, Pharmaceutical sector, Manufacturing, and Whole economy, UK, 2020



Note: data is missing for some quantiles due to estimates being considered unreliable.

Source: ASHE

There are limitations with sectoral earnings data - as seen in Chart 6 - and data for Scotland is mostly unreported. However, given the high levels of productivity within the pharmaceutical sector a similar earnings picture to the UK is expected for Scotland.

The average gross annual salary for a full-time pharmaceutical worker in Scotland in 2020 was £35,600. This is greater than the average salary in both the Scottish and UK manufacturing sector.

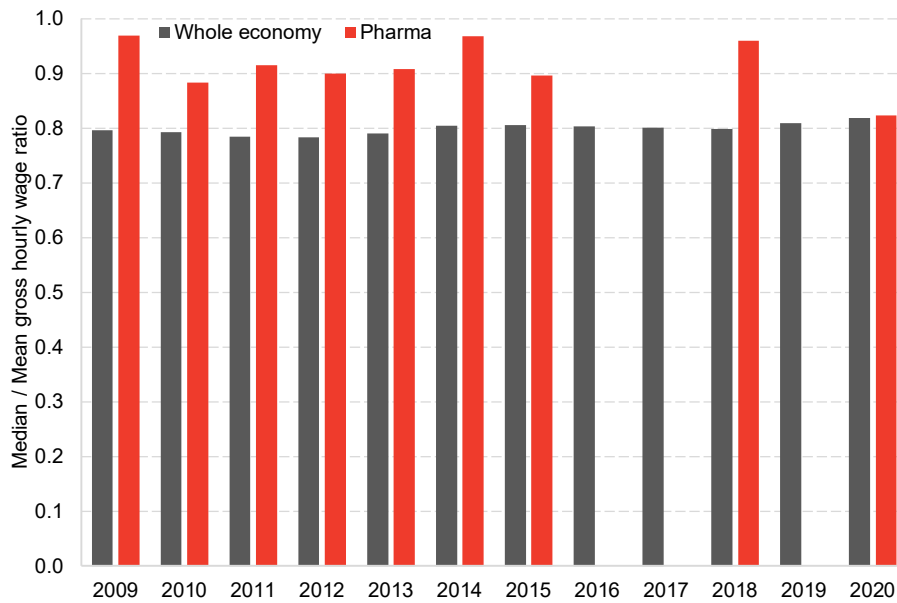
Lower income inequality and more secure employment

Understanding the ratio of the median² to average hourly wage in the Scottish pharmaceutical sector can illustrate how earnings inequality in the sector compares to the rest of the economy. The higher the ratio, the lower the income inequality.

Chart 7 shows that this ratio in the pharmaceutical sector has been historically higher than the ratio for the whole economy. This suggests that there is a lower degree of income inequality in the pharmaceutical sector compared to the rest of the Scottish economy.

² The median here refers to the value of earnings that separates the top and bottom half of the earnings distribution.

Chart 7: Ratio of median to mean gross hourly earnings, Pharmaceutical sector and Whole economy, Scotland, 2009 – 2020

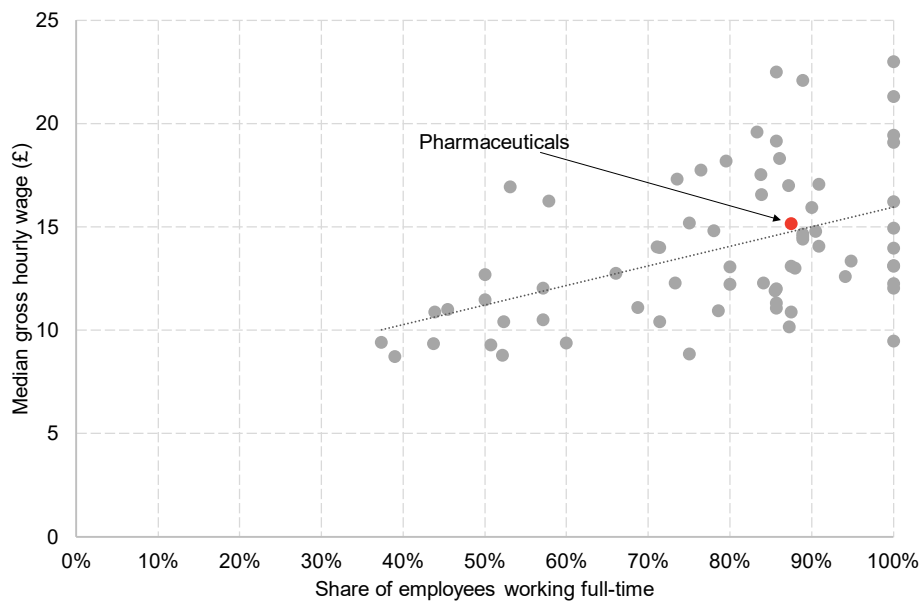


Note: Data for the Scottish pharmaceutical sector is unavailable for 2016, 2017, and 2019. The data for 2020 is provisional and subject to revisions.

Source: ASHE

Additionally, the share of full-time employees within an industry is also an important marker of pay and job security. As shown in Chart 8, industries with a higher proportion of full-time workers typically have a higher median wage. Those working full-time may also have a higher level of qualifications / training and be less vulnerable to job losses during an economic downturn, such as the one brought on by the ongoing pandemic.

