



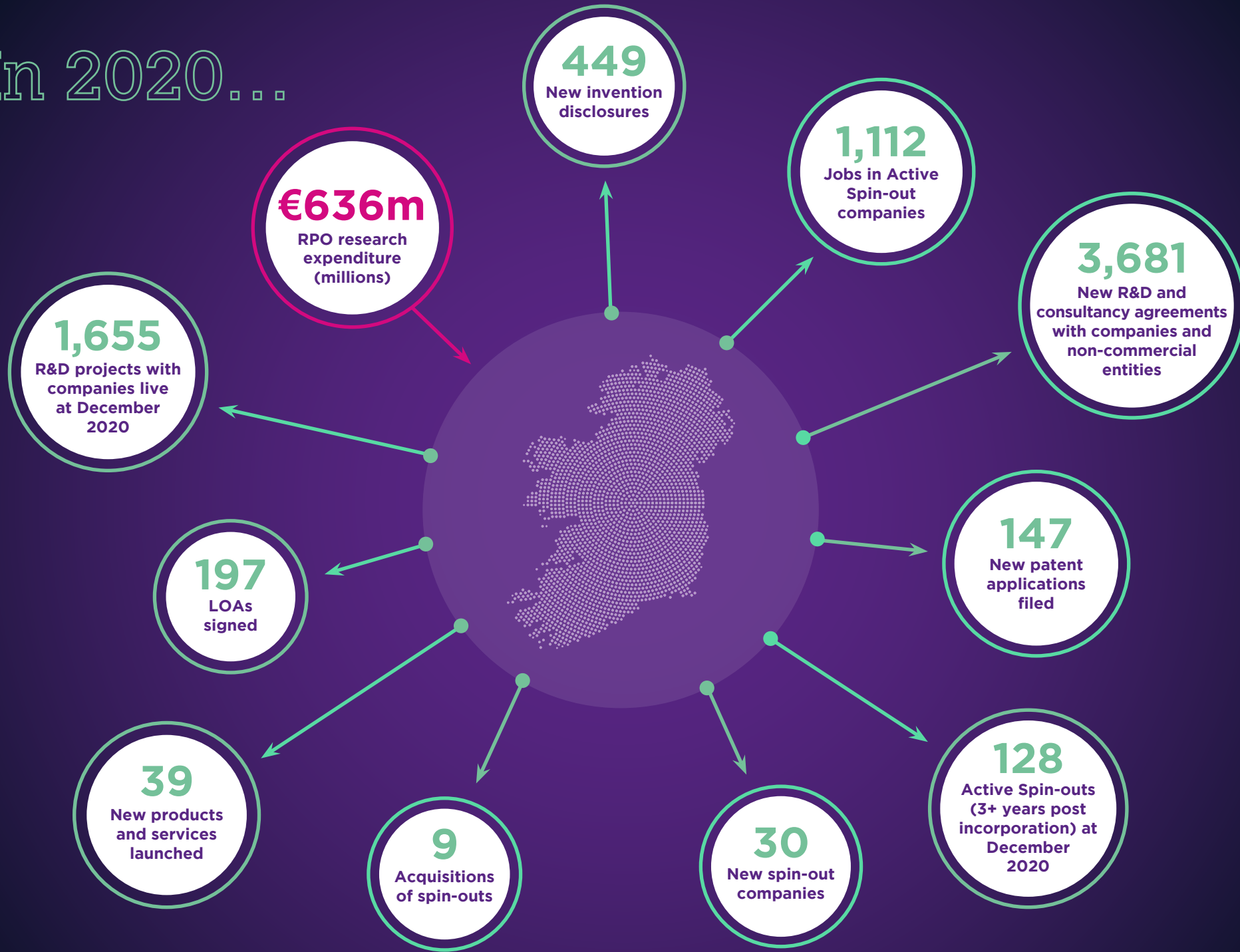
Annual Knowledge Transfer Survey

2020

Supported by



In 2020...





