The UK's innovation ecosystem

Summary of a review commissioned by the Wellcome Trust

Introduction

1. While the UK's fundamental research is world-leading, it has long been recognised that our innovation ecosystem does not always support its effective uptake. Good intellectual property (IP) management is one way of driving translation. In early 2014, the Wellcome Trust began a review of our IP strategy to ensure that our approach in this area enables research to flourish.

2. To set this work in context, we commissioned the consultancy Bain & Company to undertake an analysis of UK innovation and external IP and research funding trends. They identified four key barriers that prevent life sciences research from being effectively translated and commercialised into treatments, technologies and products:

    - Britain's academic culture doesn't facilitate translation;
    - Technology Transfer Offices often prioritise revenue over innovation;
    - Insufficient funding and support is available for concept testing;
    - There is a lack of long-term investment to underpin commercialisation.

3. Addressing these issues would not only support the effective delivery of patient and societal benefits, but would also cement the UK's position as a highly functional hub for science. It would drive additional private investment, create more highly skilled jobs, and help attract international researchers and companies.

4. To compile their findings, Bain undertook a literature review, conducted around 100 interviews with UK and international stakeholders, and carried out a survey of academics with over 1,700 responses. Although this analysis was intended to inform the Trust's thinking, it gives an interesting perspective that may be useful to partner organisations. This briefing summarises Bain's research and presents areas for further exploration. Headline IP trends are summarised at **Annex 1**. The Trust is also considering how we might address some of these issues.

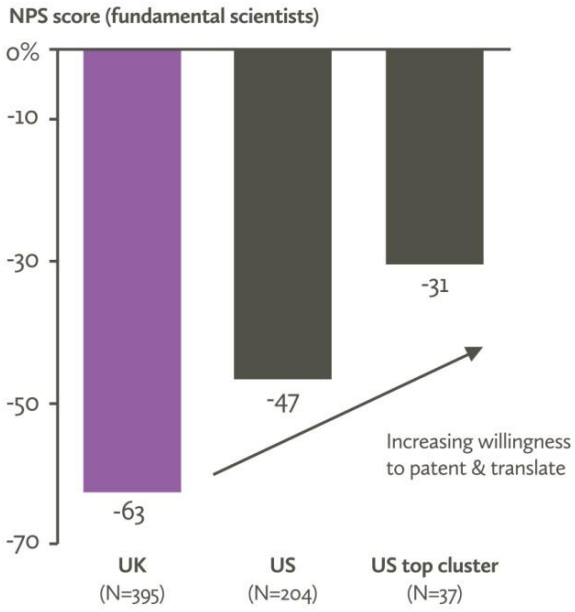
Barriers to the translation of UK science

1993	2003	2013
"There is a widely perceived contrast between our excellence in science and technology and our relative weakness in exploiting them to economic advantage" *Realising Our Potential.* Department of Trade and Industry, 1993	"UK universities are less active in commercialisation efforts than their peers in other advanced economies" *UK Competitivness: Moving to the Next Stage.* Michael Porter, 2003	"The UK has a world-class science base but there remains a need to attach world class exploitation mechanisms to gain economic benefits" *Bridging the Valley of Death.* House of Commons Science and Technology Select Committee, 2013

Britain's academic culture doesn't facilitate translation

5. In the UK, the principle metric for academic success is paper citations. This pressure to publish can disincentivise UK researchers from filing patents. Bain's survey showed that UK academics were about half as likely to patent as their counterparts in a top US cluster, with nearly a third of UK respondents saying that their decision was based on the need for publications "to drive grants or my career". There is an underlying perception that patenting slows down the scientific process.

How likely would you be to recommend patenting to an academic friend or colleague with a major research breakthrough?

