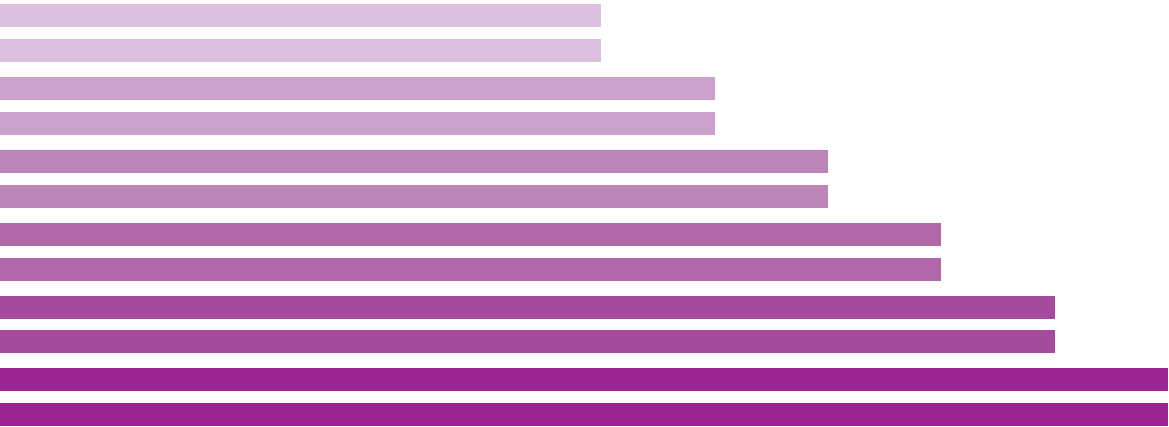


**KTI REVIEW AND
ANNUAL KNOWLEDGE
TRANSFER SURVEY
2018**



Supported by

IN 2018

218

LOAs to RPO intellectual property signed



1,824

live research collaboration agreements with industry



958

new consultancy services agreements signed



119 spin-outs thriving at least three years post-incorporation at the end of 2018



80%

of companies that signed collaboration agreements with RPOs were based in Ireland



30

new spin-out companies were formed



95%

collaboration agreements with the SME sector were with Irish SMEs



€599m

RPO expenditure



33 new products and services were launched



127

new patent applications were filed by RPOs



487

new invention disclosures



933

jobs in Active Spin-out companies



KNOWLEDGE TRANSFER IRELAND AT A GLANCE

This publication details Knowledge Transfer Ireland's activities during 2018 and highlights some of the knowledge transfer outcomes from the sector.

As part of our work, KTI collects and analyses data from Ireland's universities, Institutes of Technology and other State-funded research organisations, together termed Research Performing Organisations (RPOs), to produce the national Annual Knowledge Transfer Survey (AKTS). The AKTS tracks business engagement and commercialisation between the commercial sector and RPOs. The AKTS is published jointly with the Higher Education Authority. The AKTS 2018 can be found in the second part of this publication.

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WELCOME BY KEITH O'NEILL



“Encouraging and supporting entrepreneurs and the wider enterprise community to engage with, and benefit from, State funded research is core to KTI’s mission.”

As Chair of Knowledge Transfer Ireland’s Industry Advisory Board, I am delighted to present the KTI Review and Annual Knowledge Transfer Survey for 2018. Having previously served as a member of the KTI Advisory Board, it has been my pleasure to work with Alison and her team since 2015. Reflecting on this past year in particular, I am struck by all that KTI has achieved.

As the Irish knowledge transfer system matures, it continues to perform well. Collaborative research between RPOs and industry is thriving and we are seeing robust levels of licensing activity and spin-out company creation. The third phase of the Technology Transfer Strengthening Initiative - Enterprise Ireland’s funding programme to develop and strengthen the system in Ireland - is well managed by KTI and delivering results. The results of the Annual Knowledge Transfer Survey contained within this report provide a clear testament to this performance.

Stakeholder engagement is a key feature of KTI’s work. The diverse calendar of events, expert consultations and networking opportunities delivered by KTI throughout 2018 highlights KTI’s critical role as a catalyst for knowledge exchange. The impact of KTI is further reinforced by the recognition that Ireland is receiving as a global player in the Knowledge and Technology Transfer space. KTI continues to attract visiting delegations from around the world who are interested in learning more about our approach to knowledge transfer in Ireland. Equally, KTI participated in Irish missions abroad and featured across events programmes at global conferences; cementing Ireland’s reputation in delivering a focussed, cohesive and impactful research and innovation system.

Whilst this Annual Review looks at performance during 2018, it is also important to note the key role that KTI played in the development of the new 2019 National IP Protocol, published earlier this year. This was the culmination of significant groundwork by KTI through consultation, focus groups and extensive drafting on behalf of the Department of Business, Enterprise and Innovation. This latest version of the protocol includes a new chapter on spin-out company formation which, along with the associated Resource Guide, template Model Agreements and Practical Guides, will provide an invaluable toolkit for anyone considering starting a new company.

Encouraging and supporting entrepreneurs and the wider enterprise community to engage with, and benefit from, State funded research is core to KTI’s mission. This will remain the focus, and the challenge, for KTI in the year ahead.

Keith O’Neill, PhD
Chair, KTI Industry Advisory Board

INNOVATION UNPICKED



“If we are to consider innovation in the round we must throw off the obsession with patents, easy to measure though they might be, and look more broadly.”

Innovation isn't new. In fact, its derivation (according to the Oxford English Dictionary) goes back to the 16th century and comes from the Latin term meaning “renewed, altered” which suggests that innovation is about both starting and improving. Commercially this is directed to making a meaningful impact in the market.

There are numerous definitions and interpretations of innovation, and even more papers on the topic. The OECD is clear that innovation goes far beyond R&D itself - out to users, suppliers and consumers everywhere; to government, business and non-profit organisations, across borders, across sectors, and across institutions.

The *Oslo Manual* for measuring innovation defines four types of innovation:

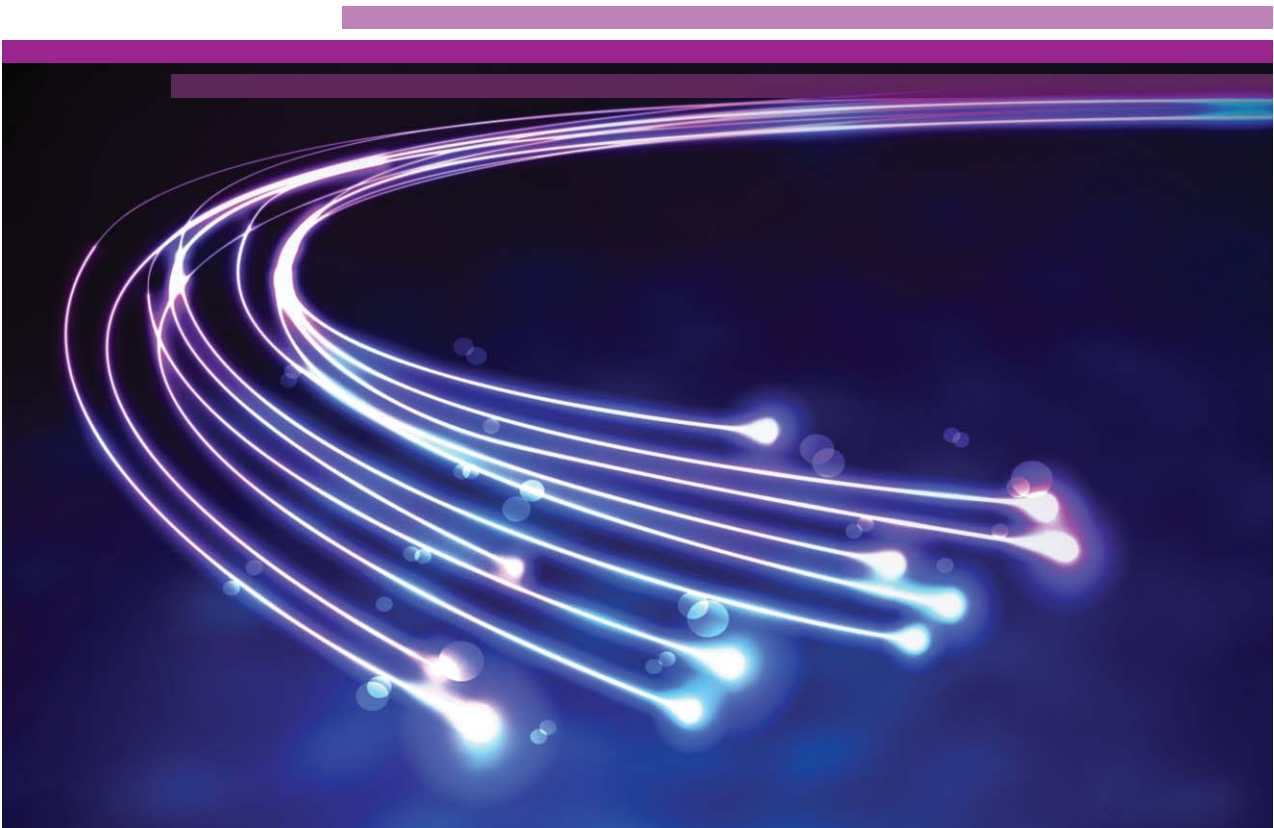
- **Product innovation:** A good or service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials, software in the product, user friendliness or other functional characteristics.
- **Process innovation:** A new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.
- **Marketing innovation:** A new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
- **Organisational innovation:** A new organisational method in business practices, workplace organisation or external relations.

The research system supports companies in each of these forms of innovation, although the most apparent areas are product and process innovations. Traditionally, the level of companies innovating with universities was measured as the number of products brought to market through licensing of intellectual property from the university. Often this was through the “push” model, whereby the university technology transfer office identified interesting technology, sought IP protection and searched for a company interested in taking a licence. There have been countless successes such as antibody humanisation technology which has led to drugs for cancer and arthritis, graphene technology and the Honeycrisp apple variety, to name a few. This model still has relevance but it is part of a much bigger offering and connection to business. Routes to market for technology increasingly involve the creation of new companies (spin-outs) to develop early stage propositions in the right kind of environment to bring them to the stage that they are sufficiently compelling.

INNOVATION UNPICKED - continued

Often this results in acquisition of the company, for example Infiniled from UCC which was acquired by Facebook owned Oculus, FeedHenry from WIT acquired by RedHat, and more. Frequently this is more than a linear transaction, with the acquirers recognising not only the value of the technology but also of the R&D and innovation happening in Ireland. This has been the case in the two examples above, with the multinationals embedding an R&D presence in Ireland to maximise the innovation potential in the skilled R&D teams - both in the spin-out and within the university.

The value of engaging with research and expertise to drive innovation is pronounced. The extent to which companies are collaborating with the third level and other state research providers can readily be seen from the national statistics in the AKTS2018. The number of collaboration and consultancy agreements signed with industry is up 11% on 2017 and the number of collaborations that were live at the end of 2018 was up a massive 38%. A significant measure, repeat business from companies, has also increased, by 19%.



INNOVATION UNPICKED - continued

Benchmarking

It's interesting to look at some of the recently published international university rankings through this lens. The Times Higher Education Young University Rankings sees Maynooth University in the top 50 and Dublin City University (DCU) in the top 100. One of the measures that contributes to the rankings is "knowledge transfer", which the Times Higher explains as a "university's ability to help industry with innovations, inventions and consultancy". The Times Higher states that knowledge transfer has become "a core mission of the contemporary global academy". The methodology for scoring looks at how much research income an institution earns from industry scaled against the number of academic staff it employs. The Times Higher posits that the extent to which businesses are willing to pay for research and a university's ability to attract funding in the commercial marketplace are useful indicators of institutional quality. The logic of this is apparent, although it bounds the extent of a university's knowledge transfer activity to research with industry and judges its success by the scale of revenue it generates from such activity. Such measures cannot take into account environmental factors, such as national strategy for research and innovation or business spend on R&D in country.

Viewing knowledge transfer in a limited (though measurable) way means the diversity of interactions with industry which extend far beyond research spend are missed. For example, researcher fellowship programmes, use of specialised equipment and facilities, access to expertise and advice and, importantly, co-development of the undergraduate and research pipeline which provides future talent to keep our third level and our companies innovating and able to compete into the future.

Reuter's publishes Europe's top 100 innovative universities each year. Trinity College Dublin appears at no. 70 in the 2019 rankings. To compile the ranking, Clarivate Analytics identified a shortlist of 600 based on the most articles published in academic journals and then reduced these to only those that filed at least 50 patents with the World Intellectual Property Organization between 2012 and 2017. Then they evaluated each candidate on 10 different metrics that included the number of patent applications filed, their success to grant and "commercial impact". The latter is possibly the most interesting as it assesses how often basic research originating at an institution has influenced commercial R&D activity. So far, so good. This commercial impact is measured by academic papers cited in patent filings which gives a valuable but not a complete picture of the commercial impact as it relies on the "users of research" (the companies) engaging in patenting. This works for some sectors such as pharma and biotech but is less applicable in other sectors where speed to market and freedom to operate are more important than building a patent estate (and indeed where patenting is not practical nor permissible). This by no means devalues the ranking achieved by TCD which was judged in parity with other European universities.

INNOVATION UNPICKED - continued

Take a broader perspective

If we are to consider innovation in the round we must throw off the obsession with patents, easy to measure though they might be, and look more broadly at the kinds of intellectual property that are licensed and the breadth and depth of interactions with business, and other types of organisations. For example, The AKTS shows us that of the licences executed in 2018, 1/3 were in respect of patented IP and a further 1/3 for software. It is also important, but difficult to quantitate, the intangible assets that are valued by companies - such as access to expertise and a talent pipeline.

No assessment can be made without considering the context in which innovation takes place. At national level this might take in the environment, for example the funding for research in higher education (HERD) and the business expenditure on R&D (BERD) along with the network of supports that are available to promote RD&I with, and within, HEIs.

The EU innovation scoreboard considers such measures in assessing relative strengths and weaknesses of national innovation systems and innovation performance. Sweden, an “Innovation Leader”, was ranked at no.1. Ireland is a “Strong Innovator” at no.10. In the context of knowledge transfer and research commercialisation, what is interesting to note is there is similarity between both countries in terms of scientific publications they produce which are amongst the top 10 most cited. Yet both public and business R&D expenditure in Ireland is each about 1/3 that of Sweden. Overall Irish IP assets, compared to Sweden, are considerably less at 1/4 PCT patents, 1/3 design rights and 1/2 trademarks. It is clear that research-wise we are punching above our weight. The level of engagement captured in the AKTS between the research base and industry and the national supports available might suggest that we are also achieving well against the funding backdrop. Indeed, the report also tells us that Ireland has created a fair innovation environment with above average access to finance and support and a high score for access to venture capital.



INNOVATION UNPICKED - continued

Implications for knowledge transfer

How should this inform our views on knowledge transfer and innovation? It confirms that knowledge transfer is now baked into Higher Education strategies and that its impact will continue to be measured.

As funders seek more sophistication in the ways in which they value return on their investment, even more attention will need to be given to explaining the role of research in innovation, including and beyond the more immediate quantitative measures. The richness in available data provides some of that context already and is demonstrating the quantity and quality of engagement in RD&I. In Ireland we are on a strong footing. With a sharp focus on innovation from research through national strategy and programmatic responses, the international benchmarks show that we have strong platform in Ireland. Coupled with the feedback from visiting delegations and international peer reviewers, we should have confidence in our on-the-ground support for knowledge transfer and research commercialisation.

As companies look to externalise more of their research and HEIs seek more industry partners and to diversify funding sources, forging long-term, collaborative relationships is gaining increasing importance internationally. Companies want to move away from a transactional model that requires a negotiation for each new research project towards a relationship model - a durable, cooperative model that enables companies to partner with academia in a fashion that allows them to stay continuously connected to early stage research and to accelerate the translation of that research into new products that drive economic growth. This requires investment in business development and relationship management by the HEIs and a fresh approach to contracting. It should also be accompanied by a mature view of success, where volume is not the only measure.

