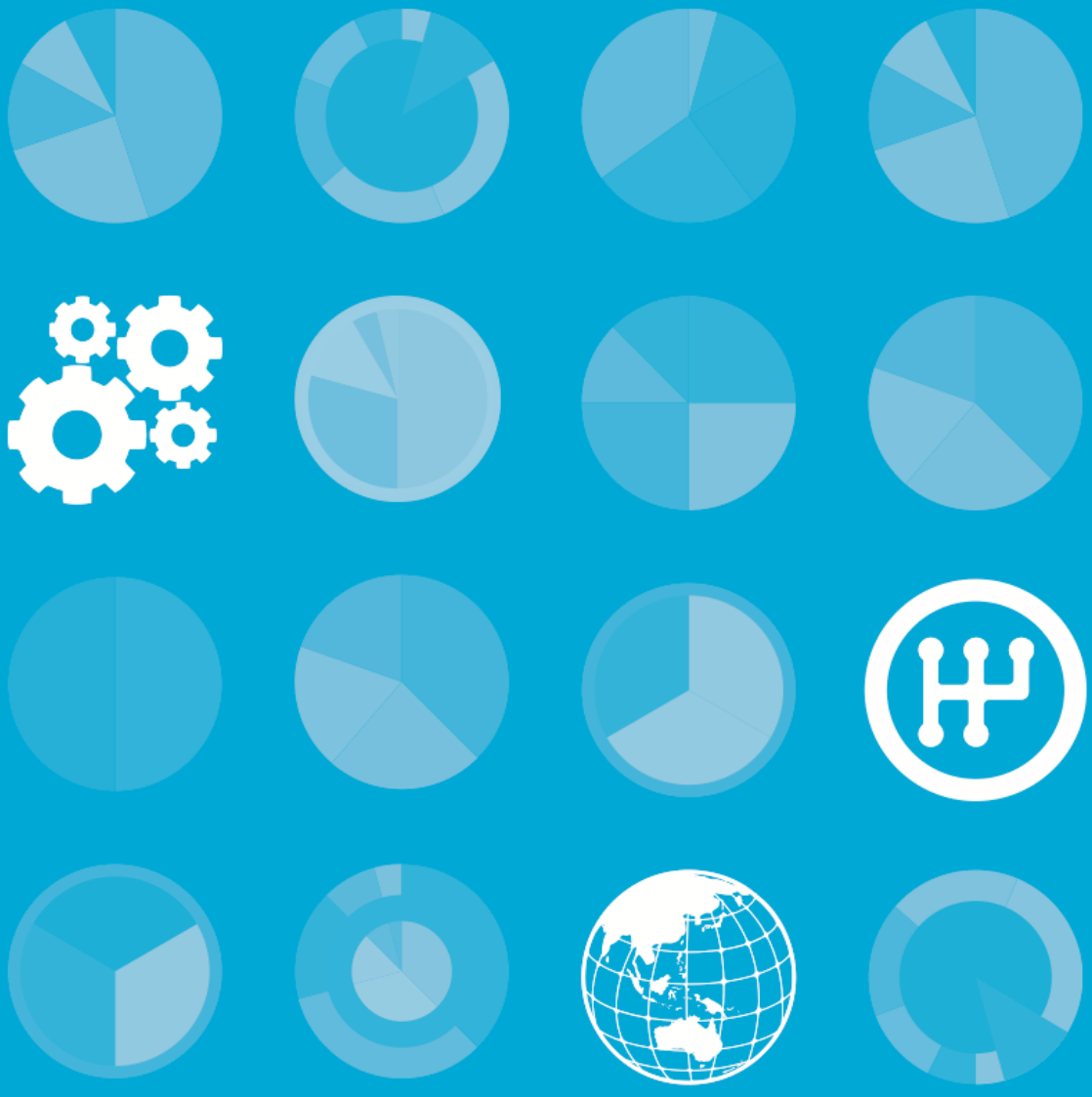
UK and Scotland's Changing Funding Landscape

SULSA Report: first in a series aiming to enlighten Scotland's Life Sciences research community about the prevailing landscape in research and funding

Jill Inkster and Allison Jackson, 2017



SULSA
Scottish Universities Life Sciences Alliance

UK and Scotland's Changing Funding Landscape

1. Introduction

The main purpose of this SULSA report is to highlight the rapidly changing research funding landscape in Scotland and the UK. This overview is aimed at Early Career Researchers to bring them up to speed with the current landscape.

The UK and Scottish Research and Innovation Landscape is complicated and changing at an unprecedented pace (Figure 1).

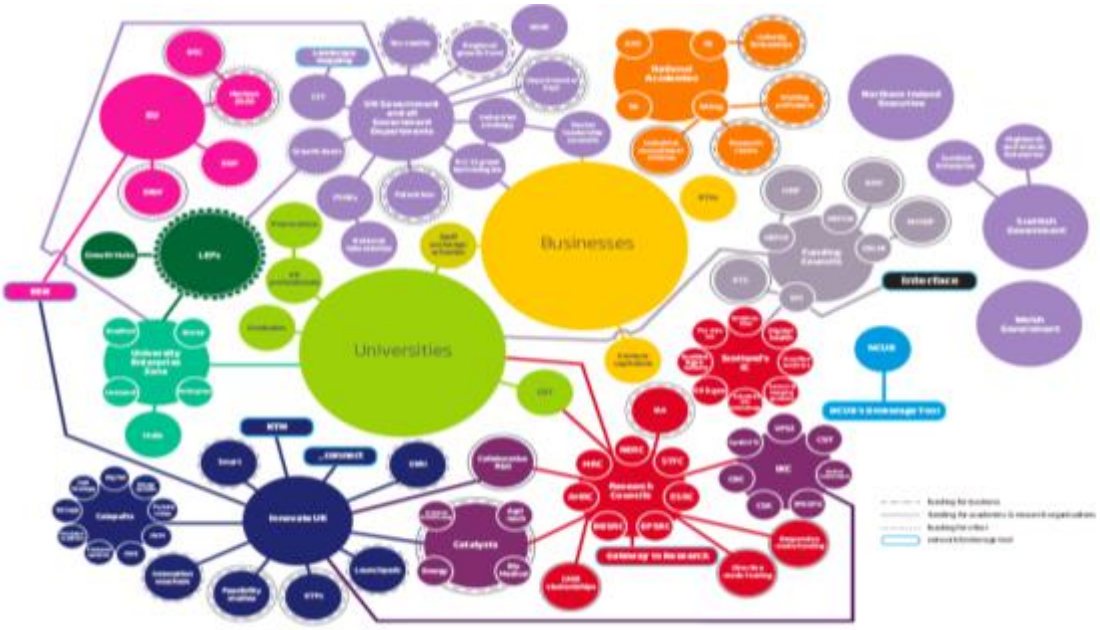


Figure 1. UK Research and Innovation Landscape Map. Source: The Dowling Review of Business-Universities Research Collaborations (July 2015)

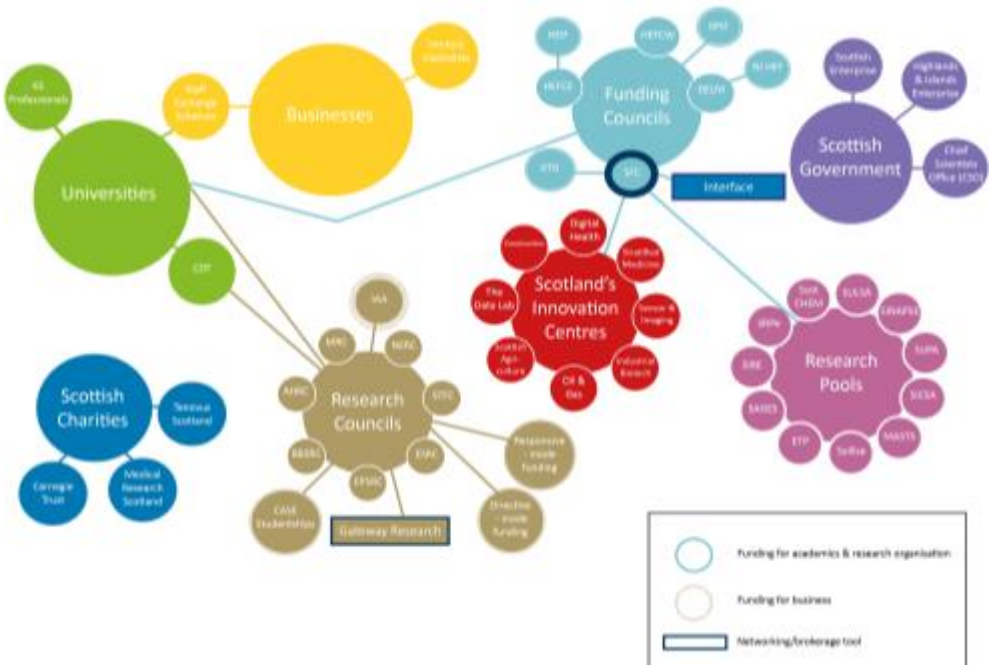


Figure 1.1 Scottish Research and Innovation Landscape Map. Source: Adapted by SULSA from The Dowling Review of Business-Universities Research Collaborations (2017).