Chart 8: Share of employees working full-time (2019) and median gross hourly wage (2020), 2-digit SIC sectors, Scotland



Source: NOMIS, BRES, ASHE

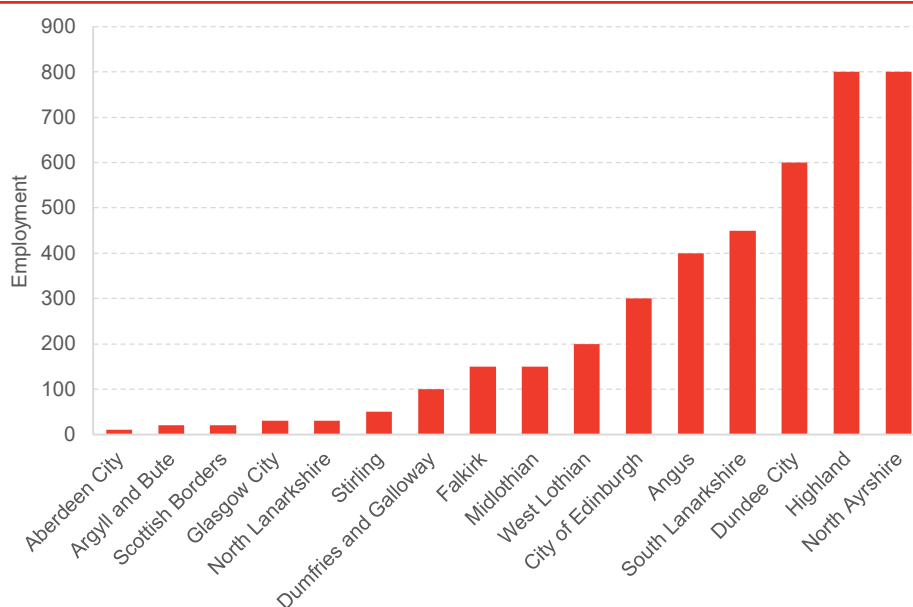
Chart 8 shows that the pharmaceutical industry had around 88% of all employees working full-time in 2019. It also shows that it pays above the Scottish median.

In summary, employees in the pharmaceutical sector are, on average, both well paid and more likely to have greater job security.

Supporting employment in rural and deprived areas

As discussed, in 2018 there were around 4,000 employees involved in the manufacturing of pharmaceutical products, half of whom were employed in 3 local authorities, North Ayrshire, the Highlands and Dundee. The spread of pharmaceutical employment across Scotland is captured in Chart 9 below.

Chart 9: Employment in Pharmaceuticals (SIC 21) by Scottish Local Authority, 2018



Source: BRES

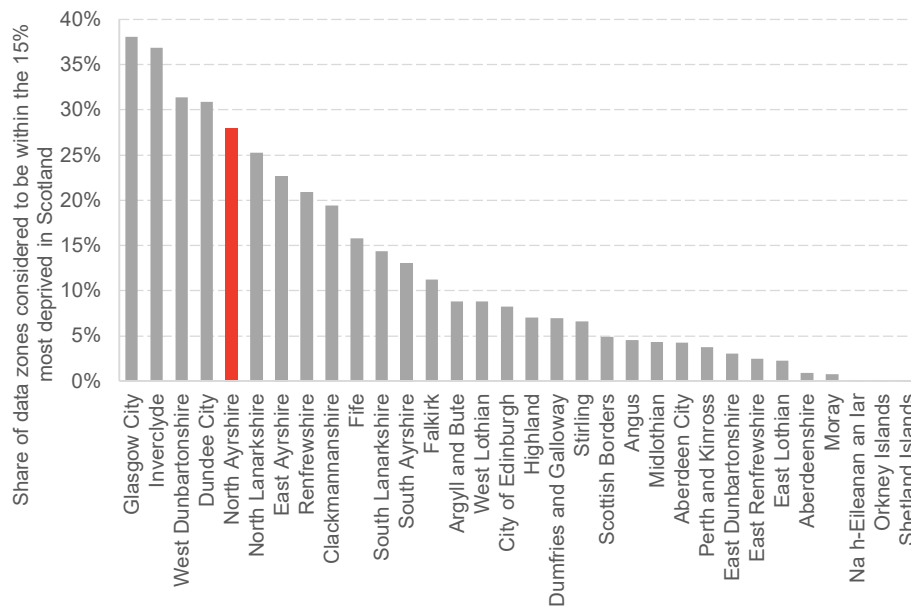
Chart 10 highlights the level of deprivation in local authorities across Scotland and finds that North Ayrshire is the fifth most deprived area in the country.

Deprivation in North Ayrshire is primarily driven by income and employment deprivation, with the area the third and fourth most deprived according to these indicators.

Employing people from historically deprived areas on secure, high-paying contracts contributes to narrowing income inequality, and North Ayrshire benefits from the highest level of pharmaceutical employment in Scotland.

Furthermore, providing employment opportunities in economically disadvantaged communities filters out into the local economy and supports jobs in other sectors, notably housing and retail.

Chart 10: Local share of 15% most deprived data zones, local authorities, 2020



Source: SIMD 2020

And finally, employing people outwith the central belt can also help promote inclusive growth. Rural communities often suffer from a lack of economic opportunities as younger residents move to urban areas in pursuit of employment. Therefore, offering well-paid, fulfilling jobs is particularly effective in retaining and attracting young talent to remote communities whilst helping maintain a demographic balance.

In providing employment in rural areas, the pharmaceutical industry is positively contributing to inclusive growth outwith the central belt.

The ongoing Coronavirus pandemic has also accelerated changes in the workplace and resulted in widespread teleworking as part of solutions to manage lockdown restrictions. Even once the pandemic is over, this shift in working will likely stay in some capacity, and could act to slow down urbanisation, allowing more jobs to be created in rural areas.

However, in order to reap the inclusive growth benefits of the pharmaceutical sector, investment is needed in areas such as data, connectivity, and skills.

2. Modelling the contribution of the pharmaceutical industry

In this section we model the economic contribution of the pharmaceutical industry to the Scottish economy.

This is carried out by hypothetically removing the pharmaceutical sector from the Scottish economy and estimating the size of the remaining economy - the difference between the original economy and the newly extracted economy is the contribution of the pharmaceutical sector to the Scottish economy.

The results highlight the direct, indirect and induced effects of the pharmaceutical sector:

- The direct impact is the direct economic activity generated by the pharmaceutical sector's day-to-day activities;
- The indirect impact is the activity supported by the pharmaceutical sector purchasing from its suppliers; and,
- The induced effect is the activity generated by the wages spent in the pharmaceutical sector.