Introduction

The Annual Knowledge Transfer Survey (AKTS) is published by KTI in conjunction with the Higher Education Authority (HEA). It provides a review of business engagement and commercialisation activity (knowledge transfer, KT) in the State funded research sector. Data are submitted to KTI by each research Performing Organisation (RPO), co-ordinated by its Technology Transfer Office (TTO)/Innovation Office and include information from other departments such as the Research Office, the Finance Department and individual research departments.

More information about knowledge transfer, including case studies of business impacts, may be found on the KTI website at www.knowledgetransferireland.com.

KTI was established in 2014 by the Department of Enterprise, Trade & Employment as a national initiative to maximise access to publicly funded research by companies and entrepreneurs and to help facilitate the commercialisation of that research to deliver impact. To that end, KTI has developed national frameworks and guidelines that standardise the system and make the process of engagement more straightforward. A single portal to research, expertise and how to engage, KTI also offers a broad suite of supporting materials and resources. These include directories and guides, a set of template legal agreements, a tool to find funding to support research and innovation, a comprehensive event calendar and more. KTI's resources are available to companies of all sizes and in all sectors.

The HEA leads the development of the higher education and research system with the objective of creating a coherent system of diverse institutions with distinct missions, which is responsive to the social, cultural and economic development of Ireland and its people and supports the achievement of national objectives.

Unlocking Knowledge Transfer

KTI launched its monthly webinar series Unlocking Knowledge Transfer in June 2020. The series brings together panels of experts to discuss some of the key areas for consideration when engaging in collaborative research or seeking to commercialise research from the Irish third level. Topics covered have included harnessing intellectual property for competitive advantage and developing an IP strategy; business decision making in a collaborative research context; how to access world class R&D through Ireland's Technology Gateway network and more. Attendance numbers have grown steadily with over 1,197 from business, academia and government agencies having registered to attend one or more webinars to date.



Ireland's Innovation Offices

Each Higher Education Institute across the country and Teagasc (the Agriculture & Food Development Authority) has an Innovation Office, also known as a Technology Transfer Office. These offices are instrumental in supporting enterprise engagement and the commercialisation of research. Acting as a bridge for industry to access the opportunities available to them from state research and expertise, they provide practical guidance and support that would not otherwise be available. Innovation Offices are co-financed by The Technology Transfer Strengthening Initiative (TTSI), a funding programme that is managed by KTI on behalf of Enterprise Ireland.

Innovation Offices support the commercialisation of research through sourcing new opportunities, licensing, contract negotiation, assisting, company formation, IP management and advising on appropriate funding.

UNIVERSITIES

- 1 Dublin City University
- 2 Maynooth University
- 3 NUI Galway
- 4 RCSI University of Medicine and Health Sciences
- 5 Trinity College Dublin
- 6 University College Dublin
- 7 University College Cork
- 8 University of Limerick