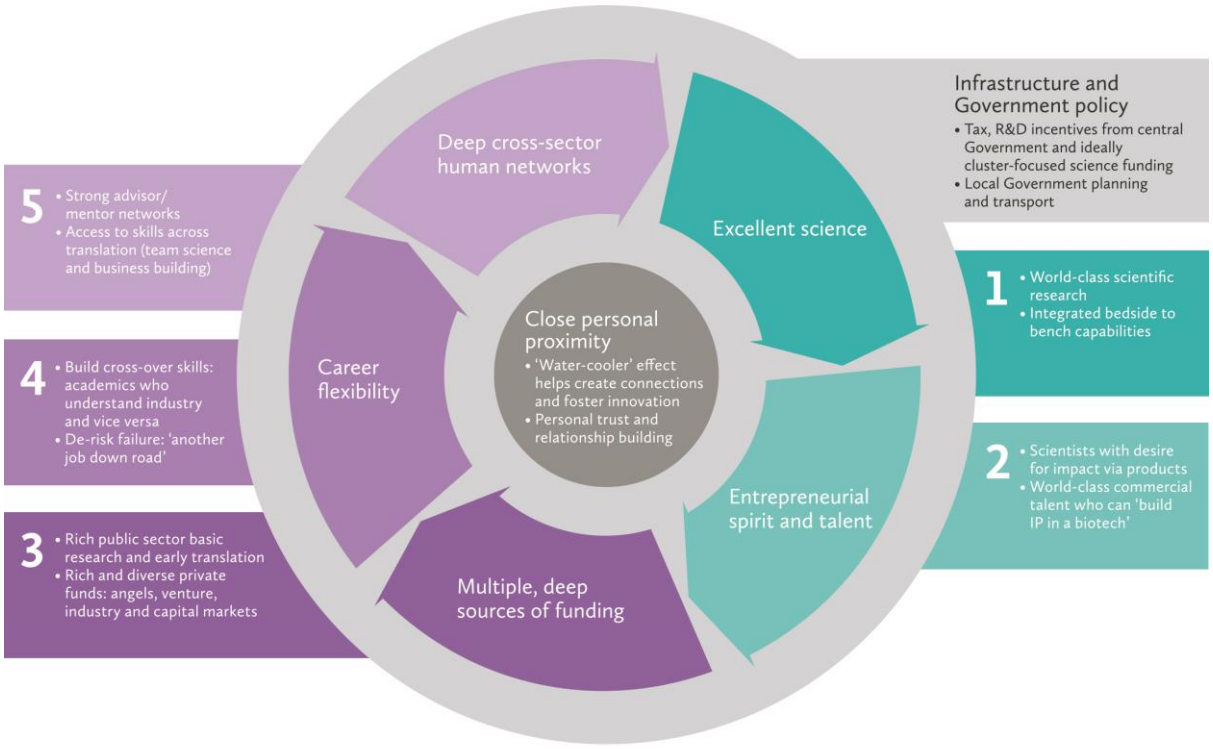


Note: NPS score = % scoring 9 or 10 (promoters) minus those scoring 0-6 (detractors);
Top US cluster universities includes: Harvard, MIT, UMass, Boston University, Stanford University, University of California, San Diego.
Source: *Bain Research Impact e-Survey; expert interviews*

6. The review highlighted that there is a lack of awareness of the commercialisation process among many academics. Training programmes could help to address this by increasing knowledge and understanding of translation and patenting, and equipping researchers with the skills they need to collaborate with commercial partners. Innovation advisor and mentor networks could also play a role in facilitating connections between academics, business representatives, investors and clinicians. This would enable researchers to better access commercial expertise and advice, and help drive a pipeline of marketable innovations.

7. It is important to celebrate, reward and recognise translational activities, particularly in grant applications. Currently, behaviours that underpin translation — such as collaborative, cross-disciplinary and cross-sector working, business advisory roles, mentorship, and entrepreneurship — are not sufficiently rewarded. Some of the most important experimental results in early translation are those that show an invention doesn't work, allowing effective 'fast to fail'. However, such null results are often discouraged because they do not lead to publication.

8. Researchers need time and space to consider impact, and translational activities should be de-risked. This could include flexible career paths at all levels, where industrial and entrepreneurial experience is encouraged and incentivised, more re-entry support for those who wish to return to academia, and other mechanisms that promote a 'revolving door' between universities and companies. R&D clusters provide one way to facilitate collaboration, promote knowledge sharing and foster local economic growth. They create an environment that helps cross-sector partnerships to flourish, and the close proximity of organisations gives people a degree of career flexibility. They are hubs for talent, ideas and investment, and bring people from diverse areas together.



