

# Response to the House of Commons Business, Innovation and Skills (BIS) Committee consultation on business-university collaboration

## Summary

- Research and innovation are essential to the future success of the UK economy and business-university collaboration is important to research and innovation. The benefits of business-university collaborations to all partners go far beyond income from intellectual property and spin-outs, although these can be important. Such benefits could be increased through even greater collaboration and openness.
- Business-university collaboration forms part of a complex, multi-directional network of interactions that is too often viewed as a one-way linear process. Efforts by Government to encourage business-university collaboration have led to some successes. For example, the World Economic Forum's ranking of the UK's university-industry collaborations has improved from ninth in 2008/2009 to fifth in 2013/2014. Now there is the opportunity to focus on demand for knowledge from business, as well as the supply of knowledge from universities.
- Opportunities to strengthen business-university collaboration include:
  - greater bi-directional mobility of people between academia and industry
  - focused support for clusters at the right time in their development to ensure they reach an internationally competitive scale.
  - ensuring fiscal rules do not inadvertently inhibit business-university alliances.
  - measures to provide and leverage investment into high quality spinouts.
  - appropriately supported institutions to harness local research and innovation to facilitate local growth.
  - clearer communication about existing initiatives to support business-university collaboration.
- Government has an important role to play in facilitating business-university collaboration for both private and public benefit as an active partner in a dynamic research enterprise alongside industry, charities, academia and the public. Putting a stable ten year investment framework for research, innovation and skills at the heart of the Government's industrial strategy and plans for growth would assist business-university collaboration by providing the long-term support required to tackle complex contemporary research and innovation challenges that often entail high risk.
- The strength of the UK's science base assists business-university collaboration. Government should commit to increased investment in research and innovation to keep pace with other leading scientific nations and should support a portfolio of different types of research and disciplines to provide a strong and diverse platform for such partnerships.

## Introduction

1. The Royal Society welcomes the opportunity to respond to the House of Commons Business, Innovation and Skills Committee consultation on '*business-university collaboration*'. The Society is the national academy of science in the UK. It is a self-governing Fellowship of many of the world's most distinguished scientists. The Society draws on the expertise of the Fellowship to

provide independent and authoritative advice to UK, European and international decision makers.

2. This response is based on advice from some of the Society's Fellows and other experts. It forms part of the Society's increasing engagement with industry following our Year of Science and Industry in 2013.<sup>1</sup> The Society is now establishing a standing committee of its Council focused on Science, Industry and Translation to oversee its growing programme of activities in this area.
3. The Society's response is divided into five sections:
  - The value and nature of business-university collaboration
  - The strengths and weaknesses of business-university collaboration in the UK and the UK's performance against international comparators
  - Effectiveness of Government initiatives to support innovation through business-university collaboration
  - Funding
  - Local growth

## **The value and nature of business-university collaboration**

### ***Business and university collaboration driving growth***

4. Research and innovation are essential to the future success of the UK economy. Innovative firms grow twice as fast as non-innovators, and innovative economies are more productive and grow more quickly.<sup>2,3</sup> Business-university collaboration is important to research and innovation, particularly as many contemporary scientific challenges are so complex and involve considerable risk.<sup>4</sup>
5. In 2011/2012 there were nearly 1000 UK spinout firms that had survived for three years. This number has increased from under 600 in 2002/2003 but broadly plateaued from 2008/2009.<sup>5</sup> However, only a small proportion of external income generated by higher education institutions comes from the direct commercialisation of research. A much greater part comes from the provision of professional training, consultancy, and collaborative and contract research.<sup>6</sup>
6. The value of business-university collaboration goes far beyond simply generating external revenue for higher education institutions and can benefit all the partners. These alliances foster skilled people who are vital to the UK's knowledge economy and whose formal and tacit knowledge can help the absorption of ideas from abroad.<sup>7,8</sup>

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<sup>1</sup> Further information is available from: <https://royalsociety.org/events/2013/year-science-industry/>

<sup>2</sup> BIS (2011). *Innovation and Research Strategy for Growth*.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/32450/11-1387-innovation-and-research-strategy-for-growth.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32450/11-1387-innovation-and-research-strategy-for-growth.pdf)

<sup>3</sup> BIS (2014). *Innovation report 2014*. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/293635/bis-14-p188-innovation-report-2014-revised.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/293635/bis-14-p188-innovation-report-2014-revised.pdf)

<sup>4</sup> Sainsbury D (2013). *Progressive capitalism*. Biteback publishing, London.

