

# Response to the Dowling Review of business-university research collaborations

## Summary

- Research and innovation are essential to the future success of the UK economy and business-university collaboration is important to research and innovation, with benefits to both partners far beyond technology transfer. The strength of business-university collaboration in the UK is much improved since the 2003 Lambert Review, and there are many examples of successful collaboration in the UK. Taken together, these demonstrate the great variety in the nature and value of research partnerships, across company sector and size as well as academic discipline. The Dowling Review provides an opportunity to analyse what is working and disseminate examples of good practice, as well as recommending policies to support collaboration.
- Several factors underpin the success and failure of collaborations between universities and businesses, and these should guide the development of support for collaboration in the future. The importance of mobility of people, appropriate management of intellectual property and support for open innovation are common themes. Understanding differences in culture and timescales, as well as the wider factors affecting business, such as access to finance for SMEs, is also crucial.
- There have been several reviews of and changes to the landscape of support for business-university collaboration. Any further changes should be within a period of relative stability, which will allow good practice and confidence to develop, while the measures in place are carefully evaluated and refined. Incentives for collaboration should focus on demand from business, as well as willingness of academics. These need to be balanced with other demands on and priorities of researchers, academic institutions and businesses.
- Government has an important role to play in facilitating business-university collaboration, and policy instruments are in place across the research and innovation system that directly aim to do so. Local and national policies and structures require careful balancing to ensure that they are complementary rather than conflicting.
- All of this should form part of a coherent local and national approach, 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. Increasing investment in research and innovation to keep pace with other leading scientific nations is important to provide the stability for business investment. Policies across government can also support collaboration indirectly, for example through appropriate infrastructure and tax policies.

## Introduction

1. The Royal Society welcomes the opportunity to respond to the Dowling Review. 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. The submission was developed on the basis of advice from several of the Society's Fellows and other experts who have varied experiences of business-university collaboration. This response builds on the Society's previous positions and contributions to discussions about this topic. The Society is keen to support excellent science wherever it is found, and maintains a longstanding interest in industry research and Government policies supporting collaboration between industry and academia. The Society has a standing committee of its Council focused on Science, Industry and Translation which oversees its growing programme of activities in this area.
3. The Society runs an Industry Fellowship programme for academic scientists who want to work on a collaborative project with industry and for scientists in industry who want to work on a collaborative project with an academic organisation. It aims to enhance knowledge transfer in science and technology between those in industry and those in academia in the UK. The scheme is funded by the Royal Society, the Engineering and Physical Sciences Research Council, the Biotechnology and Biological Sciences Research Council, the Natural Environment Research Council, Rolls-Royce plc and BP plc.
4. The Society's response is divided into four sections:
  - Business-university collaboration in the UK
  - Success factors and barriers to collaboration
  - Support for business-university collaboration
  - Broader government policy and industrial strategy

## Business-university collaboration in the UK

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

5. 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>1,2</sup> Business-university collaboration is important to research and innovation, particularly as many contemporary scientific challenges are so complex and involve considerable risk.<sup>3</sup>
6. 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>4</sup> 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

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<sup>1</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>2</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>3</sup> Sainsbury D (2013). *Progressive capitalism*. Biteback publishing, London.

<sup>4</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>

the UK's knowledge economy and whose formal and tacit knowledge can help the absorption of ideas from abroad.<sup>5,6</sup>

7. 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>7</sup> This has paid some dividends. There have since been several further reviews of business-university collaboration<sup>8,9,10,11</sup>, which have led to new initiatives and policy changes, such as the introduction of the Catapult centres<sup>12</sup>. The Society hopes that the Dowling Review will take account of this useful body of work and build on previous recommendations.

### **Strengths and weaknesses of business-university collaboration in the UK**

8. The UK has a world-class science base,<sup>13</sup> and its world-class universities<sup>14</sup> present a major strength for business-university interaction. To maintain this position sustained investment is needed particularly in the face of growing international competition.<sup>15</sup> Fostering collaboration between research and industry can help the UK to get the greatest benefit from its public investment in research.
9. International rankings indicate that the strength of business-university collaboration in the UK has notably improved in recent years. The UK moved from ninth in 2008/2009 to fourth in 2014/2015 on this measure, according to the World Economic Forum's Global Competitiveness Report,<sup>16,17</sup> and from 11<sup>th</sup> to 5<sup>th</sup> according to the Global Innovation

<sup>5</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>6</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>7</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>8</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>9</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>10</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>11</sup> House of Commons Business, Innovation and Skills Committee (2014). *Business-University collaboration*.

