

Seen as the 'third mission' in higher education, knowledge transfer and the commercialisation of research results offers a complementary channel for dissemination and delivery of economic and societal benefit. This article considers the development of knowledge-transfer policy and practice in Ireland and looks ahead to what the future holds.

The term *knowledge transfer* has been adopted to refer to research commercialisation and collaboration by the higher education sector with users of research. Increasingly this is about engaging with all users of research and expertise, from industry to the public sector and NGOs. In Ireland the focus is on supporting existing and emerging companies, with a clear link to the role of higher education in economic development. This has been a constant in research and innovation policy development over the past fifteen years. The expectations from the higher education system may be greater as we look to economic recovery from the effects of the Covid-19 crisis. Whether these can be met depends on multiple factors.

From the Strategy for Science, Technology and Innovation 2006–2013 through to Innovation 2020, the importance of research and knowledge transfer is called out in national strategy. This is likely to continue in the successor strategic plan for science and innovation that is currently in development. Producing a highly skilled workforce and providing access to the brightest minds and the latest developments are essential components in a successful knowledge economy.

The latest data, in Knowledge Transfer Ireland's (KTI) Annual Knowledge Transfer Survey, show that there were over 2,000 live research collaboration projects between third level and companies at the end of 2019. Over 200 licences were signed, providing companies with access to new intellectual property, and twenty-six new companies were created based on knowledge and intellectual property developed in higher education institutions (HEIs).

Conditions for success

These kinds of success are not created in a vacuum: they require the ecosystem in which government, the academy, and industry are key players. In practice this involves coherent strategies, appropriate policies and funding, an engaged research base, and an enterprise and

Knowledge Transfer: From Engagement to Commercialisation of Research

Development and future trends



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investment community that appreciates research as a driver for innovation and is willing to engage.

Such a triple helix exists in positive dynamic tension. It is the challenge of governments and their departments to create the right balance, enabling innovation to flourish while preserving the fundamental research base that provides security and opportunities for the future. Steering a course for the medium- to long-term future while managing the short-term priorities is a matter of adaptation and foresight, in equal measure.

Through policy and practice, the infrastructure to support innovation from research has been created and programmes designed and delivered to meet changing demand. A keystone intervention was the creation of the Technology Transfer Strengthening Initiative (TTSI), a cycle of funding that supports innovation offices in the HEIs. The rationale for the programme was based on international best practice and the recommendation from a taskforce convened by the then Department for Jobs, Enterprise and Innovation. Enterprise Ireland (EI) was given the mandate to develop and implement the programme.

Now in its third cycle, TTSI assists many of the HEIs, through co-funding for skilled people and operational costs, to identify and develop new commercial opportunities with and for enterprise. It has been highly commended in international peer review, as have the people on the ground and the initiatives that have been sparked through the programme. The demands on innovation offices are increasing, through the volume and range of activities they are required to cover and the complexity of the work they undertake. This is a sign of the system's maturity.

The challenge is how to sustain this and to provide support across the higher education sector, at a time when HEIs, companies, and investors face stark financial choices. The case for continued intervention is compelling. The data show that companies that innovate through R&D and collaborate with third level have double the turnover of those that do not, and they employ 50% more staff. The focus for delivery under such a programme, however, needs to be keyed to emerging national priorities.

Any programme of funding can only be effective if the system in which it operates is itself effective and aligned. For knowledge transfer to succeed, other supports, such as the Enterprise Ireland Commercial Fund and the people who manage it, are vital to bring new opportunities through to a stage of maturity that makes them attractive commercial propositions. Programmes that build critical research mass can provide a compelling resource to companies and are particularly valuable when combined with the right entry points.

Ireland has been particularly adept in this regard, through the Science Foundation Ireland (SFI) Research Centres of scale to the focussed EI/IDA Research Gateways and funding programmes that encourage and support companies to collaborate. This signals a research system that is open and accessible for companies. However, research in higher education remains a complex landscape which many companies say they find hard to navigate. More attention needs to be brought to how they can be assisted and how

they can be exposed to different disciplines as the significance of cross-boundary R&D becomes more essential to disruptive innovation.

Regional responses

In other countries, there has been increasing emphasis on place in research and innovation. This has long been understood in Ireland. Regional connections between HEIs and companies are strong. The formation of the Technological Universities (TUs) is significant and will see scaling in the regional research offer, with greater research capacity and capability.