Appendix A outlines key notes on how this economic modelling was carried out, with further detail on how to interpret the results of this section.

Results

Wider pharmaceutical industry

Table 2 highlights the direct, indirect and induced impact of removing the pharmaceutical sector.

Table 2: Economic impact of the wider pharmaceuticals industry*

	Output (£m)	GVA (£m)	Employment (FTE)
Direct	1,520	1,175	5,600
Indirect	195	110	2,050
Induced	835	510	7,570
Total	2,555	1,790	15,250

*totals may not sum due to rounding

Source: FAI calculations

The pharmaceutical industry contributes around £1.2bn in direct GVA to the Scottish economy.

However, when we add up the indirect and induced effects, the overall economic impact of the wider pharmaceutical sector to the Scottish economy increases to almost £1.8bn.

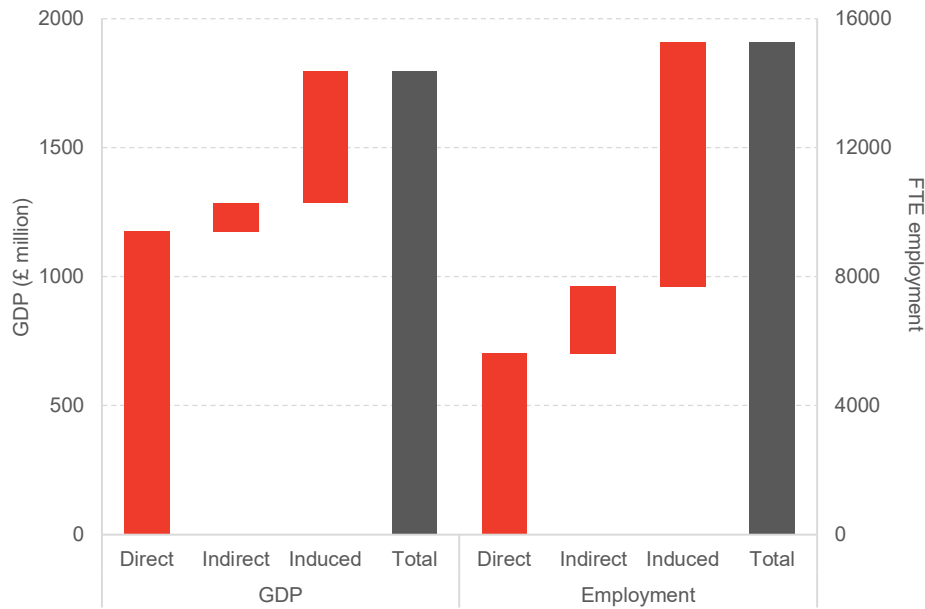
After accounting for knock-on effects, the wider Scottish pharmaceutical sector is responsible for almost £2.6bn of total output and £1.8bn of GVA. Across the Scottish economy the sector supports 15,250 direct, indirect and induced jobs. This total includes employment in the pharmaceutical sector but also, thanks to spill-over effects, employment in other parts of the Scottish economy.

Put simply, for every 1 job created in the wider pharmaceutical industry, 1.7 jobs are created elsewhere in the Scottish economy.

This compares to 1.5 in electrical equipment manufacturing, 1.2 in machinery manufacturing and 0.7 in textiles manufacturing.

Chart 11 breaks down the net gains from the direct, indirect and induced effects associated with the wider pharmaceutical sector.

Chart 11: Economic impact of the wider pharmaceutical industry



Source: FAI calculations

Manufacturing of pharmaceuticals

Similarly, Table 3 outlines the impact of manufacturing pharmaceuticals. This sector is associated with a net benefit of £2.1bn in output, £1.5bn in GVA and supports 11,350 jobs across the Scottish economy.

Table 3: Economic impact of the manufacturing of pharmaceuticals industry*

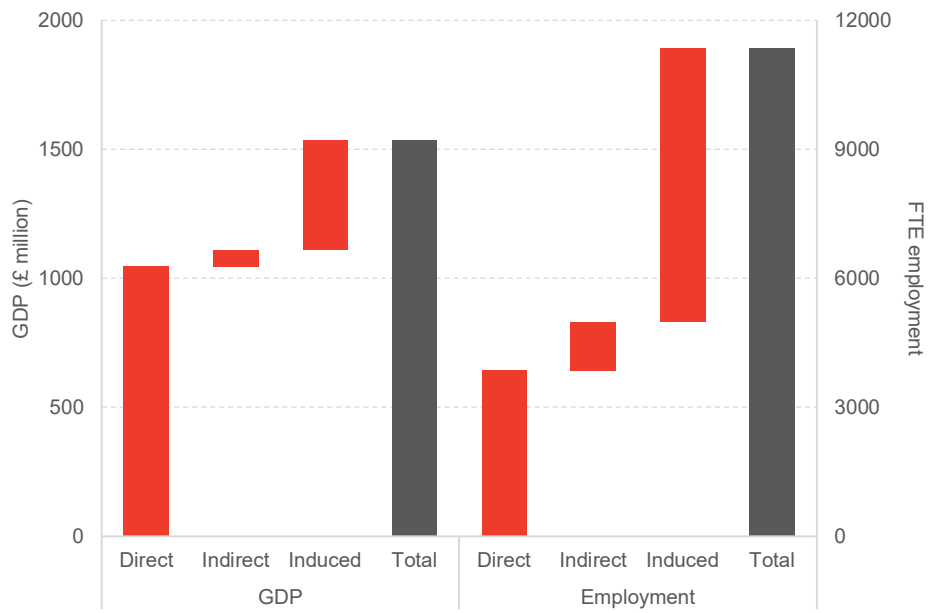
	Output (£m)	GVA (£m)	Employment (FTE)
Direct	1,295	1,045	3,850
Indirect	120	65	1,150
Induced	700	425	6,350
Total	2,120	1,535	11,350

*totals may not sum due to rounding

Source: FAI calculations

Chart 12 visualises the direct, indirect and induced effects of the manufacturing of pharmaceuticals sector.

