IOP Institute of Physics

Bridging the "valley of death": improving the commercialisation of research

Institute of Physics submission to a House of Commons Science and Technology Committee Inquiry

A full list of the Institute's submissions to consultations and inquiries can be viewed at www.iop.org

8 February 2012

8 February 2012

The Clerk
Science and Technology Committee
House of Commons
7 Millbank
London SW1P 3JA

IOP Institute of Physics

Dear Ms Flood,

Bridging the "valley of death": improving the commercialisation of research

The Institute of Physics is a leading scientific society promoting physics and bringing physicists together for the benefit of all. It has a worldwide membership of around 40 000 comprising physicists from all sectors, as well as those with an interest in physics. It works to advance physics research, application and education; and engages with policy makers and the public to develop awareness and understanding of physics. Its publishing company, IOP Publishing, is a world leader in professional scientific communications.

This submission was prepared in consultation with the Institute's Science and Business and Innovation Boards, with input from members of the Institute with direct experience of the issues raised.

The Institute welcomes the opportunity to respond to the Science and Technology Committee inquiry 'Bridging the "valley of death": improving the commercialisation of research'.

If you need any further information on the points raised, please do not hesitate to contact us.

Yours sincerely,

Dr Norman Apsley FREng CEng FInstP
Vice-president, Business and Innovation

John Brindley
Director, Membership and Business

IOP Institute of Physics

Bridging the "valley of death": improving the commercialisation of research.

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

1. Improving the effectiveness of the commercialisation of research is one of the major challenges in 'rebalancing' the UK economy. The products of physics research are at the heart of sectors ranging from high-technology manufacturing to financial services, and for these industries to grow, they will need access to the next generation of physics knowledge. Improving access to funding is an essential aspect of promoting this commercialisation, but it will not on its own improve the performance of the UK. To increase the success of the commercialisation of research in the UK, there must be an environment that supports excellent research, the development of high-level skills, and a business landscape that is both capable of providing investment and able to turn ideas into profits.

2. There is a perception that the UK has a poor record in the commercialisation of science. In contrast to the strength of its academic research base, seen to be the second strongest in the world, the UK is comparatively low-ranked in terms of business investment in research and development as a proportion of GDP. While such metrics cannot be said to be perfect measures of the strength of commercialisation of research, or of the strength of innovative businesses[1], they are measures that can easily be compared internationally and it is clear that the UK has not made significant progress toward its 'Lisbon' target of increasing gross R&D spending to 2.5% of GDP[2].

3. To strengthen the UK's position, there needs to be a concerted cross-government strategy and a long-term framework, spanning many policy areas and several government departments. At the core of this must be a strong research base that encompasses both pure and applied research areas. It should not be thought that simply reducing investment in blue-skies research and increasing investment in more applied programmes will have a wholly beneficial effect, indeed there is some evidence suggesting that pure research has a greater ultimate economic value than more applied research fields[3].

4. There must also be companies that are capable of working with the products of research and either developing them in-house, or building on them to produce innovative solutions. These companies are essential. Without the capacity to absorb the ideas and inventions from research, the options for commercialisation of such research are severely limited. Integral to the success of such companies is the presence of skilled workers, trained in areas such as physics, who are able to adapt

[1] An area where there should perhaps be more work is in identifying a more appropriate metric for knowledge exchange and commercialisation.
[2] http://ec.europa.eu/invest-in-research/pdf/download_en/kina24050enn.pdf
[3] http://www.russellgroup.ac.uk/uploads/RG_ImpactOfResearch2.pdf

to novel techniques and technologies. There has been a significant decline in the availability of investment funds for science-based companies in the UK over recent years, both in terms of early-stage venture capital and also later stage investment in companies aiming to undertake R&D[4]. While it has been a stated aim of the government to increase the levels of lending by banks to smaller businesses, this is an area where the government could do more through providing direct support for innovative businesses with leveraged investment funds and also through targeted public procurement programmes (see paragraph 16).

5. Finally, there must be effective intermediaries to link research with the steps to commercialisation. These include, but are not limited to, the work done by agencies such as the research councils and the Technology Strategy Board (TSB), and also many effective networks and programmes in science parks and other private sector enterprises. This category should also include accountants, lawyers and other professionals; areas that are sometimes neglected in analyses, but are essential for effective linkages between researchers, businesses and investors.