TECHNOLOGICAL UNIVERSITIES

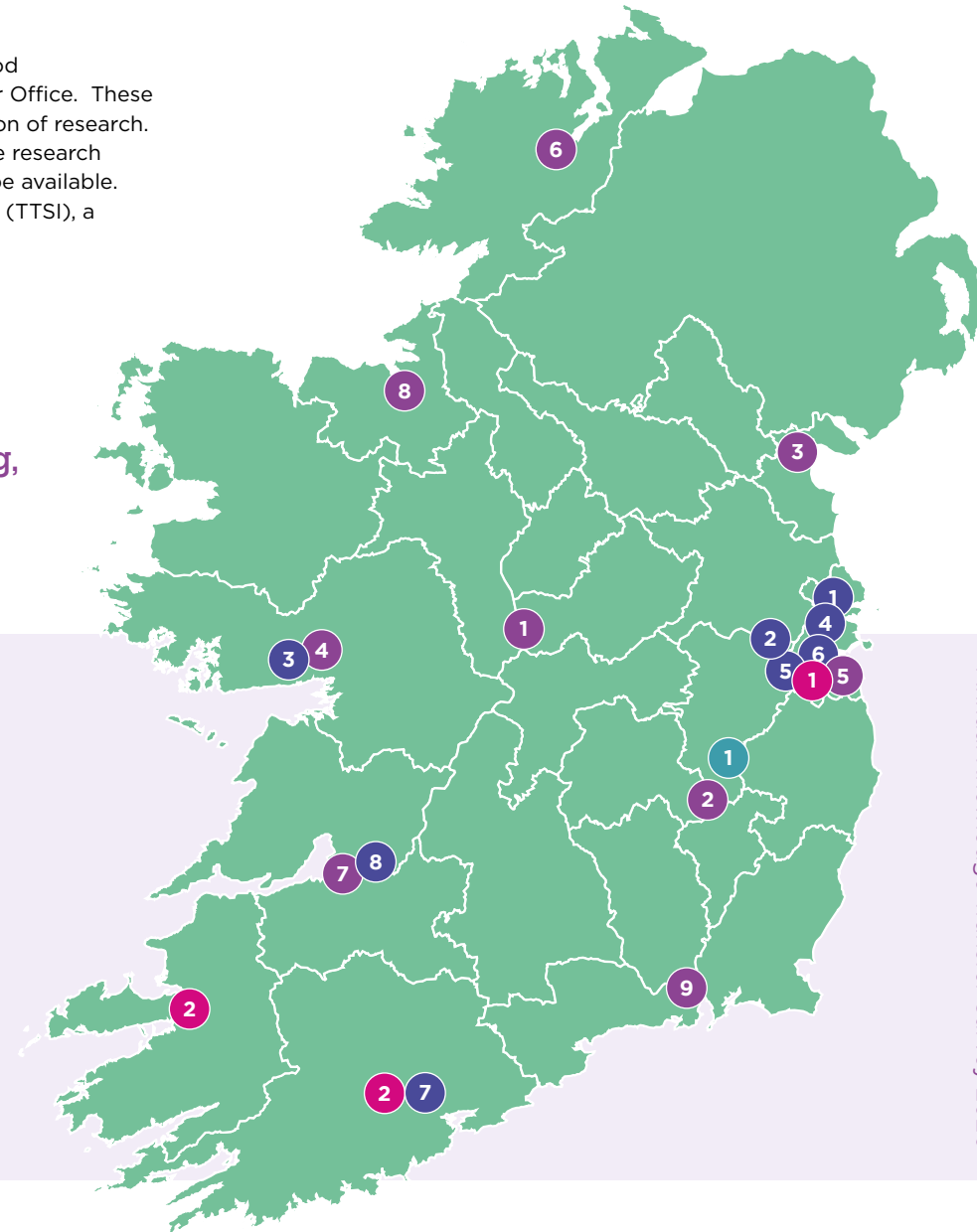
- 1 TU Dublin
- 2 Munster TU

INSTITUTES OF TECHNOLOGY

- 1 Athlone Institute of Technology
- 2 Institute of Technology Carlow
- 3 Dundalk Institute of Technology
- 4 Galway-Mayo Institute of Technology
- 5 IADT
- 6 Letterkenny Institute of Technology
- 7 Limerick Institute of Technology
- 8 Sligo Institute of Technology
- 9 Waterford Institute of Technology