<sup>5</sup> BIS, HEFCE, Scottish Funding Council, Department for Employment and Learning Northern Ireland and HEFCEW (2013). *Higher education – business and community interaction survey*.

<http://www.hefce.ac.uk/media/hefce/content/pubs/2013/201311/Higher%20Education%20-%20Business%20and%20Community%20Interaction%20Survey%202011-12.pdf>

<sup>6</sup> House of Commons Science and Technology Committee (2012). *Bridging the valley of death: improving the commercialisation of research*. <http://www.publications.parliament.uk/pa/cm201213/cmselect/cmsctech/348/348.pdf>

<sup>7</sup> Allas T (2014) *Insights from international benchmarking of the UK science and innovation system*

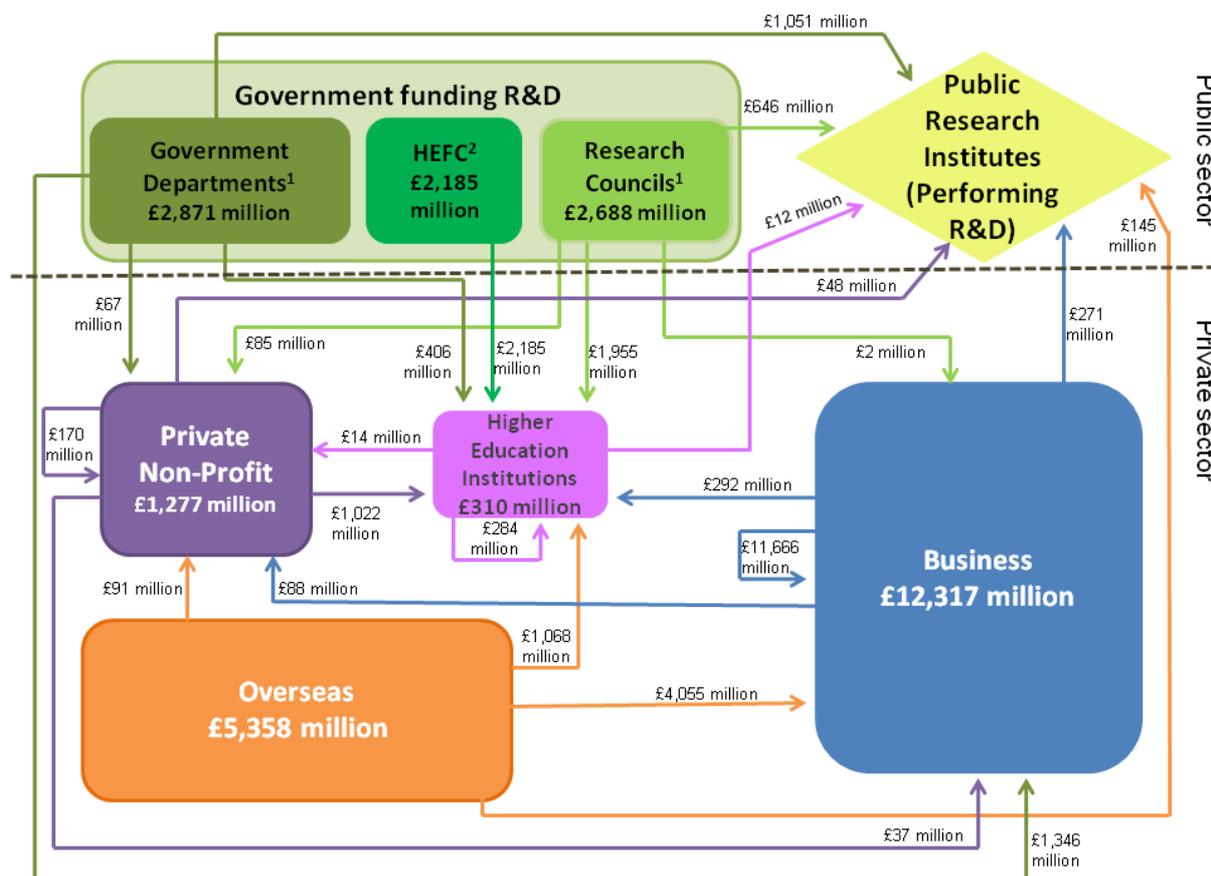
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf)

<sup>8</sup> The Royal Society (2010). *The scientific century. Securing our future prosperity*.

[https://royalsociety.org/~media/Royal\\_Society\\_Content/policy/publications/2010/4294970126.pdf](https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2010/4294970126.pdf)

### The research and innovation ecosystem

7. Too often business-university collaboration is misunderstood as one way knowledge transfer.<sup>9</sup> But research and innovation is much more multidirectional. This complexity is illustrated in figure 1 that shows the flows of R&D funding in the UK in 2012.