Are there specific science and engineering sectors where it is particularly difficult to commercialise research? Are there common difficulties and common solutions across sectors?

6. R&D can be a long-term project. Often years will elapse between the original discovery or innovation and a first sale, and further time still before the company turns a profit. These long timescales mean that for science-based companies to survive and succeed, they need access to the right investment and support at the right time.

7. Even with appropriate investment, within the physical sciences in particular, there is the further barrier that technologies and innovations tend not to reach the market as stand-alone products, but are instead incorporated into other products or devices e.g. a novel electric component in a mobile phone handset. In the same way, there is often not a single precise application, benefit or market trajectory for a new idea in the physical sciences, meaning that the innovative component must find its way through several companies, and several R&D cycles, before it can be seen to be profitable.

8. As such, for physics-based innovations to be commercialised in the UK, there must be a chain of companies producing technologies or devices into which new innovations can be incorporated. This is an area which is often neglected in the drive to create a high-technology industry in the UK, where there can be an unhealthy emphasis placed on the role of university spin-out companies. A critical mass of innovative small and large companies, and supply chains, is an essential part of any commercialisation landscape.

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

9. There will and should be a natural flow of ideas and knowledge across national boundaries – science is an international endeavour. The strength of the UK research base and the presence of leading companies means that it is able to take advantage

[4] http://www.nesta.org.uk/library/documents/Venture_Capital.pdf

of discoveries and innovations made in other countries, and, equally, there will be ideas and discoveries made in the UK that have been developed in other countries.

10. In recent years there have been some notable exports, such as the results of research undertaken at Cambridge, and other UK centres, in the field of plastic electronics and displays. It is also likely that some discoveries resulting from research in graphene will also be developed and commercialised in South Korea and Japan. However, there has also been significant UK-based R&D in these areas, with many companies exploiting the potential of these discoveries based in the UK.

11. The reasons that individual research-intensive companies, or companies looking to exploit home-grown research, move abroad or sell on to larger companies will likely be complex and unique to the situations of the companies involved. However, it is usual for R&D centres, and, to a lesser extent, manufacturing centres, to be close to large markets, rather than be based at great distance from the customers and their needs. In that sense it could be seen that the UK's competitors for hosting or attracting science-based companies are more likely to be other nations in Europe rather than the emerging markets of India, China or Singapore. The UK should focus on these countries, and use all the tools at its disposal to ensure that it keeps pace with them in its 'offer' to multinational companies, and also in its support for home-grown firms. This should include the roles of subsidies, planning laws and also areas such as skills; workers able to adapt to new fields and techniques have been quoted in the past as important factors in the 'attractiveness' of sites. The differing innovation landscapes of other large European countries, particularly Germany, seem better suited to retaining, investing in and growing science-based businesses, and a closer understanding of why this is would also be beneficial.

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

12. Since its re-launch the TSB has been the key government agency supporting innovation in business and creating an environment where businesses are encouraged to invest in R&D and knowledge exchange between universities and business. Its returns on investment, even at what could be described as a very early stage of its existence, have been significant, with figures of 700% quoted recently,[5] however the true impact of the TSB will be seen in the long term and it, and the government, should retain that focus. A more relevant short-term indicator should perhaps be the positive responses of companies that have engaged with the agency's programmes.

13. Following the last spending review, the TSB has been tasked with doing more on a budget that has remained largely unchanged, with a remit stretching from the promotion of innovation in the regions of England following the abolition of the Regional Development Agencies, through to supporting the new 'Catapult' technology and innovation centres. Existing programmes such as the Knowledge Transfer Partnerships and Knowledge Transfer Networks have shown success in bringing university departments and innovative businesses together and it is unfortunate that the recent changes have required the TSB to reduce the investment in these areas.

14. The TSB has made imaginative efforts to cope with this reduction of funding. However, there is some concern amongst businesses that TSB grants are heavily

[5] www.guardian.co.uk/commentisfree/2011/dec/08/4g-mobile-windfall?newsfeed=true

oversubscribed and, as a result, chances of successful applications are very low. If the government is serious about promoting innovation and commercialisation, it will need to properly fund the key government agency tasked with working in this area.