What is missing is looking beyond the STEM disciplines and beyond industry as the user of research and expertise. The Arts Humanities and Social Sciences (AHSS) have much to bring to innovation, not simply in policy and service innovation but as part of a cross-disciplinary approach to technology innovation, AI being the most obvious example. Building out the current supports to coherently rise to these opportunities is perhaps the most obvious next challenge. And one that will put us on par with many of our European cousins.

Dr. Alison Campbell OBE RTTP

Director, Knowledge Transfer Ireland

THE STORY BEHIND KNOWLEDGE TRANSFER IRELAND (KTI)

2012

- Government-led Task Force recommends formation of a national office responsible for development of commercialisation ecosystem.

National IP Protocol is published detailing national policy on research commercialisation.

Knowledge Transfer Ireland is established as partnership between Enterprise Ireland & Irish University Association.

- Enterprise Ireland launches TTSI2 funding programme to continue to support and develop the TTOs. Managed by KTI.

2013

2014

- Launch of KTI Web Portal.
- Inaugural KTI Impact Awards.
- First Annual Knowledge Transfer Survey (AKTS) is published which maps performance of the KT System.
- First KTI Practical Guide is published (Legal Issues in Contracts with Irish RPOs).
- KTI Model Agreements are published on IP Licensing; Confidentiality; Material Transfer.
- KTI hosts Annual Knowledge Transfer Conference on Research Commercialisation.

KTI brings the international research commercialisation conference delivered by Praxis Unico to Dublin.

- KTI Practical Guides and Model Agreements are published on Software Licensing and Consultancy.

2015

2016



- KTI publishes National IP Protocol 2016 & Resource Guide.

KTI Practical Guides and Model Agreements on Collaborative Research are published.

First KTI Newsletter is published.

KTI launches Sparks Bursary Development Programme to enable KT/TT Managers gain international experience.

KTI hosts Annual Knowledge Transfer Conference on Licensing.

2018



- KTI launches its online Find Funding Tool.

KTI publishes Review of Management of IP and Conflicts of Interests.

KTI hosts Annual Knowledge Transfer Conference on Spin-out Company Formation.

KTI Director takes up Chair of Global KT Association AUTM.

KTI Director receives Lifetime Achievement Award from Global University Venturing.



KTI's mission is to make it simple for industry and entrepreneurs to benefit from State funded research and expertise.

Enterprise Ireland's TTSI3 funding programme is developed and managed by KTI.

KTI hosts Annual Knowledge Transfer Conference on Collaborative Research.

International Panel Review of KTI Performance published.

Review of the TTSI2 Funding Programme published.

2017



CONNECTION & ENGAGEMENT



Events

In 2018 KTI delivered its programme of events aimed at sharing expertise, building knowledge, strengthening and developing networks and increasing the profile of knowledge transfer in Ireland. Highlights include a seminar on The Essential Duties of Directors and Observers delivered in January in association with Institute of Directors to technology transfer staff from across the country.

KTI's two flagship annual events – the KTI Impact Awards ceremony held in April 2018 and KTI Annual Conference “Destination Elevation” in September – each drew more than 170 attendees each from across the academic and business system in Ireland.

KTI presented at and exhibited at many third party events throughout the year that included the inaugural Amplitude Conference in Waterford and the IRDG Annual Conference. KTI also supported several specialist events delivered by the KT Community of Practice throughout the year aimed at developing the KT profession in Ireland.

Digital Engagement

Throughout 2018, Knowledge Transfer Ireland continued to proactively engage with its digital audience attracting more than 26,000 visitors to the KTI website and over 2,000 social media followers across Twitter and LinkedIn. Four quarterly newsletters were circulated by KTI during 2018 to more than 1,200 subscribers.

International Profile

Global interest in the Irish knowledge transfer system and KTI's activities continued to grow throughout 2018 and KTI welcomed delegations throughout the year from countries that included Saudi Arabia, Oman, China, Lithuania, Serbia and New Zealand. The KTI team was invited to present at global meetings that included the AUTM Canadian TT Conference in Nova Scotia; WIPO in Geneva and Fortec, Brazil's technology transfer association. In December, KTI Director Alison Campbell was a key player in a mission led by the Irish Embassy to Brazil. As Chair of AUTM, she also led the development of the first International KT Key Opinion Leader Summit. The Summit brought together 38 global thought leaders from 18 countries, many responsible for leading their national K/TT associations, for a two-day roundtable in Spain to discuss some of the critical issues facing the community. The Summit resulted in the publication of a white paper by AUTM.

Consultation & Stakeholder Support

Throughout 2018 KTI convened a number of groups to consult on key aspects of national knowledge transfer and to support and inform national knowledge transfer policy:

- In developing a new section for the national IP Protocol, KTI held a series of consultations with investors, entrepreneurs and TT professionals (individual and group discussions) and convened a working group which also involved colleagues from the relevant agencies and the HEA.

CONNECTION & ENGAGEMENT - continued

- KTI worked with the HEA to respond to requests related to HEI policies for commercialisation by the Public Accounts Committee. This included commissioning a review of HEI policies and convening a working group which led to a set of recommendations from the HEA to the Presidents of the HEIs in respect of policies for IP commercialisation and the management of related conflicts of interest. Local implementation was well underway by the end of the year.
- State Aid in RD&I between companies and RPOs had been flagged to KTI by both sectors as an area where greater clarity would be welcome. As a starting point, KTI held a discussion forum which looked at common perceptions and practice with representatives from these sectors. In parallel, KTI chairs a working group with representatives from research funding agencies and HEIs, including legal and finance and knowledge transfer to explore State Aid issues in the context of research commercialisation and industry engagement programmes. This group continues to meet with the aim of KTI publishing a Guide to State Aid in Research Commercialisation towards the end of 2019.
- The Disruptive Technologies Innovation Fund, launched in 2018 by the Department of Enterprise, Business and Innovation, awarded €500m to collaborative projects undertaken by business and research performing organisations. KTI worked with Enterprise Ireland, who manages the fund, to draft a consortium term sheet and a template agreement to be used by recipients to support the implementation of the fund.
- KTI acted in an advisory capacity to the Medical Research Charities Group as they formulated their own guidance for members in relation to developing T&C IP Guidelines.
- In September 2018, KTI facilitated a meeting between the Department of Business Enterprise and Innovation with the plenary speakers from the KTI conference, the CEOs of the commercialisation arms of Cambridge University and the University of New Hampshire. The meeting allowed for free-flowing discussion across the table and gave opportunity to share international perspectives from the US and UK.



Sharing Best Practice

In October 2018, KTI published its *Practical Guide to the Role of Directors and Observers*. Produced to provide clarity for anyone thinking about joining the board of a company, this guide describes the statutory and fiduciary duties of directors and associated liabilities. It also explains the role of an observer to the board and the issues to watch out for - including hidden liabilities. The publication of this Guide brings the total suite of KTI Practical Guides to 17 working in tandem with 30 KTI Model Agreements available for download from the KTI website.

CONNECTION & ENGAGEMENT - continued

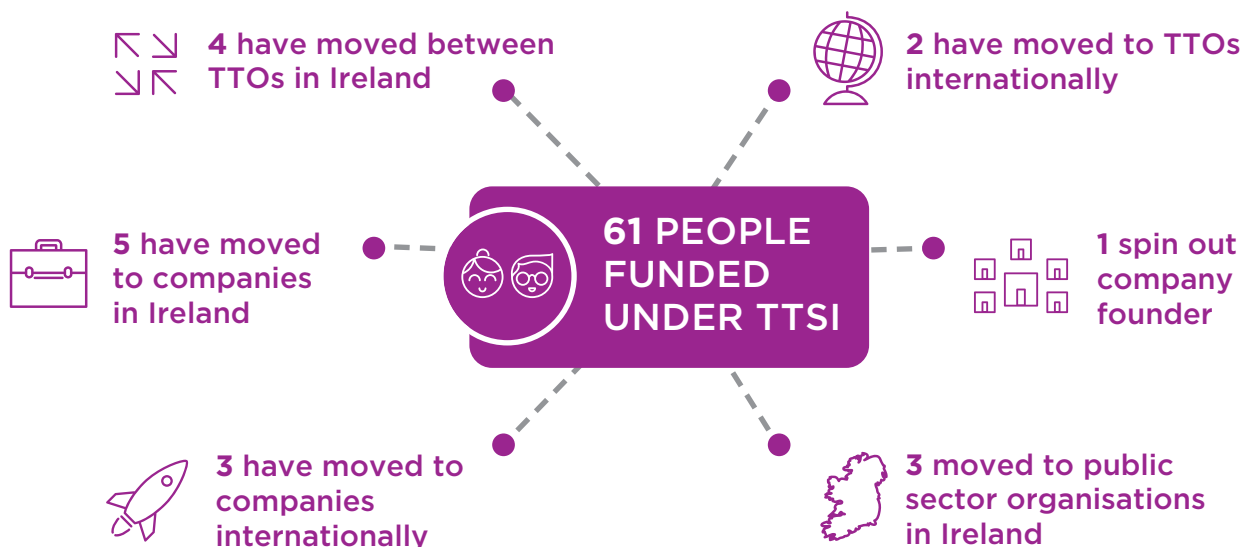
Technology Transfer Strengthening Initiative Funding Programme

Throughout 2018 the Technology Transfer Strengthening Initiative (TTSI) funding programme, managed by Knowledge Transfer Ireland on behalf of Enterprise Ireland, continued to deliver high quality outputs that impact on the Irish economy and society. 2018 saw the second year of the TTSI3 programme in operation and as part of this, the Managed Consultancy Pilot Programme was expanded to include Trinity College Dublin and University of Limerick.

TTSI is the only funding programme that supports the infrastructure and resourcing of the commercialisation and industry engagement teams in HEIs (the TTOs) to encourage the development of a world class knowledge and technology transfer system. Since its inception in 2007, the Technology Transfer Strengthening Initiative has funded 61 people in positions at technology transfer offices across the country, building a bank of knowledge and technology transfer expertise supported by the exceptional numbers of RTTP professionals registered here. At 42, Ireland has the highest number of RTTP per capita in the world.

The majority of staff have remained in post providing continuity and sustainability from the investment. A number of roles that were initially financed under TTSI have been given permanency by their respective RPOs which reflect a recognition amongst institutions of the importance of KT and TT expertise to the institution. Others have progressed within the KT system in Ireland or internationally. Industry has also benefitted from the skills base with eight people having brought their expertise into new roles in companies. In one case, a Commercialisation Executive moved from the TTO to become a serial co-founder and CEO.

Many of the outcomes and impacts from the TTOs are contained within the Annual Knowledge Transfer Survey 2018 which is found later in this publication.



HOW WE OPERATE



KTI Industry Advisory Board

The KTI Industry Advisory Board supports KTI in setting direction and reviewing our activities. Our advisors are industry and investment professionals with experience of working with the academic research base.

Members of the Industry Advisory Board

- Keith O'Neill, Abbott Laboratories (Chair from February 2018)
- Brendan Hogan, Aerogen Limited
- Helen McBreen, Atlantic Bridge Capital
- Tony McEnroe, SiriusXT Limited
- Richie Paul, Alkermes Pharma Ireland Ltd
- Colette Reilly, Department of Business, Enterprise and Innovation
- Jim Walsh, Trinity Biotech

For several IAB members, their tenure came to an end during 2018 and we would like to extend our thanks to Alan Phelan, Ena Prosser, Malcolm Skingle and the outgoing Chair Karl Flannery for their contributions, time and energy. All provided exceptional advice to KTI and have a great commitment to the development of knowledge transfer in Ireland. Thanks are also due to Brian Dalton who took up a new posting within the Department of Business, Enterprise and Innovation and we welcomed Colette Reilly to the Advisory Board.

Knowledge Transfer Stakeholder Forum

The Knowledge Transfer Stakeholder Forum (KTSF) brings together representatives from the major funding agencies and the university and Institute of Technology sector with a direct interest in the knowledge transfer agenda in Ireland. The KTSF meets with KTI to consider issues and initiatives with the aim of developing a shared and consistent knowledge transfer system in Ireland.

Members of the KTSF 2018

- Jennifer Brennan, Technological Higher Education Association
- Liam Brown, Limerick Institute of Technology
- Peter Brown, Irish Research Council
- Alison Campbell, Knowledge Transfer Ireland (Chair)
- Leo Clancy, IDA Ireland
- David Corkery, University College Cork (for the Irish Knowledge Transfer and Innovation Group of HEIs)
- Richard Howell, Department of Agriculture, Food and Marine
- Gemma Irvine, Higher Education Authority
- Jim Miley, Irish University Association
- Gearoid Mooney, Enterprise Ireland
- Darrin Morrissey, Science Foundation Ireland (now HRB)
- Mairead O'Driscoll, Health Research Board
- Ray O'Neill, Maynooth University
- Colette Reilly, Department of Business, Enterprise and Innovation*

* Colette Reilly replaced Brian Dalton as DBEI's representative during the year.

GLOBAL INFLUENCE



Irish Knowledge Transfer as an International Exemplar

The strategic national vision behind the creation of Knowledge Transfer Ireland in 2012 has been commented upon internationally and KTI remains completely unique to Ireland. Nowhere in the world does there exist an entity comparable, founded with the overall objective of improving the system of research commercialisation in Ireland. Ireland has performed well.

"We have been inspired by Ireland's activities, programmes and experience and have taken away some very exciting ideas for the future."

Gintare Narakiene,
Open R&D Lithuania

"I've been very impressed by how well developed and professional the Irish knowledge transfer system is and how much support is now available."

James Wilkie, Chief Executive,
University of Birmingham
Enterprise

"I often visit the KTI website to see the latest documents you have produced as these are very useful."

Karen Laigaard, Head of Office,
Research & Innovation,
Technology Transfer Office,
University of Copenhagen

The Annual Knowledge Transfer Survey published each year by Knowledge Transfer Ireland demonstrates a healthy and robustly performing system yielding strong and continued growth. Irish performance compares well with many international systems. For example, according to the latest AKTS2018 figures, Irish RPOs on average create 5 new spin-out companies per €20million research expenditure compared to an average of 2 from universities in the USA.

GLOBAL INFLUENCE - continued

"I am really impressed with all of the funding mechanisms available for research in Ireland. The system is incredibly well-structured and I'd like to congratulate the country on a really well-thought out system for promoting innovation from its earliest stages until it reaches the marketplace."

**Marc Sedam, Managing Director,
UNHInnovation,
University of New Hampshire, USA**

The financial support structure in place throughout the system is widely recognised as both generous and efficient. The fact that financial support provided to the system spanning the TTSI programme through to the research and commercialisation grants work hard to deliver the results we achieve.

While we still have a way to go, it is apparent that the relatively young KT system in Ireland is perceived internationally as an exemplar. We have earned the respect and admiration of many international peers who frequently look to us for advice or guidance on questions and challenges they are facing in their own countries. And we continue to attract global interest from those seeking to mimic the success that Ireland has achieved in just a few short decades.

"KTI is an inspiration and shows that tech transfer can be approached and streamlined nationwide on a larger scale."

**Einar Mäntylä, CEO,
AUDNA TÆKNITORG TTO
Iceland**

GLOBAL INFLUENCE - continued

Irish KT leading the way

Ireland's technology transfer leaders are regularly invited to take part in international initiatives and are a frequent driving force behind international knowledge transfer initiatives, in Europe and further afield.

Recent activities include engagement in European initiatives to support research commercialisation by John Scanlan from Maynooth University and Tom Flanagan of University College Dublin.

**Ireland challenges international KT Metrics Status Quo**

In 2018, John Scanlan, Director of MaynoothWorks, the Maynooth University Knowledge Transfer office, published a paper on industry and higher education engagement which explored the standard metrics as sources of additional information. For example, rather than just looking at standard metrics such as, for example, patents filed per research spend, the paper explored ratios such as IDFs per patents filed and several others. The paper argues how these ratios reveal additional useful information for any KT office.

