UK Deans of Science

Response to the House of Commons Science and Technology Committee Inquiry:

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

Background

1. UK Deans of Science (UKDS, www.deansofscience.ac.uk) is a national body that seeks to represent the individuals, usually formally designated as Deans, who are responsible for science in HEIs across the UK and who generally hold the budgets for science including any research budgets. Its primary aim is to ensure the health of the science base through the promotion of science and scientists and of scientific research and science teaching in the UK.

2. This response has been prepared by circulating the terms of reference of the inquiry to all our members, producing a draft response before discussing and finalising it at a meeting of the Executive Committee. The comments are mainly restricted to the challenges of commercialising research that originates in universities, while recognising that the vast majority of commercialisation occurs in industry.

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

3. Commercialisation is driven by entrepreneurs, not by Government nor, except in a relatively few cases, by universities. Commercialisation of university research is highly dependent on there being sufficient, sustainable funding for high quality basic and applied research to be carried out. Within the great deal of world class research that is carried out only a small proportion of a university's research portfolio is likely to provide commercial opportunity. Amongst this, the great majority of projects will be at Technology Readiness Level (TRL) 1-3, barely at proof of concept level, when they emerge from university studies. Funding directed at developing prototypes through to pilot systems (TRL 4-7/8) is needed to promote good ideas into commercial ventures. This would best be supplied in the form of staged funding and/or other incentives to encourage either UK companies to work with TRL3 material and develop this in concert with the inventors and others to commercial prototypes, or to encourage inventors and others to develop the opportunity themselves, to form new companies and take on potentially high risk, market opportunities if no existing company is interested.

4. There is often a propensity to try to retain the commercialisation of research within a university or to offer relatively unattractive licensing terms for work which is only at TRL-1 or TRL-2. UK universities have created a significant number of new companies but these tend to be fairly small and underderveloped and need investment and the involvement of professional management to take them forward and to generate significant revenues. This process takes time as well as money and talent, making such ventures high risk. The general

economic situation, the lack of investment funding and the increased aversion to risk by investors, all increase the width and depth of the valley of death, so many otherwise viable propositions will either be stalled or lost completely unless action is taken.

5. In addition to the financial risks and the challenges of finding commercial partners there is a question as to how far a university should extend its traditional role of teaching and research to encompass commercial activities that others are better placed to do. Thus many reports have suggested that universities and public research bodies should regard the IP they create as supporting wider societal and economic benefit rather than expecting commercialisation to deliver a significant income stream (see, for example, *Intellectual Property and Research Benefits*, Wellings 2008, *The Race to the Top*, Sainsbury, 2007).

6. In summary, actions that could be taken to support commercialisation of university research include:

   - a proof-of-concept fund to bridge the gap between concept and commercialisation. Such funding would also help de-risk projects. Consideration should be given by Government to co-invest in such schemes alongside established investors. There should be clear recognition that this is high risk funding. Application procedures should be simple and not require full business plans or submission of detailed monthly accounts, etc. for such early stage development, though a steering panel should be appointed to supervise the project
   - continuation of more progressive IP policies with ‘easy access’ to HEI IPR as a key mechanism to encourage early stage uptake and commercialisation of university IP
   - review and rationalisation of support networks. In 2009, one of our members, using information published by Scottish Enterprise, found that there were more legal advisers advising biotech startups than there were actual startups
   - universities creating further mechanisms to facilitate research commercialisation
   - Governments and the devolved administrations in Northern Ireland and Wales increasing their support for commercialisation of research, for example by funding of joint university/industry research programmes, with the companies funding a fixed percentage of the full research and development costs in return for the right to exploit the results of the programme
   - new local, national and international initiatives to enable universities to identify and engage with end-users and commercial mentors and non-executive directors who can advise and work with senior academics to bring IP to commercialisation. Such individuals have been located by some universities creating groups of suitable contacts, for example through University business angel clubs and Managing Director network clubs as well as using specialist head hunters
   - consideration as to whether aspects of the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) might be introduced into the UK
   - further initiatives to encourage secondments to university departments.