Technology Transfer Offices often prioritise revenue over innovation

9. University Technology Transfer Offices (TTOs) occupy a unique position in the innovation ecosystem, and have the potential to act as a gateway between academia and industry. The very best TTOs focus on exploiting knowledge for public good. A pressure to create revenue can lead to overvalued IP, licencing terms that disincentivise deals, and insufficient consideration of quality measures. Being empowered to focus on impact and run as a cost centre for venture philanthropy would enable TTOs to better meet the very different needs of their customers: academics, businesses and investors. During its review, Bain worked to establish an international model of TTO best practice through interviews, surveys, case studies and literature reviews.

10. The first role of a good TTO is engagement and acting as an institutional advocate for innovation and translation. The most effective TTOs also act as a broker between academics and industry or other sources of private capital. They make connections, catalyse successful collaborations, and help companies of all sizes to better access university expertise and skills. They report to the top of an institution and pay enough to attract talented staff with both academic and commercial experience. They have the capacity and capability to guide researchers through translation, and invest money and time to create customised commercial solutions.

11. Rather than focusing on patent filings and spin-out companies as a measure of success, exemplary TTOs consider metrics such as levels of engagement with researchers and end-users, the speed and volume of knowledge exchanged, quality of filings, and indicators of economic efficiency. They do not have a ‘one-size-fits-all’ approach to IP and carefully consider the decision to spin out companies versus incubating and developing research to a point where it is less risky and more attractive to follow-on investors.

Case study: VIB

Belgian life sciences research institute VIB has a particularly interesting TTO model. Funded by the Flemish Government, it focuses on translating basic research into industrial applications; supporting researchers in four Belgian universities. It covers the entire IP life cycle of a product or service, and its highly skilled TTO staff incubate innovations for much longer than most. It decides what to patent, what translational experiments and funds are committed, and what to licence. It has a generous inventor revenue sharing policy, and returns funds to universities which are ploughed back into R&D. Incentives focus on breakthrough research whilst encouraging academics to develop commercial insight and behaviours. http://www.vib.be/

Insufficient funding and support is available for concept testing

12. Concept testing enables researchers to carry out a few critical experiments to demonstrate that an innovative or high-risk idea has commercial potential. It is relatively inexpensive — between £50,000 to £250,000 per proposal — but needs to happen within a 12-month window between preliminary and PCT patent filings[1]. During the review, a number of people mentioned the Medical Research Council's Confidence in Concept scheme[2]. However, this is one of the few programmes of its kind and the review highlighted that there is a significant funding gap for concept testing. As well as exploring ways to increase funding, it will be important to ensure that this can be accessed with minimal bureaucracy — securing a small amount of seed investment can often be more difficult than applying for a large-scale grant.

13. In addition to this lack of funding, the review identified a capability gap. Academics often lack the knowledge that enables them to design a set of experiments that give investors the confidence to back an idea. These could include a few *in-vitro* tests to assess drug efficacy and potential differentiation, an assessment of safety hazards, studies to establish more general applicability of the technology, an evaluation of market potential and pricing, and some analysis of the regulatory process to assess rough clinical development costs and expected milestones.

14. To enable the selection and implementation of these kinds of experiments, academics should be able to access expertise and advice from TTOs, industry, investors, regulators and clinicians. Cross-functional and cross-sector collaboration is critical. Innovation advisor networks could play a key role in facilitating this; supporting researchers to turn their ideas into commercially-attractive propositions, backed by robust tests that can help secure follow-on finance.

There is a lack of long-term investment to underpin commercialisation

15. Although the UK has made enormous progress in creating the right incentives for biomedical innovation — in particular R&D tax credits, the Patent Box and translational awards — the critical barrier to commercialisation continues to be a lack of long-term capital investment. Developing research ideas takes many years and must be underpinned by stable funding throughout the lifecycle. Pharmaceutical companies will buy innovations but their appetite is limited by their areas of interest and the number of transactions they undertake each year. Traditional venture capital is not particularly suited to bioscience, backing ideas over the short-term and requiring a quick exit.