<http://www.publications.parliament.uk/pa/cm201415/cmselect/cmbis/249/249.pdf>

<sup>12</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>13</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>14</sup> Times Higher Education Supplement (2014). *World University Rankings 2014/2015*.

<http://www.timeshighereducation.co.uk/world-university-rankings/2014-15/world-ranking>

<sup>15</sup> The Royal Society, the British Academy, the Royal Academy of Engineering and the Academy of Medical Sciences (2015). *Building a Stronger Future: Research, Innovation and Growth*.

<https://royalsociety.org/~media/policy/Publications/2015/building-a-stronger-future-research-innovation-growth.pdf>

<sup>16</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>17</sup> World Economic Forum (2014). *Global competitiveness report*.

[http://www3.weforum.org/docs/WEF\\_GlobalCompetitivenessReport\\_2014-15.pdf](http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf)

Index.<sup>18,19,20</sup> Nevertheless gaps remain. For example, the UK has relatively low levels of academic corporate co-authored publications, and collaborations between universities and SMEs, although the latter are growing<sup>21,22</sup> Further analyses of the criteria used to create rankings like the Global Innovation Index might provide insights into how support for collaboration in recent years has contributed to the improvement in the UK's ranking, as well as indicating areas for potential future improvement of the system. However, the Society notes that the utility of innovation indexes is limited due to some of their methods, such as the use of survey data as a proxy for direct measures of outcomes.

10. 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. In the UK, industry research is concentrated in only a few areas and there is insufficient innovation in SMEs.<sup>23,24</sup> Measures seeking to further improve business-university collaboration in the UK must be tailored to the UK research and innovation ecosystem. Although the focus of the Dowling review is on helping researchers to better understand the interests of industry, a longstanding difficulty concerns raising the overall level of demand by UK-based business for research from all sources.<sup>25,26</sup>
11. Universities have functions beyond collaboration with business—such as education and blue-skies research—that should complement 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>27</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<sup>28</sup>, and that commercialisation is one function that sits alongside others.

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<sup>18</sup> Soumitra Dutta (Editor), INSEAD (2008-09). *The Global Innovation Index 2008/09*, Fontainebleau <https://www.globalinnovationindex.org/userfiles/file/gii-2008-2009-report.pdf>

<sup>19</sup> Cornell University, INSEAD, and WIPO (2014). *The Global Innovation Index 2014: The Human Factor In innovation*. <https://oami.europa.eu/ohimportal/documents/11370/71142/The+Global+Innovation+Index+2014>

<sup>20</sup> Note that in this case the time series is quite short and the parameters of the survey questions changed slightly between reports.

<sup>21</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>22</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>

<sup>23</sup> The Royal Society, the British Academy, the Royal Academy of Engineering and the Academy of Medical Sciences (2015). *Building a Stronger Future: Research, Innovation and Growth*. <https://royalsociety.org/~media/policy/Publications/2015/building-a-stronger-future-research-innovation-growth.pdf>

<sup>24</sup> Department for Business, Innovation and Skills (2014). *Our plan for growth: science and innovation – Evidence paper*. <https://royalsociety.org/~media/policy/Publications/2015/building-a-stronger-future-research-innovation-growth.pdf>

<sup>25</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>26</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>27</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>28</sup> Exeter Business School, Brighton Business School and SPRU – Science and Technology Policy Research (2014). 'UK Innovation Survey: Innovative Firms and Growth' [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/289234/bis-14-643-ukinnovation-survey-highly-innovative-firms-and-growth.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/289234/bis-14-643-ukinnovation-survey-highly-innovative-firms-and-growth.pdf)

12. Although the focus of the Dowling Review'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>29</sup> Currently some incentives for collaboration are directed toward universities rather than PSREs. Similarly, as the nature of collaborations and the process of research commercialisation continue to evolve in the future, the role of other types of organisations should also be accounted for. For example, the charity sector has increased its focus on collaboration and translation, through initiatives like Cancer Research Technology<sup>30</sup> and Innovations at the Wellcome Trust<sup>31</sup>. The role of these broader stakeholders should be considered in any work focussed on improving business-university collaboration.