**Figure 1: Flows of R&D funding in the UK in 2012.**<sup>10</sup> Source: Office of National Statistics (2014). *UK Gross Domestic Expenditure on R&D, 2012* [http://www.ons.gov.uk/ons/dcp171778\\_355583.pdf](http://www.ons.gov.uk/ons/dcp171778_355583.pdf)

8. Following the 2003 Lambert Review, considerable efforts have gone into increasing the supply and quality of commercial ideas from universities into businesses through a range of policy measures such as the successful Higher Education Innovation Fund (HEIF).<sup>11</sup> This has paid some dividends. The World Economic Forum's ranking of the UK's university-industry collaborations has improved from ninth in 2008/2009 to fifth in 2013/2014.<sup>12,13,14</sup>

<sup>9</sup> The Royal Society (2010). *The scientific century. Securing our future prosperity.* [https://royalsociety.org/~media/Royal\\_Society\\_Content/policy/publications/2010/4294970126.pdf](https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2010/4294970126.pdf)

<sup>10</sup> This figure only illustrates flows of funding rather than the whole of the UK's research and innovation system that includes many other important stakeholders such as the Intellectual Property Office, British Standards Institutions and the national academies.

<sup>11</sup> Lambert R (2003). *The Lambert Review of business-university collaboration.* [http://www.eua.be/eua/jsp/en/upload/lambert\\_review\\_final\\_450.1151581102387.pdf](http://www.eua.be/eua/jsp/en/upload/lambert_review_final_450.1151581102387.pdf)

<sup>12</sup> World Economic Forum (2008). *Global competitiveness report.* [http://www3.weforum.org/docs/WEF\\_GlobalCompetitivenessReport\\_2008-09.pdf](http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2008-09.pdf)

<sup>13</sup> World Economic Forum (2013). *Global competitiveness report.* [http://www3.weforum.org/docs/WEF\\_GlobalCompetitivenessReport\\_2013-14.pdf](http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf)

Nevertheless gaps remain. For example, the UK has relatively low levels of academic corporate co-authored publications, and collaborations between universities and SME's., although the latter are growing<sup>15,16</sup>

9. A longstanding difficulty concerns raising the overall level of demand by UK based business for research from all sources.<sup>17,18</sup> The Government has a role in shaping the behaviour of both universities and companies, as shown by many successful competitor countries. Policies that bring together companies and universities, formally and informally, need sensitive and sustained support.
10. Universities have functions beyond collaboration with business, such as education and blue skies research, that should compliment rather than compete with successful industrial alliances. Evidence is emerging that pushing business-university collaboration too far can risk damaging high quality academic work and may result in reduced commercial benefits.<sup>19</sup> Universities should therefore be seen as a resource to be drawn on to assist commercialisation, noting that their most important output is highly skilled people, and that commercialisation is one function that sits alongside others.
11. Although the focus of the BIS Committee's call for evidence has been on business-university collaborations the Society wishes to draw attention to the opportunities for Public Sector Research Establishments (PSREs) to enhance work with industry.<sup>20</sup> Currently some incentives for collaboration are directed toward universities rather than PSREs.

## **The strengths and weaknesses of business-university collaboration in the UK and the UK's performance against international comparators**

### **The strength of the UK science base**

12. The UK has a world class science base. With just 0.9% of global population, 3.2% of the world's R&D expenditure and 4.1% of researchers, the UK accounts for 9.5% of downloads, 11.6% of citations and 15.9% of the world's highest quality articles.<sup>21</sup> The UK's world class universities, which by one ranking system include three in the top ten in the world, present a major strength for business-university interaction.<sup>22</sup> To maintain this

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<sup>14</sup> Innovation indexes such as that produced by the World Economic Forum do have limitations such as the use of survey data as a proxy for direct measure of outcomes, which can be difficult to directly quantify. Also in this case the time series is quite short and the parameters of the survey questions changed slightly between reports.

<sup>15</sup> Allas T (2014) *Insights from international benchmarking of the UK science and innovation system*  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf)

<sup>16</sup> BIS, HEFCE, Scottish Funding Council, Department for Employment and learning Northern Ireland and HEFCW 2013). *Higher education –business sand community interaction survey*.

<http://www.hefce.ac.uk/media/hefce/content/pubs/2013/201311/Higher%20Education%20-%20Business%20and%20Community%20Interaction%20Survey%202011-12.pdf>

<sup>17</sup> Lambert R (2003). *The Lambert Review of business-university collaboration*.