Following this work, John worked as part of the ASTP survey committee that collected and analysed European KT data for 2016. ASTP is the European association for Knowledge Transfer. The group repeated the same ratio calculations and produced a set of plots of averages of these ratios, which provide insight into normal EU performance, but more importantly variance from such norms and what they might mean. This work was published as an additional chapter in the 2018 ASTP annual report. Presently, the same group is working on a customised feedback tool which will be sent to each member showing their general metrics in comparison to the rest of the members.

Finally, John and a colleague from Université Paris Saclay have developed a methodology for Knowledge Transfer Office (KTO) comparison, not based on their outputs but based on the similarities of their offices. The idea is to allow any EU KTO to identify and share practice with other EU KT offices which share fundamental characteristics such as internal culture, external KT drivers and office budget. The work will be published at the R&D Management conference in Paris in June 2019.

GLOBAL INFLUENCE - continued



Irish expertise guides European KT development

Horizon 2020 has funded a capacity building programme for Technology Transfer known as ProgressTT. The programme brought together a consortium comprising advisory firm MITO Technology, research centre Fraunhofer MOEZ, the University of Bologna in Italy, Knowledge Innovation Market consultancy firm in Barcelona and the European Association for Knowledge Transfer, ASTP. ProgressTT identified best practices and selected international experts in Technology Transfer to deliver workshops and one-to-one mentoring and coaching to enhance the performance of 30 select Technology Transfer Offices across Europe with a view to improving performance and building capacity.

Tom Flanagan, Director for Enterprise & Commercialisation at UCD was recruited by the ProgressTT consortium to its expert panel to mentor the Technology Transfer Office at the University of Hasselt in Belgium and deliver a series of workshops. Tom mentored the Hasselt University team through the development of a 5 year Strategic Plan for Growth. Preparatory work included a thorough stakeholder analysis and a detailed landscape and operational review.

Two years on, the 5 Year Strategic Plan developed by the Hasselt University Tech Transfer Team is well underway. On reviewing their plan, the Flemish Government has doubled their funding, increasing their business development team from 7 to 15 people. Their results in contract research, invention disclosures, patents, licences and spin-out companies have all increased and are tracking to their ambitious plan to double their impact. For example, their contract research income from industry has grown from €15m to €22m in the past two years.

Tom has written a chapter on the mentor/mentee experience in the ProgressTT book Capacity Building in Technology Transfer: The European Experience published by Springer. UCD also contributes a best practice capsule highlighting its “Sprint”, “Commercialisation Bootcamps” and “VentureLaunch” programmes used to create and support the development of hi-tech start-ups.

THE KTI TEAM



Alison Campbell
Director



Elizabeth Carvill
Communications Manager



Rowena Elliott
Projects Executive



Siobhan Horan
Programme Manager

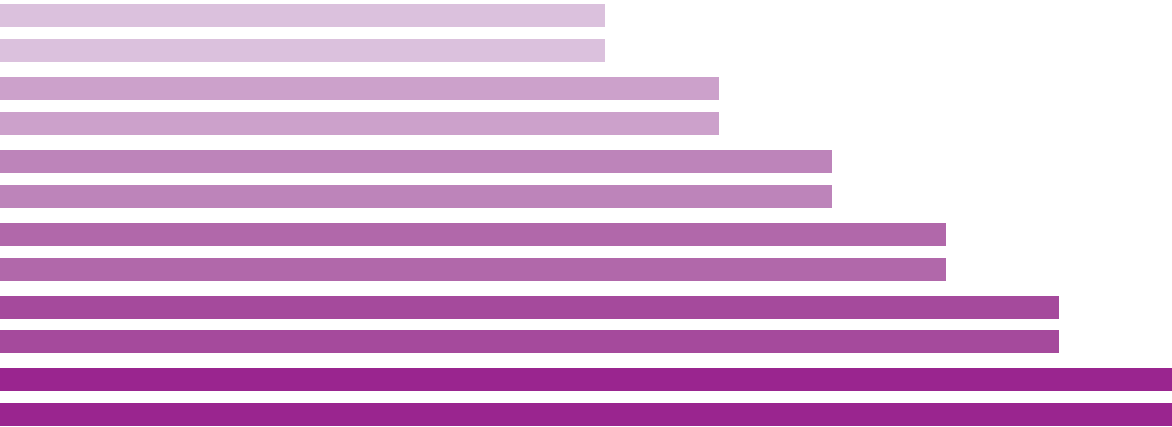


Ursula O'Keefe
Administrator

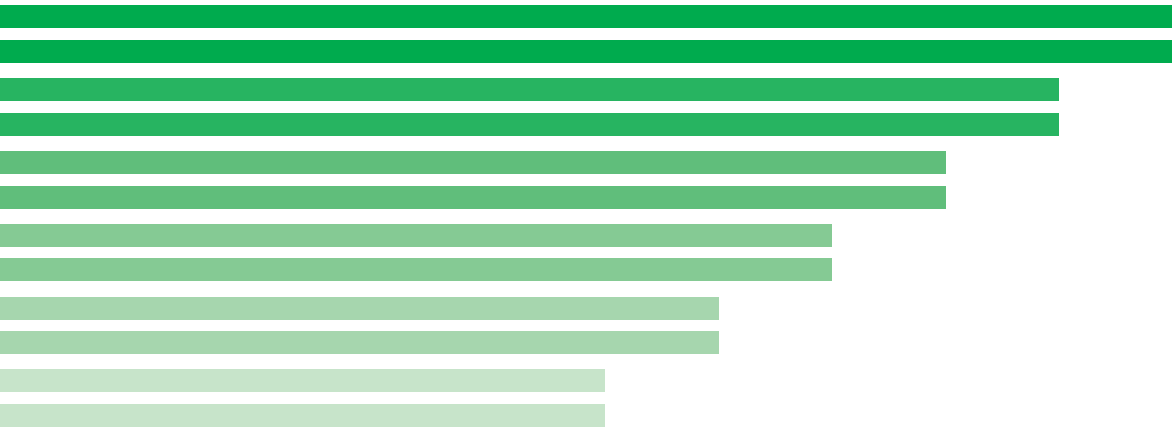


Michelle O'Reilly
Operation Manager

During 2018 we benefitted from having two students in the team who participated in the Enterprise Ireland Work Experience Placement Programme - Ronan Devaney and then Chloe McMorow.



THE ANNUAL REVIEW OF BUSINESS INTERACTION
AND COMMERCIALISATION FROM PUBLICLY -
FUNDED RESEARCH IN IRELAND



1. INTRODUCTION

The Annual Knowledge Transfer Survey (AKTS) is a review of business engagement and commercialisation activity (knowledge transfer).

The AKTS is produced by KTI in conjunction with the Higher Education Authority (HEA) with data collected from Research Performing Organisations¹ (RPOs). This is the fifth time that this annual survey has been published and it provides a longitudinal study on knowledge transfer performance in Ireland.

The purpose of knowledge transfer with the research base is to maximise the two-way flow of technology, IP and ideas. In turn this enables companies (existing and new) and the public sector, to drive innovation leading to economic and social benefit and enables RPOs to advance research and teaching. The AKTS covers the range of KT activities that include licensing, spin-out creation, intellectual property commercialisation and business engagement such as collaborative research, consultancy services and use of facilities and equipment.

The main contact at the RPO for this survey was the technology transfer office (TTO)², sometimes called the Innovation Office. The survey required other departments in the RPO to support the TTO in providing data. These were mainly the Research Office and the Finance Department, although in some cases information is provided by individual research departments. This placed a significant burden on the TTOs in coordinating the returns. KTI wishes to thank the Technology Transfer Offices in the RPOs for their continued support and contribution to this survey.

Many of the positive impacts of knowledge transfer cannot be captured by simple quantitative measures alone. While this report contains some examples of business impacts, more information is available through the body of case studies which may be found on the KTI website at www.knowledgetransferireland.com.



¹ RPOs are the Universities, Institutes of Technology and other State-funded entities undertaking research, see Appendix 2.

² See glossary at Appendix 4.

2. EXECUTIVE SUMMARY

The AKTS 2018 presents data for the period 1 January - 31 December 2018. Data are collected on behalf of KTI and the HEA by Insight Statistical Consulting.

The RPOs that are required to submit to the AKTS comprise Ireland's seven Universities and fourteen Institutes of Technology and five further institutions engaged in research. A complete list of RPOs is provided in Appendix 2. During 2019, DIT, IT Tallaght, and IT Blanchardstown came together to form the Technological University Dublin. This change along with other Technical Universities in formation will be reflected in next year's AKTS 2019. This year there was an excellent response with 25 of 26 RPOs submitting data to the survey. One institution, Dun Laoghaire Institute of Art, Design & Technology, failed to provide a return. In some limited cases, there were partial returns, mainly where RPOs do not routinely capture certain data and this is flagged in the relevant sections of this report.

Activity and output measures are stable per annum with trends suggesting average figures of 470 invention disclosures and approximately 120 priority patent applications per annum. The annual rate of spin-out company formation is around 20-30 new companies per year. The number of licences, options and assignments executed is, on average, around 200 per year.

R&D engagement with companies is also stable. When figures for collaboration agreements and consultancy services are combined there are around 2,000 new agreements per year. However, as consultancy work is not well captured within the RPOs, these data may be erratic.

What is clear is that collaboration with Irish companies is thriving. This year 80% of companies that signed collaboration agreements with RPOs were based in Ireland and 95% of collaboration agreements signed with the SME sector were with Irish SMEs. More generally, over 1,000 different companies have signed agreements with RPOs relating to research projects and there were 365 companies for whom this is a repeat engagement over the past three years.

The number of new product and service launches on the market by companies, as a result of a licence from an RPO, has varied between 24-38 over the past three years. In 2018 the number was 33. With the small numbers involved any change can appear as a large discrepancy.

Active Spin-out companies are three years and more post-formation. As this is cumulative, the number of such companies has been growing in recent years. There were 119 Active Spin-outs at the end of 2018 and a further three spin-outs were acquired during the year. It is estimated that the Active Spin-outs employ over 900 people.

To generate these outputs there is significant work undertaken within the technology transfer offices in the RPOs. The role includes: supporting the RPO in preparation of funding proposals; negotiating a range of contracts with industry relating to collaboration and consultancy services; evaluating new intellectual property, IP protection and management, licensing, spin-out company creation, managing incubation facilities, student enterprise training and building KT networks.

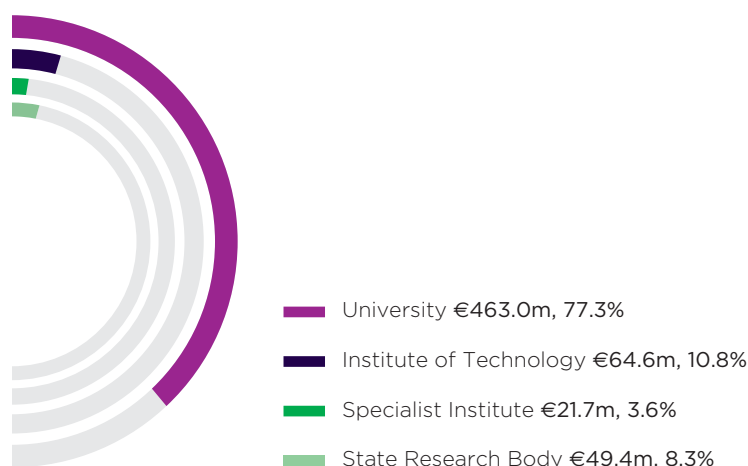
3. RESEARCH FUNDING IN IRELAND

The latest figure available for Ireland's total investment in Higher Education R&D (HERD) is €748.8m for 2016.

The figure for research expenditure (less block grant) by the RPOs in 2018 was provided by the individual Finance Departments³. The total is approximately €599 million (€563 million, 2017). This represents the total expenditures on all types of basic and applied research in Irish RPOs from all funding sources: government, industry, non-profit foundations, etc. It excludes any academic costs dedicated to research, costs of administrative support and capital expenditures on new equipment, buildings or land.

The University sector accounted for most of the research expenditure at approximately 77% (€463 million). The Institutes of Technology sector accounted for approximately 11% (€65 million). The Specialist Institute sector (RCSI, NCAD, NCI) and the State Research Bodies (Marine Institute and Teagasc) accounted for the rest. This is a similar profile to previous years.

Figure 1: Research expenditures by type of RPO, 2018



³ Non responder: IADT.

4. BUSINESS ACCESS TO RESEARCH AND EXPERTISE WITHIN IRELAND'S RPOs

One of the principle ways that business benefits from working with RPOs is through access to research and expertise.

The total number of collaboration agreements (including innovation voucher funded projects) and consultancy services agreements executed with industry in 2018 was 2,111⁴. This represents an increase of 11% on 2017 (1,896). Overall the RPOs have signed collaboration agreements with 1,077 different companies and there were 365 repeat engagements with the same company, or companies, within the past three years, an increase of 19% on the previous year (306, 2017). There were 1,824 research collaboration projects (wholly and part-funded) with industry live at 31 December 2018. This is an increase of 3.8% on 2017.

A note on definitions

Collaborative Research

Collaborative research programmes are where the RPO and company work together on a research project of mutual interest. Funding may be solely from the company or may be part-funded by the company with some level of co-funding from government sources.

Characteristics of collaborative research with industry: *The purpose of collaborative research is the generation of new knowledge. Typically, there will be an expectation of publication although the project may be governed by aspects of confidentiality. Intellectual property may be created and how the company benefits will be determined in the collaboration agreement and will depend on the contribution to the project made by the company.*

Consultancy Services

Consultancy services projects are where the RPO provides professional-level work to an external client organisation through an academic, researcher or other member of RPO staff in exchange for a commercial fee. The work is specified (or agreed) by the client against deliverables agreed with the RPO.

Characteristics of consultancy services: *The purpose of consultancy is not typically the generation of new knowledge, rather it draws on existing knowledge. There will usually be no expectation of publication, results will be confidential and will be transferred to the client. The type of work might typically involve one or more of the following: advice; analysis; production of a report. Projects will generally be of a short term.*

Contracts relating to Enterprise Ireland Innovation Vouchers are broken out as a specific category under Collaborative Research to provide more detail and consistency in reporting. Consultancy Services includes contracted services and consultancy advice. It is worth noting that data relating to Consultancy are traditionally more problematic to collect as the engagements are often not managed centrally within the RPO.

⁴ Non responder: IADT.

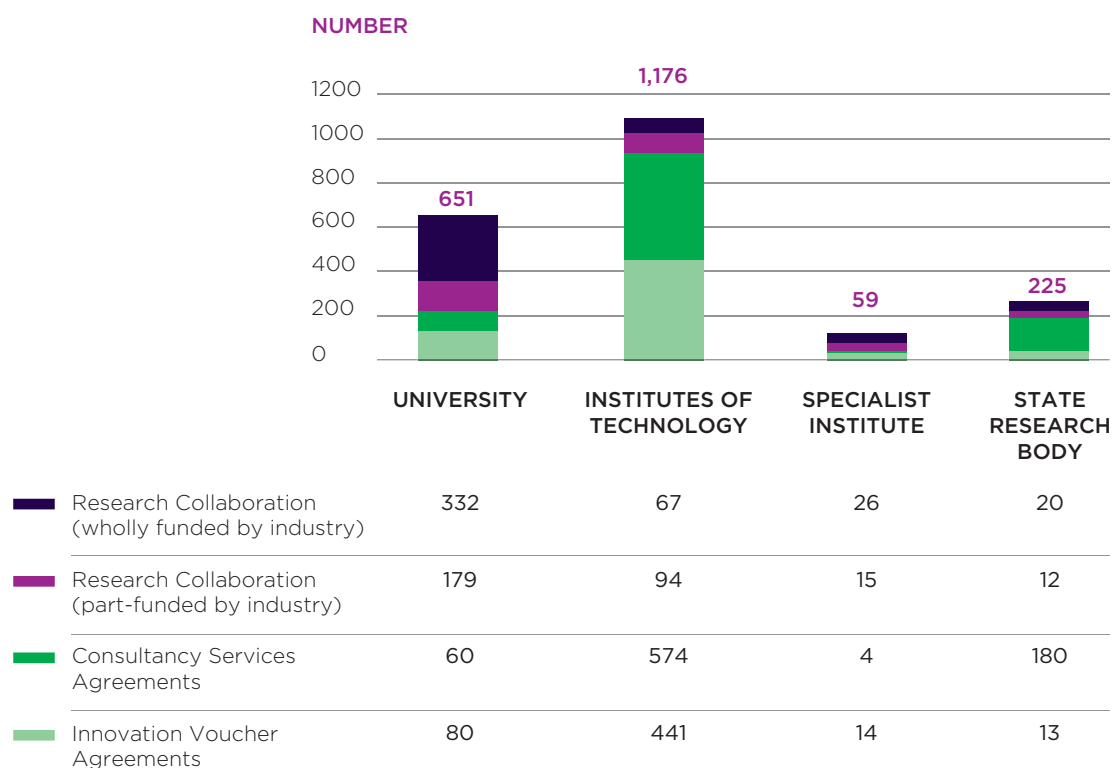
4. BUSINESS ACCESS TO RESEARCH AND EXPERTISE WITHIN IRELAND'S RPOs - continued

The number of industry-related Collaborative Research Agreements signed (part and wholly funded by industry) has increased this year by 9% to 745 (684, 2017). Of these, the number of Collaborative Research Agreements signed that relate to projects fully funded by industry has risen again this year (445, 2018; 427, 2017) and the proportion of fully funded agreements dominated, at 60% of the total. When the Innovation Voucher funded projects are included, the total number of agreements signed that related to R&D projects rises to 1,293 (1226, 2017).