## Success factors and barriers to collaboration

13. Determinants of success and failure for collaboration vary widely by academic discipline, industrial sectors and company size.<sup>32</sup> Nevertheless, several key principles underpinning research partnerships can be drawn out.

### Mobility

14. Mobility between academia and industry is fundamental for successful collaborations.<sup>33</sup> Effective knowledge exchange needs to be bi-directional and prolonged, so as to build mutual understanding, trust and a shared language. It can also be valuable for collaborators to work on specific practical problems.
15. 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. This might help break down the cultural barriers between the two.
16. 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, mentioned above.<sup>34</sup> Further initiatives would be welcome. Other opportunities for action include secondments,<sup>35</sup> internships, professional masters and entrepreneurship hubs.

<sup>29</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>30</sup> <http://www.cancertechnology.co.uk/>

<sup>31</sup> <http://www.wellcome.ac.uk/Funding/Innovations/index.htm>

<sup>32</sup> Department for Business, Innovation and Skills (2014). *The case for public support of innovation: At the sector, technology and challenge area levels*. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/334369/BIS\\_14\\_852\\_The\\_Case\\_for\\_Public\\_Support\\_of\\_Innovation.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/334369/BIS_14_852_The_Case_for_Public_Support_of_Innovation.pdf)

<sup>33</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>34</sup> Further details are available from: <https://royalsociety.org/grants/schemes/industry-fellowship/>

<sup>35</sup> The Higher Education Academy (2014). *A pilot study: strengthening university business engagement through staff secondments*. <https://www.heacademy.ac.uk/sites/default/files/resources/A%20Pilot%20Study%20-HEA%20Strengthening%20University%20Business%20Engagement.pdf>

## Intellectual Property, open innovation and collaboration

### *Intellectual property*

17. 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>36</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.
18. 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>37</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 are relatively low in both the US and the UK.<sup>38</sup> This suggests that the value of business-university collaboration comes from factors other than ownership of IP and that the strict control exerted by some university technology transfer offices may not be warranted.
19. 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*

20. By being less protective of their IP universities have the opportunity to harness increasing interest in open innovation from companies that are looking outwards for ideas.<sup>39</sup> This model is in contrast to the large in-house research laboratories of the past. Mutually beneficial collaborations and personal relationships are important for open innovation, which 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. There is a role for Government intervention here, in partnership with industry and the charity sector, as exemplified by the Stevenage Bioscience Catalyst, that is backed by Government support, situated close to the GlaxoSmithKline headquarters and aims to link large companies with SMEs and academia.
21. A longer standing example of open innovation is the Division of Signal Transduction Therapy (DSTT) - thought to be one of the world's largest and longest standing collaborations between

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<sup>36</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>37</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>38</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>

<sup>39</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)



academia and the pharmaceutical industry.<sup>40</sup> It is supported by six major pharmaceutical companies, including AstraZeneca and GlaxoSmithKline, as well as the Medical Research Council and developed out of existing strengths in research at the University of Dundee. The companies share the discoveries, resources, support services and reagents developed by the participating academic laboratories. The academics and participating companies work under a single binding agreement and the companies have the right to licence the IP that the academic collaborators generate.<sup>41,42</sup> The DSTT has also spawned two biotechnology companies that market reagents and services developed by the DSTT.

### Clusters

22. Geography still matters in many sectors,<sup>43</sup> and excellence persists in particular cities or regions.<sup>44,45</sup> 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>46</sup> There is a strong correlation between research assessment results and the number of venture-backed companies and R&D companies that surround a University,<sup>47,48</sup> and evidence shows that companies, especially those from abroad, often choose to site their R&D labs near the best universities.<sup>49</sup> AstraZeneca's recent decision to site their new headquarters in Cambridge is an example of this.
23. 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>50</sup> 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>51</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.
24. 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—particularly in biomedicine once the Crick Institute is operational—and in Scotland involving

<sup>40</sup> <http://app.dundee.ac.uk/pressreleases/2012/may12/drugdiscovery.htm>

<sup>41</sup> King Z (2007). *Division of signal transduction therapy, University of Dundee a case study.*

<http://www.henley.ac.uk/web/FILES/management/ZKingDSTTcasestudyZKing.pdf>

<sup>42</sup> Further details by personal communication with Sir Philip Cohen, founder of DSTT (February 2015).