Chart 12: Economic impact of the manufacturing of pharmaceuticals industry



Source: FAI calculations

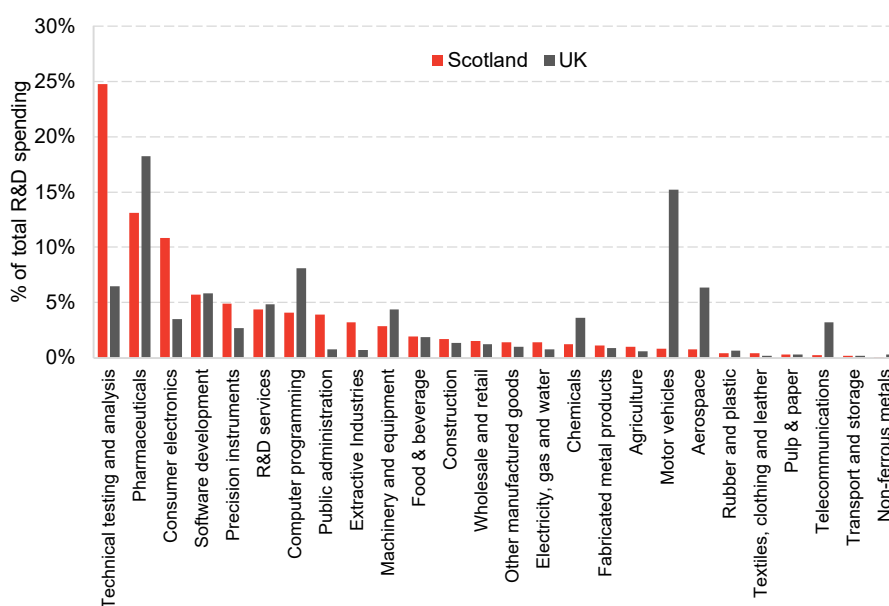
3. Pharmaceutical investment

Manufacturing of pharmaceuticals research and development

Research and Development expenditure in pharmaceuticals was just under £165m in 2018 - accounting for around 12% of total businesses research and development in Scotland. This figure is up almost £45m since 2012.

Pharmaceutical manufacturing is the second largest spender on R&D after the technical testing and analysis services industry which contributes a quarter of R&D spend (the pharmaceutical industry also contributes to the technical testing and analysis services industry). Chart 13.

Chart 13: R&D expenditure by industry as a share of total R&D expenditure, Scotland and UK, 2017



Note: We present data for 2017 because 2018 data is not available for all sectors for comparison. The share of R&D spending in the pharmaceutical sector has not changed fundamentally between 2017 and 2018.

Source: BERD, Scottish Government, FAI calculations

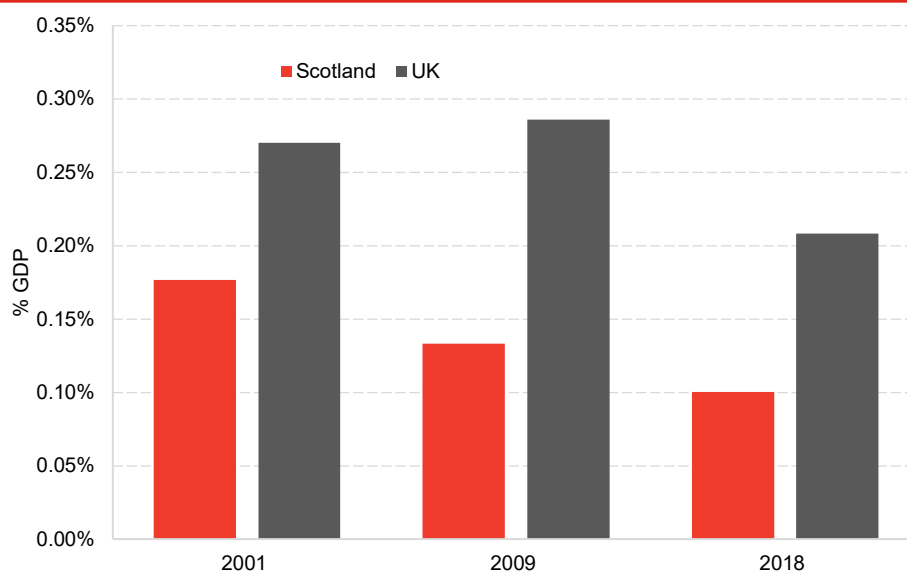
However, despite this strong performance, R&D expenditure in the pharmaceutical sector as a share of GDP is lower in Scotland compared to the rest of the UK. Furthermore, in the past decade, pharmaceutical R&D expenditure, as a share of Scottish output, has been falling. ABPI members believe that improvements and investment in healthcare data can help reverse this trend. The latest available data shows R&D expenditure stayed fairly constant between 2017 and 2018 at £164m (0.10% of Scottish GDP). Chart 14.

The Scottish Government has identified the manufacturing of pharmaceuticals as a key contributor to its 'Life Sciences' [growth sector](#) (growth sectors are key Scottish sectors that are seen as competitive on the global stage).

The six growth sectors as set out in Scotland's [Economic Strategy](#):

- Life Sciences
- Sustainable Tourism
- Creative Industries (including digital)
- Energy (including renewables)
- Financial & Business Services
- Food & Drink (including agriculture & fisheries)

Chart 14: R&D expenditure in the pharmaceuticals sector as % of GDP, Scotland and UK, 2001, 2009 and 2018



Source: BERD, Scottish Government, ONS National Accounts, FAI calculations

Life Sciences research and development

The 'Life Sciences' growth sector includes pharmaceutical manufacturing and other related activity including discovery, R&D, platform technologies, diagnostics, triple A, medical devices as well as specialist suppliers who support the sector.

The manufacturing of pharmaceuticals makes up a significant share of employment and economic activity associated with the life sciences sector -

- The manufacturing of pharmaceuticals is the second largest employer in the life sciences sector after natural science and engineering R&D.
- In the past few years, the manufacturing of pharmaceuticals contributed upwards of £500m directly to life sciences GVA. In 2017, around 40% of life sciences GVA came from pharmaceutical manufacturing.

