Knowledge Transfer And Intellectual Property In The UK: The New Challenges

By Angela Kukula

The UK is one of the world's highest ranking nations for research and innovation. While it has only 0.9 percent of the world's population, it contributes 3.2 percent of global R&D expenditure, has 4.1 percent of the world's researchers and publishes 6.4 percent of the world's research articles rising to 15.9 percent of the most highly-cited articles.[1] The UK ranks consistently in the top five nations globally for innovation.[2] The reasons for this are undoubtedly complex, but have roots in: the longevity of the UK's premier research universities,[3] the UK's leading role in the industrial revolution and the dominance of the British Empire in the 18th and 19th centuries.[4] There is concern however that action needs to be taken for the UK to maintain this position, leading to the UK government's stated aim of increasing expenditure on R&D from the current 1.7 percent of gross domestic product (GDP) to 2.4 percent by 2027.[5]

UK universities play a vital role in the innovative and productive capacity of the UK. It has been estimated that, through the broad range of activities they undertake, universities contribute more than £73 billion per year in output for the British economy, more than 3 percent of UK GDP and generate more than 750,000 jobs.[6]

Whilst much of this is from their direct employment of staff and their wide ranging supply chains, a growing proportion of their impact is from the benefits of their academic exploration and research. In 2014-15[7] universities undertook £7.9 billion worth of research. This is estimated to deliver returns equivalent to £28.9 billion in additional gross value added.[8]

The UK Industrial Strategy white paper, published in November 2017[9] outlined the government's objective to improve living standards and drive economic growth across the UK by increasing productivity. Universities were identified as a major contributor to this objective. The white paper recognised the UK's research–intensive universities as key to boosting the UK's performance in innovation, and forming local 'innovation clusters' to address the needs of business and contribute to regional development. The white paper expresses an intention to provide extra core funding for university research and innovation, to enable institutions to undertake more work alongside businesses and raise productivity in all parts of the economy.

The university sector in the UK is very heterogeneous in size and in terms of institutional emphasis on teaching or research leading to a wide variety of engagements with business and the community. Depending on institutional priorities, emphasis ranges from; the support of local small and medium-sized enterprises (SMEs), through access to facilities and the provision of expertise, to global licensing activities and the establishment and incubation of new businesses based on university research. As a result of this wide range of interactions, it is now more common to see the term "knowledge exchange" used in place of "technology transfer," the latter being thought of as referring only to the more focused activities of licensing and spinning out of companies.

The UK's knowledge exchange sector has grown over the past 20 years into an internationally well regarded and maturing industry. Successive government reviews over the last 10 years have shown the system to be highly productive and to outperform the U.S. in some measures.[10] Many global companies cite the UK as one of the best places in the world to invest in R&D because of the quality of the UK research base.[11] This also acts as a strong pull-factor for enterprise investors and is vital in creating investor confidence.[12]

The UK boasts three of the world's top ten universities[13] and these three institutions are also amongst the best performing in terms of knowledge exchange with all three ranking in the top ten for parameters such as contract research with industry, intellectual property (IP) income and number of spin-out companies created.[14]

Nonetheless, knowledge exchange remains the subject of close scrutiny with a view still persisting that whilst UK universi-

1. International Comparative Performance of the UK Research Base —2013.

A *report prepared by Elsevier for the UK's Department of Business, Innovation and Skills* (BIS) (October 2013) *https://www.gov.uk/government/publications/performance-of-the-uk-research-base-international-comparison-2013.*

2. Soumitra Dutta, Bruno Lanvin and Sacha Wunsch-Vincent (Editors) The Global Innovation Index 2018. Energising the World with Innovation—*https://www.globalinnovationindex.org/gii-2018-report.*

3. Oxford University was founded in the 11th century and Cambridge University in the 13th century.

4. At its height the British Empire oversaw over 412 million people (23% of the world population) and covered 24% of the world's total land area.

5. Industrial Strategy. Building a Britain fit for the future. (November 2017) *https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/730048/industrial-strategy-white-paper-web-ready-a4-version.pdf.*

6. The Economic Impact of Universities in 2014-15. Report for Universities UK (October 2017) *https://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2017/the-economic-impact-of-universities.pdf.*

7. The latest academic year from which figures are available

8. T*he Economic Impact of Universities in 2014-15* (October 2017).

9. *Industrial Strategy. Building A Britain Fit For The Future* (November 2017).