There is much more of a focus on Innovation and Impact, in both funding available and the REF. The UK-wide R&D budget has received welcome injections via the Industrial Challenges Fund and the Global Challenges Research Fund, however the science budget has remained fairly stable in recent years, which equates to a decrease as a proportion of GDP (Figure 2). For early career researchers, in particular, successfully securing funding is an extremely difficult task. With the added complication of Brexit and a potential second Scottish Independence Referendum, it is important that researchers understand this complex and ever-changing landscape to both appreciate the current constraints, and also know where existing potential for new opportunities lie.

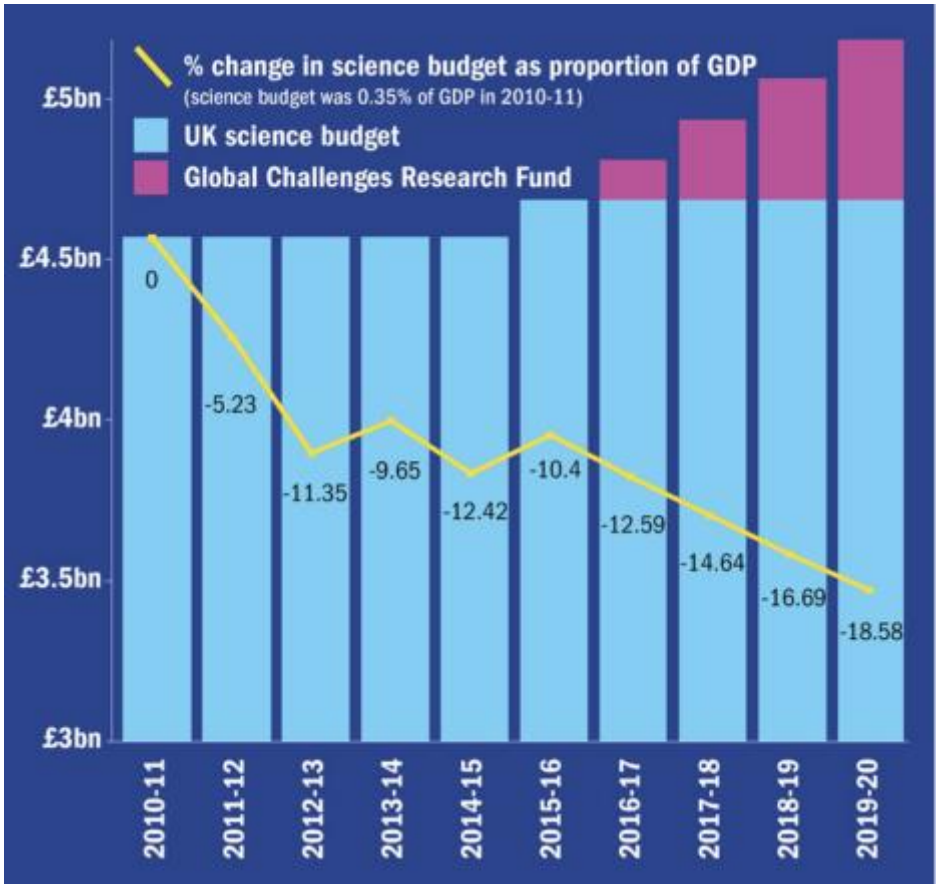


Figure 2: The UK science budget as a proportion of GDP; Proportion of GCRF of the UK science budget (Scienceogram UK and calculations by Times Higher Education).

2. UK-wide Research and Innovation Landscape

2.1 The Introduction of UK Research and Innovation (UKRI)

Under the new Higher Education and Research Act 2017 the UK is undergoing serious reforms to the architecture of research funding. The newly introduced UK Research and Innovation (UKRI) will pull the seven UK research councils, Innovate UK and research functions of Higher Education Funding Council for England (HEFCE) together under one single strategic research body (Figure 3). Sir Mark Walport, currently the UK Government's Chief Scientific Adviser, will be the chief executive of UKRI.

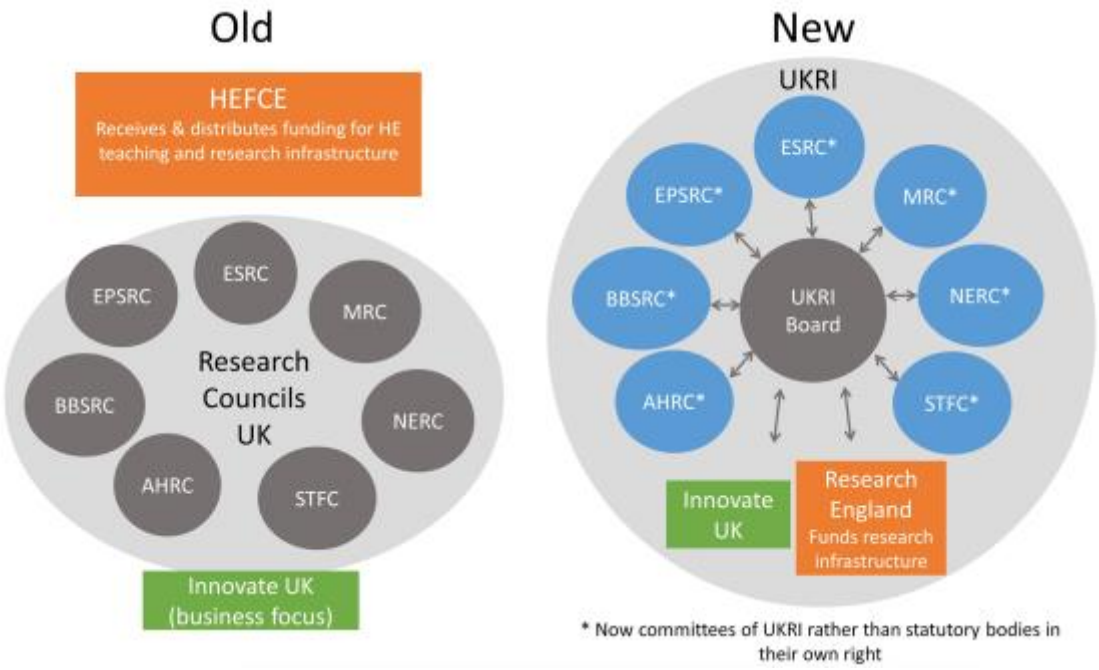


Figure 3: The new UKRI Landscape. Source: Gill Evans and Dorothy Bishop, 2016.

The aim of this pooling is to enhance and improve cross-council collaboration, support the development of new research areas, provide a strengthened unified voice and a better environment to share expertise.

With regards to how this may impact Scotland, the Scottish Funding Council (SFC) have identified potential tensions between UKRI responsibilities for core funding in England and for UK research funding. The Department for Business, Innovation and Skills (BIS) Secretary of State is only required to consider the balance between UK Research Councils and Research England, and not the wider UK. The SFC state that "*without consideration of the UK context across all these matters, there may be potential for universities in the devolved nations to be doubly disadvantaged by the funding decisions that are made within the new arrangements*." Thus, further fragmentation within the UK could occur for the devolved nations.