[http://www.eua.be/eua/jsp/en/upload/lambert\\_review\\_final\\_450.1151581102387.pdf](http://www.eua.be/eua/jsp/en/upload/lambert_review_final_450.1151581102387.pdf)

<sup>18</sup> This issue was raised in the original Lambert Review and again at a Royal Society PolicyLab ten years after the Review's original publication.

<sup>19</sup> House of Commons Science and Technology Committee (2013). *Bridging the valley of death: improving the commercialisation of research*. <http://www.publications.parliament.uk/pa/cm201213/cmselect/cmsstech/348/348.pdf>

<sup>20</sup> House of Commons Science and Technology Committee (2013). *Bridging the valley of death: improving the commercialisation of research*. <http://www.publications.parliament.uk/pa/cm201213/cmselect/cmsstech/348/348.pdf>

<sup>21</sup> Elsevier (2013). *International comparative performance of the UK research base – 2013*.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/263729/bis-13-1297-international-comparative-performance-of-the-UK-research-base-2013.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263729/bis-13-1297-international-comparative-performance-of-the-UK-research-base-2013.pdf)

<sup>22</sup> Times Higher Education Supplement (2014). *World University Rankings 2013/2014*.

<http://www.timeshighereducation.co.uk/world-university-rankings/2013-14/world-ranking>

position sustained investment is needed particularly in the face of growing international competition.<sup>23</sup>

## **Mobility**

13. Mobility between academia and industry is fundamental for successful collaborations.<sup>24</sup> Effective knowledge exchange needs to be bi-directional and prolonged, so as to build mutual understanding, trust and a shared language. It also helps to work on specific practical problems.
14. In the UK moving from academia to industry is often seen as less prestigious within universities and hence a one way move. This perception could be corrected by offering more opportunities for scientists to spend part of their time in industry and part in academia that might help break down the cultural barriers between the two.
15. There are still not enough opportunities and encouragement for academic-industry mobility. The Royal Society is helping to tackle this challenge through its Industry Fellowship scheme.<sup>25</sup> The scheme funds mobility for scientists between the private and academic sector for an extended period. Further initiatives would be welcome. Other opportunities for action include secondments, internships, professional masters and entrepreneurship hubs.

## **Intellectual Property, open innovation and collaboration**

### ***Intellectual property***

16. Since the Lambert Review, universities have been more proactive in seeking economic return from their Intellectual Property (IP). The research councils have insisted that agreements exist between businesses and universities but helpfully have not been prescriptive about their contents.<sup>26</sup> A strength of the UK's arrangements when compared to many other countries, is the flexibility to tailor IP agreements and costs to deliver industrially significant projects of various types.
17. However, evidence has emerged that the increased interest from universities in IP might, in some cases, have proved a barrier to business-university collaborations.<sup>27</sup> The commercial value of some intellectual property may be overestimated and rights exercised too early in the process of knowledge generation. As discussed, direct returns from technology transfer activities is relatively low in both the US and the UK.<sup>28</sup> This suggests that the value of business-university collaboration comes from factors other than ownership of IP and

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<sup>23</sup> The Royal Society, the British Academy, the Royal Academy of Engineering and the Academy of Medical Sciences (2013). *Fuelling prosperity. Research and innovation as drivers of UK growth and competitiveness.*

[https://royalsociety.org/~media/Royal\\_Society\\_Content/policy/publications/2013/2013-04-22-Fuelling-prosperity.pdf](https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2013/2013-04-22-Fuelling-prosperity.pdf)

<sup>24</sup> Wilson T (2012). *A review of business-university collaboration.*

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/32383/12-610-wilson-review-business-university-collaboration.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32383/12-610-wilson-review-business-university-collaboration.pdf)

<sup>25</sup> Further details are available from: <https://royalsociety.org/grants/schemes/industry-fellowship/>

<sup>26</sup> Parker R (2013). *2003 Lambert Review: seminal and pragmatic.* <http://blogs.royalsociety.org/in-verba/2013/07/15/2003-lambert-review-seminal-and-pragmatic/>

<sup>27</sup> The Royal Society (2012). *Science as an open enterprise.*

[https://royalsociety.org/~media/Royal\\_Society\\_Content/policy/projects/sape/2012-06-20-SAOE.pdf](https://royalsociety.org/~media/Royal_Society_Content/policy/projects/sape/2012-06-20-SAOE.pdf)

<sup>28</sup> BIS, HEFCE, Scottish Funding Council, Department for Employment and learning Northern Ireland and HEFCW (2013). *Higher education – business and community interaction survey.*

<http://www.hefce.ac.uk/media/hefce/content/pubs/2013/201311/Higher%20Education%20-%20Business%20and%20Community%20Interaction%20Survey%202011-12.pdf>

that the strict control exerted by some university technology transfer offices may not be warranted.