<sup>43</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>44</sup> INSEAD, The World Intellectual Property Organisation and Cornell University (2013) *Global Innovation Index.*

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

<sup>45</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>46</sup> Academy of Medical Sciences (2011). *Submission to the Innovation and Research Strategy.* [www.acmedsci.ac.uk](http://www.acmedsci.ac.uk)

<sup>47</sup> Sainsbury D (2013). *Progressive capitalism.* Biteback publishing, London.

<sup>48</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>49</sup> Abramovsky L, Harrison R and Simpson H (2007). *University research and the location of business R&D.* *Economic Journal* **117**, 519.

<sup>50</sup> PricewaterhouseCoopers (2010). *Government's many roles in fostering innovation.*

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

<sup>51</sup> Academy of Medical Sciences (2011). *Submission to the 2011 innovation and research strategy.*

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

cities including Dundee, St Andrews, Stirling, Strathclyde, Edinburgh, Glasgow and Aberdeen. Future investments in research infrastructure might create further opportunities for academic engagement with business, and Government should support the development of clusters as and when they emerge.

### Timescale

25. 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.
26. Although the Dowling review is focussed on the development of long-term research partnerships, the Society would like to note that traditional consultancy, which can be a short-term relationship, supports much industrial activity and can often solve an immediate industrial problem using the facilities and expertise of an individual or team at a university.
27. One example from the other end of the timescale is Rolls Royce, which has formalised long-term partnerships with key universities, forming its network of University Technology Centres. Academic and industry researchers collaborate in the centres, which have supported the development of new tools, processes and skills, as well as supporting PhD studentships.<sup>52</sup> This approach works for a large company, with clear research needs and the ability to invest for the long term.

### Financing innovation

28. A lot of attention is paid to supporting small companies to engage in collaborations with universities, but the capacity of these companies to do so is often limited by other concerns; these companies face many hurdles before they can grow.<sup>53</sup> Supporting these businesses to develop would indirectly support them to engage in collaborations. One of the key issues small companies face is access to finance.
29. 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 technology, venture capital for research intensive SMEs in the UK is too scarce.<sup>54</sup> 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.

<sup>52</sup> NCUB (2014). *State of the Relationship*. <http://www.ncub.co.uk/sor14/rolls-royce-utc.html>

<sup>53</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>54</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)



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>55</sup>

30. 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>56</sup> National academies such as the Royal Society can play a part in brokering similar such engagements.

## Support for business-university collaboration

31. To design measures to effectively support business-university collaboration, examples of good practice and existing productive relationships should be analysed. The examples the Society has reviewed demonstrate the diversity and unpredictability of these examples, illustrating the value of government maintaining a flexible approach to support for collaboration. The Dowling Review provides an opportunity to systematically analyse what is working and disseminate examples of good practice, as well as recommending policies to support collaboration.
32. Just as the outcomes of research are unpredictable, so are the outcomes of collaborations; it can be unclear at the outset what the results of a collaboration will be. Successful academic-business collaborations often occur in a ‘bottom-up’ way, and those that are targeted for support do not always produce clear results. Nurturing and developing collaborations as they arise, rather than attempting to initiate them should therefore be a focus of broad support measures offered by Government.
33. Government has initiated, expanded and invested in many schemes and structures to support business-university collaboration. There are instruments in place in funding bodies, such as Innovate UK, which includes support for the network of Catapult centres, and HEFCE, which funds the HEIF scheme through universities. There is also support at the local level, for example through local enterprise partnerships (LEPs), and nationally, through the National Centre for Universities and Business.
34. This recent focus on supporting collaboration has been welcome, but following such a period of change there is a need for stability to allow good practice to develop and build confidence in and understanding of the support that is now in place. If the Dowling Review identifies further measures that could support collaboration, their implementation should

<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> 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>

recognise the importance of this stability. The amount of existing business demand to collaborate with academia will in part determine the effectiveness of these measures.