In 2018, the number of Consultancy Services Agreements signed with industry increased by 22% to 818 from 670 the previous year.

The total number of each type of agreement entered by the relevant groups of RPOs in 2018 is illustrated in Figure 2 which demonstrates a propensity for collaborative research in the university and specialist institution groups. The IoT group shows a greater propensity to engage in shorter term projects through Consultancy Services and projects funded by companies through Innovation Vouchers. The high figure for Consultancy Services in the State Research Body sector is reflective of Teagasc's mission to provide consultancy to the agri-food sector.

Figure 2: Number of collaboration and consultancy services agreements with industry in 2018 by RPO type



POTATOES POWER SUCCESS - Longstanding collaborative research project between Teagasc and IPM develops new potato varieties for export

TTO Support:

- Relationship Management
- Licensing
- Contracting



IPM Potato Group Ltd is a major player in the development of new and improved potato varieties and markets seed potatoes of Irish, Scottish, Dutch and French origin in over 40 countries. Teagasc and IPM have been collaborating on research projects since the early 1970s when they formed an initial partnership to breed varieties of potatoes initially for the domestic market and now for a diverse range of global markets.

Given the long lead times in developing new potato breeds (it takes 12 years to produce a new potato variety due to rigorous testing for consumer quality, market suitability, disease resistance and adaptation to different agro-ecologies) a close, long-term partnership was required. This long-term strategy has enabled clear goals to be set and resources put in place between the parties. As part of the collaboration thousands of seedlings are tested with one or two varieties usually being released each year for different market segments such as fresh consumption, processing and export. To date, 45 varieties have been released under the project with over 29 of these still being marketed commercially or under early development.

Since the project began Teagasc has provided the company with technology transfer support throughout having helped with the protection of intellectual property of new varieties of potatoes, leading to licensing of the new varieties that enable the collection of royalties to support further research and breeding efforts and ensuring robust collaboration agreements are in place.

Speaking of the relationship, Sean Mulvany Head of Technology Transfer at Teagasc said: *"The enduring relationship between Teagasc and IPM is a real example of successful knowledge transfer. We are very pleased to have been able to support the project and to play a part in making sure Teagasc's excellent research relationship continues with IPM into the future. We look forward to offering continued support in this regard."*

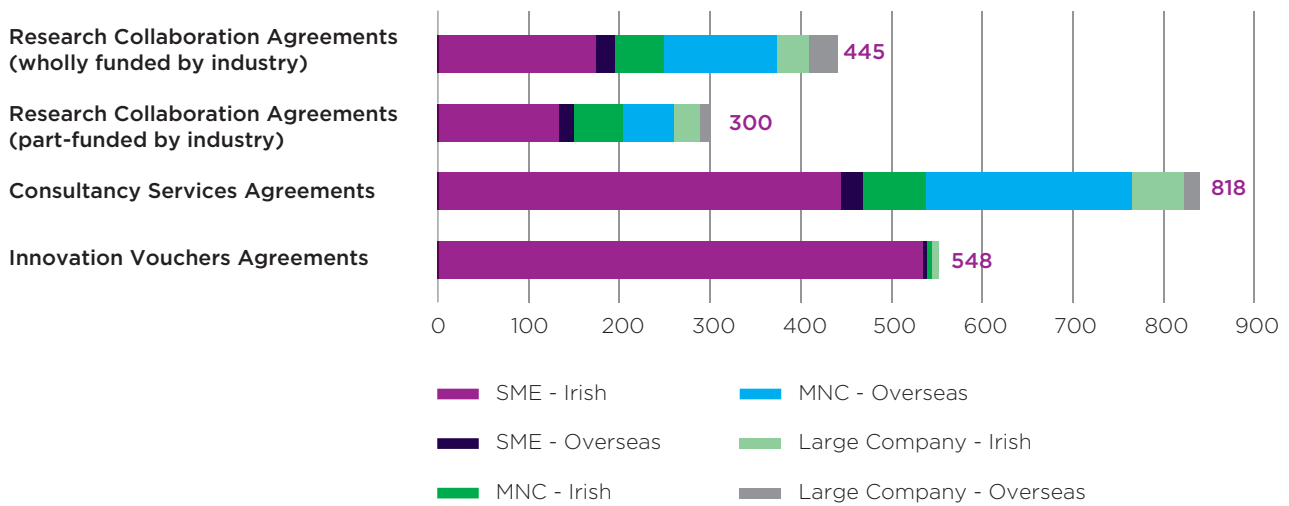
This duration and apparent strength of the relationship between Teagasc and IPM shows just how beneficial, productive and impactful a well-structured and well-supported collaborative research project can be, the repeat engagements that can come about and the very real, tangible outcomes that can result.

4. BUSINESS ACCESS TO RESEARCH AND EXPERTISE WITHIN IRELAND'S RPOs - continued

4.1 Working with Irish companies

From the information provided about sharing research and expertise with companies⁵, 80% of companies with whom the RPOs have executed collaborative agreements (including Innovation Voucher projects) are based in Ireland, (82% 2017). 95% of collaboration engagements with SMEs are with Irish SMEs. When Consultancy engagements are included this figure is 94%. Of the engagements with MNCs, 42% are with Irish located companies. Both of these figures are consistent with 2017 figures.

Figure 3: Locations of companies with whom the RPO has executed a collaborative research or consultancy services agreement in 2018, by number of agreements



Breaking this down further, results indicate that 65% of Research Collaboration agreements (wholly or part funded by industry, excluding Innovation Voucher funded projects) signed by RPOs in 2018 were with Irish companies (68% 2017). Of these Research Collaboration agreements with Irish companies, 44% were projects co-funded by the State (38%, 2017) and 56% were fully funded by an Irish company (62%, 2017). Of the Research Collaboration Agreements signed with Irish companies (part and wholly funded by the company) 60% were with Irish SMEs (290), 25% with Irish-based MNCs (122) and a further 15% (75) with large Irish companies.

Irish companies account for 99% (548) of agreements signed in 2018 in respect of Innovation Voucher projects, which was the same as the previous year. Of the Consultancy Services agreements executed with industry in 2018, 69% (563) were with Irish companies (70% in 2017).

⁵ Non responder: IADT.

INNOVATION CALLING - DCU, Trinity and Pilot Photonics collaborate to innovate and propel company towards global telecoms market

Funding:

- Department of Business, Enterprise and Innovation - DTIF
- Enterprise Ireland
- Science Foundation Ireland
- Irish Research Council

TTO Support:

- Relationship management
- Licensing
- Spin-out company creation



Pilot Photonics is a DCU spin-out company from 2011 that develops optical components for telecommunications and other applications including Internet of Things and autonomous vehicle based on an exclusive DCU licence to patented technology. In December 2018, a new collaborative research project between Pilot Photonics, DCU and Trinity College Dublin was one of 27 projects successfully awarded finance under the Disruptive Technologies Innovation Fund (DTIF).

Speaking of this success and the support received from Invent, the TTO at DCU, Frank Smyth CEO of Pilot Photonics said: *"We are very proud to have won a DTIF project with the help of DCU research and great support from Invent. The consortium of Pilot Photonics, DCU and TCD intends to deploy its technology to tackle the capacity crunch in the internet and to allow this critical infrastructure to grow impacting millions of lives every day."*

The objective of the project, which will run for three years until 2022, is to develop a new photonic integrated circuit that will allow optical channels to be bonded together to make maximum use of the available bandwidth. This technology will greatly increase bandwidth in core telecoms networks and as such will be transformative for the company. Building on Pilot Photonics' existing product range and benefitting from the existing sales channels and customer base, this technology will position the company to target the global telecoms market.

The collaboration builds on an enduring relationship and signals the quality of research and expertise within the universities. Richard Stokes, Director of Innovation at DCU said *"The consortium deserves huge credit for their success as the DTIF process was incredibly competitive. The project will enable Pilot to move to the next level and be a true market leader. The company has the opportunity to develop a world-leading photonic chip solution with many commercial applications."*

DCU is exploring further collaborative opportunities with the company.

4. BUSINESS ACCESS TO RESEARCH AND EXPERTISE WITHIN IRELAND'S RPOs - continued

4.2 Revenue from agreements with industry

4.2.1. Revenue from research agreements with industry

The AKTS asked for the percentage of research expenditure in year that was derived from industry-related projects.⁶ The agreement may have been signed in previous years but the project (and associated funding drawn down) will be live in 2018. RPOs were asked for the percentage of research expenditure that related to direct funding from industry. This was 8% which equates to €54 million.

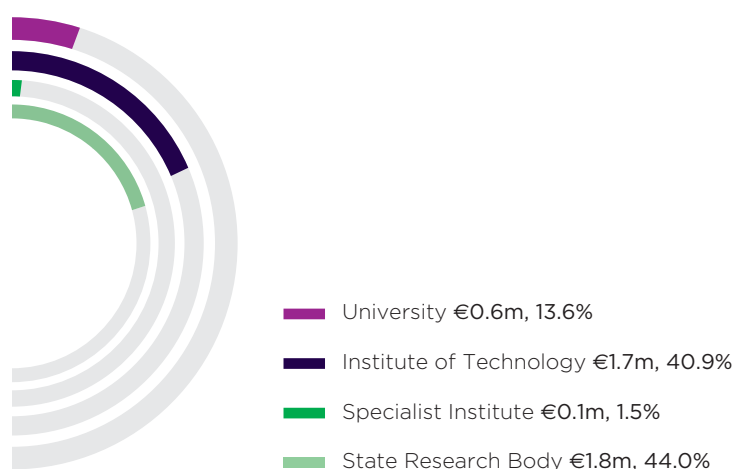
Recognising the importance of leveraged funding, the RPOs were asked for the first time to provide information on the percentage of research expenditure that had been derived through collaboration with industry. This includes direct revenue from industry plus any associated revenue from the delivery of the R&D e.g. from a State funding agency supporting the project. This shows 17% (€101m) of research expenditure by RPOs related to research collaboration is funded wholly or in part by industry.

When viewed in this way, on average the percentage of research expenditure by universities derived from industry ranged from 3% to 45% and for the IoTs from 4% to 65%.

4.2.2. Revenue from Consultancy Services to business

The gross revenue from Consultancy Services was €4.1 million⁷. Ten of the RPOs returned a zero sum. Gross revenue in the previous year was €4.0 million. In the university sector the range was from €4k to €390k and in the IoT sector €0 to €740k. Teagasc reported most Consultancy Services revenue amongst the remaining institutes, reflecting its mission. Given that consultancy activity tends not to be managed institutionally and in many cases the contracts and finances are not managed centrally, the data returned by the RPOs are likely to be an underestimate of the value of consultancy activity from across the RPO sector.

Figure 4: Revenue from consultancy services to business by RPO type 2018



A further €1.8 million revenue was received from Consultancy Services to non-commercial entities. Around 46% of this was from services supplied by Teagasc, 26% from the IoT sector, and 28% from the university sector.

⁶ Non responder: IADT.

⁷ IADT, NUIG and NCI unable to provide figures.

4. BUSINESS ACCESS TO RESEARCH AND EXPERTISE WITHIN IRELAND'S RPOs - continued

4.3 Access to research & expertise by non-commercial entities

New for this year is tracking of engagements with non-commercial entities which offers a more complete picture of the relevance of research and expertise to external organisations.

Research expenditure in 2018 from non-commercial entities was €55.5m across 13 RPOs. The majority (€44.8m) was from the University sector, €3.7m was from specialist institutes and €6.1m from Teagasc.

There were 296 Collaborative Research Agreements with non-commercial entities and 140 consultancy agreements were signed with non-commercial entities.



MATHS AND MOTORS - University of Limerick Research Consultancy Project develops transformative model for motor insurance industry

Funding:

- Science Foundation Ireland
- Enterprise Ireland

TTO Support:

- Contracting
- Consultancy Agreements



Xtract is an Irish start-up that has developed a connected claims platform for all Internet of Things (IoT) crash data. The company aggregates and visualizes data for motor claims handlers at the moment of impact which empowers them to determine liability, deflect fraud and automate vehicle damage triage.

Profitability in the global motor insurance market is rapidly deteriorating partly due to undetected fraudulent claims, difficult liability assessment and lengthy processing times. Aiming to develop a software application that can re-create a car crash in real time to alleviate these issues, in 2017, Xtract commissioned a consultancy project with the Mathematics Applications Consortium for Science and Industry (MACSI) at the University of Limerick.

The MACSI researchers developed mathematical and statistical modelling techniques. The physical model detects impacts using GPS and accelerometer data recorded prior to and during an accident and identifies the time and force of an impact, the physical point of impact on the vehicle and provides an estimation of the trajectory taken by the vehicle and aspects of the driving itself.

The research team worked closely with Xtract's software team to ensure seamless implementation of the mathematical model into the Xtract software. The company now aims to further scale business development across Europe and the US, armed with a robust, production ready model for the motor claims industry.

Speaking of the project Michael Flanagan, CEO at Xtract says; *"The model produced during this consultancy project provided Xtract with the technical foundations that subsequently enabled us to secure pilots, commercial contracts and build strong global partnerships."*

The TTO supported the interaction through provision of the KTI consultancy agreement template tailored to MACSI's needs. Xtract 360 Ltd and the University of Limerick won the KTI Impact Award for Consultancy in 2018.

5. INVENTION DISCLOSURES

An invention disclosure records a tangible discovery or development.

The Invention Disclosure Form (IDF) contains the basic information needed to evaluate the intellectual property associated with the invention and, where appropriate, to protect and commercialise it.

In 2018 there were 487 invention disclosures reported (455, 2017). Consistent with previous years⁸ the majority of IDFs were in the University sector 72% (351). A further 18% (90) were in the Institute of Technology sector; 5% (23) in the Specialist Institutes group; and 5% (23) and in the State Research Body sector.

For this survey joint invention disclosures are also recorded. Joint invention disclosures relate to the same invention where the inventors involved work for different RPOs and where each inventor has separately disclosed their invention to their employing institution. Any subsequent IP protection and commercialisation is usually undertaken by the RPO that is best placed to lead, under an arrangement with the other RPO called an Inter-Institutional Agreement (IIA). In 2018 9% of disclosures were joint (46).