18. It is important that the search for short-term benefit to the finances of universities does not work against the longer term benefit to the national economy. A more discriminating approach may be needed in identifying and supporting technologies that have the potential to deliver long-term economic value, as well as strengthening the collaborative and contract research that make up the majority of universities' income from collaboration with business.

### **Open innovation**

19. By being less protective of their IP universities have the opportunity to harness increasing interest in open innovation from companies that are now looking outwards for ideas.<sup>29</sup> This model is in contrast to the large in-house research laboratories of the past. Open innovation is about more than just openness. More important are the underpinning mutually beneficial collaborations and personal relationships. However, open innovation does not remove the need for corporate in-house R&D. If a company is to gain from external ideas, internal R&D skills are needed to give 'absorptive capacity' – the ability of companies to assimilate and use knowledge.

### **Clusters**

20. Despite the so called 'death of distance' in some information intensive parts of the economy, geography still matters in many sectors.<sup>30</sup> This is reflected in recent international research and innovation indexes that show uneven or 'spiky' distributions where excellence persists in particular cities or regions.<sup>31,32</sup> At the centre of many of these concentrations are clusters of world-leading universities and companies.
21. Clusters play a key role in fostering business-university collaborations as they provide economies of agglomeration through an ecosystem of different-sized companies, universities and investors that stimulates the exchange of people and ideas.<sup>33</sup> Evidence shows that companies, especially those from abroad, often choose to site their R&D labs near the best universities.<sup>34</sup> There is also a strong correlation between research assessment results and the number of venture backed companies and R&D companies that surround it.<sup>35,36</sup> When considering supporting clusters Governments need to be careful to ensure that this is done at the right time in the development of an industry/technology. This is demonstrated by repeated unsuccessful attempts to emulate Silicon Valley.<sup>37</sup>

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<sup>29</sup> The Royal Society (2010). *The scientific century. Securing our future prosperity.*

[https://royalsociety.org/~media/Royal\\_Society\\_Content/policy/publications/2010/4294970126.pdf](https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2010/4294970126.pdf)

<sup>30</sup> The Royal Society (2010). *The scientific century. Securing our future prosperity.*

[https://royalsociety.org/~media/Royal\\_Society\\_Content/policy/publications/2010/4294970126.pdf](https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2010/4294970126.pdf)

<sup>31</sup> INSEAD, The World Intellectual Property Organisation and Cornell University (2013) Global Innovation Index.

<http://www.globalinnovationindex.org/content.aspx?page=GII-Home>

<sup>32</sup> European Commission (2014). *Innovation Union Scoreboard.*

[http://ec.europa.eu/news/pdf/2014\\_regional\\_union\\_scoreboard\\_en.pdf](http://ec.europa.eu/news/pdf/2014_regional_union_scoreboard_en.pdf)

<sup>33</sup> Academy of Medical Sciences (2011). *Submission to the Innovation and Research Strategy.* [www.acmedsci.ac.uk](http://www.acmedsci.ac.uk)

<sup>34</sup> Abramovsky L, Harrison R and Simpson H (2007). *University research and the location of business R&D.* *Economic Journal* **117**, 519.

<sup>35</sup> Sainsbury D (2013). *Progressive capitalism.* Biteback publishing, London.

<sup>36</sup> Sainsbury D (2007) *The race to the top. A review of Government's science and innovation policies.*

[http://www.rsc.org/images/sainsbury\\_review051007\\_tcm18-103118.pdf](http://www.rsc.org/images/sainsbury_review051007_tcm18-103118.pdf)

<sup>37</sup> PricewaterhouseCoopers (2010). *Government's many roles in fostering innovation.*

<http://www.pwc.com/gx/en/technology/pdf/How-governments-foster-innovation.pdf>

22. Successful clusters are characterised by a critical mass of academic and commercial endeavour with exchange of people across these sectors, strong capital and financial infrastructure, and a highly educated local population.<sup>38</sup> To compete with world leading clusters in places such as Boston, Shanghai and Bangalore, UK clusters will need to be on a similar scale. Examples of opportunities to develop internationally competitive clusters in the UK include the Greater South-East around the 'golden triangle' of London, Oxford and Cambridge, and in Scotland involving cities including Dundee, St Andrews, Stirling, Strathclyde, Edinburgh, Glasgow and Aberdeen.