35. Support mechanisms need reliable funding to become embedded in the research landscape and should be carefully evaluated and developed. Through evaluation and dissemination of best practice, government can ensure that funding to support collaboration is invested effectively. Investment in innovation support provides returns for UK PLC, but it is not on the same scale as many competitors.<sup>57</sup> Investment in innovation should not come at the expense of other parts of the research base. To position innovation and research in competition with one another risks doing damage to the system as a whole.

### Catapult Centres

36. Technology and innovation centres, such as Catapult Centres, form part of the infrastructure for successful translational science and can support the development of long-term partnerships between academia and industry. Similar bodies, such as the Fraunhofer Centres in Germany, have demonstrated the success of this approach within their industrial landscape.<sup>58</sup> The Catapult Centres in the UK have been generally well received as a helpful initiative. Significant resources are required to undertake inherently risky translational research and for initiatives like the Catapult centres, funding and support needs to be long-term. Having made a substantial investment in establishing the Catapult centres, the UK should continue to provide them with sufficient support to maximise the returns on this investment.
37. Hermann Hauser's recent Mid-Term Review recommended that the network of Catapult Centres be expanded.<sup>59</sup> If additional funding should become available for the Catapult Centres in future, it is important that it not be spread too thinly. A clear and transparent process should be used to identify areas in which to establish Catapult Centres in future.
38. As the Catapult Centres become embedded in the research landscape there is scope for them to support business-university collaboration more effectively. Hauser's Review also recommended that "Catapults should work with Innovate UK to develop more effective SME engagement strategies and develop a stronger more coherent engagement model for working with universities." The House of Commons Business, Innovation and Skills committee made a similar recommendation that "Government conduct a light touch review that identifies effective examples of collaboration between universities and industry throughout the Catapult network"<sup>60</sup>.

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<sup>57</sup> Hauser H (2014). *Review of the Catapult network*. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/368416/bis-14-1085-review-of-thecatapult-network.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/368416/bis-14-1085-review-of-thecatapult-network.pdf)

<sup>58</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>59</sup> Hauser H (2014). *Review of the Catapult network*. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/368416/bis-14-1085-review-of-thecatapult-network.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/368416/bis-14-1085-review-of-thecatapult-network.pdf)

<sup>60</sup> House of Commons Business, Innovation and Skills committee (2014). *Business-University collaboration*. <http://www.publications.parliament.uk/pa/cm201415/cmselect/cmbis/249/249.pdf>

### Knowledge Transfer Partnerships

39. Knowledge Transfer Partnerships (KTP) have so far proved quite successful at promoting the flow of knowledge between the business and the university sector.<sup>61, 62</sup> 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.

### Impact assessment

40. The Society supported 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>63</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.
41. Strengthening incentives for academics to collaborate with industry might be an effective way to support business-university collaboration, but, as the House of Commons BIS committee notes, "impact criteria should enhance research quality assessments, not detract or distract from basic research, which may not have an immediately obvious commercial application."<sup>64</sup> It is too early to offer a firm conclusion on the effect on research of including commercial impact criteria in the most recent REF assessment.
42. The inclusion of impact in the most recent REF assessment has yielded a large number of case studies, which demonstrate the diversity of existing collaborations. Analysis of these should provide a valuable source of examples of best practice to be drawn out, shared and built upon, indicating how and when Government support can be most effective in supporting research partnerships.
43. While there is some value in assessing commercial impact of research it does have limitations. In addition to those discussed above there are issues about:
- commercial confidentiality;
  - the need to accept that some failure come with risk taking;
  - the difficulty disentangling the contribution of more 'basic' research to commercial impact, it remains to be seen whether to definitions used in the recent REF were appropriate;
  - the methodological challenges measuring commercial impact;
  - who is best placed to judge commercial impact;
  - The additional work created for institutions when preparing their submissions. The recent REF put a heavy administrative burden on the research community.

<sup>61</sup> Regeneris consulting (2010). *Knowledge Transfer Partnerships Strategic Review*.  
<http://webarchive.nationalarchives.gov.uk/20140827133341/http://www.innovateuk.org/assets/pdf/corporate-publications/ktp%20strategic%20review%20feb%202010.pdf>

<sup>62</sup> NCUB (2013). *Knowledge Transfer Partnerships. A best practice approach to open innovation*.  
<http://www.ncub.co.uk/reports/knowledge-transfer-partnerships-a-best-practice-approach-to-open-innovation.html>

<sup>63</sup> Royal Society (2009). *Response to HEFCE's second consultation on the assessment and funding of higher education research*. RS Policy Document 12/09.