Figure 5: Invention disclosures in 2018 by RPO type

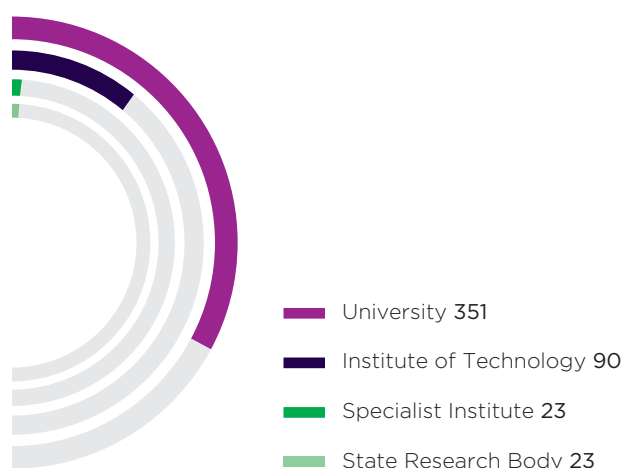
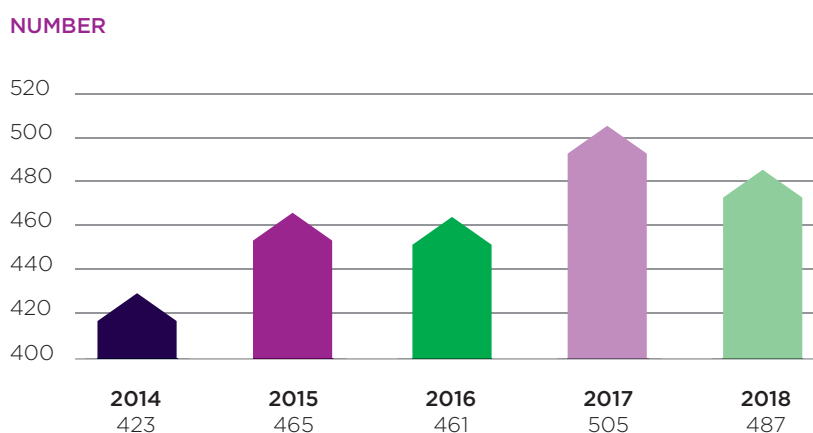


Figure 6: Invention disclosures, 2014 – 2018



⁸ Non responder: IADT.

6. PATENT ACTIVITY

A patent confers upon its holder, for a limited period, the right to exclude others from exploiting (making, using, selling, importing) the patented invention, except with the consent of the owner of the patent.

A patent is a form of “industrial property”, which can be assigned, transferred, licensed or used by the owner. Filing a patent application with a national patent office is the first step in seeking protection for the invention and establishes a priority date for the invention.

6.1 Initial patent filings

To understand the level of new IP being protected, in cases where initial patent applications were filed for the same invention in more than one jurisdiction, only one priority patent application filed is counted in the year of application. On this basis, the number of new patent filings made in 2018 was 127⁹, marginally up on previous years.

Figure 7: Priority patent applications, 2014-2018

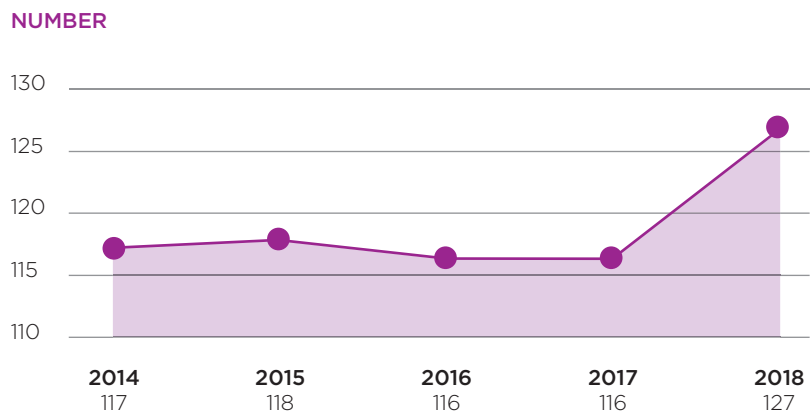
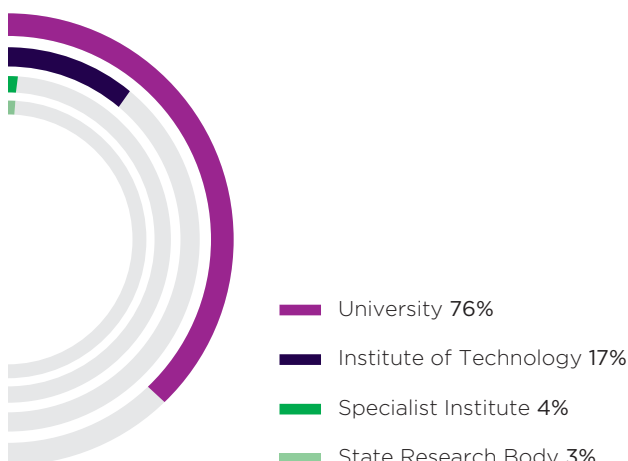


Figure 8 shows a similar split to previous years, with the University sector accounting for three-quarters (76%) of all priority patent applications made by RPOs in 2018 (78%, 2017). The IoTs accounted for 17% of the filings made (15%, 2017). The Specialist Institutes and State Research Bodies were together responsible for the remaining 7% of filings.

Figure 8: Invention disclosures in 2018 by RPO type



⁹ Non responders: IADT, NCI.

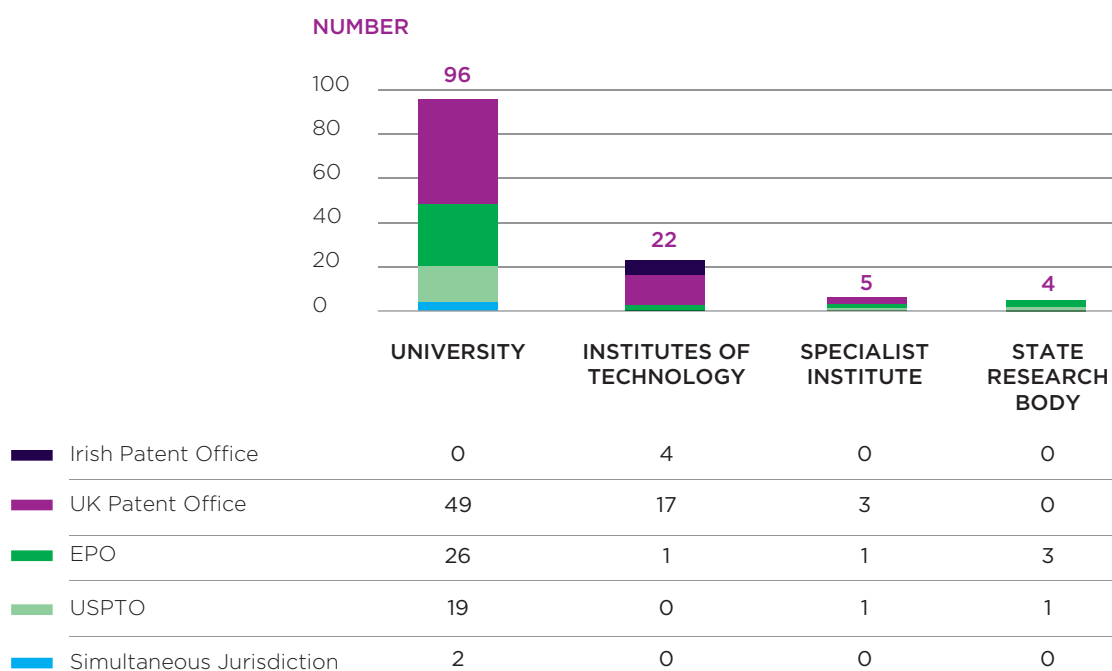
6. PATENT ACTIVITY - continued

6.1.1. Patent filing jurisdictions

The choice of priority patent filing territories is diverse. Not all applications are filed initially with the Irish Patent Office as patent applicants often prefer to file direct in territories where the invention may be commercialised, or direct with the European Patent Office (EPO).

Filings are also made with the UK IP Office (UKIPO) to expedite the official “search” relating to the application so that the RPO has a better understanding of patentability and claims required at the end of the priority year. This early search can also point the way for the applicant to potential competitors and licensees. The results of this process give applicants greater confidence in deciding whether to pursue, abandon or alter the patent application. The UK IPO is the favoured jurisdiction with 54% of initial priority filings made in 2018 (52%, 2017). The EPO is next with 24% (36%, 2017). The level of priority filings made in the Irish patent office has been similar over the earlier three years (3-4%) with four (4) of RPO priority filings was made through the Irish patent Office in 2018. Figure 9 shows this breakdown.

Figure 9: Initial priority patent filing jurisdictions



6. PATENT ACTIVITY - continued

6.2 PCT applications and nationalisation

The Patent Cooperation Treaty (PCT) makes it possible to seek patent protection for an invention in many countries simultaneously by filing an international patent application. The PCT application can take its priority date from an initial national filing with a PCT application usually made 12 months after the first filing.

The RPOs reported that, of the 116 initial filings made in 2017, 78 (67%) were progressed to PCT applications in 2018¹⁰. All universities progressed some initial filings to PCT during 2018 and the range was 18-100%. Only three IoTs reported progressing patent applications to PCT and the range for those that did was 33-100%. That only three IoTs progressed initial patent applications may be due, in part, to the limited number of filings made in the IoT sector.

Eighteen months after a PCT application has been filed, it must be nationalised in individual countries and regions selected from those previously designated in international applications. This is a costly procedure and patent applications are often licensed prior to this stage. Where they are not yet licensed, the RPO will only progress to this stage if the invention shows significant commercial promise. The data on national filings relate to such filings made in the name of the RPO and which may be paid for by the RPO or by the licensee (by way of the licence contract). In 2018, 35 PCT applications entered the national phase (43, 2017). Most of these nationalised applications (80%) were made by the University sector (six universities)¹¹ whilst just two IoTs took patent applications into the national phase.

¹⁰ Non responders: IADT, NCI.

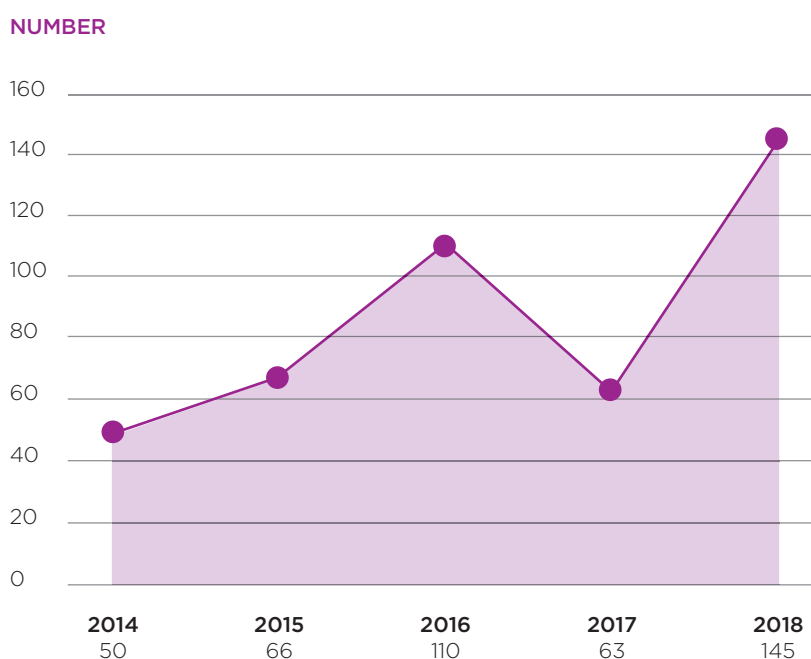
¹¹ Non responder: NUIG.

6. PATENT ACTIVITY - continued

6.3 Patents granted

The total number of patents granted in 2018 was 145, an increase of 130% on the previous year (63, 2017)¹². This increase is primarily due to the large portfolio of patents being granted simultaneously in many EU jurisdictions. It is likely that this large jump is unique to 2018. Most of these patents (92%) were granted to inventions from the University sector (83%, 2017). Patent grant depends on the complexity of prosecution within the relevant patent office and takes place of a long time frame, so absolute numbers are not necessarily an indicator of success within any one year. The data as gathered do not lend themselves to linking back to original filing. For the purposes of this analysis, patents granted in each territory in the year are counted even if they are related to the same original patent filing. The five-year trend in the number of patents granted from 2014 to 2018 is shown in Figure 10.

Figure 10: Number of patents granted each year



6.4 RPO patent portfolio

The number of patent families owned by the RPOs at the end of 2018 was 646¹³. This has dropped from 712 in the previous year. The biggest share of the portfolio is held by the universities, which together hold 84% of the RPO patent estate (86%, 2017). This may reflect the maturity of the university TTOs. A patent family may include patent applications or granted patents that derive from the same original filing.

6.5 Reimbursement of patent costs

Six RPOs (five universities and one IoT) said that they achieved some reimbursement of patent costs from licensees in 2018. This ranged from just under €18,000 to over €51,000.

¹² Non responders: IADT, NCI.

¹³ Non responders: IADT, LYIT, NCI.

READY FOR THE OFF - Licence from IT Carlow results in novel therapeutic horse saddle

Funding:

- Enterprise Ireland

TTO Support:

- Licensing
- Negotiation
- IP Protection



A novel, therapeutic horse-riding saddle aid that improves and enhances therapy through movement and connection with the horse is about to be launched on the market thanks to a five year project and the support of the TTO at IT Carlow.

The IP for the project arose as part of a final year industrial design project which led to the invention that was protected through the TTO at IT Carlow. The invention went on to win the People's Choice Award and Judges Choice Award at the 2015 Universal Design Grand Challenge. As part of the prize a Commercial Feasibility Fund from Enterprise Ireland was awarded.

Subsequently a patent application was filed by the Institute of Technology and in 2018 the patent for the invention was exclusively licensed to Thoroughbred Remedies Ireland Limited, Ireland's largest equestrian shop and equine supplement manufacturer. The company is soon to launch the new horse-riding saddle aid for use by people with a variety of physical, cognitive, emotional and development disabilities. This represents a departure for the company into a new, associated line of products.

Speaking of the project, Philip Masterson from the company TRI Equestrian said, *"Accessing innovative products through the direction of the TTO office at IT Carlow provides us with sound opportunities to expand our range into new markets."*

Speaking of the project, the TTO Director at IT Carlow said, *"It is very rewarding to see a project that was supported by the TTO and nurtured from an undergraduate concept into a commercial product which will provide real benefits to those that use it."*

IT Carlow continues to work with the company to refine product development and prototyping for commercial scale-up.

7. LICENSING

Rights to intellectual property, including copyright, know-how, patents and trademarks are granted through licences, options and assignments (LOAs).

A licence

Is an agreement between an RPO and one or more third parties, whereby intellectual property rights are transferred for the purpose of commercialisation. The RPO retains ownership of the intellectual property but permits the licensee to exploit it in accordance with contractual terms and conditions.

An option agreement

Is an agreement in which the RPO grants a potential licensee or assignee a period of exclusivity during which it can decide whether it may wish to take a licence to the intellectual property and negotiate the terms of a licence agreement. The option period may include evaluation of the IP by the potential licensee (including assessing the technology). This is called an Option & Evaluation agreement.

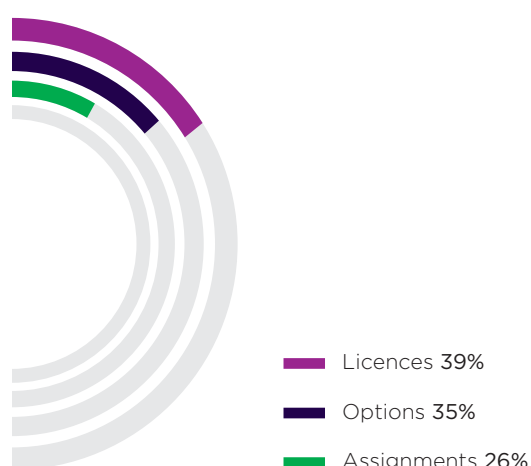
An assignment

Is an agreement transferring ownership of intellectual property rights from the RPO to a third-party.