The inclusion of Innovate UK remains one of the most controversial aspects of the reform. The potential to strengthen the link between the UK research and business base exists by integrating Innovate UK. However, it also raises the question of potential implications

surrounding Innovate UK's ability to blend with the research councils given their different focus and 'customer' base. James Wilsdon writing on Wonkhe claims that neither partner is completely happy and "*the innovation lobby fears that its funding will come under pressure from the research side; and the research councils worry that innovation support will grow at their expense if and when ministerial priorities change*" (Wilsdon, 2017).

Stephen Curry writing in The Guardian argues "*this bill legislates for a downgrading of the research councils. They are no longer councils but committees. They will lose the protection of their Royal Charters. And their chief executives will not,* ex officio*, have a seat on the board of the powerful new over-arching council, UKRI*" (Curry, 2016). The fact that one powerful chair and chief executive will oversee the totality of UK publicly funded research is something that has never been experienced in British science history.

As stated in the White Paper, the UK boasts a vastly productive and high-performing research system. The implications of a poorly introduced reform could be damaging. The newly formed UKRI will have full power over the future of disciplines, departments and individual research centres and will influence their size, shape and direction. Who will benefit and suffer from this will remain unknown until formal implementation in 2018/19.

Despite the uncertainty surrounding the creation of UKRI it will potentially allow greater co-ordination across the research councils whilst providing the research community a stronger voice in its interaction with Government. What is essential, is that the new UKRI board have a clear understanding of the funding, research and innovation landscape across Scotland, and indeed the rest of the UK. To ensure this, Universities Scotland are seeking representation on the board for devolved Administrations.

2.2 Industrial Strategy Challenge Fund

Whilst the budgets allocated to the research councils for their traditional responsive-mode grants remain stagnated, to support the UK Government's Innovation Agenda, £1bn will be invested in cutting-edge technologies to create jobs and raise living standards. Administered by Innovate UK and the Research Councils (until the new body UKRI is fully implemented in 2018) the funding from the flagship Industrial Strategy Challenge Fund (ISCF) will be spent across six key areas over the next four years. These areas include:

- Healthcare and medicine;
- Robotics and artificial intelligence;
- Batteries for clean and flexible energy storage;
- Self-driving vehicles;
- Manufacturing and materials of the future;
- Satellites and space technology

By bringing together world-leading research with the ambitions of business within these categories the ISCF aims to drive innovation and create opportunities for businesses and sectors across the UK, whilst unlocking markets and industries of the future in which the UK can be world-leading.

Business and Energy Secretary Greg Clark said:
"The UK is home to some of the world's best innovators at the very forefront of global excellence. The funding I am announcing today, providing hundreds of millions of pounds of support to develop the next generation of technologies across a range of sectors, shows our determination and commitment to making sure the UK remains at the very forefront of research innovation for years to come" (Clark, 2017).

The first three areas set to receive investment through the fund, as announced in the Spring 2017 Budget, include the SULSA-related healthcare and medicine. This involves an investment of £197m over four years to develop first-of-a-kind technologies for the manufacture of medicines that will speed up patient access to new drugs and treatments, building on the exporting strengths of the UK's biopharmaceutical sector.

Chief Executive of Innovate UK Dr Ruth McKernan said:
"*By announcing these first challenges we are giving businesses the green light to start finding solutions to some of our major societal and industrial challenges and at the same time helping us fully realise economic impact from our world class science base"* (McKernan, 2017).

Over the next four years the government will invest £250 million to support the delivery of ISCF by investing in highly-skilled research talent. This will include an additional 1,000 PhD places and support for new fellowships for early and mid-career researchers in the relevant field.

2.3 Research and Development

These increases in investment are welcome news as between 2004 and 2014, business R&D intensity more or less flat lined. Richard Jones writing on Wonkhe (Jones, 2017) reports that business investment in R&D is just over 1% of GDP in the UK, around a mere half the rate in Germany and substantially below the OECD average (Figure 4). Jones concludes that what we've been doing up to now hasn't worked. The Industrial Strategy Challenge Fund will help combat this.

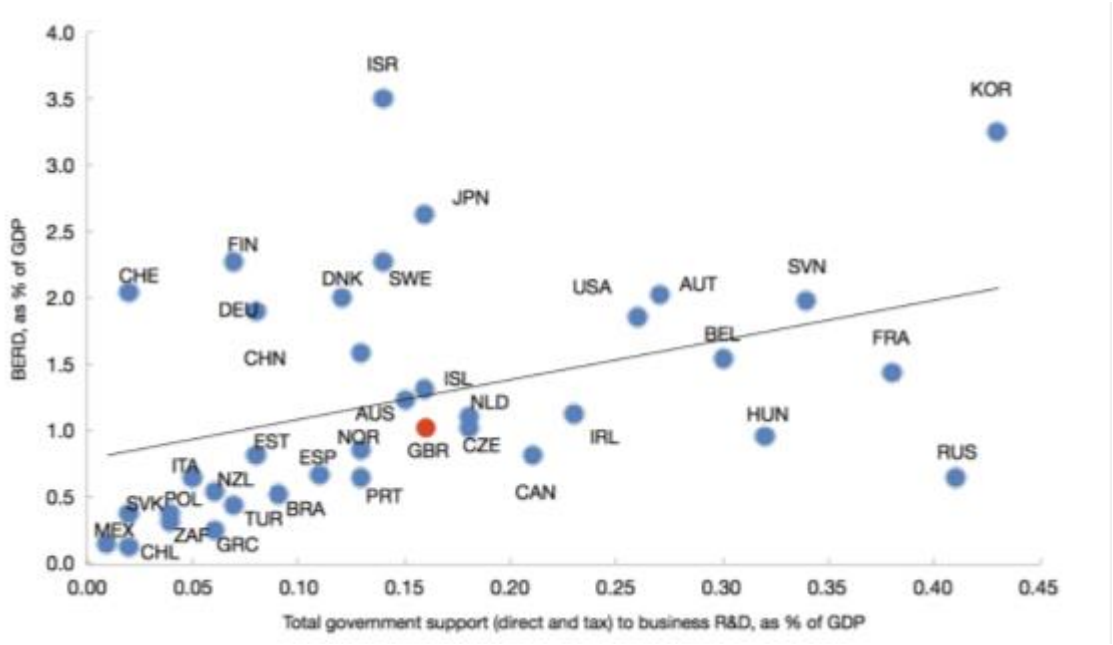


Figure 4: Business Research and Development Intensity and Government Support to Business R&D. Source: OECD Science, Technology and Industry Scoreboard 2015. BERD is the Business Enterprise Research and Development. The UK is shown as 'GBR' in red.

Britain needs to work on commercialisation, as all too often ideas developed in the UK end up being commercialised elsewhere. Furthermore, within the UK we experience gross regional disparities in economic performance (Figure 5). The dominance of London and the south east of England identifies a striking difference between prosperous parts of the UK and less prosperous parts. This is an issue that careful industrial strategy planning must address as an unbalanced national landscape requires a long-term deliberate strategy to correct the issue.

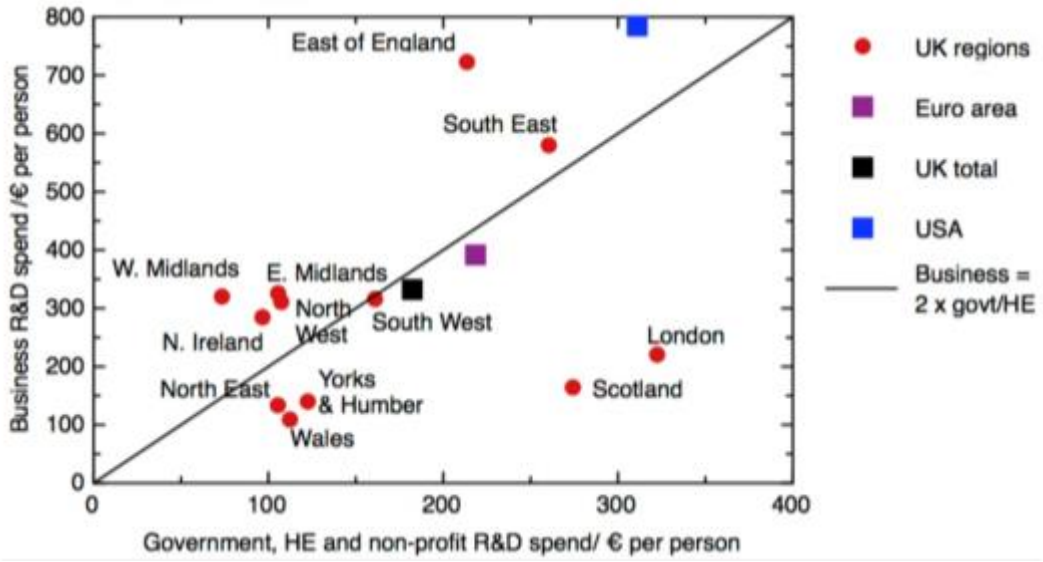


Figure 5: Business and Government/Higher Education R&D in the UK by NUTS 2 Regions.
Source: Eurostat, updated March 2016