### **Timescale**

23. The academic and business sectors often work on different timescales and this can sometimes be a barrier to successful collaboration. One example is that many universities' research staff are often employed for three years cycles. Companies in fast moving technology areas, however, can be reluctant to commit beyond the current financial year, and their R&D timeframes tend to cover shorter one-two year periods. This is especially relevant for early stage SMEs for whom the full cost of a university researcher (£60k-£100k over three years) might well be too great a financial commitment. Differences in timescale also impact on investment, as the expected return time for R&D investment does not always match the innovation cycles of some fields (see below).

### **Fiscal policies**

24. Current fiscal rules exempt research charities, including universities, from paying VAT on research buildings. However, if the amount of commercially sponsored research carried out within the building exceeds a limit currently set at 5%, VAT is to be paid on the entire building. This means that both universities and business are discouraged from working together, as the former would have to bear a cost they would otherwise be exempted from, or the latter would have to cover the entire additional cost, exceeding extramural research budgets. It is thus important to ensure that policies in one area do not unintentionally conflict with priorities in another.

## **Effectiveness of Government initiatives to support innovation through business-university collaboration**

### **Catapult Centres**

25. Technology and innovation centres, such as Catapult Centres, that form part of the infrastructure for successful translational science offer a promising way of commercialising research. Similar bodies, such as the Fraunhofer Centres in Germany, have demonstrated the success of this approach within their industrial landscape.<sup>39</sup> The recent introduction of Catapult Centres in the UK has been generally well received and these Centres are seen as a helpful initiative in assisting translational research in areas such as drug discovery. There are expansion opportunities in fields as diverse as agri-biotechnology and energy harvesting. However, the funding model should ensure that money is not spread too thinly – significant resources are required to undertake inherently risky translational research.

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<sup>38</sup> Academy of Medical Sciences (2011). *Submission to the 2011 innovation and research strategy*.

<http://www.acmedsci.ac.uk/viewFile/publicationDownloads/Contribu.pdf>

<sup>39</sup> Hauser H (2010). *The current role of technology and innovation centres in the UK*.

<http://www.bis.gov.uk/assets/biscore/innovation/docs/10-843-role-of-technology-innovation-centres-hauser-review>

## Knowledge Transfer Partnerships

26. Knowledge Transfer Partnerships (KTP) have so far proved quite successful at promoting the flow of knowledge between the business and the university sector. On the business side, KTPs could be especially beneficial for emerging start-ups, and their uptake could improve if smaller companies had to commit a smaller amount of resources to enter the partnership. On the academic side, a culture valuing industrial engagement and appropriate career incentives is necessary to stimulate researchers to enter the partnership (see above).

## Funding

### Investing in the race to the top

27. Despite the many strengths of the UK science and innovation system, the Society shares the concerns about the impact of the *'sustained, long-term pattern of under-investment in public and private research and development and publicly funded innovation'* expressed in a recent report published by BIS.<sup>40</sup> This was articulated in the recent joint UK national academies statement *'Fuelling prosperity'* that contrasted the UK's gross expenditure on R&D of 1.8% of GDP with that of many of our international competitors such as the US that invests 2.8% and Finland that invests nearly 4%.<sup>41</sup> The gap between UK business investment in R&D and that of our competitors is even wider.<sup>42</sup> The UK national academies therefore recommended that the Government should commit to increased investment in research and innovation to keep pace with other leading scientific nations. The UK performs relatively well internationally in terms of university-business collaboration but increased investment to match those of our competitors is likely to offer further improvement.<sup>43,44</sup>
28. The returns from research are often unpredictable and frequently come from a small number of successful and risky outputs that sometimes materialise long after the initial research was conducted. To reap the full rewards of investment in research an iterative cycle of ideas is needed between those involved in what might be described as 'basic' and 'applied' investigations, although such distinctions should not be over emphasised.<sup>45</sup> The UK should therefore seek to support a portfolio of different types of research and disciplines to provide a strong platform for business-university collaborations.