7.1 Licences, options and assignments (LOA)

The total number of licences, options and assignments executed by RPOs has increased by 33% from 2017. In 2018, 218 LOAs were signed¹⁴ (164, 2017). However, looking at the breakdown across licence, option and assignment, whilst the absolute number of licences signed was fairly consistent (86, 2017; 84, 2018), the number of options and assignments increased. This can be seen in Figure 12 which shows five year trends.

Figure 11: LOAs by type 2018



¹⁴ Non responder: IADT.

7. LICENSING - continued

Figure 12: Total number of licences, options and assignments executed, 2014 - 2018



7. LICENSING - continued

A breakdown of licensing type by RPOs in Figure 13 shows that the University sector executed most LOAs 67% (73%, 2017) and that 42% of university IP transactions were licence. Licensing accounted for 32% of the total LOAs in the IoT sector. The number of assignments within the IoT sector was 25% in 2018, a decrease of 10% on 2017, which was high at 35%.

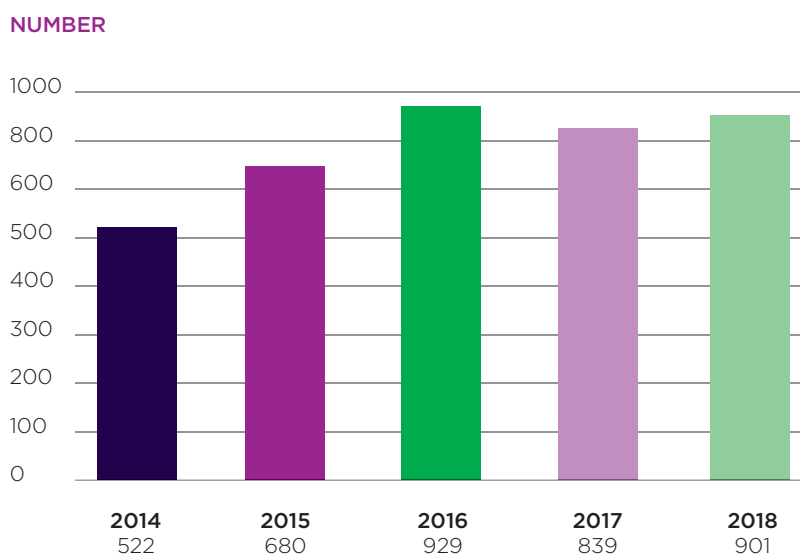
Figure 13: Type and number of licences, options and assignments executed in 2018 by RPO type



7. LICENSING - continued

The total number of licence, option and assignment agreements that were active at the end of 2018 was 901.¹⁵ This was an increase of 7% on the previous year (839, 2017). The majority, 78%, were in the University sector (77%, 2017). Figure 14 shows the cumulative portfolio of active agreements over the past five years.

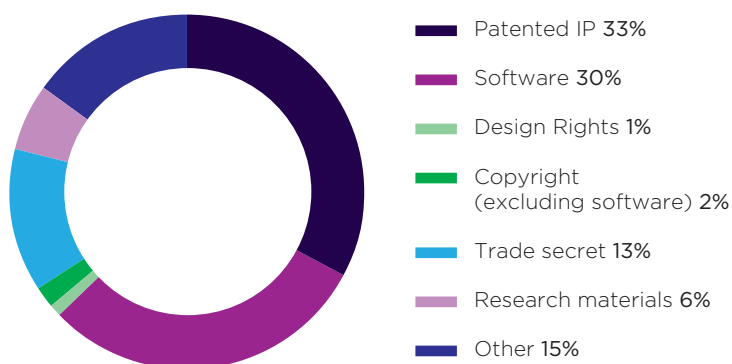
Figure 14: Total current licence and assignment portfolio, 2014 – 2018



7.2 Types of IP licensed

Figure 15 shows the types of intellectual property that were the subject of licence agreements during 2018.¹⁶ More than one piece of IP may be licensed within one agreement e.g. software plus know-how. This year, the category “other” includes biological materials, video and know-how.

Figure 15: Underpinning IP



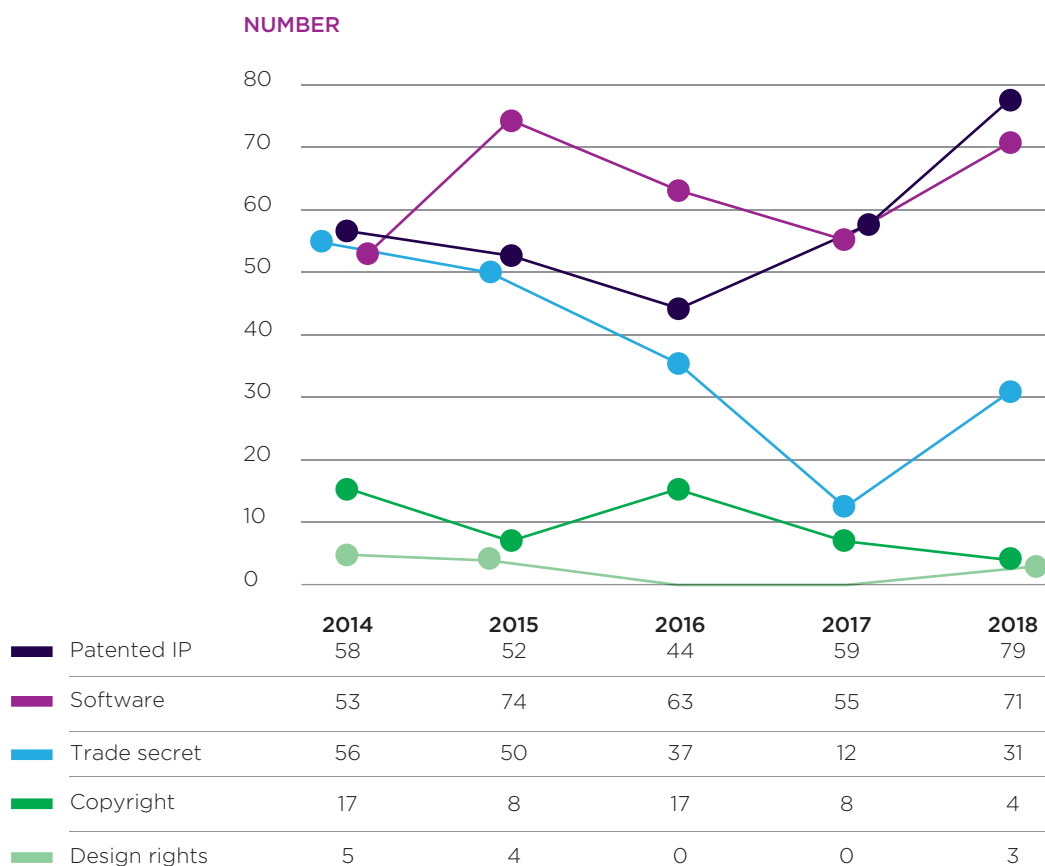
¹⁵ Non responders: IADT, IT Tralee, LYIT, NCI.

¹⁶ Non responder: IADT.

7. LICENSING - continued

Trends over the past five years are shown in Figure 16 which indicates that the majority of licences are to patented IP and to software. The high level of software licensing, combined with copyright licences, is indicative of the vibrant ICT sector which depends less on patented IP.

Figure 16: Major types of intellectual property in LOAs, 2014 - 2018

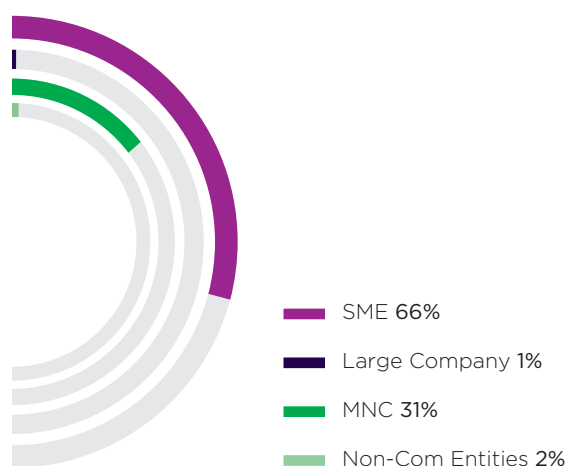


7. LICENSING - continued

7.3 Licensees

Figure 17 shows the types of organisations with which agreements were made in 2018.¹⁷ Irish and overseas companies are aggregated. Most LOAs (66%) were transacted with SMEs (63% in 2017).

Figure 17: Licensee/assignee by company size 2018



Of the LOAs signed, 76% were with Irish companies, the same as the previous year. Of these Irish contracts, 61% were with Irish SMEs. Of the non-Irish companies, LOAs were predominantly executed with MNCs (74%).

7.4 Material transfer agreements (MTAs)

A further type of agreement is a material transfer agreement, under which the institution transfers tangible research materials to another entity, and the recipient uses the materials for their own research purposes. The agreement specifies the rights of the provider and the recipient with respect to the materials and any derivatives. MTAs may be granted to or received from a commercial entity or another research organisation. Frequently, the transfer is out to a company by way of a licence agreement. 102 out-going MTAs to companies were signed in 2018 (87, 2017).¹⁸ Most MTAs (91%) were reported by the University sector (93%, 2017).

7.5 Products on the market

Of previous licences from the Irish RPOs, 33 led to market launches of products or services in 2018¹⁸ (24, 2017). Of these, 21 (64%) were from five Universities and 11 (33%) were from two IoTs. The remaining product/service launch was from a licence from Teagasc.

¹⁷ Non responder: IADT.

¹⁸ Non responders: IADT, LYIT.

7. LICENSING - continued

7.6 A deeper dive into products launched and reported in the AKTS2017

A third-party review, commissioned by KTI, was undertaken by IP Pragmatics to look into the new products and services that came onto the market in 2017 based on licences from Irish RPOs as reported in the AKTS2017. Once IP has been transferred, the RPO may not be aware of the contribution of their IP to the products or services offered by licensees, particularly when the IP leads to improvements in existing products, rather than the development of a completely new product line. Therefore, the number returned will be an underestimate of the contribution made by licences from RPOs to new launches.

The available and validated data from the AKTS 2017 identified 22 products and services which derived from licences from RPOs were brought to market by 17 different companies. This represents a decline over the past two years from a peak of 36 products launched in 2015. The dominant sector this year was ICT at 50%.

The bulk of these (88%) were based on licences to Irish companies. Of the licensee companies, 53% had been spin-outs from the RPO. A total of 32 different types of IP were transferred to generate the 22 products and services. As in previous years, about a third of the licences are based on patents originally filed by the RPO and a third on software code and algorithms. Other types of intellectual property, such as copyright or plant variety rights are also used where appropriate.

Looking back over the five years from 2013-2017, a total of 138 products or services have been brought to market based on research and IP from 16 RPOs.

ANALYTICS AND ACQUISITION - Access to UCC licensed technology expands company product range and creates jobs

Funding:

- Enterprise Ireland
- Department of Agriculture Food and the Marine

TTO Support:

- Licensing
- Relationship management



Cork based company, Luxcel BioSciences was acquired by California-headquartered Agilent Technologies Limited, a leading global provider of analytical laboratory solutions in January 2018. As part of the acquisition, underpinning IP licensed by Luxcel from UCC was transferred to Agilent, a process supported and facilitated by the TTO at UCC.

The licensed technology arose from an earlier collaboration between Luxcel and UCC to develop innovative live-cell monitoring technology and the licence led to development of Luxcel's specialist MitoXpress® product range. This provides cost effective and easy to use fluorescence-based in vitro cell test kits that typically allow the user to understand the role of cell metabolism across a variety of important research areas including cancer, metabolic disorders, cardiovascular disease, immunology and infectious disease.

The acquisition of the technology licence has allowed Agilent to expand its cell analysis portfolio. It has also led to the company opening a state-of-the-art research centre in Cork and growing its headcount in Ireland from 13 to 40 staff. Commenting on the licensed technology, Todd Christian, General Manager at Agilent said *"Technological advancements allowing researchers to examine cell health and function kinetically and in real time are driving global demand for complete cell analysis solutions. Luxcel's assay kits are optimized for standard fluorescent plate readers for broad customer application helping to address the growing demand."*

The company continues the relationship with UCC having engaged the university on consultancy and collaborative research projects. Speaking of the relationship, Director of Tech Transfer at UCC, Rich Ferrie said *"Luxcel's growth and integration with Agilent makes it a major player in the innovation ecosystem here in Cork. UCC remains a key research partner for the company through a range of ongoing research collaborations and projects. Our office is delighted to provide tech transfer support to underpin this exciting innovation partnership."*

8. COMPANY CREATION

The number of new companies created and sustainability of spin-outs is recorded.

Spin-out

A spin-out is an incorporated entity which at the time of formation was dependent on the exploitation of specific intellectual property rights of the RPO. The rights to the company can be linked to a specific researcher who was within the RPO at the time of company formation and who would be considered an academic founder. The RPO will hold equity in the spin-out and/or has issued the company with a licence to the IP.

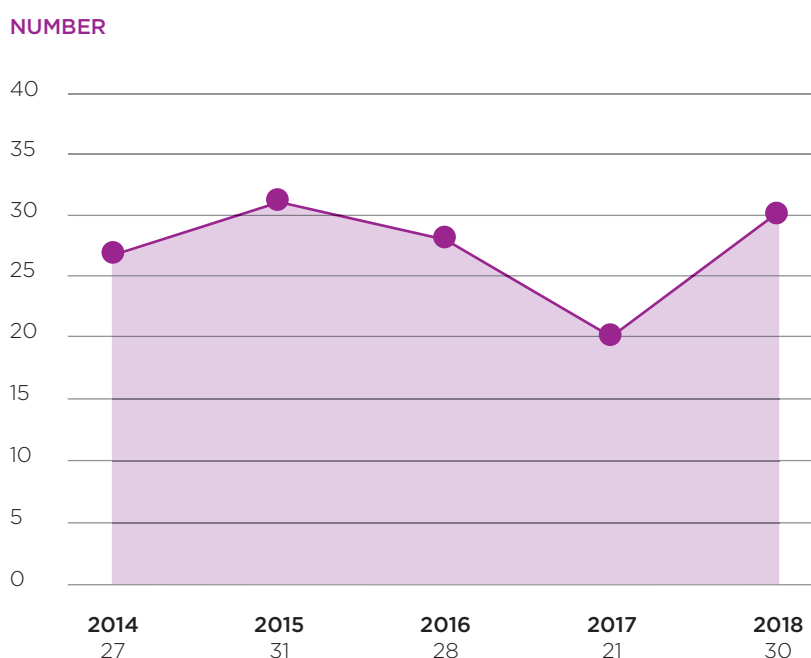
Start-up

A start-up is a company formed by staff or students in the RPO not based on knowledge or intellectual property generated by the RPO and where there is no formal IP licence or equity share with the RPO.

A total of 30 new companies were spun-out from 11 of the RPOs in 2018¹¹ (21, 2017).¹⁹ Whilst this represents a 42% increase on the previous year, where numbers are low the deviation appears more pronounced.

Although there has been a downward trend in the number of spin-outs between 2014 and 2017, the increase in 2018 brings the median over the last five years to 28. There were 30 start-ups reported²⁰, by three universities, two IOTs and one Specialist Institute. As start-ups are created independently from the RPOs, they will be under-reported in this survey. There were four spin-outs merged or acquired during 2018.

Figure 18: Spin-outs established, 2013 – 2017



The aggregate number of spin-out companies in which an RPO holds equity or share options, at the end of 2017, was 190 (193, 2017). The University sector accounts for 82% of this portfolio.

¹⁹ Non responder IADT.

²⁰ Non responders: IADT, MU, UL, WIT.