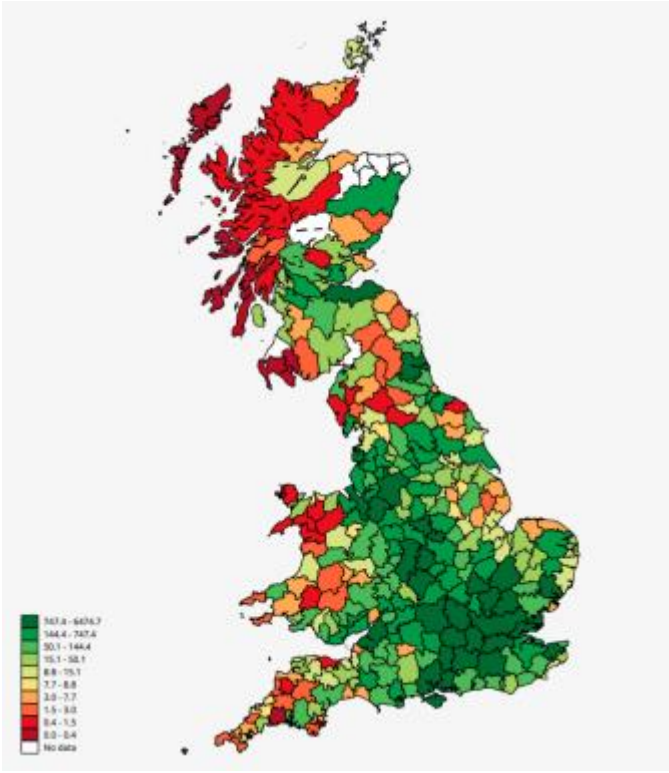


Figure 6: R&D stock by travel-to-work area. £ million. Source: NCUB, 2015.

2.4 Global Challenges Research Fund

Another important and substantial injection of funding into the research landscape is the Global Challenges Research Fund (GCRF). As part of the UK's Official Development Assistance (ODA) the UK Government is investing £1.5 billion towards the GCRF during the period 2016/17 – 2020/21. The amount of funding allocated is increasing year on year until 2021. Whilst all the Research Councils will have an independent GCRF budget, interestingly the majority of the budget in later years will be in a common pot, to facilitate flexibility and interdisciplinary projects (Figure 7).

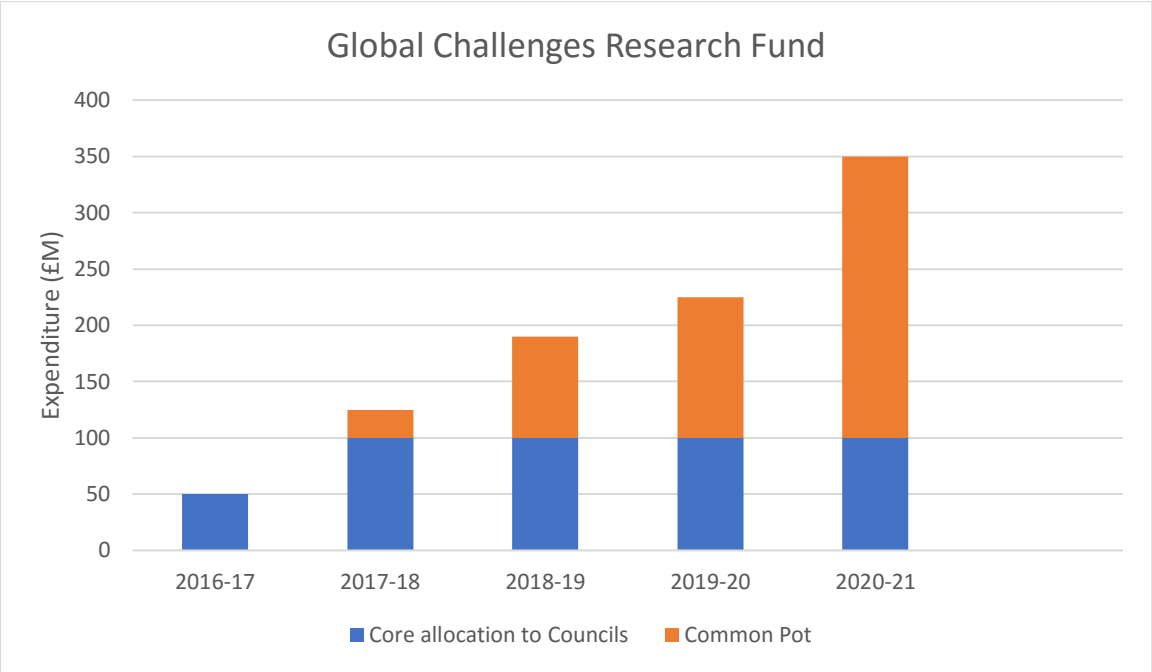


Figure 7: Global Challenges Research Fund Expenditure. Source: Modified from slide presented by RCUK on spending profile of GCRF.

ODA funded activity focuses on outcomes that promote the long-term sustainable growth of countries on the OECD Development Assistance Committee (DAC) list (Appendix A). Administered through delivery partners including the Research Councils and national academies (Appendix B), the aim of the GCRF fund is to ensure that the UK take a leading role in addressing challenges faced by developing countries whilst promoting their welfare and economic development through:

- Disciplinary and interdisciplinary research;
- Strengthening capacity for research and innovation within both the UK and developing countries;
- Providing an agile response to emergencies where there is an urgent research need.

From this fund the SFC was allocated £2m for 2016/17 which is expected to increase year on year. This funding will be allocated amongst Scottish Higher Education Institutes (HEIs) proportionate to their share of SFC's Research Excellence Grant. The SFC state that other eligible applications for the GCRF include:

- To support research activities and infrastructure which are consistent with the terms and objectives of GCRF;
- To support primp-priming activities to underpin GCRF bids to the Research Councils

These activities will allow Scottish HEIs to develop their international links whilst showcasing the global impact of their research.

Any research proposals submitted should clearly demonstrate that its primary purpose is to promote the economic development and welfare of Low and/or Middle Income Countries on the DAC list of ODA recipients as its main objective.

Overall, this fund helps to cement the protection of science spend within Government, alongside their pledge to allocate 0.7% of Gross National income to Official Development Assistance (ODA). GCRF has the potential to enhance the international reach of UK HEIs and the SFC expect Scottish HEIs to be part of this.

For a breakdown of budget allocation and government research spend please see Appendix C and D respectively.

2.5 REF: Focus on Impact

Lord Stern's Research Excellence Framework (REF) review was published in July 2016. Within this review an emphasis was made on research impact which is defined as "*an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia"* (Stern, 2016). Stern argued that potentially very valuable channels, whereby the UK's research base impacts on industry, public engagement, and policy, are not being captured. This new emphasis on impact has drawn mixed reactions from the academic world.

Criticism surrounds the extra pressure government is placing on universities to focus on work that has demonstrable economic benefits. Matthias Uecker from the University of Nottingham says the new proposals "*may have the effect of disincentivising research that does not translate into immediate measurable impact for public policy or industry in the UK*" (Uecker, 2017). A benefit for the SULSA community is its ability to demonstrate impact far more easily than researchers in the humanities, for example, although in many cases the timescales are long.