Increasing employment in the pharmaceutical sector has been a key driver in wider employment growth in the life sciences sector. Between 2015 and 2018 pharmaceutical employment grew by a third, which is higher than all other component sectors. Table 4.

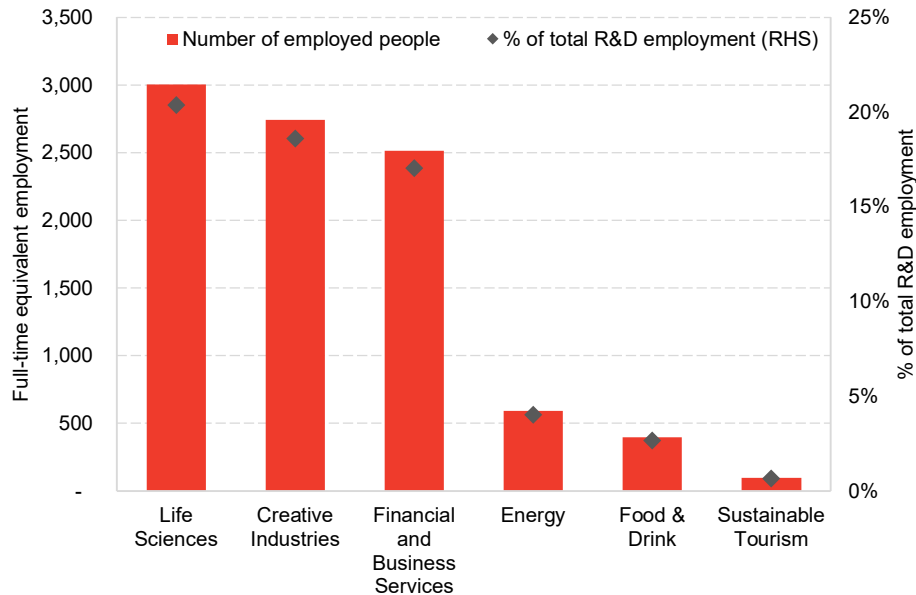
Table 4: Life Sciences Employment, 2015 - 2018

Sector	% Change
Basic pharmaceutical products and pharmaceutical preparations	33%
Manufacture of irradiation, electromedical and electrotherapeutic equipment	25%
Manufacture of medical and dental instruments and supplies	20%
Research and experimental development on biotechnology	29%
Other R&D (natural sciences and engineering)	0%

Source: Scottish Government Growth Sectors database

The Life Sciences sector, which includes pharmaceuticals, is an important player in R&D across Scotland’s growth sectors. In 2018, the life sciences sector supported around 3,000 R&D jobs – a fifth of all Scottish R&D jobs. This is a significant footprint, as evidenced in Chart 15.

Chart 15: Employment supported by R&D across different Scottish growth sectors, 2018



Source: BERD, Scottish Government, FAI calculations

In summary, the pharmaceutical industry contributes significantly to one of Scotland's key growth sectors and provides significant investment through research and development. In 2020, this research expertise has been crucial to the economy as the world faced the ongoing COVID-19 pandemic.

COVID-19 & pharmaceuticals research and development

In recent months, positive news of a Covid-19 vaccine has boosted optimism across the world. On the 9th November 2020, Pfizer & BioNTech announced that their COVID-19 vaccine was up to 90% effective in clinical trials.

The Pfizer & BioNTech collaboration has resulted in the first COVID-19 vaccine that, as of the 8th December 2020, has been administered to a wider than trial population.

Other notable collaborations include AstraZeneca, a biopharmaceutical company, and the University of Oxford who have also developed a COVID-19 vaccine.

The recent rollout of the COVID-19 vaccine is a direct result of collaboration between large research-intensive pharmaceutical firms, biotechnology companies and leading academic institutions. This unprecedented partnership has expedited the development, production, and distribution of a vaccination to combat COVID-19.

This spirit of collaboration should be retained following the pandemic and has the power to increase investment in R&D and clinical trials.

4. Clinical Trials & Research

[NHS Research Scotland \(NRS\)](#) simplifies access to Scotland’s world-class research infrastructure, supporting the placement, setup and delivery of clinical research studies and innovative research collaborations from all sectors and therapy areas. As a partnership of Scottish NHS Boards and the Chief Scientist Office (CSO) of Scottish Government, it ensures NHS Scotland provides the best environment to support research.

Scotland’s unique whole country approach to research creates an efficient, supportive and attractive research environment. Investments in nationwide clinical research infrastructure provide researchers, clinicians and industry access to state-of-the-art facilities to conduct clinical trials. This includes:

- Clinical Research Facilities (CRF’s)- dedicated clinical research space and expertise
- Networks and specialty groups - national expertise and support across all therapy areas
- Safe Havens - secure platform for use of NHS electronic data
- Biorepositories - national systems streamline access to anonymised tissue and associated clinical data for use in research
- Imaging - dedicated facilities and expertise across Scotland
- Efficient start up services

NHS Research Scotland supports collaboration between government, the NHS, industry and academia.

Collaboration, as outlined in this section and the previous section, is a key driver of research and development in the pharmaceutical sector.

Table 5 highlights the rise in the number of commercial clinical studies taking place in Scotland over the past nine years. Whilst fluctuating year-to-year, the number of studies has grown by 29% when analysing the earliest and latest data.

Table 5: Number of new commercial studies in Scotland, 2011/12 to 2019/20

Year	Number of Studies
2011/12	183
2012/13	220
2013/14	247
2014/15	208
2015/16	239
2016/17	239
2017/18	249
2018/19	229
2019/20	236

Source: NHS Research Scotland

An increasing number of studies has also meant that the amount spent by pharmaceutical companies on trials and research has grown.