[1] A PCT (Patent Co-operation Treaty) filing refers to a single international patent application, filed with a PCT Receiving Office such as the UK Intellectual Property Office, and seeking simultaneous protection in a number of PCT contracting states. This is followed by a 'national phase' in any countries where patent protection is sought.
[2] http://www.mrc.ac.uk/funding/browse/confidence-in-concept-scheme

16. During the review, a number of people highlighted concerns around the Alternative Investment Market (AIM) and its suitability for biotech. There is little appetite for technology companies, a lack of buyers and liquidity, and an absence of science-savvy brokers that makes it difficult to sell a technical story. Without an effective stock exchange, the UK market for bioscience is inherently low profit.

17. There is a pressing need for additional Government incentives that will attract new sources of long-term funding. AIM biotech listings could be made more attractive to investors, possibly through tax reform. NASDAQ[3] could be made more accessible to UK companies — a stable group of technology funds utilise this market, and provide a reliable liquidity route and a vital source of growth capital. Incentives to encourage generalist pension funds to invest in biotech propositions could also be encouraged, and innovation uptake across the NHS must also be improved, with a quicker and cheaper path to market, and less fragmented decision-making to better support commercial multi-centre trials.

Case study: Novo Group

The Novo Group considers long-term financing for life sciences to be so important that they created a sophisticated end-to-end funding model. Basic and pre-clinical research are supported by classic grants with no expectation of financial return; a former venture capitalist and leading scientists administer Novo Seeds to support pre-clinical to Phase I translational science with the expectation of breaking even; global biotech fund Novo Ventures backs Phase II to III with classic venture managers who aim to beat stock market returns; and Novo's late-stage investment activities are targeted towards well-established life science companies with a goal of creating value through active support and long-term ownership. http://www.novo.dk/

Case study: Syncona Partners

In 2012, the Trust founded independent investment company Syncona Partners with a £250 million capitalisation. Syncona supports the creation of sustainable healthcare businesses, backing partner companies over the long-term and funding at any stage. Its portfolio includes a £12.8 million investment in newly-formed company Blue Earth Diagnostics, who focus on developing imaging agents for use in positron emission tomography (PET) scanning. It has also funded £12 million to support phase II clinical studies and further develop a gene therapy for choroideremia through the creation of a spin-out company called NightstaRx. Choroideremia is an incurable degenerative disease that causes progressive loss of vision, and affects 1 in 50,000 people worldwide. http://www.synconapartners.com/

[3]NASDAQ is the largest stock exchange in the US, and the world's first electronic stock market.

Annex 1: Headline global IP trends identified by Bain & Company

- **Legal complexity kills innovation**. Funders' reach-through rights[4] over research materials and tools can hinder commercialisation and deter potential investors.

- **Single patents are becoming less valuable**. Big companies are increasingly dependent on strong IP portfolios which enable cross-licensing deals, and 'patent trolls' are buying up vast collections of IP which they aggressively defend.

- Since the 2013 US Supreme Court ruling that non-altered human genes cannot be patented, the **boundaries of what can be protected are tightening**. This could impact diagnostics as tests using DNA can only be defended with less robust process patents[5].

- Already an established approach to protecting manufacturing processes, **trade secrets[6] are now being used for therapies and diagnostics**. Copyrighting[7] of health-related software is also becoming increasingly important.

- A number of **new sharing models are starting to emerge**. These include discounted access to research models in return for future commercial rights, non-competitive IP sharing consortia to stimulate early research, and the Easy Access IP model[8] which simplifies university licencing deals.

- The **forward-selling of future IP has appeared as a possibility in UK universities**. This could have a huge negative impact on the health, societal and economic benefits arising from research.

[4]Reach through provisions give the provider of materials rights to resulting inventions.
[5]Process patents are usually granted to protect a manufacturing process, and are not infringed until someone practices all of the steps involved.
[6]Trade secrets are protected by the law of confidentiality and can be used by companies to guard commercially-sensitive information about processes or products. If this information is shared, recipients are usually asked to sign a Non-Disclosure Agreement.
[7]Copyright uses exclusive rights to use and distribute a work or product.
[8]http://www.easyaccessip.org.uk/