Jonathan Adams, director of research evaluation for Thomas Reuters argues that "*work over the last 20 years has given us a clear idea that not much makes sense for the evaluation of the economic and social impact of research. The problem is that it is very complex, but the government wants a very simple indicator. Research takes a long time to translate into new products and processes, so the lag between investment and change is extended, variable and uncertain*" (Adams 2017).

However, there are some benefits to draw from the impact focus. Steven Hill, Head of Research Policy at HEFCE claims that preparing for the impact element of the REF has given strategic insight and other benefits to universities, he says:

"One of the reasons for a rounded assessment of research excellence that includes broader societal impact is to incentivise university and researchers to increase their focus on delivering benefits from research. The impact evaluation provides evidence that this objective is being met. The inclusion of the impact element in REF, alongside other changes – such as the requirement to consider broader impact in Research Council applications – is leading to a change in culture" (Hill, 2017).

As such, researchers will begin to experience increased levels of in-depth thinking and perception by adding this extra element to their research.

Once formed, the UKRI will take on responsibility for the REF, working with funding bodies in devolved administrations in the same way that HEFCE does currently. How this will affect the next REF, if at all, remains to be seen.

REF2014 impact case studies can be viewed on the impact case study database (www.hefce.ac.uk/rsrch/REFimpact)

2.6 Shift from Responsive Mode Funding

Although funders still welcome applications for responsive mode funding, these new initiatives and financial injections via the Industrial Challenges Fund and Global Challenges Research Fund signal a shift to government and research councils setting the agenda by creating the challenges and priorities.

Responsive mode funding is steered by what the applying Principal Investigator wants to research and will be reviewed by the relevant research council. Although the proposal must be relevant to the research council's mission, it does not have to meet a set of pre-defined specifications as they do not exist for responsive mode.

The amount being allocated by the government for responsive mode grants has flatlined, with more money being invested year on year into challenge led grants. Being responsive is no longer the priority. This shift means that researchers are no longer shaping their own research and in order to be successful they now have to respond to the priorities and challenges set.

3. Scottish Research and Innovation Landscape

Scotland has a thriving research community, and does extremely well per-capita in secured research funding compared to the rest of the UK. In 2012/13, Scottish HEIs won £231 million in Research Council funding, accounting for 15.7 % of the Research Council grant funding awarded to UK HEIs on a competitive basis reflecting the high quality of their research, when compared to Scotland's 8.3 % of the UK's population share.

3.1 Scottish Funding Council

Established in 2005, The Scottish Funding Council (SFC), is the non-departmental public body charged with funding Scotland's further and higher education institutions, including its 19 universities. The SFC invests £1.6 billion per year on learning and teaching, skills development, research and innovation, staff, buildings and equipment. The SFC funds their research pools (including SULSA), and the Scottish Innovation Centres, as well as part-funding Interface.

3.2 Industrial and Life Sciences Strategies for Scotland

3.2.1 The Industrial Strategy Challenge Fund will also support the UK government's Green Paper for Building our Industrial Strategy which outlines 10 key pillars of focus (Figure 8).

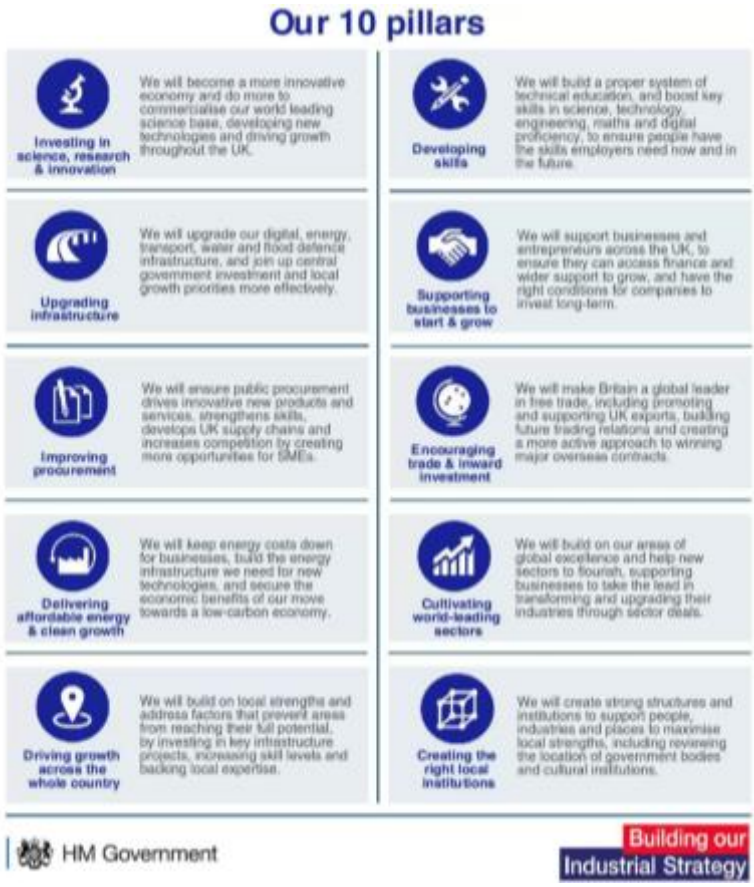


Figure 8: Industrial Strategy 10 Pillars. Source: HM Government, 2017

Adam Marshall, Director General, British Chambers of Commerce said:

"Business communities across the UK will be pleased to see that harnessing the potential of our cities, towns and counties lies at the heart of the Government's approach to Industrial Strategy. There are dynamic business communities in every corner of the UK – and it is their future success that will make our country more competitive and more prosperous" (Marshall, 2017).

So how will this affect Scotland? In January 2017, the UK government invited contributions from businesses, local groups and workers from across Scotland to help shape its vision for a modern Industrial Strategy. This strategy will aim to reduce regional disparities in opportunities and prosperity within the UK.

Energy and Industry Minister in Theresa May's first Government, Jesse Norman, said:

"Scotland makes a huge contribution to the UK's economy, cementing it as the fifth largest worldwide. The Government's new Industrial Strategy is designed to build on Scotland's economic strengths within the UK as a whole, creating more opportunities, prosperity and jobs. Our new Industrial Strategy provides an opportunity for the UK to make fresh choices about how its economy develops. We invite people and businesses across Scotland to have their say in shaping it, so that growth and well-being can be more widely spread in an economy that works for all" (Norman, 2017).

With this ambition of creating an economy that works for everyone, the Green Paper includes a number of planned proposals which will benefit Scotland, including:

- The Industrial Strategy Challenge Fund and foundation of UKRI, creating new opportunities for Scotland's world class universities and research institutions to bid for UK Government funding.

- Opportunities for entire sectors to propose new ways of working with different levels of Government to create the conditions for success, building on the success of City Deals in Scotland

- Looking beyond current commitments to support the development of the offshore wind industry in Scotland as well as supporting research into cost effective new renewable technologies

3.2.2 Life Sciences Strategy

In 2017 the Scottish Government published an updated Life Sciences Strategy entitled *Life Sciences Strategy for Scotland 2025 Vision*, that builds upon the 2011 Strategy. Priority areas in the 2011 Strategy were regenerative medicine, stratified medicine, assisted living, sustainability and wellbeing.

In refreshing the strategy, Scotland is responding to emerging global trends such as the ageing population, proliferation of chronic diseases and increasing cost pressures on healthcare payers. The 2017 update sets an ambitious target of growing the industrial turnover of the life sciences sector to £8 billion by 2025. The latest sector figures (2014 data) show that company turnover is in excess of £4.2 billion and gross value added (GVA) around £2 billion. This will be achieved through the creation of a dynamic and competitive environment with a robust business base capable of attracting key skills, talent and investment. Accordingly, four strategic themes were identified – innovation and commercialisation, sustainable production, internationalisation and business environment (Figure 9).

Figure 9: Life Sciences Strategy: Strategic Plan. Source: Life Science Scotland, 2017.

See Appendix E for Life Sciences Scotland's summary of Scotland's life sciences advantages.

Ultimately, this updated strategy seeks to make Scotland the location of choice for Life Sciences businesses, researchers, healthcare professionals and investors whilst increasing Scotland's economic growth via Life Sciences.