Table 6 highlights spending on commercial trials and research between 2011/12 and 2019/20. The contract value of trials has increased six-fold over this period and separate findings from [KPMG](#) revealed that clinical trials generated £2.7bn of GVA to the UK economy in 2019³.

Table 6: Value of commercial research and clinical trial spending in Scotland (£m), 2011/12 to 2019/20

Year	Contract Value
2011/12	3.1
2012/13	5.3
2013/14	13.1
2014/15	13.3
2015/16	16.7
2016/17	19.6
2017/18	17.1
2018/19	18.3
2019/20	20.9

Source: NHS Research Scotland

Whilst these numbers are positive, there is still room for improvement if Scotland is to establish itself as a leading player within global pharmaceutical research and development.

As a result, we spoke with several stakeholders from the pharmaceutical industry to understand what lessons can be learnt to attract greater levels of R&D activity in Scotland. Many of those we engaged with highlighted collaboration as a fundamental element to successful industry research and one that should be retained once the pandemic is over. Stakeholders also highlighted the need for better curation and use of NHS healthcare data in order to deliver efficiencies in clinical research. See Box 1.

ABPI Scotland also provided the FAI with some clinical trial case studies - shown overleaf – which highlight the importance of continued partnership between industry, the NHS and academia.

Box 1: Key themes from stakeholder discussions

- COVID-19 has highlighted the benefits of collaboration, particularly between Scottish and UK pharmaceutical companies and government. Collaboration which should remain once the pandemic is over.
- Better relationships have formed during the crisis and continuous work must be done to maintain trust brokered during this crisis.
- COVID-19 has accelerated the transition to digital solutions and has enabled remote trial monitoring which removes barriers for those living away from pharmaceutical research hubs, allowing greater efficiency in research.
- Better data infrastructure, including the routine capture of patient outcome information, would attract research and development but this must be coupled with policies that facilitate rapid uptake of innovation.
- There is a real opportunity for Scotland, given its strength in life sciences, to become a formidable player in pharmaceutical research.

³ It is important to note that the methodology used for this impact analysis differs from the methodology employed in this report.

Case Study - BMS

Bristol-Myers Squibb - Beating cancer and investing in research and clinical trials in Scotland

Global pharmaceutical company, Bristol-Myers Squibb (BMS) has invested over £22m in clinical research and collaborative projects in Scotland in recent years. As one of the world's largest pharmaceutical companies BMS is committed to improving human health across a variety of disease areas.

For example, BMS is funding a clinical study at the University of Glasgow which is using genetic patient screening to understand the different immune responses from those suffering with rheumatoid arthritis. Over 60,000 people across Scotland suffer from rheumatoid arthritis and around 2,500 new patients are diagnosed each year. This collaboration will help improve disease management and provide insights for further medical research and is being delivered thanks to £1.1m of funding from BMS.

Across the UK, and as part of their oncology research, BMS is partnering with Cancer Research UK (CRUK) and their subsidiary, Cancer Research Technology (CRT) to discover new treatments for those living with cancer. This five-year project is CRT's largest ever partnership and BMS have committed £22m to improve patient outcomes and discover new treatments.

As well as supporting cancer research, the company has partnered with the University of Edinburgh to use real world data to understand the impact of anticoagulation on non-valvular atrial fibrillation (NVAf) and ischaemic stroke through the analysis of a new data repository called 'DataLoch'. BMS has contributed nearly £100K to the study, which is using NHS Scotland's secure healthcare data to help clinicians make more informed decisions to improve patient outcomes.

BMS has a number of collaborations with businesses based in Scotland and have worked with Cambrex (formerly Solid Form Solutions) in Penicuik for the past 5 years. BMS are able to use Cambrex's leading edge skills in particle solid form discovery to help inform manufacturing and pharmaceutical development. In 2020, BMS invested £139k in various development projects with Cambrex and this success is helping them grow and expand their business.

Case Study - GSK

GlaxoSmithKline/University of Dundee Division of Signal Transduction Therapy

The University of Dundee's Division of Signal Transduction Therapy (DSTT) is one of the world's most significant collaborations between the commercial pharmaceutical industry and any academic research institute.

Founded in 1998, expanded in 2003 and renewed in 2008, 2012 and 2018, the DSTT is the world's longest running collaborations and GSK is proud to have renewed its membership of the Dundee consortium for a further 4 years.

The latest renewal means the consortium has attracted more than £65 million in funding since its inception and is widely regarded as a model for how academia and industry can interact productively for which it was awarded a Queen's Anniversary Prize for Higher Education in 2006.

Dr Malcolm Skingle, Director of Academic Liaison at GlaxoSmithKline:

"I have worked at the interface between academia and industry for more than 25 years and, over this time period, the DSTT at Dundee has produced ground-breaking science. Their openness when working with industry has put Dundee firmly on the world's scientific stage."

5. Joint Working Projects

Beyond medicine – Joint working between the pharmaceutical industry and the NHS

In this section, we will detail how the industry in Scotland collaborates with the NHS through joint working projects which are designed to deliver a ‘triple win’ in the form of benefits to patients, the NHS and the pharmaceutical company or companies involved⁴.

Joint Working is a specific type of NHS/pharmaceutical industry collaboration rather than a generic term for all cross-sector working. A key focus of this report has been to illustrate the willingness of industry to work with the health service more effectively. Whilst no exact figure exists, our research indicates that the pharmaceutical industry in Scotland spends significant sums on these types of projects each year.

There are clear structures in place governing joint working where the benefits must be clearly set out in advance and all projects underpinned by a formal Joint Working Agreement with an executive summary made available to the public.

Agreements must take place at a corporate/organisational level and not with individual health professionals and must include an exit strategy, contingency arrangements, clear milestones, and a commitment to measure, sustain and document outcomes to enable scaling across the NHS. The potential benefits of Joint Working include:

For patients:

- Care closer to home
- Fewer hospital admissions
- Better information about conditions and treatment options
- Better experience of the healthcare system

For the NHS:

- Higher quality care
- Services configured around patient needs
- Better health outcomes & use of resources
- Lower hospital admissions

For the industry partner:

- Potential expansion of the relevant and eligible patient population as a result of the activity
- Increase in the appropriate use of medicines aligned to local or national guidance
- Better understanding of the challenges faced by the NHS in delivering high-quality patient services and care
- Faster implementation of NHS policy which may be relevant to a company’s business

⁴ ABPI, (2020), Joint Working - a toolkit for industry and the NHS, Available at: [ABPI](#).