10. For example, in contrast to the US, UK universities are recognised as pursuing a broader range of knowledge exchange activities for public good. Global Innovation Policy Center International IP Index 2018. *https://www.theglobalipcenter.com/ipindex2018/.*

11. *International Comparative Performance of the UK Research Base – 2013.* (October 2013).,

12. *Global Innovation Policy Center International IP Index 2018.*

13. University of Oxford, University of Cambridge and Imperial College London—according the Times Higher Education world university rankings 2019, *https://www.timeshighereducation.com/world-university-rankings/2019/world-ranking#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/stats.*

14. *https://www.hesa.ac.uk/data-and-analysis/providers/business-community.*

ties are good at basic research, they are somehow poor at turning that research into commercial opportunity. This view is not borne out by data that show total income generated from collaboration with external partners of around £4.2bn[15] per annum, providing close to £10 return on every £1 invested,[16] and demonstrating the value that businesses place on such interactions. The emphasis on the role of universities in the UK industrial strategy also demonstrates government confidence in the sector to generate economic impact.

UK universities have been free to set their own policies on the ownership and exploitation of (IP) created in the course of research since 1985.[17] There is an expectation that universities will optimize conditions for exploitation and impact generation from their research, and where research is grant funded, there is an implied responsibility to exploit imposed by funders, such as Research Councils UK and the many charities that make up the UK's research environment. As a result university policies tend towards ensuring that research outcomes have social and economic benefit whilst also ploughing back any income generated into basic research.

Because of this lack of centralisation, there is no one system for ownership of university IP, and no unified exploitation policy. Managing IP arising from academic research is done within the context of a university's own structure, strategy and culture. The activity is usually governed by an institutional IP or knowledge exchange policy agreed by the university's governing body.

In terms of implementing institutional policy, almost every UK university has staff dedicated to knowledge exchange. Depending on internal resources (financial and structural) and the internal and external audiences that the university seeks to address, these staff may be based in a dedicated commercialisation office or company, in a research (grant) support office, or embedded within academic departments. Where there is no dedicated staff, activities may be outsourced to commercial consultancies and intermediaries (such as IP Group or IP Pragmatics) and in some limited cases are undertaken by staff associated with other university knowledge exchange offices.[18]

All UK universities will have an explicit or implied aim of improving their interactions with business. However there are a range of ways in which they do this depending on their particular mission and the resources available to them. All UK universities are required to complete the Higher Education Business and Community Interaction (HEBCI) survey annually, setting out the ways in which they interact with external audiences.[19] The survey collects information on the infrastructure, capacity and strategy of higher education providers, and also numeric and financial data regarding activities concerned with the use, application and exploitation of knowledge assets. As such, it is a powerful indicator of university performance in knowledge exchange and the quality and completeness of this data is a particular strength of the UK knowledge exchange ecosystem.

Data from the survey[20] shows that around two-thirds of UK universities have reported the filing of patent applications, creation of spin-out companies or the generation of revenues from IP transactions.[21] There has been a modest growth in university-business research over the last three years (growing from £1.21bn in 2014/15 to £1.29bn in 2016/17) with other measures of interactions with business such as consultancy income and income from IP remaining stable at around £450m per annum and £150m per annum respectively.

■ Dr. Angela Kukula,
The Institute of Cancer Research,
Director of Enterprise,
London, England
E-mail: Angela.Kukula@icr.ac.uk

However, a small number of high-value deals are responsible for a significant proportion of the reported external income and there is a concentration of activity among large, research intensive universities. Of the 163 institutions providing data to the survey, over 25 percent of total IP revenue was produced by just two (The Institute of Cancer Research, London and the University of Cambridge) and just 15 institutions were responsible for over 80 percent of IP revenue. A similar skewing is seen in the establishment of spin-out companies. The number of spin-outs set up by universities and still alive after three years (a statistic used as a control for quality) is 865, with almost 25 percent of these having been created by just four institutions.