3.3 Scotland's Innovation Centres

In 2012, the SFC launched their Innovation Centre programme in partnership with Scottish Enterprise and Highlands and Island Enterprise, to support the relationship between universities and business. Backed by industry, the centres aim to boost innovation and entrepreneurship, accelerate technological advances, create job opportunities and grow the economy in Scotland's key sectors.

For SULSA researchers this means skills and training support for the next generation of researchers, and knowledge exchange practitioners through masters and post-doctoral level provision. In addition, the Innovation Centres generally have budgets for grant funding (for academic-industrial partner projects). The Innovation Centres deploy a wide range of activities (Figure 10).

Awareness and Profile Raising (Community Building)	Supporting Industry-Academic Collaborations	Skills and Training
• Host own IC events and conferences. • 'Piggy-back' on to other organisations' events. • Learning journeys and international engagement. • Websites for each IC and a shared ICs website[4]. • Social media. • Blogs. • Case studies. • Newsletters.	• Providing opportunities for industry, academics and others to come together to discuss sector/industry challenges and potential solutions. • Support to scope project ideas. • Application support and guidance. • IC match-making service, as well as linking with Interface and with Business Development teams within HEIs. • Grant funding to support collaborative R&D projects.	• MSc programmes and places. • Internships. • Industry placements and secondments. • Online learning and CPD.

Figure 10: Innovation Centre Activities. Source: EKOS Limited – Business Engagement and Economic Impact Evaluation

According to Hair and Docherty "*the level of innovation cooperation between businesses and universities in Scotland is much lower than for the rest of the UK, as is the absorptive capacity of business for research knowledge. This is a major challenge, but also a significant opportunity, for the Scottish economy*" (Hair and Docherty, 2015).

With a commitment to spend £120 million towards Innovation Centres over five years (2013-18) the SFC are tackling this issue head on. Eight Innovation Centres currently exist (Figure 11).

Innovation Centre	Location	Affiliated University
CENSIS: Centre for Sensor & Imaging Systems	Glasgow	University of Glasgow
Construction Scotland Innovation Centre	Hamilton	Edinburgh Napier University
Digital Health & Care Institute	Glasgow	University of Strathclyde
Industrial Biotechnology Innovation Centre	Glasgow	University of Strathclyde
Oil and Gas Innovation Centre	Aberdeen	Aberdeen??
Scottish Aquaculture Innovation Centre	Stirling	University of Stirling
Stratified Medicine Scotland Innovation Centre	Glasgow	University of Glasgow
The Data Lab	Aberdeen, Edinburgh and Glasgow	Universities of Edinburgh, Glasgow and Robert Gordon

Figure 11: Scotland's Innovation Centres: Driving Demand Led Innovation, November 2015

In a highly competitive research environment it is essential that Scottish HEIs and researchers actively engage and build upon their innovation and business collaboration. With business attitudes towards academic collaboration improving, catalysed in part by the Innovation Centres, there is a huge opportunity for Scottish HEIs. Take the University of Glasgow for example where recent successes in securing large-scale collaborations with industry partners include their £29m Quantum Technology Hub, £11m Urban Big Data Centre, £55m James Watt NanoFabirication Centre, £16m Imaging Centre of Excellence and £20m Stratified Medicine Scotland Innovation Centre.

Professor Graeme Reid conducted an independent review on the Innovation Centres in 2016 and found that "*the Innovation Centres programme is on the right track and they have emerged from any initial teething troubles and tensions associated with the start-up phase and are now entering a more mature operational phase. It will take time for a wider range of businesses in Scotland to build familiarity and trust in the Innovation Centres programme and discover how best to gain advantage from the services they offer*" (Reid 2016).

Full details on each of the Scottish Innovation Centres can be found on the SFC's website.

3.4 Scotland's Research Pooling Partnerships

The research pooling initiative was created by SFC in 2003 to encourage researchers across Scottish higher education to pool their resources and respond to increasing international competition.

SFC Research Pools:

- Energy Technology Partnership (ETP)
- Marine Alliance for Science & Technology for Scotland (MASTS)
- ScotCHEM
- Scottish Alliance for Geoscience, Environment and Society (SAGES)
- Scottish Imaging Network: A Platform for Scientific Excellence (SINAPSE)
- Scottish Informatics and Computer Science Alliance (SICSA)
- Scottish Institute for Research in Economics (SIRE)
- Scottish Research Partnership in Engineering (SRPe)
- Scottish Universities Life Sciences Alliance (SULSA)
- Scottish Universities Physics Alliance (SUPA)
- Soillse (Gaelic language and culture)

The Scottish Universities Life Sciences Alliance (SULSA) is one of the most successful pools, having leveraged approximately £400 million since its inception in 2007, with continued funding until 2021. SULSA has four research themes: Development and Regulation, Ecosystems, Technology and Analysis, and Understanding and Treating Disease. SULSA's member universities in the 2017/18 academic year are the Universities of Aberdeen, Dundee, Edinburgh, Glasgow, St Andrews and Strathclyde, with Heriot Watt and Robert Gordon joining this year.

SULSA aims to enhance Scotland's vibrant life sciences research community by improving opportunities for collaboration, funding and translational research.

3.5 Other Scottish Initiatives to Drive Innovation

Additional Scottish organisations focused on driving innovation are Scottish Enterprise, Highlands and Islands Enterprise and Interface.

Scottish Enterprise: Scotland's main economic development agency who work with partners in the public and private sector to identify and exploit the best opportunities to deliver a significant, lasting effect on the Scottish economy. Encourages international trade, inspires business growth via innovation, helps secure investment and develops Scotland's talent. Scottish Enterprise's Resource Budget for 2016/17 amounts to £237.780 million, including £212.627 million of grant in aid and a ring fenced non-cash budget provision of £25.153 million.

Highlands and Islands Enterprise (HIE): an ambitious organisation with a unique remit that integrates economic and community development to generate sustainable growth. Aims to make the Highlands and Islands a highly successful and competitive region by supporting business and enterprise growth, strengthening communities, developing growth sectors and creating the conditions for a competitive low-carbon region. During 2015-16 HIE received funding of £66.2 million from the Scottish Government.

Interface: a central hub that connects organisations from a wide variety of national and international industries to Scotland's 23 higher education and research institutes, with support from SFC, Scottish Enterprise and HIE.

3.6 Scotland's Future - Brexit

Looking forward, there's no sign of the funding landscape settling with Brexit and a possible second Scottish independence referendum on the horizon. Unfortunately, as Brexit and Immigration are not devolved issues, the Scottish Government is not involved in these negotiations. However, when powers are repatriated, many will be passed to the devolved nations to administer (e.g. agriculture, health, education and environment).

The Scottish Universities benefit hugely from EU funding. So, at a time where Scottish research is attracting more European Union investment than ever, the prospect of a hard Brexit will cause major setbacks. Since 2014, almost £250 million has been secured by Scottish organisations from the EU Horizon 2020 research programme.
Between 2014 and 2015 alone, Scottish universities received £94 million from EU sources, contributing 9.4% of their total research income.

Data from the Higher Education Statistics Agency (HESA) shows by far the largest EU income is in Clinical sciences (£19.9M), Biosciences (£15.3M) and Physics (£10.5M) followed by IT, systems sciences & computer software engineering (£6.8M), Earth, Marine and Environmental Sciences (£6.3M), Electrical, electronic & computer engineering (£5.3M) and Chemistry (£5M). Whilst the Life Sciences secure the most EU funding by amount, it equates to about 10 % of their research income. Other sectors such as engineering rely on EU funding for nearly half of their research income.

As quoted on The National, MSP for Further Education, Higher Education and Science Shirley-Anne Somerville said:

"*Scottish universities and research institutions remain committed to collaborating with our European partners and attracting the best international talent – but have been clear that this requires continued access to the single market and EU funding"* (Somerville, 2017).

To make this possible, the UK would have to pay into the EU budget for 'assisted' status for EU research programmes, an idea which is not backed by the Tory Government. Whether the EU would even allow it is also unknown prior to conclusions of the Brexit negotiations.

The detrimental effect to Scotland goes far beyond funding cuts from the EU. In 2016, The British Heart Foundation invested £63 million in research into cardiovascular disease in Scotland alone, which will be carried out across the SULSA universities of Dundee, Edinburgh, Aberdeen, Glasgow and St Andrews. BHF's Scotland Director James Cant says the success is fragile:

"*People want to come here, we've attracted the world's top researchers – but some of our key talent is not From Scotland or the UK. Of our Principal Investigators in the UK, 19% are non-UK residents*" (Cant, 2016).