STATE BODY

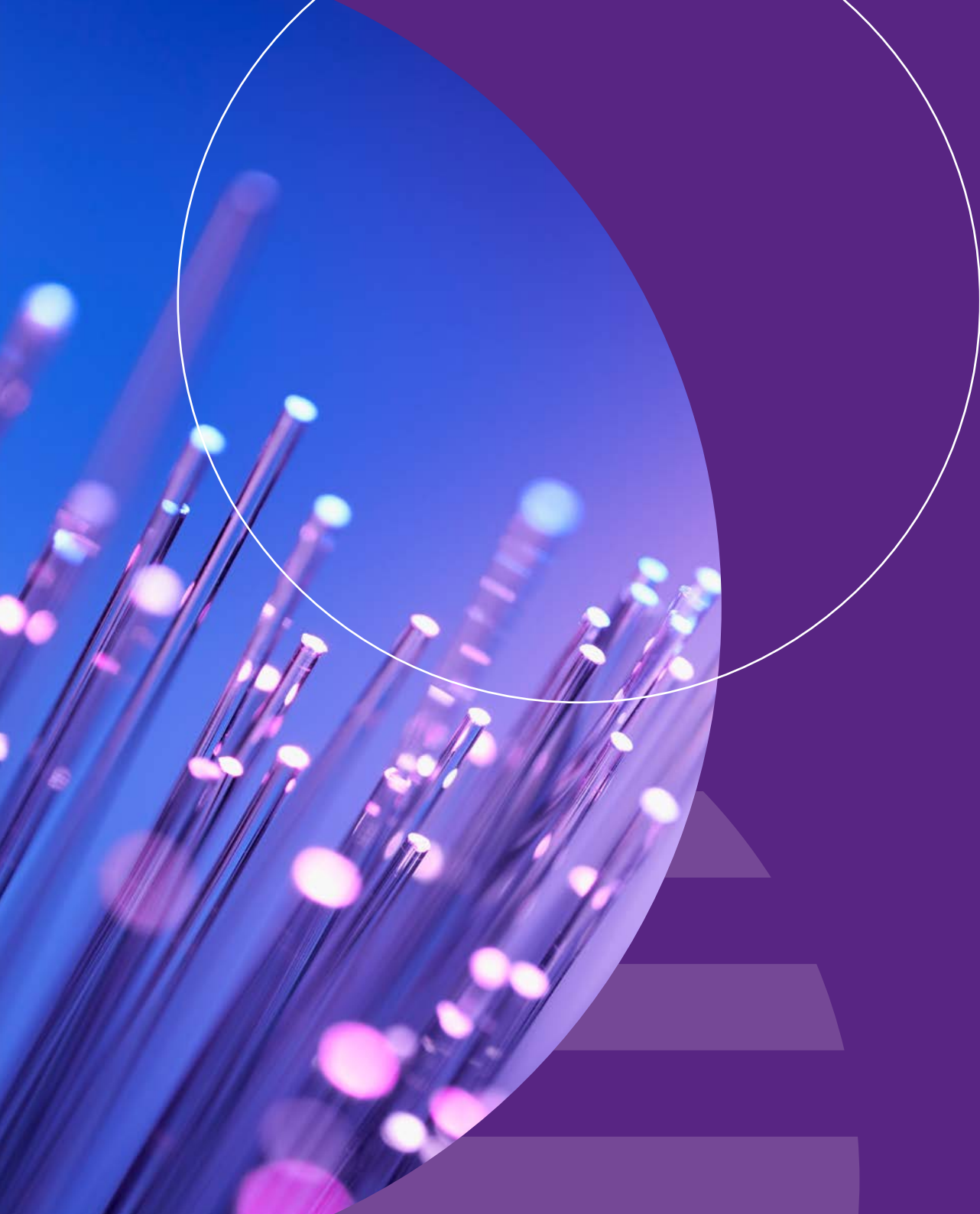
- 1 Teagasc - Agriculture and Food Development Authority



Directory of Research, Innovation Supports for Industry

Throughout 2020, KTI led a Steering Group on behalf of the Department of Enterprise, Trade and Employment to develop a new national Directory of Research, Development and Innovation Supports for Industry. A comprehensive guide to publicly funded research and development capability, the Directory serves as a reference point for those seeking to innovate through R&D including access to expertise, facilities and R&D funding. The Directory is available for download on the KTI website.