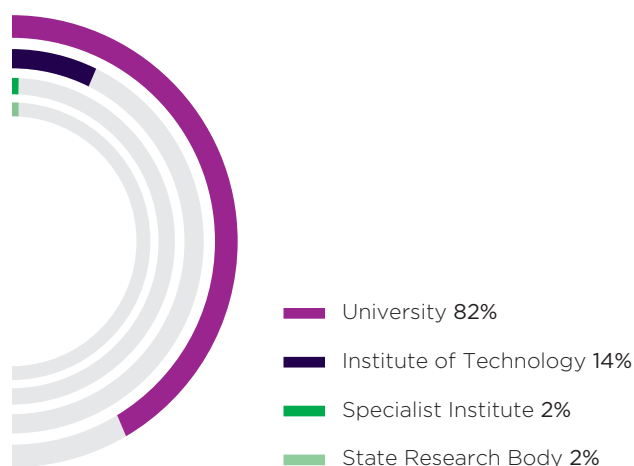
8. COMPANY CREATION - continued

8.1 Active Spin-out companies

An Active Spin-out is defined as an RPO-created spin-out company that is at least three years post-formation (three years since being reported as an RPO Spin-out) and, as at the end of the reference year, has at least one paid employee and has raised equity and/or has booked sales revenue. It is an incorporated entity which at the time of formation was dependent on the exploitation of specific intellectual property rights of the RPO. The RPO will have executed a licence to the spin-out for the IPR and/or will hold equity in the Spin-out.

There were 119 Active Spin-outs reported at the end of 2018²¹ that were at least three years post-incorporation. Of these, 99 were from the University sector (82%) with 14 coming from the Institutes of Technology sector (14%). This is consistent with the previous years. The distribution is shown in Figure 19.

Figure 19: Active Spin-out at end of 2018



²¹ Non responder: IADT.

8. COMPANY CREATION - continued

8.1.1 A deeper dive into the Active Spin-outs reported in AKTS 2017

The data on active spin-out companies provided to the AKTS 2017 were explored further as a part of a review undertaken on behalf of KTI by IP Pragmatics. The review also looked at data on those spin-outs that achieved a successful exit such as a trade sale to capture further impacts from RPO spin-outs.

The study validated 113 Active Spin-out companies (spin-outs that are active three or more years post formation) from 17 different RPOs.

Approximately 35% of the companies were between 3 and 5 years old with 42% being 6 to 10 years old and 23% of Active Spin-outs being over 15 years old. The majority (81%) of these Active Spin-outs have come out of Universities and a further 15% from IoTs.

Active Spin-outs predominate in the ICT (35%) and Health and Med Tech (27%) sectors followed by Manufacturing & Materials (19%). More than one type of IP may be used as the foundation for any individual spin-out, and the total number of different types of IP reported was 157. In aggregate, 34% of the 2018 Active Spin-outs used patents, 28% software and 28% relied on licensed know-how.

The majority of the companies remain micro companies (64%) and have fewer than 10 employees. Some companies are growing, however, and four now have over 50 employees. As a group, the Active Spin-out companies currently provide employment for at least 1160 people. This figure was derived from a variety of public data sources.

In common with other spin-outs across the world, many of the companies choose to establish themselves close to their founding institution. This allows them to retain close links and perhaps continue collaborative research with their RPO. Some may also be based in RPO-associated incubation facilities. Three of the Active Spin-outs are based outside of Ireland and at least 31% (40) have established offices and/or appointed distribution agents in one or more overseas territories.

8.2 Company incubation

All Higher Education Institutes (HEIs – universities and IoTs) have an associated incubator facility in which early stage companies can develop. In addition to space for the company, services offered to the incubated company include advice on IP, networking events and access to professional services. According to the 24 RPOs that returned data, the total number of incubator clients at the end of 2018 was 945 (956 in 2017). The majority were based in IoT incubators (698) with 237 in University incubators and a further 10 companies supported in the NCAD, NCI and Teagasc incubators. A total of 320 new companies entered HEI incubators and 223 exited during the year.

A NOSE FOR SUCCESS - NUI Galway Spin-out company Neurent Medical develops novel treatment for nasal inflammation

Funding:

- Enterprise Ireland
- Science Foundation Ireland

TTO Support:

- IP Protection and Licensing
- Collaborative research agreements
- Relationship Management



Neurent Medical is a Galway-based medical device company specialising the treatment of rhinitis, an inflammatory disease of the nose. The company, having spun out of NUI Galway, is developing a low risk, single use device that will enable a novel kind of therapy be performed in a doctor's office under local anaesthetic. This treatment option provides significantly lower risk to patients than current interventions which require the use of an operating theatre. Widespread use of the device will also remove substantial cost from the healthcare system.

The company emerged from the Enterprise Ireland BioInnovate programme at NUI Galway in 2015 and benefitted from €495k in Enterprise Ireland commercialisation funding. In May 2018 Neurent Medical announced that it had raised €9.3m (\$11m) in a Series A Financing round led by Fountain Healthcare Partners and with participation from Atlantic Bridge Capital, the Western Development Commission, Enterprise Ireland and a syndicate of Irish and US medical device veterans. This is the largest VC backed fundraising event for a University Medtech Spinout company in Europe in the last decade. On the back of this investment Neurent Medical plans to recruit 25 staff into the company by the end of 2021.

The Technology Transfer Office at NUI Galway has provided support to the company from its inception and the company acknowledges the support it has received *"Collaborating with RPOs is hugely valuable in the early stage of product development in life sciences. The global expertise on our doorstep at CURAM is something which every life science start up should be trying to leverage when answering big research questions. The founding team were supported by the TTO from the earliest concept in 2015. Their support in patent filings was invaluable enabling the company to inherit a very early IP position."* said Brian Shields CEO at Neurent Medical.

The relationship between Neurent Medical and NUI Galway is strong with the company funding a collaborative research programme that began in 2019. In addition, the company and the university were also successful in securing €2.8m funding under the first call of the Disruptive Technologies Innovation Fund (DTIF) for a project set to begin in 2019 which will enable the company to expedite plans for second generation technology. Brian Shields, co-founder of Neurent Medical with David Townley, was named Enterprise Ireland's high potential start-up Founder of the Year in 2019.

9. REVENUE GENERATION FROM LICENSING AND SPIN-OUTS

Annual revenue return from licensing and sale of equity is recorded.

Revenue generation from licensing IP or from the realisation of spin-out equity may be considered a proxy for success. However, it is important to put revenue generation in context. Consistent with the national Policy for Research Commercialisation, the objective of commercialisation by RPOs is to support business innovation and competitive advantage.

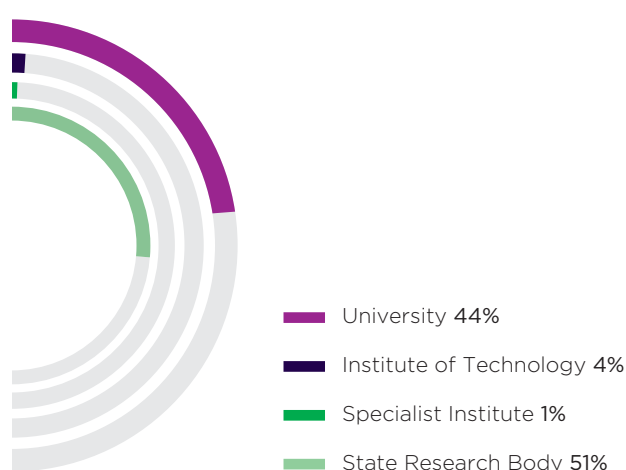
This in turn should lead to the development of new services and products for the benefit of society and the economy. The relationship between business and entrepreneurs with RPOs is more sophisticated than simple rights acquisition. Value is added through the other interactions that enterprise has with the RPOs, such as access to expertise through research contracts and consultancy.

9.1 Licence revenue

The revenue from all types of know-how and IP (patents, copyright, designs, material transfer agreements, confidentiality agreements, plant breeder rights, etc.) before disbursement to the inventor or other parties was surveyed. Revenue includes licence issue fees, annual fees, royalties, option fees and milestones, termination and cash-in payments.

All seven universities reported revenue from licensing whilst only four out of the 12 IOTs who responded to this section of the survey generated licence income. From the data provided, the aggregate revenue from licensing in 2018 was €1.8 million (€1.7 million, 2017; €2.7 million, 2016).²² Licence revenue in the State Research Sector accounted for 51% of all licence revenue in the year. This was due to royalty streams from the sale of plant varieties.

Figure 20: Licence revenue by RPO sector 2017



9.2 Revenue from equity and dividends in spin-out companies

The realisation of equity is unpredictable, depending on external factors such as the maturity of the spin-out and market forces. Two universities realised revenue from the sale of equity in a spin-out company in 2018 and one university and one IOT achieved a dividend return. The total revenue from equity sale and dividends was €968k (€1.2 million 2017).

²² Non responders: IADT, LYIT.

10. USE OF FACILITIES AND EQUIPMENT

Access to facilities and equipment in RPOs can be highly beneficial to companies.

The survey asked for information on the use of RPO facilities and equipment. Information is patchy because in most cases the use of facilities and equipment by external organisations is managed at the local level, for example by a school or research department, and not tracked centrally. Feedback has been that such data are extremely difficult to obtain and yet, where it has been tracked by some RPOs, the indication is that this is an area in which State investment in the RPO infrastructure is providing value to industry.

A total of 355 contracts were reported by just 12 RPOs²³ (219, 2017; 848, 2016). The majority of these (66%) are accounted for by four out of five universities that returned data. All but one of the RPOs reporting contracts also reported revenue generation. The total gross revenue reported was €1.6 million. This is an increase of 45% on 2017 (€1.1 million), however, as these data are not robust, due to lack of central recording, it is unwise to read too much into the results.



²³ Non-responders: UCC, UDC, IADT.

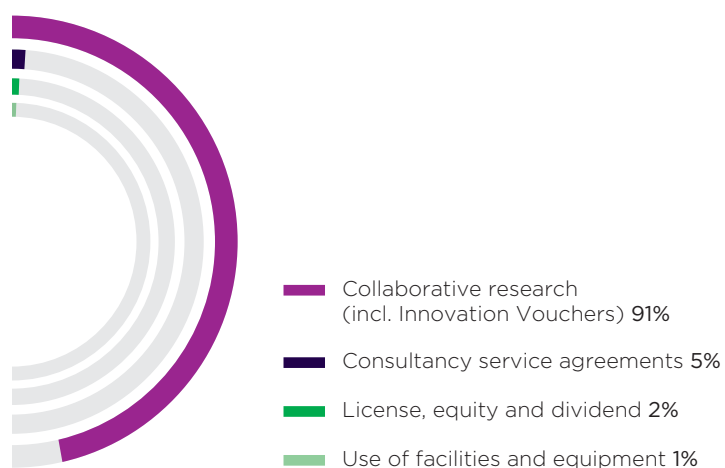
11. SUMMARY OF COMMERCIALISATION REVENUE

Revenue generated through the various types of knowledge transfer activity is considered.

The majority of commercialisation revenue (96%) is derived from industry engagements including Collaborative Research, Innovation Voucher projects and Consultancy Services. Commercialisation revenue from licensing, spin-out dividends and equity sale, adds a further 2% in commercialisation revenue with use of facilities and equipment contributing 1%.

The data presented in Figure 21 exclude research collaboration and consultancy services with non-commercial entities and research income from State or other non-profit research funding sources e.g. research funding agencies, charities.

Figure 21: Revenue from commercialisation activities with industry



APPENDIX 1. SUMMARY DATA BY RPO

Selected data relating to the returns made by the 25 RPOs are presented in tables A1-C2. Where an RPO was unable to return data, the entry is greyed out.

The data should not be viewed as league tables of performance. Activity and outcomes depend on a complex range of factors which include the RPO mission, activity and research base. For example, one RPO may be more focused on working with many local companies on small-scale projects whilst another larger RPO may have a greater breadth and depth of research in an area that lends itself to a more national or international engagement and creation of IP. Other factors include the resourcing to support KT activity and how long a TTO has been in existence. It also needs to be recognised that some of the information requested had to be obtained from different departments within the RPO and not all data may be captured with the same level of detail.

A1: Research Expenditure, research agreements and consultancy with Industry 2018

University, Specialist and State Research Organisations

	Research expenditures (€) (less block grant) in the reference year	Research expenditure derived from research engagements with industry	Number of collaborative research agreements with industry	Number of innovation voucher project agreements with industry	Number of consultancy services agreements with industry	Total Number of Collaboration, innovation voucher and consultancy services agreements with industry
University						
Dublin City University	€35,314,075	€4,414,259	34	4	4	42
Maynooth University	€26,300,995	€789,030	52	2	2	56
NUI Galway	€70,745,219	€7,074,522	48	11	2	61
Trinity College Dublin	€102,530,760	€24,648,395	72	31	8	111
University College Cork	€100,220,971	€24,053,033	72	17	14	103
University College Dublin	€91,750,000	€5,229,750	204	10	25	239
University of Limerick	€36,101,967	€16,318,089	29	5	5	39
Total	€462,963,987	€82,527,078	511	80	60	651
Specialist and State Research Organisations						
National College of Art and Design	€375,457	€60,073	13	9	4	26
National College of Ireland	€160,000	€9,600	1	4	0	5
Royal College of Surgeons in Ireland	€21,189,921	€2,797,070	27	1	0	28
Marine Institute	€5,500,000	€0	0	0	0	0
Teagasc	€43,900,000	€9,315,580	32	13	180	225
Total	€71,125,378	€12,182,323	73	27	184	284

APPENDIX 1. SUMMARY DATA BY RPO - continued

A2: Research Expenditure, research agreements and consultancy with Industry 2018

Institutes of Technology

	Research expenditures (€) (less block grant) in the reference year	Research expenditure derived from research engagements with industry	Number of collaborative research agreements with industry	Number of innovation voucher project agreements with industry	Number of consultancy services agreements with industry	Total Number of Collaboration, innovation voucher and consultancy services agreements with industry
Institutes of Technology						
Athlone Institute of Technology	€4,181,293	€710,820	14	50	199	263
Cork Institute of Technology	€12,767,799	€896,299	22	85	101	208
Dublin Institute of Technology	€15,632,157	€703,447	13	20	53	86
Dundalk Institute of Technology	€3,730,000	€223,800	3	23	2	28
Galway-Mayo Institute of Technology	€3,000,591	€447,988	10	13	1	24
Dun Laoghaire IADT						
Institute of Technology Blanchardstown	€829,176	€140,960	0	1	0	1
Institute of Technology Carlow	€2,739,481	€197,243	3	83	20	106
Institute of Technology Sligo	€2,356,000	€1,531,400	32	28	0	60
Institute of Technology Tralee	€2,429,900	€315,887	30	20	2	52
Institute of Technology Tallaght	€1,646,028	€98,762	11	3	10	24
Letterkenny Institute of Technology	€719,361	€273,357	2	26	4	32
Limerick Institute of Technology	€1,733,295	€414,084	9	22	2	33
Waterford Institute of Technology	€12,833,196	€769,992	12	67	180	259
Total	€64,598,277	€6,724,039	161	441	574	1176

APPENDIX 1. SUMMARY DATA BY RPO - continued

A3: Research Expenditure, research agreements and consultancy with non-commercial entities 2018

University, Specialist and State Research Organisations

	Research expenditures (€) (less block grant) in the reference year	Research expenditure derived from non-commercial entities	Number of collaborative research agreements with non-commercial entities	Number of consultancy services agreements with non-commercial entities	Total Number of Collaboration and consultancy services agreements with non-commercial entities
University					
Dublin City University	€35,314,075	€557,962	39	5	44
Maynooth University	€26,300,995	€334,023	6	8	14
NUI Galway	€70,745,219	€3,763,646	0	0	0
Trinity College Dublin	€102,530,760	€11,841,952	89	9	98
University College Cork	€100,220,971	€18,069,841	76	0	76
University College Dublin	€91,750,000	€9,330,975	4	10	14
University of Limerick	€36,101,967	€938,651	6	1	7
Total	€462,963,987	€44,837,050	220	33	253
Specialist and State Research Organisations					
National College of Art and Design	€375,457	€135,915	6	0	6
National College of Ireland	€160,000	€0	0	0	0
Royal College of Surgeons in Ireland	€21,189,921	€3,602,287	5	0	5
Marine Institute	€5,500,000				
Teagasc	€43,900,000	€6,146,000	1	75	76
Total	€71,125,378	€9,884,202	12	75	87

