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CaSE
Campaign for Science and Engineering

CaSE response to the House of Commons Science and Technology Committee – Bridging the "valley of death": improving the commercialisation of research

1. The Campaign for Science & Engineering (CaSE) is a membership organisation aiming to improve the scientific and engineering health of the UK. CaSE works to ensure that science and engineering are high on the political and media agenda, and that the UK has world-leading research and education, skilled and responsible scientists and engineers, and successful innovative business. It is funded by around 750 individual members and 100 organisations including industries, universities, learned and professional organisations, and research charities.

What are the difficulties of funding the commercialisation of research, and how can they be overcome?

2. The strength of the UK's research base is well known. With just 1% of the world's population, we produce around a tenth of the world's research publications including 14% of the research that has the highest impact[1]. However, the UK's ability to commercialise that research – bridging the "valley of death" – has long been a source of concern.

3. Many of the current support mechanisms for commercialisation aim to link universities and industry (e.g. University Technology Transfer Offices), 'pushing' university research into the private sector. Small to medium-sized enterprises (SMEs) are considered to be important recipients for this research. However, due to their size and levels of resource there are limitations on the level of commercialisation that SMEs are capable of. The Association of the British Pharmaceutical Industry estimates that it costs about £1 billion and takes between 12 and 15 years to bring a new medicine to market. In addition, associated failure rates are high, out of 250,000 new compounds initially investigated, only five are likely to make it through the clinical trial process to market[2]. A well-supported and diverse industrial sector should be the goal, comprised of firms of all different sizes in recognition of the fact that one size doesn't fit all.

4. One of the reasons that the valley of death exists is the high risk, high cost, and often long timescales associated with the commercialisation of research. As it is the UK as a whole that reaps both economic and societal benefits from the successful commercialisation of research, it can be argued that it is appropriate for the Government to absorb some of this early stage risk in the absence of sufficient appetite or ability from the private sector. However, the absorption of this risk should come with its own rewards and it may be appropriate for the state to try and recoup some of the benefits more directly, in addition to the indirect benefit system (taxation) currently used.

5. In addition to financial capital, human capital also plays an important role in the commercialisation of research. Venture capitalists and angel investors benefit from academic research groups possessing business/industry experience. At present, the Research Excellence Framework[3] incentivises the opposite, discouraging universities from hiring staff with backgrounds in industry, due to gaps in (or an absence of) publication records.

What, if any, examples are there of UK-based research having to be transferred outside the UK for commercialisation? Why did this occur?

6. At a recent NESTA organised event held under the Chatham House rule, one attendee remarked that they had chosen to merge their UK-based pharmaceutical company with a US company so that they could be listed on NASDAQ. The attendee cited a lack of appetite for investing in biotechnology (and research and development more generally) stock from the London markets as the rationale.

7. The commercialisation of scientific and engineering research is becoming an increasingly global endeavour. If manufacturing is taken as part of the commercialisation process (and arguably it should be, successful commercialisation relies on affordable manufacturing), then the decision taken by Dyson to move its manufacturing operations to the Far East, provide a useful example. At the time of the announcement, company founder James Dyson offered the following as an explanation, "Increasingly in the past two to three years our suppliers are Far East based and not over here. And our markets are there too." [4]

What evidence is there that Government and Technology Strategy Board initiatives to date have improved the commercialisation of research?

8. As many of the Technology Strategy Board's (TSB) initiatives are fairly recent, and commercialisation is a long-term process, there is little evidence to date of their effectiveness or ineffectiveness. NESTA put together an early review of the SBRI scheme administered by the TSB, and suggested data that should be captured in order to assess the effectiveness of the scheme in future. CaSE supports the rigorous independent evaluation of TSB initiatives and in particular levels of return on investments. The work done by independent consultancy PACEC, which showed that collaborative R&D projects which had been completed by the end of 2009 estimated a gross value added of £6.71 per £1 of government funding, has been useful in showing the impact of the TSB[5].

9. In addition to the importance of monitoring the impacts of TBS initiatives, there is a wider need to look systematically at how the UK's science and innovation system is changing and how it can be strengthened. The 'Science of Science and Innovation Policy' (SCiSIP) program in the US has to date supported over ninety projects to improve the models, analytical frameworks and metrics that are applied in science policy decision making. CaSE suggests the UK would benefit greatly from a similar initiative.

What impact will the Government's innovation, research and growth strategies have on bridging the valley of death?

10. The development of Catapults, inspired by the success of Germany's Fraunhofers, is welcomed. However, the comparatively low levels of funding of this initiative will inevitably limit its success. The Catapult centres, of which seven are expected, have been allocated a total of £200 million over the next four years, with the Cell Therapy Catapult set to receive £50 million[6]. Should the remaining £150 million be allocated equally, the High Value Manufacturing Catapult can expect £6.25 million per year for the next four years. This figure is diluted further when considering the seven institutions which comprise the Catapult. If funding were to be divided equally again, each institution could expect just under £900,000 per year. In comparison, the Fraunhofer Institute for Manufacturing Technology and Advanced Materials (which comprises four institutions) reported a total operating budget of just under €30 million in 2010/2011[7]. Although our calculations are simplistic, they still illustrate the gulf in funding.