Case Study - Novartis

Patient Focussed Joint Working Projects

Novartis Pharmaceuticals UK Ltd collaborates with the NHS to develop new services that better serve the needs of patients. By working together to discover access solutions, our partnerships aim to transform the care given to patients, irrespective of their care setting. We want to see the NHS be a sustainable health service, not just for today but also for future generations and firmly believe that greater collaboration with industry can support the NHS in meeting the healthcare challenges of the 21st century¹.

In Scotland, Novartis has invested £795,601.50 on eleven joint working projects (JWP) between 2014 and 2020, which have led to improved patient centred outcomes and sustainable services².

One example is the NHS Lothian & Novartis Pharmaceuticals JWP to develop and implement a Myeloproliferative Neoplasm (MPN) Clinical Nurse Specialist service, first established in 2015. The project was designed to provide expert care and treatment, improve patient experience, and devise a nurse led service comprised of telephone & outpatient clinics that address capacity issues and relieve significant burden on follow up systems³.

The evidence collected included:

- Nurse-led service released 800 appointment slots per year, equating to 72.7 consultant clinics per year
- 94% of patients felt the MPN service improved with the implementation of the CNS, and 98% were happy to be clinically reviewed by the CNS which then supported the business case which led to sustainable funding and continuation of the service⁴.

1 See [Novartis Joint Working Project](#).

2 Data on file (compiled from completed Scotland JWAs)

3 Orchestrating a Winning Performance, NHS Scotland Conference, 2017

4 NHS Lothian Myeloproliferative Clinical Nurse Specialist (MPN CNS) Business Case

Case Study - AstraZeneca

*Transformation of NSTEMI (Non-St-elevation myocardial infarction)
- Care with AstraZeneca at the Golden Jubilee National Hospital*

AstraZeneca alongside NHS Greater Glasgow, the University of Glasgow, the Scottish Ambulance Service and the Golden Jubilee National Hospital entered into a joint working project to redesign treatment pathways and create an Acute Coronary Syndrome e-Registry to improve outcomes for those suffering from a heart attack.

Around 22% of all premature deaths in Scotland are caused by cardiovascular disease and NHS Scotland spends around £800m per year to treat heart disease¹.

In this project, which ran in two parts from December 2013 to June 2015, then May 2016 to April 2019, A&E patients presenting with a high risk NSTEMI (Non-St-elevation myocardial infarction- a type of heart attack) were sent to undergo angiography and revascularisation within 24 hours of admission as international studies have found that doing so can not only maximise the clinical benefit of treatment, but can also reduce time spent in hospital .

In practice, this meant linking the Golden Jubilee with the Scottish Ambulance service to redirect high-risk patients in the West of Scotland to the Golden Jubilee hospital, and as of June 2019, 600 patients had benefited from this pathway with NHS Scotland saving over £1.1m as a result².

A key part of this project has been the creation of an Acute Coronary Syndrome e-Registry. This registry has consolidated six different treatment pathways into one and now enables clinicians to access near real-time data to prioritise at-risk patients³.

Following its completion, this service redesign was awarded the inaugural Innovation award at the National Cardiothoracic Benchmarking Collaborative in London⁴.

1 British Heart Foundation. The CVD Challenge in Scotland. London BHF 2018. Available from: [BHF](#).

2 Golden Jubilee Foundation. Innovative new ways help to treat heart attack patients. Jubilee Life 2019;11:6-7. Available from: [Golden Jubilee Foundation](#).

3 Golden Jubilee Foundation. Innovative new ways help to treat heart attack patients. Jubilee Life 2019;11:6-7. Available from: [Golden Jubilee Foundation](#).

4 Golden Jubilee Foundation. Innovative new ways help to treat heart attack patients. Jubilee Life 2019;11:6-7. Available from: [Golden Jubilee Foundation](#).

Case Study - Eli Lilly

Eli Lilly and NHS Greater Glasgow and Clyde Health Board – Reducing glycaemic episodes for diabetic inpatients

Approximately 23 per cent of patients with diabetes in NHS Greater Glasgow and Clyde Health Board will suffer a glycaemic episode at some point after being admitted to hospital.

In Scotland, Lilly worked with the Health Board to understand the extent of this problem and its root causes. The project implemented a routine medication review for patients at risk of a hypoglycaemic episode, funding a specialist nurse to support work with patients.

More than 220 patients have been seen to date, and more than 200 of them have received a change in their medication to improve blood glucose control, leading to decreased length of hospital stays and re-admission rates while improving patient satisfaction.

Case Study - MSD

Scottish Ambulance Service, NHS Fife, SCI Diabetes, University of Dundee, National Services Scotland and MSD Joint Working Project

The Scottish Ambulance Service (SAS) have been working with NHS Fife Diabetes Service with the support of SCI Diabetes, the University of Dundee, National Services Scotland and MSD to better manage hypoglycaemia in their patients with diabetes.

The project emphasis was on appropriate follow-up of patients who experience a hypoglycaemic event that results in an ambulance call out. Results from the project showed a 38% reduction in ambulance callouts for patients experiencing a hypoglycaemic event and a 38% reduction in those requiring to be conveyed to Accident and Emergency.

This means that there will be more ambulance capacity available within the NHS Fife area and it will help to reduce pressure on Accident and Emergency, it has also resulted in a £230,000 saving split between the SAS and NHS Fife.

This project involves a pooling of skills and resources between the SAS and MSD over 18 months, SAS contribution: £9800; MSD Contribution: £9900; Total £19700.

6. Conclusions

The pharmaceutical industry plays a key role in the Scottish economy, contributing significantly to employment and economic activity.