### Research and UK industrial strategy

29. Government has an important role to play in facilitating research and business-university collaboration for both private and public benefit. This lies between correcting 'market failures' and 'picking winners'. When carried out well such an approach has been proved

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<sup>40</sup> Allas T (2014) *Insights from international benchmarking of the UK science and innovation system*  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf)

<sup>41</sup> The Royal Society, the British Academy, the Royal Academy of Engineering and the Academy of Medical Sciences (2013). *Fuelling prosperity. Research and innovation as drivers of UK growth and competitiveness.*  
[https://royalsociety.org/~media/Royal\\_Society\\_Content/policy/publications/2013/2013-04-22-Fuelling-prosperity.pdf](https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2013/2013-04-22-Fuelling-prosperity.pdf)

<sup>42</sup> Allas T (2014) *Insights from international benchmarking of the UK science and innovation system*  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf)

<sup>43</sup> World Economic Forum (2008). *Global competitiveness report.*  
[http://www3.weforum.org/docs/WEF\\_GlobalCompetitivenessReport\\_2008-09.pdf](http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2008-09.pdf)

<sup>44</sup> World Economic Forum (2013). *Global competitiveness report.*  
[http://www3.weforum.org/docs/WEF\\_GlobalCompetitivenessReport\\_2013-14.pdf](http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf)

<sup>45</sup> The Royal Society, the British Academy, the Royal Academy of Engineering and the Academy of Medical Sciences (2013). *Fuelling prosperity. Research and innovation as drivers of UK growth and competitiveness.*  
[https://royalsociety.org/~media/Royal\\_Society\\_Content/policy/publications/2013/2013-04-22-Fuelling-prosperity.pdf](https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2013/2013-04-22-Fuelling-prosperity.pdf)

successful by schemes such as the Defence Advanced Research Project Agency (DARPA) in the US and the Fraunhofer Institutes in Germany.<sup>46,47</sup> Putting a stable ten year investment framework for research, innovation and skills at the heart of the Government's industrial strategy and plans for growth would assist business-university collaboration by providing the long-term support required to tackle complex contemporary research and innovation challenges that often entail high risk.

30. To be successful the 'Eight Great Technologies' initiative recently announced by the Science Minister needs:
  - continued backing by government funding for the long-term to encourage companies to invest.
  - to form part of both national and regional strategy.
  - to avoid being too prescriptive in picking winners, focusing too heavily on existing rather than emerging industries or the list of technologies becoming redundant.
  - funding not to be spread too thinly.
31. The UK's 'Eight Great technologies' seem compatible with and complementary to the European Strategy for Key Enabling Technologies. However, one does not need to be exactly nested within the other. A more organic solution would be preferable that flexibly builds the ecosystem around the people involved and their competencies rather than the process and strict organisational principles.
32. The Society takes the view that the Government can play an active role in encouraging business investment in research. It therefore supports the recommendation of the Witty Review to make an explicit long-term commitment to the HEIF and an increase of funding through this mechanism.<sup>48</sup>

### Financing innovation

33. Small high technology companies that are sometimes the focus business-university collaboration face many hurdles before they can grow.<sup>49</sup> At each stage of the iterative process of product or service development more investment is required. Acquiring this investment is often difficult and many businesses fail because they cannot attract further funding. A particularly difficult time is when a business has a working prototype of a product or service that has not yet been developed enough to earn money through commercial sales, the so called 'valley of death'.<sup>50,51</sup> Securing investment has been particularly difficult for companies seeking sums of £1m-£10m and those outside the 'golden triangle'.
34. Despite Government schemes, such as the Enterprise Investment Scheme (EIS) and Seed Enterprise Investment Scheme (SEIS) that provide tax breaks for those who invest in

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<sup>46</sup> Mazzucato M (2011). *The entrepreneurial state*. [http://www.demos.co.uk/files/Entrepreneurial\\_State\\_-\\_web.pdf?1310116014](http://www.demos.co.uk/files/Entrepreneurial_State_-_web.pdf?1310116014)

<sup>47</sup> Hauser H (2010). *The current role of technology and innovation centres in the UK*.

<http://www.bis.gov.uk/assets/biscore/innovation/docs/10-843-role-of-technology-innovation-centres-hauser-review>

<sup>48</sup> Witty A (2013). *Encouraging a British invention revolution: Sir Andrew Witty's review of universities and growth*.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/249720/bis-13-1241-encouraging-a-british-invention-revolution-andrew-witty-review-R1.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/249720/bis-13-1241-encouraging-a-british-invention-revolution-andrew-witty-review-R1.pdf)

<sup>49</sup> Academy of Medical Sciences (2013). *Response to the House of Commons Science and Technology Committee inquiry into bridging the 'valley of death' and improving the commercialisation of research*. [www.acmedsci.ac.uk](http://www.acmedsci.ac.uk)

<sup>50</sup> House of Commons Science and Technology Committee (2013). *Bridging the valley of death: improving the commercialisation of research*. <http://www.publications.parliament.uk/pa/cm201213/cmselect/cmsctech/348/348.pdf>

<sup>51</sup> While the 'valley of death' metaphor does not fit easily within the networked model of innovation it can be useful in some circumstances to help articulate gaps.