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Executive Summary



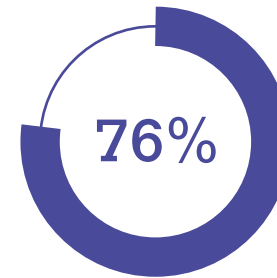
Alison Campbell, Director, KTI

Executive Summary

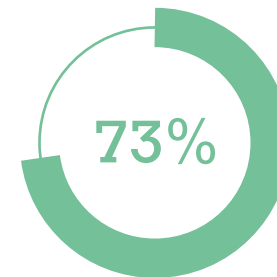
Submission to the AKTS is from Ireland's Higher Education Institutes (eight Universities, two Technological Universities¹, nine Institutes of Technology and two Colleges). Teagasc, the Marine Institute and Irish Manufacturing Research (IMR)² also contribute. A complete list of these research performing organisations (RPOs) is provided in Appendix 2.

Research projects between companies and RPOs are significant pillars of RD&I activity. In 2020 there were 1,386 new R&D agreements signed with companies, representing new projects involving 1,088 different companies. The total figure for new contracts entered into between companies and RPOs increases to 2,066 when access to expertise through consultancy agreements is included. As at 31 December 2020, there were 1,655 live R&D projects with companies taking place.

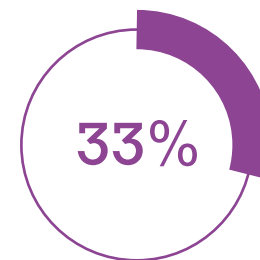
Non-commercial entities (NCE) also benefit from engaging with RPOs with 477 Collaborative Research Agreements and 1,138 consultancy agreements signed. This brings the total number of third party R&D and consultancy agreements signed in 2020 to 3,681.



R&D agreements with Irish Companies



R&D agreements with Irish SMEs



Repeat company engagements

¹ Munster Technological University (MTU) was formed in January 2021 by Cork Institute of Technology and the Institute of Technology Tralee. For ease of reference, data from these two IoTs are combined and reported as MTU.

² IMR appears in this study for the first time this year.

The majority of intellectual property licences, options and assignments to companies were for patents and software at 30% and 27% respectively.

2020 saw 39 new product and service launches on the market by companies, as a result of a prior licence from an RPO.

Looking at five-year trends, the average number of spin-out companies formed each year is 28. In 2020, 30 new spin-outs were created. Nine companies, whose genesis has been as a university spin-out, were acquired. The number of jobs in Active Spin-out companies that are three or more years post incorporation is conservatively estimated to be 1,112.

Revenue return to RPOs across knowledge transfer channels shows that the majority (89%) of is derived from research engagements and consultancy services. The percentage of RPO annual research expenditure derived through collaboration with industry (including 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) was 15% (€96 million)³. The percentage of research expenditure in RPOs that related to direct funding for collaborative research from industry was 8% (€48 million). The total gross revenue from Consultancy Services was €8.4 million of which 55% was for consultancy to industry and 45% for consultancy to non-commercial entities. Approx. half of this is accounted for by Teagasc. Licensing, spin-out dividends and equity sale combined account for 9% of total revenue.

Revenue from commercialisation activities with companies

85%



Collaborative research
(including Innovation Vouchers)

9%



Licence, equity and dividend

4%



Consultancy service agreements

2%



Use of facilities and equipment

³ Three institutions do not currently analyse data by industry-related contribution to research expenditure (NUI Galway, Dún Laoghaire Institute of Art, Design and Technology and the Marine Institute).