Powerful as it is, however, the HEBCI data belies the range of interactions that universities have with businesses and the community. Whilst the early focus of knowledge exchange was on licensing research discoveries to industry or forming new companies, more recently this has given way to a much broader range of interactions: a recent survey identifies 27 different modes of engagement.[22] And neither the degree of engagement nor the utility to the consumer is easy to gauge from headline metrics. A large proportion of UK companies (nearly a quarter) report universities as highly important sources of information for innovation[23] whereas only around 6 percent have formal agreements with a university partner.

As a general rule, the older, more research-intensive universities are more likely to focus their knowledge exchange activities on large national and international organisations, whereas the newer and more teaching-intensive universities tend to be more embedded in their local and regional economies and relatively more concerned with skills and professional development activities.[24]

15. 2016-17 figures.

16. Tomas Coates Ulrichsen. "Assessing the economic impacts of the Higher Education Innovation Fund: A Mixed-Method Quantitative Assessment," (Oct 2015), *https://www.researchgate.net/publication/304246932_Assessing_the_Economic_Impacts_of_the_Higher_Education_Innovation_Fund_a_Mixed-Method_Quantitative_Assessment*

17. Prior to 1985, innovations resulting from publicly funded research including that in universities were owned and exploited by the state-owned, National Research and Development Corporation (later British Technology Group Ltd (BTG)). BTG was privatised in 1985 and its monopoly right to university IP abolished.

18. For example, the provision of knowledge exchange services by Oxentia—a company spun-out of Oxford University's technology transfer company

19. *https://www.hesa.ac.uk/data-and-analysis/publications/hebci-2015-16.*

20. *https://www.hesa.ac.uk/data-and-analysis/providers/business-community#.*

21. *https://www.hesa.ac.uk/data-and-analysis/publications/hebci-2015-16.*

22. "The Changing State of Knowledge Exchange. UK Academic Interactions with External Organisation 2005-2015," (February 2016) *http://www.ncub.co.uk/reports/national-survey-of-academics.html.*

23. Jonathan Haskel, Alan Hughes and Elif Bascavusoglu-Moreau. "The Economic Significance of the UK Science base." (A report for the campaign for Science and Engineering). (March 2014) *http://www.sciencecampaign.org.uk/resource/UKScienceBase.html.*

24. Alan Hughes and Michael Kitson."Connecting with the Ivory Tower: Business Perspectives and Knowledge Exchange in the UK," (November 2013), *http://www.ncub.co.uk/reports/connecting-with-the-ivory-tower-business-perspectives-on-knowledge-exchange-in-the-uk.html.*

One example of successful university business collaboration is the Faculty on the Factory Floor collaboration[25] between the University of Coventry and the Unipart group of companies. This initiative has created an environment that brings teaching, research and live manufacturing together. For Coventry University it provides access to training in industry-leading technology, summer placements for undergraduates and the opportunity for university staff to work with experienced industry professionals. For the company, the collaboration provides access to industry-ready graduates and enhanced knowledge exchange opportunities due to the close proximity to researchers.

Another example is the Experimental Medicine Initiative to Explore New Therapies (EMINENT) network[26] coordinated by University College London (UCL) which brings together teams of researchers from the Universities of Cambridge, Glasgow, Newcastle, Imperial College London and UCL with GSK researchers to study the fundamental biological mechanisms responsible for a range of inflammatory diseases. The aim of the network is to combine the disease biology expertise of the academic scientists with GSK's drug development expertise and resources to lead to breakthroughs that could accelerate the development of innovative treatments.

Other innovative models for business creation and growth (*e.g.*, SETsquared)[27] and research translation (*e.g.*, Apollo Therapeutics),[28] have also proliferated in recent years and increasingly the social sciences and arts are also being brought into knowledge exchange collaborations to stimulate different ways of thinking (*e.g.*, the inclusion of the Royal Colleges of Art and Music in the MedTech Superconnector project).[29]

Another unique feature of the UK knowledge exchange environment is the provision of specific government funding. The UK government provides support for research translation and knowledge exchange to around 80 percent of English Universities[30] through the Higher Education Innovation Fund (HEIF).[31] This funding stream has played a critical role in driving the change of focus from IP exploitation to embracing broader knowledge exchange activities, ensuring that income generation is not the primary aim of university knowledge exchange. HEIF is unique in that it is "non-hypothecated"—*i.e.* it can be used to fund any kind of knowledge exchange activity at a university's discretion and in line with their institutional strategy.[32] The only stipulation is that universities in receipt of HEIF funds must submit a formally assessed strategy document indicating how they intend to use the money.[33] HEIF has allowed universities receiving this funding to expand their knowledge exchange activities without immediately trying to cover their costs and as such is an important means for universities to experiment with different models and methods of knowledge exchange.