11. CaSE has welcomed the announcement in December's Innovation and Research Strategy that Smart awards would return, funded at the level of £75m over three years[8]. By encouraging SMEs to engage in the strategically important areas of science, engineering and technology, this could increase the compatibility of research undertaken in universities and SMEs. CaSE also welcomes the idea of competitions aligned with priority investment areas using the Smart schemes and hopes that an inducement prize model will be used to incentivise innovation (see paragraph 14).

12. The Small Business Research Initiative (SBRI) aims to improve the success of small R&D-based businesses in obtaining contracts from government bodies. Although based on the US Small Business Innovation Research (SBIR) programme system, the maximum size of contracts covered by the supply2gov database has been £100,000, compared with a typical size of $850,000 under the SBIR[9]. An evaluation by the Richard Report in 2006 found that despite the scheme's relaunch in 2004, hardly any of the projects funded involved any R&D[10]. CaSE welcomes the 2011 Plan for Growth[11] commitment of £20 million, but suggests that going forward the Government sets a new target rate for government R&D contracts per annum going to SMEs (previously this was 2.5%[12]) and where possible, the program focuses on firms that can prove they will spend on innovation. The SBIR must be recognised by all government departments as a primary tool to increase procurement efficiency.

13. CaSE welcomed the announcement of forthcoming reforms to the R&D tax credit schemes announced in the Autumn Statement. Many of the reforms, such as a move to an 'above the line' tax credit and payment of unused credit (if the company is loss making) to the company were included in CaSE's response[13] to the HM Treasury consultation on R&D tax credits. All of our suggestions focused on ensuring that the benefits of the R&D tax credit are seen by those making decisions on R&D spend (not just a company's tax department) so they are encouraged to undertake greater levels of R&D in future. The effect of these tax credits must be monitored to ensure they result in increased levels of R&D in addition to contributing to the UK's attractive innovation ecosystem.

14. CaSE welcomes the announcement in the Innovation and Research Strategy of a new prize fund of £250,000 to be coordinated by NESTA[14]. In contrast to prizes such as the Queen Elizabeth II Engineering Prize, it's possible that inducement prizes will be more effective in driving innovation in the short term. As an example, the Ansari X Prize in the US offered a prize of $10 million for the first non government organisation to launch a reusable manned spacecraft into space. This led to approximately $100 million in R&D investment, and laid the basis for the commercialisation of civilian space flights[15]. The amount of prize money offered is crucial and must match the social value of intended goal, in order to avoid inadequate incentives or inefficient duplications of investment.

Should the UK seek to encourage more private equity investment (including venture capital and angel investment) into science and engineering sectors and if so, how can this be achieved?

15. In 2009, then Science and Innovation Minister Lord Drayson announced a UK Innovation Investment Fund of a £150m with a view to this being built up to £1bn over ten years through match funding from private investors for investments in clean technology, bioscience and advanced manufacturing companies[16]. Although this fund fell short of its 'aspirational' £1 billion when it closed in the summer of 2011, it did leverage an additional £175 million from private sector investors which is currently being invested. Re-using this model of state funds as seed capital in a private equity fund structure may be one way to leverage private equity investment. CaSE suggests that the return on investment of this scheme is monitored.

What other types of investment or support should the Government develop?

16. Announced in the December Pre-Budget Report, the Patent Box (which taxes income from patents at a reduced rate of corporation tax), will take effect from April 2013. Despite support for the initiative from large companies (which hold the majority of patents), it has also received criticism. The patent box is a costly initiative; the Treasury estimated in the June 2010 budget that a Patent Box would eventually cost £1.1 billion a year[17]. In modelling the potential effects of the patent box, the Institute for Fiscal Studies found that although the patent box would increase the UK's share of patent holdings it was unlikely to result in the amount of real activity to accompany newly created patent income in order to outweigh the loss in revenue[18].

17. The Green Investment Bank, currently operating as UK Green Investments, is an excellent opportunity to directly address the valley of death by providing gap finance and long-term patient capital to allow innovative companies to attract private finance. However, the level of financing needs to be greatly increased if it is to operate successfully as a bank as opposed to just a funding body. The current budget of £100 million in the first instance followed by an additional £100 million next year is likely to be insufficient. A further issue arises if the bank is classified as being within the public sector, whereby any borrowing it undertakes would appear to work against measures to reduce the deficit on the Government's balance sheet. As the Government's primary objective is reducing the deficit, this may explain why the Government appears reluctant to include the Green Investment Bank on the balance sheet. However, the ability of the bank to both borrow and lend is crucial if it is to operate commercially and attract private sector investors, rather than simply acting as a relatively small un-leveraged fund. CaSE supports the recommendation from the House of Commons Environmental Audit Committee report on the Green Investment Bank that, 'the Department for Business, Innovation and Skills should raise with the Treasury the scope for a 'temporary and extraordinary' exclusion of a public sector Green Investment Bank from the strictures of the Government's fiscal controls'[19].