7. Above all it Government must recognise the impossibility of predicting future needs of the applications of science and fund basic science accordingly. In life sciences there are times when the concept of a commercial proposal is very clear but the technique to deliver it is not available or not fully developed; conversely, there are cases of a major breakthrough in development of a technique, not specifically designed to answer just one problem, but having very wide applicability (eg DNA sequencing, polymerase chain reaction). Difficulties may also occur when an invention is effectively complete. For example, in the development

of an oral vaccine where there can be a lack of platforms in the UK to complete trials to bring the ideas to the market.

8. Whatever initiatives may be taken, it is essential that they enable the taking of major risks to commercialise inventions while protecting the financial health of a university.

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

9. Inclusion of this question suggests that the Committee recognises that different areas have varying potential for commercialisation. While 'traditional' science and technology areas have been the source of some considerable success in terms of commercialisation (for example, ICT, life sciences, chemistry, physics, engineering, etc.) the most successful commercial outcomes measured in terms of revenue returns to the university can originate from less likely areas and from work at the intersection of several disciplines.

10. There are few areas where it could be said to be 'easy' to find backing to commercialise research outcomes. These tend to be in disciplines such as web-based or software development where a product is almost ready for delivery and the market opportunity is fairly obvious. Areas in which there is a major challenge to find sufficient funds for commercialisation include sophisticated engineered products and systems, novel materials, new therapies and medical technologies, biotech, pharma and, perhaps particularly, in new clean technologies where the financial return is often unproven and any developments have substantial lead-times to market making them unattractive investments to any but the largest companies. However, in counter-argument to this, some very large companies are the most resistant to very novel ideas, wishing instead to buy up successful companies or near to market inventions.

11. Although being critical to the support of the world class research base in other disciplines, mathematics has the potential for perhaps the wide and deepest 'valley of death'. Most cryptography and cyber security relies on mathematics developed many decades (and sometimes centuries ago). While it impossible for government to plan so far ahead, the discipline must be kept vibrant and viable through appropriate funding and supported where appropriate to commercialise its outputs, with Information Security being an example of the usefulness of mathematics that needs to be nurtured.

12. At least some of the solutions to the difficulties mentioned here have been described in the response to the first question above. However, setting up regular broad-based UK "technology exhibitions" as a focus for R&D organisations and companies could bear fruit across different sectors, where an aggregation of technology and information can be brought together to generate new product opportunities.

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

13. Generally transfers can occur either directly from the research laboratory, or when a small company is bought out or invested in by overseas parties. This is normal and natural. However, if UK companies and investors could be encouraged to take a longer-term attitude

to opportunities (as they do in Germany and Scandinavian countries) we might succeed further with more home-grown commercialisation.

14. In other cases the specific nature of the work may give rise to overseas investment as illustrated by the following examples. There are other (often confidential) examples where the research that has been contracted by an overseas company has been commercialised outside the UK by that company.

- Many thousands of sites worldwide exhibit contamination of soil, groundwater and surface water by hazardous industrial chemicals. These chemicals, such as fuels and solvents, pose a serious and long-term threat to soils and water quality. With funding from Scottish Enterprise's Proof of Concept programme, researchers at the University of Edinburgh developed novel remediation technology for the removal of hazardous subsurface contamination. When no UK licensing partner could be established, the technology was eventually licensed to a Canadian company and is under-going successful trials in the USA.
- One of the greatest commercial successes in Lancaster University was the development of a novel technique for the irrigation of high value fruiting crops. The technique reduces the amount of irrigation water applied, maintains crop yields and increases fruit quality leading to a significant increase in wine quality. As a result, the impact of the technique, now widely adopted, is measured in £Ms. While there has been subsequent investment within the UK to develop the technique domestically, a clear market demand overseas (in Australia) drove rapid commercialisation. Critical to this commercialisation was the existence of the Commonwealth Scientific Industry Research Organisation (CSIRO), established to ensure rapid commercialisation and impact of national science programmes into all areas of the Australian economy, more often than not, in close partnership with major national industry sectors (such as the wine industry). We may draw a passing parallel with this organisation and the network of Catapult Centres being established by the TSB in the UK, although the Australian investment in CSIRO is significantly higher.

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

15. Our members have commented favourably on a number of national initiatives including HEIF, KTPs, Innovation Vouchers and SMART awards, the Scottish Enterprise Proof of Concept programme and the TSB funding calls that have all contributed to, and improved, commercialisation and knowledge exchange.