If a hard Brexit makes it too difficult for these residents to remain in Scotland, or perhaps they'll find living in the UK too onerous, Scotland will lose highly-skilled researchers. 16 % of

academic staff in Scottish HEIs are from the EU – this rises to 23 % amongst research-only staff.

The future remains unclear but for now Health charities plan on lobbying governments at Holyrood and Westminster to help retain Scotland's position, by seeking associated country status to allow access to EU research funding and the Horizon 2020 fund.

4. Summary

It is undeniably an exciting time for Life Sciences in Scotland and the UK. Despite the unwelcome Brexit implications and uncertainties surrounding the formation of UKRI, opportunities are arising. For example, The Industrial Strategy, Scotland's updated Life Sciences Strategy and the Global Challenges Research Fund all provide a welcome injection into the Life Sciences sector. Whether these opportunities are fully maximised will depend on how well the Scottish Government, SFC, Higher Education Institutions and enterprise agencies work together.

For further information and to stay up to date we recommend following Wonkhe and Times Higher Education.

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Appendix A

Table 1. OECD Development Assistance Committee (DAC) List of ODA Recipients

Least Developed Countries	Other Low Income Countries	Lower Middle Income Countries and Territories	Upper Middle Income Countries and Territories
• Afghanistan • Angola • Bangladesh • Benin • Bhutan • Burkina Faso • Burundi • Cambodia • Central African Republic • Chad • Comoros • Democratic Republic of the Congo • Djibouti • Equatorial Guinea • Eritrea • Ethiopia • Gambia • Guinea • Guinea-Bissau • Haiti • Kiribati • Lao • Lesotho • Liberia • Madagascar • Malawi • Mali • Mauritania • Mozambique • Myanmar • Nepal • Niger • Rwanda • Sao Tome and Principe • Senegal • Sierra Leone • Solomon Islands • Somalia • South Sudan • Sudan • Tanzania • Timor-Leste • Togo • Tuvalu • Uganda • Vanuatu • Yemen • Zambia	• Democratic People's Republic of Korea • Kenya • Tajikistan • Zimbabwe	• Armenia • Bolivia • Cabo Verde • Cameroon • Congo • Cote d'Ivoire • Egypt • El Salvador • Georgia • Ghana • Guatemala • Guyana • Honduras • India • Indonesia • Kosovo • Kyrgyzstan • Micronesia • Moldova • Mongolia • Morocco • Nicaragua • Nigeria • Pakistan • Papua New Guinea • Paraguay • Philippines • Samoa • Sri Lanka • Swaziland • Syrian Arab Republic • Tokelau • Ukraine • Uzbekistan • Vietnam • West Bank and Gaza Strip	• Albania • Algeria • Antigua and Barbuda • Argentina • Azerbaijan • Belarus • Belize • Bosnia and Herzegovina • Botswana • Brazil • Chile • China • Colombia • Cook Islands • Costa Rica • Cuba • Dominica • Dominican Republic • Ecuador • Fiji • Former Yugoslav Republic of Macedoni • Gabon • Grenada • Iran • Iraq • Jamaica • Jordan • Kazakhstan • Lebanon • Libya • Malaysia • Maldives • Marshall Islands • Mauritius • Mexico • Montenegro • Montserrat • Namibia • Nauru • Niue • Palau • Panama • Peru • Saint Helena • Saint Lucia • Saint Vincent and the Grenadines • Serbia • Seychelles • South Africa • Suriname • Thailand • Tonga • Tunisia • Turkey • Turkmenistan • Uruguay • Venezuela • Wallis and Futina

Source: OECD, DAC List of ODA Recipients

Appendix B

Global Challenges Research Fund Delivery Partners – National Academies and UK Research Councils

UK Research Councils

- Arts and Humanities Research Council
- Biotechnology and Biosciences Research Council
- Economic and Social Research Councill
- Engineering and Physical Science Research Council
- Medical Research Council
- Natural Environment Research Council
- Science and Technology Facilities Council
- Research Councils UK

National Academies

- Academy of Medical Sciences
- British Academy
- Royal Academy of Engineering
- Royal Society

Appendix C

Global Challenges Research Fund Budget Allocation

Global Challenges Research Fund

GCRF (£m)	(£m) Resource					
	16/17	17/18	18/19*	19/20*	20/21*	SR Total
National Academies	11	11	11	11	11	45
AHRC	5	7	7	7	7	25
BBSRC	10	20	20	20	20	70
EPSRC	10	15	15	15	15	55
ESRC	5	10	10	10	10	35
HEFCE	20	37	37	37	37	130
MRC	14	34	34	34	34	115
NERC	5	10	10	10	10	35
STFC	0	4	4	4	4	11
International Partnership Programme	32	30	30	30	30	122
Unallocated GCRF	**0**	**38**	**122**	**216**	**315**	**377**
Totals	**112**	**215**	**299**	**393**	**492**	**1,019**

* Indicative only.
Totals may not add due to rounding.

The Science and Research Budget

Table 1. The Science and Research Budget

Science and Research Budget Total	(£m)					
	16/17	17/18	18/19*	19/20*	*20/21**	SR15 Total
Resource budget	**4,808**	**4,896**	**4,990**	**5,094**	-	**19,788**
Of which …						
Global Challenges Research Fund (GCRF)	112	215	299	393	492	1,019
Newton Fund	90	105	115	125	*150*	435
Capital budget	**1,130**	**1,149**	**1,169**	**1,189**	***1,209***	**4,637**
Of which …						
World Class Labs	614	610	588	594	*588*	2,406
Grand Challenges Fund	516	539	581	595	*621*	2,231

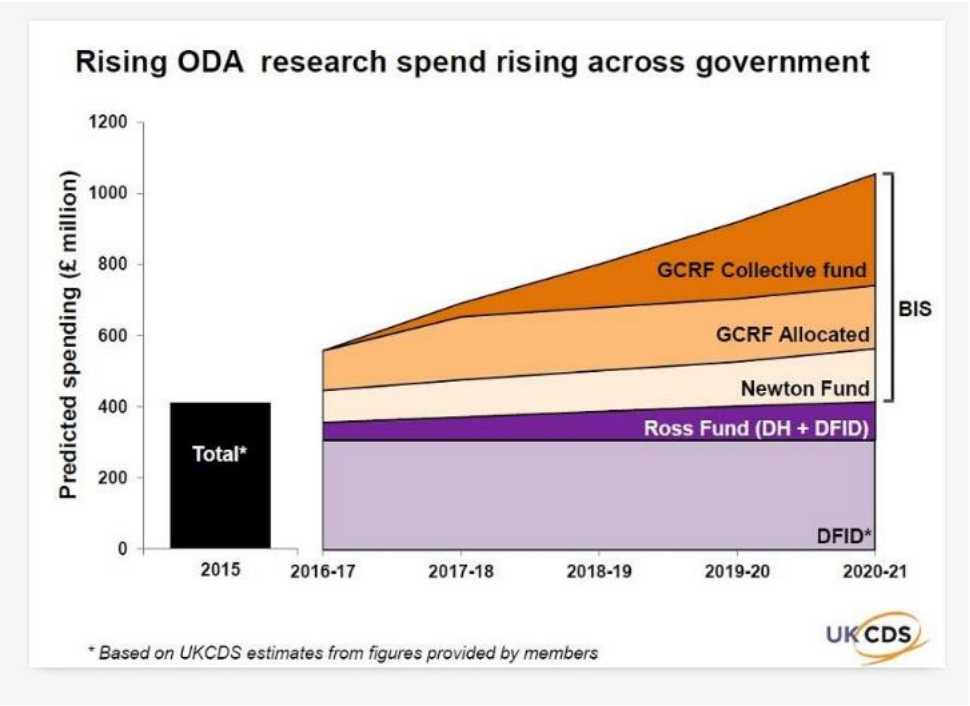
*indicative only
Totals may not add due to rounding.
The SR15 period is from 2016/17 – 2019/20.