As the TUs develop, attention is being given to how they can best support research and innovation, both from within the TUs and through targeted programmes, such as the Regional Technology Cluster Fund. An element to their success in knowledge transfer will be working together to develop and share new practice to ensure that 'regional' and 'national' are synonymous. Collaboration in knowledge transfer in the sector has been strong and bodes well for accelerating the pace of development and the voice of the sector to be heard.

That Ireland has a vibrant knowledge-transfer system is clear. This has been underscored in 2020 as the system responded to the challenges of Covid-19. Throughout the country, HEIs have played an important role collaborating with the private sector. For example, research teams at NUI Galway and University of Limerick worked together to develop a novel solution to sanitise public spaces called UVC Drone. Using ultraviolet (UV) light radiation to sterilise, the UVC Drone has been programmed with a bespoke AI algorithm to switch on overnight when the premises are unoccupied and to recharge itself once cleaning has finished.

At Waterford Institute of Technology, the SEAM research centre produced a prototype for full face masks with integrated humidity moisture which means they don't fog up. Working with local manufacturing companies, this type of personal protective equipment (PPE) can now be sourced in Ireland. Bringing TU Dublin technology to the market, spin-out company Kastus Technologies provides an antimicrobial coating which offers 99.99% reduction in harmful bacteria and fungi on a range of surfaces. Confirmed to be effective against Covid-19, this has been a win-win for the company and for society at large.

No room for complacency

These examples are but a few. There has been substantial breadth and depth of collaboration with companies and in the types of new companies formed from third level. But this is not cause for complacency. As the system matures, the way that knowledge-transfer support is delivered changes with it. There are, and will continue to be, insufficient resources to support all opportunities and transactions equally. There will need to be more prioritisation of where effort should be expended and associated practice developed to enable swifter triage and to speed up negotiations.

The latter can be enabled by increased use of national template agreements, a direction of travel that is increasingly supported by the funding agencies. It also requires support from senior leadership in the HEIs and agencies

to balance risk management and the fear that the next blockbuster may be missed against the need to get the deal done. That way, companies can get on with the business of innovating to grow, scale, and create the high-value jobs that are at the core of the national strategy for research commercialisation. To this end, companies and founders need to be helped to understand the way that HEIs can do business with them and be willing to respond with pace.

Future trends

Two significant trends in knowledge transfer are worth drawing out, as they have implications for future practice. The first is that larger companies are looking more to smaller companies as innovation partners. These will often be spin-outs from HEIs, which are able to develop and de-risk the technology or concept in a way that a HEI cannot, with a commercial focus and dedicated investment funding. The spin-out may also offer different commercial terms and timelines that are not available in an academic institution.

This will not in itself significantly disrupt the volume of engagement between third level and companies. But it does suggest that professional project management (before and during delivery) and ease of contract negotiation are areas that will be increasingly important for HEIs. This trend also points to a more pervasive role for spin-out companies in the innovation ecosystem, and to the importance of creating spin-outs from research.

The second trend, picked up at the AKTS 2019 workshop, is the volume of research in third level that depends on engagement with companies. If we look at research expenditure during the year across the HEIs, 14% of budget was related to collaboration with industry, whether the funding came directly from the company or through co-funding from government agencies. This provides a glimpse at the proportion of research carried out with the enterprise base. It is encouraging but may also suggest a vulnerability in the system, should there be a drop in the level of company engagement or the level of public funding for such engagement.

The Irish higher education sector, if properly supported, is well placed to play a key role in reigniting the economy. Returns have been seen already as companies have accessed research and expertise. The sector has shown itself agile and responsive during the pandemic. But this has not happened overnight. It is as a result of long-term intentional investment in research and in knowledge-transfer supports.

Expectations for the future must be realistic. Viewing the sector in isolation as a panacea is unwise. Outputs must be measured against inputs and with an appreciation of the capacity constraints in the sector. Research and innovation investment will need to be positioned to assist immediate challenges without compromising the future, which relies on sustaining high-quality research as a platform from which to innovate. The research and innovation ecosystem in which HEIs operate needs to remain cohesive and supportive to allow them to achieve. It's a balancing act, but one at which we have proven adept.