18. A radical and successful funding model currently employed in the US exists in the form of the Defence Advanced Research Projects Agency (DARPA). It has an annual budget of $3.2 billion dollars and relies on highly skilled programme managers as opposed to peer review for its funding decisions. The focus on radical innovation and high-risk investment allows it move from fundamental technological advances to prototyping. DARPA output has included the global positioning system (GPS), stealth aircraft and the precursor to the internet. DARPA also played an important part in the formation of Silicon Valley. By funding the establishment of new computer science departments in the 1960s, they greatly increased the numbers of researchers with expertise in this area, accelerating the rate of technological change. In order to accelerate computer chip fabrication specifically, they funded the opening up of a lab at the University of Southern California. Anyone who possessed a superior design for a new microchip could have the chips fabricated there and it was during this time the first personal computer emerged[20]. The success of Silicon Valley is well documented, but the role of DARPA (and of the state) in its creation is less so. Without the investment of the state in DARPA, it's unlikely that the US would be benefitting from the economic benefits of the companies that comprise Silicon Valley today.

[1] The Royal Society 'The Scientific Century: Securing our future prosperity' RS Policy document 02/10 March 2010 http://royalsociety.org/policy/publications/2010/scientific-century/

[2] The Associated of the British Pharmaceutical Industry 'Why we should care about where clinical trials are done' 9 June 2011 http://www.abpi.org.uk/our-work/news/2011/Pages/090611.aspx

[3] Higher Education Funding Council for England 'Research Excellence Framework' http://www.hefce.ac.uk/research/ref/

[4] BBC News 'Dyson to move to Far East' 5 February 2002 http://news.bbc.co.uk/1/hi/business/1801909.stm

[5] Technology Strategy Board 'Evaluation of collaborative R&D published' 29 September 2011 http://www.innovateuk.org/content/news/evaluation-of-collaborative-rd-published.ashx

[6] Department for Business Innovation and Skills 'Strategy for UK Life Sciences' 5 December 2011 http://www.bis.gov.uk/assets/biscore/innovation/docs/s/11-1429-strategy-for-uk-life-sciences.pdf

[7] Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM 'Annual Report 2010/2011' http://www.ifam.fraunhofer.de/jahresberichte/jb10/jb2010_en.pdf

[8] Technology Strategy Board 'Smart' http://www.innovateuk.org/deliveringinnovation/smart.ashx

[9] M. Mazzucato 'The Entreprenuerial State'DEMOS http://www.demos.co.uk/publications/theentrepreneurialstate

[10] Doug Richard 'Small Business and Government: The Richard report' 2008 http://www.bl.uk/bipc/pdfs/richardreport2008.pdf

[11] Department for Business, Innovation and Skills 'The Plan for Growth' http://cdn.hm-treasury.gov.uk/2011budget_growth.pdf

[12] NESTA 'Buying Power? Is the Small Business Research Initiaitve for procuring R&D driving innovation in the UK?'June 2010 http://www.nesta.org.uk/library/documents/Buying_Power_150610.pdf

[13] Campaign for Science and Engineering 'CaSE response to R&D Tax Credits Consultation' 2 September 2011 http://sciencecampaign.org.uk/?p=7034.

[14] Department for Business, Innovation and Skills 'Innovation and Research Strategy for Growth' December 2011 http://www.bis.gov.uk/assets/biscore/innovation/docs/i/11-1387-innovation-and-research-strategy-for-growth.pdf

[15] Luciano Kay 'The effect of inducement prizes on innovation: evidence from the Ansari XPrize and the Northdrop Grumman Lunar Lander Challenge' 14 Sep 2011 http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9310.2011.00653.x/full

[16] Lord Drayson ‘UK Innovation Fund’ 9 July 2009 http://webarchive.nationalarchives.gov.uk/+/web.bis.gov.uk/ministers/lord-drayson/uk-innovation-fund

[17] HM Treasury ‘Budget 2010’ June 2010 http://www.hm-treasury.gov.uk/d/junebudget_complete.pdf

[18] Institute for Fiscal Studies ‘Corporate Taxes and Intellectual Property: Simulating the Effect of Patent Boxes’ IFS Briefing Note 112 2010 http://www.ifs.org.uk/bns/bn112.pdf

[19] House of Commons Environmental Audit Committee ‘The Green Investment Bank’ 3 March 2011 http://www.publications.parliament.uk/pa/cm201011/cmselect/cmenvaud/505/50502.htm

[20] M. Mazzucato ‘The Entrepreneurial State’ DEMOS July 2011 http://www.demos.co.uk/publications/theentrepreneurialstate