Firm allocations are provided in the non-shaded columns for financial years 2016/17–17/18, later years are indicative. Indicative budgets for GCRF and the Newton Fund are shown for 2020/21.

Source: Department for Business and Innovation Skills (2016)

Appendix D

ODA Government Research Spend



Source: UK CDS (2016) Rising ODA Research Spend

Appendix E

Life Sciences Scotland: Scotland's Advantages in the Life Sciences

VIBRANT, DIVERSE AND GROWING COMPANY BASE

One of the largest Life Sciences clusters in Europe, Scotland employs over 37,000 people across some 700 organisations. Companies in the sector contribute in excess of £4.2bn turnover and about £2bn gross value added to the Scottish economy. Since 2010, company turnover increased by 29%, gross value added by 24% and total employment in companies by 13%[1].

Scotland is home to a range of multinationals and small and medium enterprises (SMEs) with a strong track record of creating and growing start ups. A thriving entrepreneurial culture in our universities creates more spin-outs than any other region of the UK[5].

Scotland has comprehensive supply chains and world-class manufacturing expertise supplying chemical and healthcare equipment, pharmaceutical services, medicines, vaccines and diagnostics to the world.

ACCESS TO WORLD LEADING RESEARCH

Scotland is an ideal location to source partners for major Life Sciences projects, with world leading research expertise across human healthcare, animal and plant sciences, aquaculture, agritech and industrial biotechnology.

Scotland ranks worldwide among the top three for research productivity and impact[7], with 19 universities and higher education institutions, and world leading research centers, that attract some of the brightest international scientists. For example, Scotland has the largest concentration of animal health and aquaculture researchers in Europe.

Scotland has invested heavily to develop innovation and excellence centres to catalyse collaborations between industry and academia. These interactions support business performance through the rapid and efficient translation of solutions to industrial and scientific challenges.

STRONG EVOLVING INVESTMENT ENVIRONMENT

Scotland has one of the most active business angel networks in Europe and is only second to London in the UK in terms of the number of Life Sciences companies receiving venture finance. The Scottish Investment Bank is the most active Life Sciences investor in the UK[6].

Scotland also provides a range of supportive mechanisms to enable businesses to prosper including Regional Selective Assistance, Training Plus grants, R&D grants, Patent Box (UK) and the lowest rate of corporation tax of the G20 countries.

PROVEN TRACK RECORD OF INVENTION AND MEDICAL ADVANCES

Scotland has a proven track record over centuries of pioneering invention and medical innovation and is well positioned to revolutionise the Life Sciences landscape of the future.

INNOVATION READY UNIFIED HEALTH SERVICE

Scotland has an invaluable resource for the data-driven approach to healthcare of the future, with all patients in NHS Scotland having a unique identifier and electronic health record.

Through NHS Research Scotland (NRS) our health service has a single access point for industry, dedicated clinical research facilities and globally competitive approval and start-up times. We also encourage innovators within NHS Scotland to work with industry partners, both through the Health Innovation Partnership (HIP) and also through Scottish Health Innovations Ltd (SHIL) which supports the development, protection and appropriate commercialisation of innovative ideas arising from healthcare professionals.

Scotland has a wealth of clinical expertise, a stable population actively engaged in clinical research and a growing registry of patients willing to share e-health records for the development of novel treatments and therapies.

SKILLED AND DYNAMIC WORKFORCE

Scotland has a cohort of ambitious, passionate and globally connected leaders across academia and industry, working to ensure that Scotland is well positioned to seize future opportunities.

Our Life Sciences skills investment plan, developed in partnership with industry, ensures Scotland is prepared for the future needs of the sector.

Our universities generate highly skilled graduates and PhDs, and our colleges train technicians and modern apprentices in strategic collaboration with industry.

NETWORKS, CONNECTIONS AND BUSINESS ENVIRONMENT

As well as being one of the largest, Scotland is recognised as one of the most accessible, well-connected and collaborative Life Sciences clusters in Europe.

With a compact geography, engaged and connected industry leaders and strong and active support from the Scottish Government, Scotland can quickly respond to business needs and global opportunities.

Scotland has a network of business incubators and science parks providing the ideal environment for growth, and has been demonstrated to be one of the most cost effective manufacturing locations in Europe.

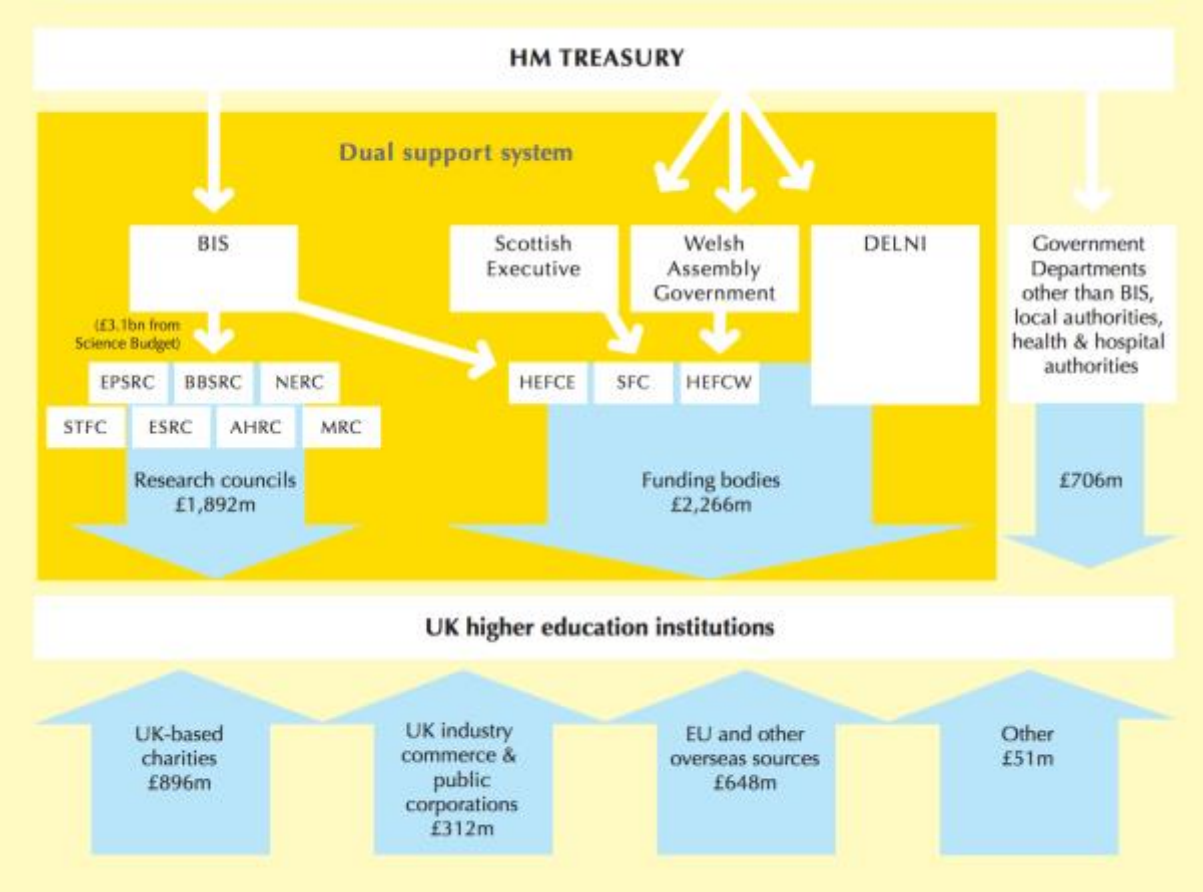
QUALITY OF LIFE

Scotland is a great place to live and work. Recognised globally for its history, heritage and culture, Scotland is a truly international and cosmopolitan country offering an exceptional and affordable location for global business. Short commute times, affordable housing, excellent education and healthcare, combined with easy access to breathtaking scenery and a range of leisure and sporting activities makes Scotland a fantastic place for a fast paced, low stress living experience, ensuring a stable workforce and high staff retention.

Source: Life Sciences Scotland, 2017

Appendix F

UK Higher Education Institutions' Income from Research Grants & Contracts and Funding Council Grants, 2010 example.



Source: Research Information Network, 2010.