In Scotland, the wider pharmaceutical sector directly supports over 5,600 FTE jobs and a total of 15,250 jobs across the whole Scottish economy once spill-over effects are calculated. The wider pharmaceutical sector supports around £1.8bn in Scottish GVA.

More specifically, the manufacturing of pharmaceuticals directly supports over 3,850 FTE jobs in Scotland and supports around 11,350 FTE jobs across the whole economy. Pharmaceutical manufacturing supports around £1.5bn in Scottish GVA.

Beyond the statistics the pharmaceutical industry delivers broader benefits that are not captured by traditional economic analysis.

The pharmaceutical industry contributes to the health and wellbeing of our economy through its research and development, collaboration, and in particular its joint working projects, which deliver benefits to patients, industry, and the NHS.

Historically, the sector has had lower income inequality compared to other Scottish industries and offers higher wages and greater job security than many other sectors.

The industry also plays a vital role in contributing to inclusive growth and the well-being economy. As our analysis shows the pharmaceutical sector employs a significant number of people in rural areas and local authorities which suffer from a high degree of deprivation.

Employing workers in these communities not only produces direct benefits to the economy but also creates positive knock-on effects in local economies, including increased consumer spending.

In summary, the pharmaceutical sector employs a significant number of people in Scotland and generates a significant amount of economic activity for the Scottish economy. The sector contributes to inclusive growth through the quality of its employment and wider healthcare benefits.

Whilst there are challenges going forward, not least around Scotland's future trading arrangements, the sector has gained significant trust through increased collaboration during the Coronavirus pandemic. Maintaining this trust and utilising newfound collaboration between industry, government, and academia, has the potential to ensure the sector continues to grow and succeed.

Appendix

Appendix A

Economic Impact Assessments

The economic impact and wider spill-over effects of the pharmaceutical industry are estimated through hypothetically removing the industry from the Scottish economy.

This model estimates the impact that this sector has on economic output and growth in Scotland, both directly and through knock-on effects.

This report looks at the economic impacts of the pharmaceutical sector on output, GVA and employment in Scotland.

Output here is the total value of goods and services produced within the economy. Output is calculated as GVA plus intermediate goods and services that are excluded in GVA calculations.

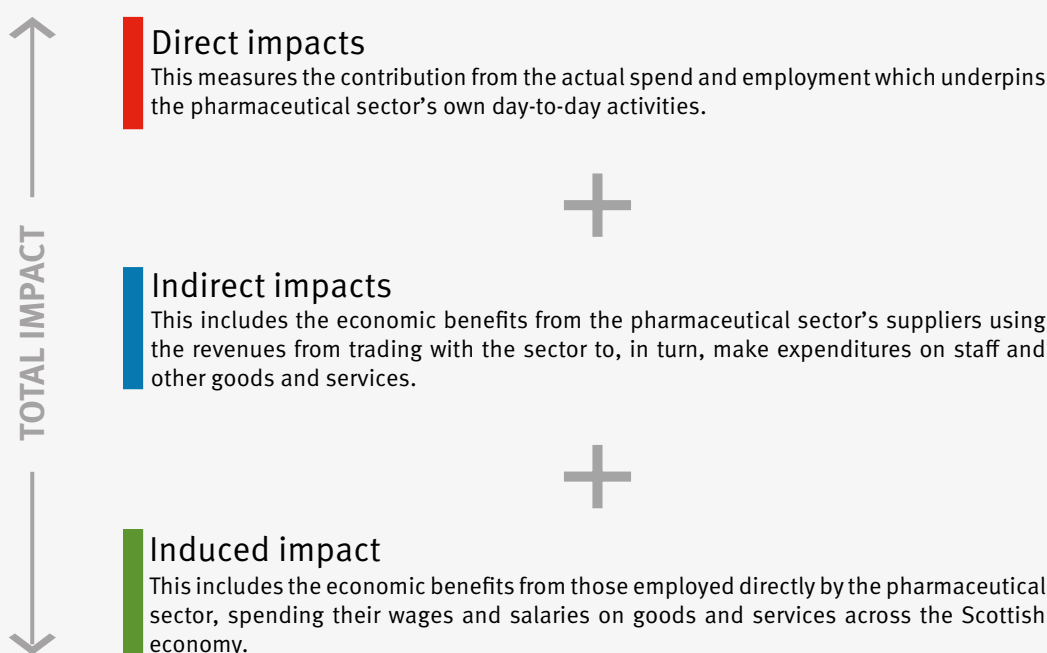
GVA is the value of all final goods and services produced within the economy in a given period of time and is used to measure economic growth. GVA can be expressed generally as the difference between revenue from sales and the cost of inputs.

Following standard regional modelling practices, we model GVA instead of Gross Domestic Product (GDP). GVA is technically GDP at basic prices, i.e. excluding taxes and subsidies on products.

Employment here refers to full-time equivalent (FTE) jobs. One FTE job is equivalent to one person working full-time for one year or, two people working half the hours of a full-time worker for one year, and so on.

When evaluating an economic impact like this, we examine three types of activity: direct, indirect and induced effects. Diagram 1.

Diagram 1: Direct, indirect and induced impacts



Source: Fraser of Allander Institute

Methodology

ABPI provided us with employment data for pharmaceutical sector firms across Scotland. This employment was mapped to Standard Industrial Classifications (SIC) codes. This mapping allows the impact of lost jobs in these firms to be modelled using the Scottish Government's (2017) input output (IO) tables.

Using the IO tables, we applied a Hypothetical Extraction Method (HEM). This essentially “shuts down” the sector to examine the resulting impact on the economy. It does this by extracting the purchases and sales made by sectors the pharmaceutical sector from the model of the Scottish economy.

This results in a reduction in economic activity across the whole economy.

Once extracted, the total output of the post-extraction economy is smaller due to both the loss of final sales of the extracted sector, but also from its purchases and/or sales to the remaining sectors, and the loss of forward and backward linkages elsewhere in the economy, as captured by the IO table.

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