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

15. The Catapult centres have the potential to bridge the gaps between research and commercial success. However, there are still many details to be clarified about the centres (indeed several thematic areas have yet to be announced) and long-term success will depend heavily on the ability of the centres to attract external industrial funding partners.

16. An area which has been largely absent from the strategies that has an important role to play in promoting commercialisation, and which has perhaps the strongest need for cross-government, long-term support is public procurement. The government procurement budget is orders of magnitude greater than the direct and indirect support provided to research and science-based companies through other programmes. Innovative procurement has the potential to be a 'game-changer' in the support and growth of physics-based high-technology businesses, but it needs a strong and visible commitment from the government.

17. Recent announcements from the Cabinet Office have focused on reducing the short-term bottom line costs of the purchase of goods and supplies rather than emphasising the role of procurement as a means of supporting science-based businesses. The Small Business Research Initiative (SBRI)[6], steered by the TSB, has been expanding slowly into several government departments, but if it is to achieve its full potential it should be fully embraced by all departments, particularly the larger spending departments such as the Ministry of Defence. The recent White Paper[7] has indicated some expansion of the programme, but a more significant step is required.

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?

18. Yes, but this is not the only solution. The problems of the investment 'valley of death' for science-based start-ups, and the lack of private investment capital, are longstanding (even through the economic 'good times') and were well characterised in the ETB's *SET and the City* report in 2006. However, the role of venture capital funds investing in early stage funding should not be over-emphasised. There are often legitimate business reasons for commercial funds being unwilling to put money in at the earliest stage, and, in countries where there is significantly more money at this level, much of it is leveraged or provided directly by state-funded operations. The government should play its part in providing investment for science-based businesses through directly supporting investment funds and also through agencies such as the TSB.

---

[6] www.innovateuk.org/deliveringinnovation/smallbusinessresearchinitiative.ashx

[7] https://connect.innovateuk.org/c/document_library/get_file?p_l_id=5116418&folderId=6206066&name=DLFE-66929.pdf

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

19. There is scope for larger companies to invest time and resource in businesses that could potentially form a part of their supply chain, or become business partners, through programmes such as *Microsoft BizSpark*[8]. Such programmes have been evident in other countries but less so in the UK and there should be investigations into what the barriers are in the UK to such projects.

20. R&D tax credits have shown success since their introduction, and have been seen to have a positive impact on business' decisions to increase or maintain R&D expenditure[9], and also in demonstrating to multinational R&D-intensive companies that the UK is 'open for business'. The introduction of the 'Patent box' is welcome as an example of long-term thinking in R&D policy, and should have a positive effect on research-intensive businesses in the UK.

21. The recently announced changes to an 'above the line' system should also have a beneficial effect, particularly in larger companies where the incentive will be able to act more directly on managers and decision-makers in research departments. There are still some areas where uncertainty could be reduced, particularly in the process by which HMRC assess whether work undertaken is eligible for relief under the schemes. Currently, companies that submit their returns to the schemes do not receive acknowledgement of the eligibility of the claim outside of irregularly-timed audits by HMRC. This process may mean that innovative companies whose work has been deemed ineligible may be left with a tax bill stretching back several years, and reduces confidence on the part of companies applying. An additional focus should be increasing the level of awareness amongst assessors of the roles that physics R&D can play in different businesses across the economy.

[8] http://www.microsoft.com/bizspark
[9] http://www.cbi.org.uk/pdf/20090204-cbi-r&d-tax-credit-survey-report.pdf

The Institute of Physics is a leading scientific society promoting physics and bringing physicists together for the benefit of all. It has a worldwide membership of around 40 000 comprising physicists from all sectors, as well as those with an interest in physics. It works to advance physics research, application and education; and engages with policy makers and the public to develop awareness and understanding of physics. Its publishing company, IOP Publishing, is a world leader in professional scientific communications.

IOP Institute of Physics

76 Portland Place

London W1B 1NT

Tel: +44 (0) 20 7470 4800
Fax: +44 (0) 20 7470 4848
Email: physics@iop.org
Website: www.iop.org
Registered Charity No. 293851