16 External evaluations of the KTP programme indicate that funding that increases dedicated human capacity to commercialise research and has significant (additional) impacts in terms of new product and service development and employment, much more so than the simple supply of financial grants to carry out commercialisation. Interventions which continue to focus on the training and development of dedicated R& D staff in SMEs should continue to be supported as a priority. However, there are some disadvantages to universities in KTPs as the university supplies much of the expertise, it may be mentioned in a patent, but not share in the profit accruing from successful projects.

17 The excellent industry-led funding calls from the Technology Strategy Board are generally at the very applied end of the research spectrum rather than directed to commercialisation. It is possible that a similar approach aimed at facilitating commercialisation of research following from TSB collaborative R&D projects would be helpful.

18 We believe that useful lessons may be to be learnt from the Scottish Enterprise Proof of Concept programme, which has led to several successful new company formations in key technology areas. Such funding can encourage significant private investment in a project. Unfortunately in spite of beginning as a programme with a light touch, increasing regulation means that the programme is now less well regarded.

19 Although there are several positive statements to be made about TSB and other initiatives, national statistics continue to indicate that the UK lags seriously behind its international competitors in the proportion of GDP that is devoted to research and development. What is even more disturbing is the rate at which emerging economies are increasing their investment in science (the BRIICS). The TSB might better perform more matchmaking between R&D providers and UK businesses. The Catapult Centres may encourage this, but the opportunity should be available for any TRL3-7 development project to bid for TSB funding.

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

20 These strategies are unlikely to have a significant effect without the Government agreeing some quantitative measure of success. We noted with deep concern that it decided to drop even the limited target of the previous Government of the (very low) figure of 2.5% of GDP being spent on research and development. It has also decided to stop funding the excellent R&D Investment Scoreboard so will have almost no robust way of judging the success or failure of any of its policies. Unfortunately it would seem that the more government money is made available, the more potential equity investors withdraw and demand that even more risk be eliminated before they invest their money. It could be better to stimulate investments through further demand side action through fiscal changes rather than seeking to address the delivery side.

21 However, some actions can have a beneficial effect for example,

- initiatives such as SBRI, improved R&D Tax Credits and increased tax incentives for private investment in very small companies can provide pragmatic help in bridging the valley of death. These encourage sustainable "organic growth" of young companies, in which, in the current environment it would be very unrealistic to expect significant bank or venture capital funding
- policy incentives driving closer collaboration and sharing of services in universities offers significant opportunity for HEIs more effectively to collaborate, combine and commercialise the outcomes from research
- leverage of TSB funding with European Regional Development funding which should aim to ensure these regionally funds are more closely aligned to technology commercialisation, rather than low-level business support
- the UK- China (and other) science programmes should attract more UK and international venture capital and increase collaboration between companies and UK (and Chinese universities) as well as gaining easier access to certain export markets.

22 There is much support for SMEs, though it needs to be channelled to those companies that have real potential for growth. The high tech, high growth companies may have the potential to punch above their weight and lead to notable wealth and job creation, but they probably only exist in a very few sectors such as IT and medical technology. Many other SMEs are low tech and are unlikely to achieve significant growth in the near future or contribute to the UK's strategy to become a high technology, high value-added economy. In contrast, support mechanisms for universities to work with large companies, who may be better placed in some cases to commercialise research, do not seem to be available.

23 It is too early in the lifetime of Catapults to evaluate their usefulness in research commercialisation but hopefully this will happen in the limited number of sectors where they have/are being established.

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?

24 Categorically, yes.

25 One of the major issues is the scattered nature of intellectual property across the university sector. Any policy that encourages connectivity across universities to pool their IPR offer whether nationally or locally would make it easier for venture capitalists and business angels to understand the range of opportunity available.

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

26 Further support could include:

- more incentivising of universities to develop their contacts with alumni, perhaps through a fund similar to the matched funding that was set up by to encourage philanthropic donations
- focussing on increasing the intake of high quality graduates into the SME sector
- more short-term posts based in industry, specifically to support university-industry collaborations on a regional basis.

27 Above all, where SMEs exist that have the potential to deliver high technology, high value added scientific manufacturing and R&D it is essential that they are enabled to operate in science parks, preferably near universities, or where this is not possible, exist within networked clusters that may also include connections with large companies.

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