<sup>64</sup> House of Commons Business, Innovation and Skills committee (2014). *Business-University collaboration*.  
<http://www.publications.parliament.uk/pa/cm201415/cmselect/cmbis/249/249.pdf>

### Academic engagement

44. Impact assessment is one way to incentivise collaboration and capture best practice, but many academics are not intrinsically motivated to collaborate with business. Often those researchers who do engage with industry or establish spin-out companies do so for personal motivations or off the back of personal connections, and businesses can find it difficult to identify academic partners who are willing to engage fully on a project.
45. There can be opportunity costs associated with spending time on engagement with industry, as this is not always recognised in the same way as research and publications. As discussed above, collaborations benefit from the movement of people between industry and academia. However, career structures mean that for a researcher, re-entering the academic system after spending time in industry, and vice versa, can be difficult.
46. Improving recognition for collaboration in academic career structures, as some universities and funders are beginning to do, could support more researchers to engage with industry and develop research partnerships<sup>65</sup>. Any such changes should aim to properly recognise collaboration by broadening incentive structures, whilst ensuring that those researchers who choose not to engage with industry are not penalised.

### Broader government policy and industrial strategy

47. Beyond direct support for research and innovation, various areas of Government policy can directly and indirectly affect research partnerships between business and academia. It is therefore important to ensure that policies in one area do not unintentionally conflict with priorities in another.
48. For example, travel and telecommunications are fundamental to collaboration. Improving broadband delivery and wireless provision, as well as key road links would support business generally and ease the practicalities of collaboration, particularly outside London.<sup>66</sup>

### Fiscal policies

49. 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. Removing this restriction would facilitate greater engagement between academia and industry, by making it easier for universities to do more commercial work. It would also allow them to support companies spun out from their research base for longer, incubating them in house in order to support them to grow.

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<sup>65</sup> Marston L (2011). *All together now: Improving cross-sector collaboration in the UK biomedical industry*. [http://www.nesta.org.uk/sites/default/files/all\\_together\\_now.pdf](http://www.nesta.org.uk/sites/default/files/all_together_now.pdf)

<sup>66</sup> Adonis A (2014). *Mending the fractured economy. Smarter state, better jobs. Final report of the Adonis Review*. [http://www.yourbritain.org.uk/uploads/editor/files/Adonis\\_Review.pdf](http://www.yourbritain.org.uk/uploads/editor/files/Adonis_Review.pdf)

50. For SMEs, the overhead costs associated with engaging with a university can be prohibitive, which could influence the general perception of the affordability of engaging with universities. Universities can find innovative ways to engage with SMEs by understanding their needs and perspectives. For example, the University of Southampton established and operates a professional consultancy company, ECS Partners Ltd<sup>67</sup>, which can engage in short-term consultancy projects and is less restricted in the overhead costs it charges.

### Investing in the race to the top

51. 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>68</sup> This was articulated in the recent joint UK national academies statement '*Building a Stronger Future*' that noted the disparity between the UK's gross expenditure on R&D of 1.7% of GDP and the investment levels of 3%, recommended by the House of Commons BIS committee<sup>69</sup>, or 2.9%, set by the BIS report mentioned above.<sup>70</sup> The academies recommended that the Government should commit to increased investment in research and innovation to keep pace with other leading scientific nations.<sup>71</sup> The UK performs relatively well internationally in terms of university-business collaboration but increased investment is likely to offer further improvement.<sup>72,73</sup>
52. The gap between UK business investment in R&D and that of our competitors is even wider than that for public investment.<sup>74</sup> 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 HEIF and an increase of funding through this mechanism.<sup>75</sup>
53. An environment that attracts additional investment would also provide incentives for globally mobile international companies to establish and retain their research bases in the UK;

<sup>67</sup> <http://www.ecs.soton.ac.uk/business/consultancy>

<sup>68</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>69</sup> House of Commons Business, Innovation and Skills Committee (2014). *Business-University collaboration*. <http://www.publications.parliament.uk/pa/cm201415/cmselect/cmbis/249/249.pdf>