An increasing amount of knowledge exchange in the UK is collaborative in nature. Additional funding has been made available to encourage collaboration in the form of the Connecting Capabilities Fund (CCF).[34] The aim of CCF is to share good practice across the higher education sector, forge external technological, industrial and regional partnerships, and deliver the Government's Industrial Strategy priorities. In its opening round, the fund has invested £67 million in 14 collaborative projects involving 54 higher education institutions.[35] Following existing measures to evaluate and rank research and teaching in UK universities, the UK government has recently announced that it will also implement a Knowledge Exchange Framework (KEF),[36] the aim of which is to foster a culture of continuous improvement in knowledge exchange. The KEF will consist of two components: a collection of metrics, not dissimilar to those already collected in the HEBCI survey, that will demonstrate performance in different aspects of knowledge exchange with universities compared against each other in peer-groups;[37] and a concordat that university leaders will be asked to sign in order to demonstrate senior support for knowledge exchange and a commitment to increase the professionalism of knowledge exchange activities.

The need to demonstrate professionalism and excellence in knowledge exchange has also been recognized by PraxisAuril, the association representing knowledge exchange practitioners in the UK.[38] In addition to being a founder member of the Association of Technology Transfer Professionals (ATTP) and promoting its Registered Technology Transfer Professional (RTTP) qualification, PraxisAuril has recently launched the Candidate RTTP status for individuals aspiring to attain RTTP. PraxisAuril has also piloted a review framework for knowledge transfer offices to help them to evaluate the maturity of their different activities, and offers a range of training courses and networking opportunities to allow the sharing of best practice. Many of these activities relate to the wider knowledge exchange policy environment that sets a clear expectation on universities to do more in terms of exploiting the intellectual asset base in the UK.

With the advent of the KEF and its prominence in the Industrial Strategy, knowledge exchange has reached an important milestone in the UK in terms of the recognition of its power to engage with business for innovation and growth, to deliver skills, and generate societal benefits. This recognition has come with additional funding, but also greater scrutiny, a greater emphasis on collaboration, a need to demonstrate competence and the expectation of delivery of improved outcomes that is likely to continue for some time. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=3380548*

25. *https://www.coventry.ac.uk/ame/.*

26. *https://www.ucl.ac.uk/eminent-consortium.*

27. The SETsquared partnership comprises the universities of Bath, Bristol, Exeter, Southampton & Surrey. *http://www.setsquared.co.uk/.*

28. Apollo Therapeutics is a university-business initiative to drive forward therapeutic innovation with the goal of significantly improving the speed and potential of university research being translated into novel medicines. *http://www.apollotherapeutics.com/.*

29. Members of the MedTech SuperConnector collaboration are: Imperial College, The Institute of cancer Research, the Royal Veterinary College, Bucks New University, The Francis Crick Institute, Queen Mary University of London, The Royal College of Art and the Royal College of Music. *http://medtechsuperconnector.com/*

30. Where it is provided, universities in Scotland, Wales and Northern Ireland receive innovation funding through their respective devolved administrations.

31. *https://re.ukri.org/knowledge-exchange/the-higher-education-innovation-fund-heif/.*

32. HEIF is allocated on the basis of the metrics collected in the HEBCI survey under the premise that more funding is provided to those universities most successful in deploying it.

33. *https://webarchive.nationalarchives.gov.uk/20180405122213/http://www.hefce.ac.uk/ke/heif/strategies/.*

34. https://re.ukri.org/knowledge-exchange/the-connecting-capability-fund-ccf/.

35. *https://re.ukri.org/news-events-publications/news/research-england-invests-67-million-in-collaborative-projects-to-drive-university-commercialisation/.*

36. *https://re.ukri.org/knowledge-exchange/knowledge-exchange-framework/.*

37. Peer groups are largely based on overall research income and academic capacity.

38. *https://www.praxisauril.org.uk/.*