APPENDIX 1. SUMMARY DATA BY RPO - continued

A4: Research Expenditure, research agreements and consultancy with non-commercial entities 2018

Institutes of Technology

	Research expenditures (€) (less block grant) in the reference year	Research Expenditure derived from non-commercial entities	Number of collaborative research agreements with non-commercial entities	Number of consultancy services agreements with non-commercial entities	Total Number of Collaboration and consultancy services agreements with non-commercial entities
Institutes of Technology					
Athlone Institute of Technology	€4,181,293	€0	10	11	21
Cork Institute of Technology	€12,767,799	€0	0	8	8
Dublin Institute of Technology	€15,632,157	€0	0	1	1
Dundalk Institute of Technology	€3,730,000	€0	0	0	0
Galway-Mayo Institute of Technology	€3,000,591	€0	10	4	14
Dun Laoghaire IADT					
Institute of Technology Blanchardstown	€829,176	€0	3	0	3
Institute of Technology Carlow	€2,739,481	€43,832	3	0	3
Institute of Technology Sligo	€2,356,000	€0	31	0	31
Institute of Technology Tralee	€2,429,900	€0	0	0	0
Institute of Technology Tallaght	€1,646,028	€0	0	1	1
Letterkenny Institute of Technology	€719,361	€0	0	0	0
Limerick Institute of Technology	€1,733,295	€228,102	0	5	5
Waterford Institute of Technology	€12,833,196	€513,328	7	2	9
Total	€64,598,277	€785,261	64	32	96

APPENDIX 1. SUMMARY DATA BY RPO - continued

B1: IP and IP Transactions 2018

University, Specialist and State research organisations

	Total number of invention / software disclosures received during the year	Total number of new patent applications filed during the year	Previously filed priority patent filed progressed to PCT in year %	Total number of patents granted in year	Total number of patents families owned by the RPO at year end	Total number of licences, options and assignments executed (LOAs)	Market launches of products or services in year based on RPO licence
University							
Dublin City University	36	11	18%	86	63	28	3
Maynooth University	12	7	100%	1	10	7	0
NUI Galway	59	14	100%	15	117	16	1
Trinity College Dublin	73	15	65%	11	124	23	7
University College Cork	69	20	53%	9	65	30	7
University College Dublin	79	20	75%	8	98	28	2
University of Limerick	23	9	50%	3	68	13	1
Total	351	96		133	545	145	21
Specialist and State Research Organisations							
National College of Art and Design	2	1	0%	1	0	0	0
National College of Ireland	7						
Royal College of Surgeons in Ireland	14	4	40%	4	22	5	0
Marine Institute	0	0	0%	0	0	0	0
Teagasc	23	4	100%	2	27	12	1
Total	46	9		7	49	17	1

APPENDIX 1. SUMMARY DATA BY RPO - continued

B2: IP and IP Transactions 2018

Institutes of Technology

	Total number of invention / software disclosures received during the year	Total number of new patent applications filed during the year	Previously filed priority patent progressed to PCT in year %	Total number of patents granted in year	Total number of patent families owned by the RPO at year end	Total number of licences, options and assignments executed (LOAs)	Market launches of products or services in year based on RPO licence
Institutes of Technology							
Athlone Institute of Technology	4	0	0%	0	0	3	0
Cork Institute of Technology	15	2	0%	3	11	6	6
Dublin Institute of Technology	33	9	33%	1	20	29	2
Dundalk Institute of Technology	4	0	0%	0	1	1	0
Galway-Mayo Institute of Technology	0	0	0%	0	0	2	0
Dun Laoghaire IADT							
Institute of Technology Blanchardstown	1	0	0%	0	0	0	0
Institute of Technology Carlow	9	1	100%	0	0	2	0
Institute of Technology Sligo	4	4	0%	1	1	3	0
Institute of Technology Tralee	3	3	0%	0	0	3	0
Institute of Technology Tallaght	0	0	0%	0	4	0	0
Letterkenny Institute of Technology	0	0	0%	0	0	0	0
Limerick Institute of Technology	6	0	0%	0	0	0	0
Waterford Institute of Technology	11	3	50%	0	15	7	3
Total	90	22		5	52	56	11

APPENDIX 1. SUMMARY DATA BY RPO - continued

C1: IP and IP Transactions 2018

University, Specialist and State research organisations

	Number of spin-outs established during the year	Number of staff or student start-ups established during the year	Number of Active spin-outs in existence at the end of the year	Number of spin-outs merged or acquired during the year	Number of companies supported within the incubator in year	Number of contracts with companies for use of facilities and equipment at the RPO
University						
Dublin City University	5	0	10**	0	24	42
Maynooth University	0	0	6	0	33	12
NUI Galway	2		12	0	42	0
Trinity College Dublin	6*	15	28**	0	28	20
University College Cork	3*	9	13**	3	16	
University College Dublin	5	1	18	1	47	
University of Limerick	2		12	0	47	159
Total	22*	25	97**	4	237	233
Specialist and State Research Organisations						
National College of Art and Design	1	0	1	0	1	0
National College of Ireland	1	1	0	0	7	0
Royal College of Surgeons in Ireland	0	0	2	0	n/a	1
Marine Institute	0	0	0	0	0	0
Teagasc	0	0	2	0	2	29
Total	2	1	5	0	10	30

* There was one joint spin-out reported for TCD and UCD. This is reflected in the total.

** There were two joint Active Spin-outs reported - one for DCU and UCC and one for UCC and TCD. This is reflected in the total.

APPENDIX 1. SUMMARY DATA BY RPO - continued

C2: IP and IP Transactions 2018

Institutes of Technology

	Number of spin-outs established during the year	Number of staff or student start-ups established during the year	Number of Active spin-outs in existence at the end of the year	Number of spin-outs acquired or merged during the year	Number of companies supported within the incubator in year	Number of contracts with companies for use of facilities and equipment at the RPO
Institutes of Technology						
Athlone Institute of Technology	0	0	0	0	28	11
Cork Institute of Technology	1	2	3	0	82	1
Dublin Institute of Technology	3	0	6	0	106	1
Dundalk Institute of Technology	0	0	1	0	34	0
Galway-Mayo Institute of Technology	0	0	0	0	75	23
Dun Laoghaire IADT						
Institute of Technology Blanchardstown	0	0	1	0	48	0
Institute of Technology Carlow	0	0	1	0	38	1
Institute of Technology Sligo	0	3	0	0	55	-
Institute of Technology Tralee	0	0	1	0	26	1
Institute of Technology Tallaght	0	0	0	0	46	5
Letterkenny Institute of Technology	0	0	0	0	50	-
Limerick Institute of Technology	0	0	0	0	84	0
Waterford Institute of Technology	2		1	0	26	8
Total	6	5	14	0	698	51

APPENDIX 2. LIST OF RESEARCH PERFORMING ORGANISATIONS (RPOS)

C2: IP and IP Transactions 2018

Institutes of Technology

Reporting Sector	Institution	Year of foundation of TTO
University		
	Dublin City University	2007
	Maynooth University	2005
	National University of Ireland Galway	2005
	Trinity College Dublin	1987
	University College Dublin	2003
	University College Cork	1982
	University of Limerick	2005
Institute of Technology		
	Athlone Institute of Technology	2008
	Cork Institute of Technology	2009
	Dublin Institute of Technology	2007
	Dundalk Institute of Technology*	2012
	Dun Laoghaire Institute of Art, Design & Technology	2012
	Galway-Mayo Institute of Technology	2008
	Institute of Technology Blanchardstown*	2000
	Institute of Technology Carlow	2008
	Institute of Technology Sligo	
	Institute of Technology Tallaght*	2000
	Institute of Technology Tralee	2009
	Letterkenny Institute of Technology	1998
	Limerick Institute of Technology	2008
	Waterford Institute of Technology	2008
Specialist Institute		
	National College of Art and Design	2013
	National College of Ireland	2011
	Royal College of Surgeons in Ireland	2007
State Body Sector		
	Marine Institute	n/a
	Teagasc	2011

* DIT, ITB and IT Tallaght were granted Technological University status and became Technological University Dublin in January 2019.

APPENDIX 3. THE INTERNATIONAL RTTP QUALIFICATION

Ireland's Recognised Technology Transfer Professionals

Seamus Browne	Royal College of Surgeons in Ireland
Alison Campbell	Knowledge Transfer Ireland
Ronan Coleman	Cork Institute of Technology
Peter Conlon	Maynooth University
David Corkery	University College Cork
Kevin Dalton	University College Cork
Paul Dillon	University of Limerick
Gordon Elliott	Trinity College Dublin
Richard Ferrie	University College Cork
Tom Flanagan	University College Dublin
Aoife Gallagher	Royal College of Surgeons in Ireland
Ian Gallivan	NUI Galway
John Gleeson	University of Limerick
Carolyn Hughes	Dublin City University
Derek John	Royal College of Surgeons in Ireland
Stacey Kelly	University College Dublin
Margaret Lawlor	University of Limerick
Breda Lynch	Athlone Institute of Technology
Paul Maguire	Dublin Institute of Technology
Andrew Marsh	University College Cork
Siobhan Mac Sweeney	Institute of Technology Tralee
Neil McLoughlin	Dundalk Institute of Technology
Graham McMullin	Trinity College Dublin
Conor Morris	University of Limerick
Anthony Morrissey	University College Cork
David Murphy	NUI Galway
Patrick O'Boyle	Dublin City University
Kieran O'Connell	Dublin Institute of Technology
Peter Olwell	Dublin City University
Emma O'Neill	Dublin City University
Joan O'Sullivan	University of Limerick
James O'Sullivan	Waterford Institute of Technology
Karl Quinn	Genomics Medicine Ireland ex. University College Dublin
Tim Roche	Formium ex. University College Cork
Kieran Ryan	NUI Galway
John Scanlan	Maynooth University
Richard Stokes	Dublin City University
Jacinta Thornton	NUI Galway
Paul Tyndall	University College Dublin
Emily Vereker	Health Research Board ex. Trinity College Dublin
Miriam Walsh	Teagasc
Ena Walsh	University College Dublin

APPENDIX 4. GLOSSARY

Active Spin-out

An Active Spin-out is an RPO-created spin-out company that is at least three years post-formation (three years since being reported as an RPO spin-out) and, as at the end of the reference year, has at least one paid employee and has raised equity and/or has booked sales revenue. It is an incorporated entity which at the time of formation was dependent on the exploitation of specific intellectual property rights of the RPO. The RPO will have executed a licence to the spin-out for the IPR and / or will hold equity in the spin-out.

Assignment

Contract transferring ownership of right in IP to a third party.

Collaborative research

A research project/programme between an industry party and an RPO. The project/programme may be: wholly-funded by the industry party or; part-funded by the industry party (in cash and/or in kind, including participation in the research itself) and part-funded by the State or other external sources. Collaborative research may involve two or more parties.

Characteristics of collaborative research with industry: The purpose of collaborative research is the generation of new knowledge. Typically, there will be an expectation of publication although the project may be governed by aspects of confidentiality. Intellectual property may be created and how the company benefits will be determined in the collaboration agreement and will depend on the contribution to the project made by the company.

(Excludes contract services, consultancy, innovation vouchers, academic collaborations and research grants).

Consultancy Services

RPO provides professional-level work to an external client organisation through an academic, researcher or other member of RPO staff in exchange for a commercial fee. The work is specified (or agreed) by the client against deliverables agreed with the RPO. May include Consultancy agreements, "Contract services" agreements and projects contracted under a work order. Characteristics of consultancy services: The purpose of consultancy is not typically the generation of new knowledge, rather it draws on existing knowledge. There will usually be no expectation of publication, results will be confidential and will be transferred to the client. The type of work might typically involve one or more of the following: advice; analysis; production of a report. Projects will generally be of a short term.

(Excludes collaborative research, research grants, Academic collaboration, Training and provision of Continuing Professional Development (CPD)).

Equity

Shareholding in a legal entity.

FTE

Full Time Equivalent - People working part-time are only included for the fraction that they are employed.

Incubator

A dedicated facility on the RPO campus in which early stage companies are housed and supported (pre- and post-formation). The facility may offer desk space, laboratory space or a mix of both.

Innovation Vouchers

Innovation Vouchers worth €5,000 are available to assist a company or companies to explore a business opportunity or problem with a registered knowledge provider (i.e. higher education institutes, public research bodies).

Invention disclosure

The invention disclosure is the first actual recording of potential new intellectual property (IP). The researcher/inventor and TTO/ILO will complete an Invention Disclosure Form (IDF) which is a written, signed and dated record. The IDF contains basic information, including supporting data, which helps to evaluate and subsequently, potentially, protect and commercialise the intellectual property. For avoidance of doubt, the IP may be software.

ILO

Industry Liaison Office - the team responsible for managing KT services, including intellectual property management, licensing, partnering with industry and the creation of new companies.

Joint invention/ software disclosure

Simultaneous reporting of an Invention Disclosure for the same invention or software to more than one RPO that has been created jointly by more than one RPO via the TTO/ILO.

KT

Knowledge transfer - the sharing of expertise, capability, technology and intellectual property between the research base and industry or the public sector with the aim of developing new or improved products, processes and services that deliver societal and economic benefit.

APPENDIX 4. GLOSSARY - continued

Large Company

A company which is based in one country only and which has more than 250 employees and has either an annual turnover greater than €50m or an annual Balance Sheet total greater than €43m.

Large Company Irish

A Large Company which is based in Ireland.

Licence

A contract under which IP rights are transferred from one party to another for the purpose of commercialisation.

LOA - Licence, Option or Assignment

A contract under which IP results are transferred, or agreed to be transferred, from one party to the other for the purpose of commercialisation.

MNC

A multi-national corporation that has its facilities and other assets in at least one country other than its home country. Such companies have offices and/or factories in different countries and usually have a centralised head office where they co-ordinate global management.

MNC Irish

An MNC which has its HQ based in Ireland and/or which has a significant R&D presence in Ireland.

Non-commercial entity

Public sector organisation or charity.

Option

A contract under which the RPO grants a potential licensee a period of exclusivity during which it can decide whether it may wish to take a licence to the intellectual property and negotiate the terms of a licence agreement. The option period may include evaluation of the IP by the potential licensee (including assessing the technology). This may be called an Option & Evaluation agreement.

PCT

Patent Cooperation Treaty - the Treaty makes it possible to seek patent protection for an invention simultaneously in each of a large number of countries by filing an "international" patent application.

Priority filing

The first filing of a patent application which will establish a priority date from which all national patents will derive. Depending on patent strategy the priority filing may be done as a provisional application or national patent application or regional or international (PCT) patent application.

Reference year

The twelve-month reporting period from January 1st to December 31st.

Research grant

An academic grant not involving industry. An award to an RPO by a research funding agency (e.g. government agency, charity) to perform a programme of research with the intention of disseminating the research results and in which an industry party is not involved. Typical research funders may include; SFI, ERC, Wellcome Trust etc.

RPO

Research Performing Organisations. Universities, institutes of technology and other research institutions funded primarily by public funds.

SME

Has less than 250 employees and has either an annual turnover not exceeding €50m or an annual Balance Sheet total not exceeding €43m.

SME Irish

SME which has its head office in Ireland.

Sole invention / software disclosure

An Invention Disclosure for an invention or software created by one RPO and reported to that RPO via the TTO/ILO.

Spin-out

A spin-out company is an incorporated entity which at the time of formation was dependent on the exploitation of specific intellectual property rights of the RPO. The rights to the company can be linked to a specific researcher who was within the RPO at the time of company formation and who would be considered an academic founder. The RPO will hold equity in the spin-out and/or has issued the company with a licence to the IP.

Start-up

Company formed by staff or students from the RPO not based on knowledge or IP generated by the RPO and where there is no formal IP licence or equity share with the RPO.

TTO

Technology Transfer Office – the team responsible for managing KT services, including intellectual property management, licensing, partnering with industry and the creation of new companies.



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