<sup>70</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>71</sup> The Royal Society, the British Academy, the Royal Academy of Engineering and the Academy of Medical Sciences (2015). *Building a Stronger Future: Research, Innovation and Growth*. <https://royalsociety.org/~media/policy/Publications/2015/building-a-stronger-future-research-innovation-growth.pdf>

<sup>72</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>73</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>74</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>75</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)

opportunities to collaborate with the UK research base are often cited as a key reason for foreign companies to conduct R&D in the UK.<sup>76</sup>

54. 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>77</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

55. Industrial strategies that help stimulate key sectors are important and need to be supported by effective policies in areas such as procurement, regulation, taxation, immigration and access to data and finance to help create the conditions that are conducive to investment.<sup>78</sup>

56. As well as sectoral industrial strategies, in recent years Government has identified ‘eight great (plus two)’ technologies as priorities for support in the UK. These technologies were in part chosen due to Britain’s “distinctive capability” to develop them.<sup>79</sup> For this approach to be successful, the initiative needs continued backing by government funding and to form part of both national and regional strategy. Strong collaborations between business and academia will need to be supported. If the UK can be at the cutting edge in the development of these technologies, this also has the potential to attract inward investment from overseas.

### Local, national and international structures

57. 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. Local institutions and structures, including universities, Catapult Centres, Local Enterprise Partnerships and University Enterprise Zones, can play a role in supporting collaboration at the local level. Measures to encourage local growth through science and innovation should be simple and clearly communicated to all relevant stakeholders. To be effective, they need to include sufficient financial incentives, support for interdisciplinary research, and focus on the strengths of local industry and university research.

58. Innovators and entrepreneurs looking to partner are sometimes swamped by a confusing array of different initiatives and institutions. There has been progress to create simple, single

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<sup>76</sup> Department for Business, Innovation and Skills (2014). *Innovation report 2014: Innovation, Research And Growth*. [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>77</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>78</sup> The Royal Society, the British Academy, the Royal Academy of Engineering and the Academy of Medical Sciences (2015). *Building a Stronger Future: Research, Innovation and Growth*. <https://royalsociety.org/~media/policy/Publications/2015/building-a-stronger-future-research-innovation-growth.pdf>

<sup>79</sup> Willetts D (2013). *Eight Great Technologies*. <http://www.policyexchange.org.uk/images/publications/eight%20great%20technologies.pdf>



points of entry for business, both at the local level at individual universities, and at the national level, for example through the Research Councils 'Gateway to Research'<sup>80</sup>. It is welcome that these efforts have focussed particularly on engaging SMEs, and it will be important that their use and effectiveness is monitored and evaluated, and that separate systems work in a complementary way, rather than creating confusion.<sup>81</sup>

59. Efforts to support companies, particularly SMEs, to establish research partnerships with academics need to form part of national and regional strategy that recognises regional distinction without complete fragmentation. At the local level, research partnerships can build connections to support growth and development, and nationally, when partnerships are based on research best fit, they can help companies to access cutting edge knowledge. These different approaches to collaboration can be complementary, but care should be taken to avoid creating confusion about different approaches. This should take account of the different ways that large companies and SMEs might engage; large companies often know quite well where the research they want to tap into is happening, whereas SMEs might be more focussed on their local area.
60. An example of local support tailored to SMEs are 'iNets'. These are sector-specific networks for innovation that aim to support SMEs in the South West to connect with relevant academic expertise, to provide practical support for businesses. The iNets receive funding from the European Regional Development Fund.<sup>82</sup> Historically, European Union Framework Programme funding has been an effective source of support for collaborations between businesses and universities.<sup>83</sup> In considering any changes to the UK's relationship with the European Union, the impact on research, involving business-university collaboration, should be considered.

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<sup>80</sup> <http://gtr.rcuk.ac.uk/>

<sup>81</sup> House of Commons Business, Innovation and Skills Committee (2014). *Business-University collaboration*. <http://www.publications.parliament.uk/pa/cm201415/cmselect/cmbis/249/249.pdf>

<sup>82</sup> <http://www.inets-sw.co.uk/>

<sup>83</sup> Technopolis (2010). *The impact of the EU RTD Framework Programme on the UK*. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/32488/10-1158-impact-eu-rtd-framework.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32488/10-1158-impact-eu-rtd-framework.pdf)