technology, venture capital for research intensive SMEs in the UK is too scarce.<sup>52</sup> This is in part because of the cyclical nature of venture capital whereby poor returns from technology investments 15 years ago has made investors more cautious despite the potentially excellent rewards from new technologies such as stratified medicines and the internet of things. Another difficulty is that many investors are seeking returns over only a few years while research that offers potentially significant rewards for both businesses and society sometimes takes much longer.<sup>53</sup>

35. One financing opportunity would be to attract funds of funds that hold portfolios of other investment funds rather than investing directly in bonds, stocks or other securities. This might be achieved with matched or partly matched investment from the public sector. Successful existing mechanisms, such as the Research Partnership Investment Fund (RPIF), that leverage investment from industry might be used to attract this finance or act as a model to achieve this goal. Another option might be to attract longer term investors such as pension funds, sovereign wealth funds, insurance companies and livery companies, although regulations can sometimes restrict the ability of these investors to fund some innovative endeavours.<sup>54</sup>
36. Many of those involved in investment have limited experience of science and technology and vice versa, so there would be value in greater interaction between these two communities. For example, the Lloyds Banking Group runs a scheme where senior staff attend a Warwick based engineering course designed to give them a better understanding of innovation.<sup>55</sup> National academies such as the Royal Society can play a part in brokering similar such engagements.

### **Impact assessment**

37. The Society in principle supports the inclusion of impact as one of the features of the Research Excellence Framework (REF) and commercial impact should form part of a basket of measures to judge success.<sup>56</sup> Since metrics can drive behaviour the Society believes that they should be broad and flexible to take account of current strengths in the system that may not traditionally be measured. Currently it is too early to offer a firm conclusion on the effect of including commercial impact criteria in the most recent REF assessment.
38. While there is some value in assessing commercial impact of research it does have limitations. In addition to those discussed above there are issues around:
  - commercial confidentiality
  - the need to accept that some failure come with the risk taking.
  - the difficulty disentangling the contribution of more 'basic' research to commercial impact.
  - the methodological challenges measuring commercial impact.
  - who is best placed to judge commercial impact.

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<sup>52</sup> The Royal Society (2010). *The scientific century. Securing our future prosperity.*

[https://royalsociety.org/~media/Royal\\_Society\\_Content/policy/publications/2010/4294970126.pdf](https://royalsociety.org/~media/Royal_Society_Content/policy/publications/2010/4294970126.pdf)

<sup>53</sup> Health Economics Research Group (HERG), Office of Health Economics and RAND Europe (2008.), *Medical research: what's it worth?* [http://www.wellcome.ac.uk/stellent/groups/corporatesite/@sitestudioobjects/documents/web\\_document/wtx052110.pdf](http://www.wellcome.ac.uk/stellent/groups/corporatesite/@sitestudioobjects/documents/web_document/wtx052110.pdf)

<sup>54</sup> House of Commons Science and Technology Committee (2013). *Bridging the valley of death: improving the commercialisation of research.* <http://www.publications.parliament.uk/pa/cm201213/cmselect/cmsctech/348/348.pdf>

<sup>55</sup> House of Commons Science and Technology Committee (2013). *Bridging the valley of death: improving the commercialisation of research.* <http://www.publications.parliament.uk/pa/cm201213/cmselect/cmsctech/348/348.pdf>

<sup>56</sup> Royal Society (2009). *Response to HEFCE's second consultation on the assessment and funding of higher education research.* RS Policy Document 12/09.

## Local growth

39. The Society supports the concept of institutions to harness local research and innovation to facilitate local growth. This is particularly important outside the Greater South-East and following the closure of Regional Development Agencies (RDAs). Local institutions need to form part of national and regional strategy that recognises regional distinction without complete fragmentation. However, at the present time local investment is not on the scale of that recommended in the Heseltine Review.<sup>57</sup>
40. To be effective University Enterprise Zones, specific geographical areas intended to increase interaction between universities and businesses, need to include sufficient financial incentives, support for interdisciplinary research, support for collaboration between academia and industry and focus on the strengths of local industry and university research.
41. One challenge is that innovators and entrepreneurs looking to partner are sometimes swamped by a confusing array of different initiatives and institutions. Measures to encourage local growth through science and innovation should be simple and clearly communicated to all relevant stakeholders.

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<sup>57</sup> Heseltine M (2012). *No stone unturned*.  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/34648/12-1213-no-stone-unturned-in-pursuit-of-growth.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/34648/12-1213-no-stone-unturned-in-pursuit-of-growth.pdf)