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Research Funding In Ireland

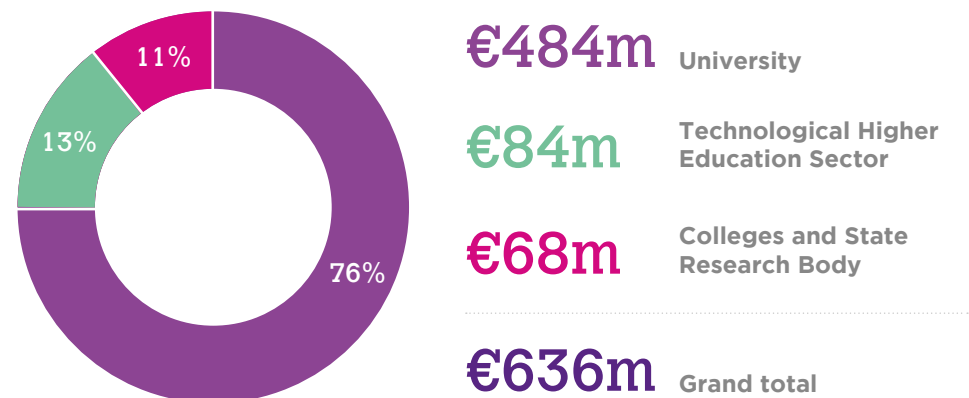
Research Funding in Ireland

The AKTS uses in-year data on actual research expenditure provided by individual RPO Finance Departments to enable a more direct comparison with data from other countries. Research expenditure does not include block grant and capital expenditure.

In 2020 this was €636 million. In 2019 this was €636 million, however this excluded IMR, suggesting a decrease in research expenditure in real terms of €9 million when looking at the same group of RPOs across the two years.

Ireland's Higher Education R&D (HERD) budget was €876.1 million for 2018-2019, an increase of 17% since the last HERD survey in 2016. HERD includes block grant and capital expenditure.

Research expenditure by type of RPO, 2020





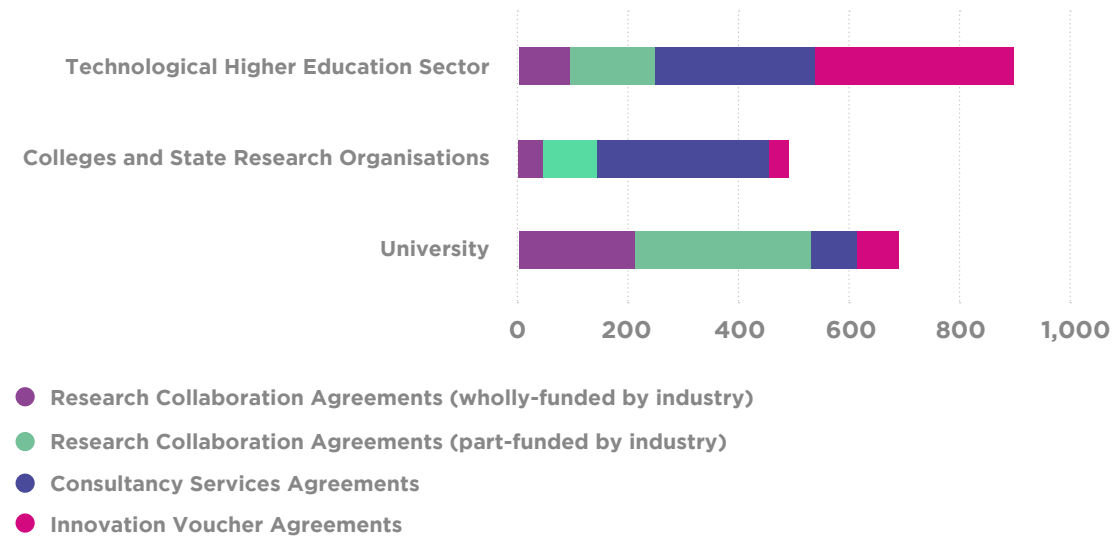
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Working with Companies and Non-Commercial Entities


R&D and Consultancy


One of the principle ways that business and non-commercial organisations benefit from working with RPOs is through access to research and expertise. This may be in the form of research projects with the RPO or access to consultancy services.

Number of R&D and consultancy services agreements with industry in 2020 by RPO type

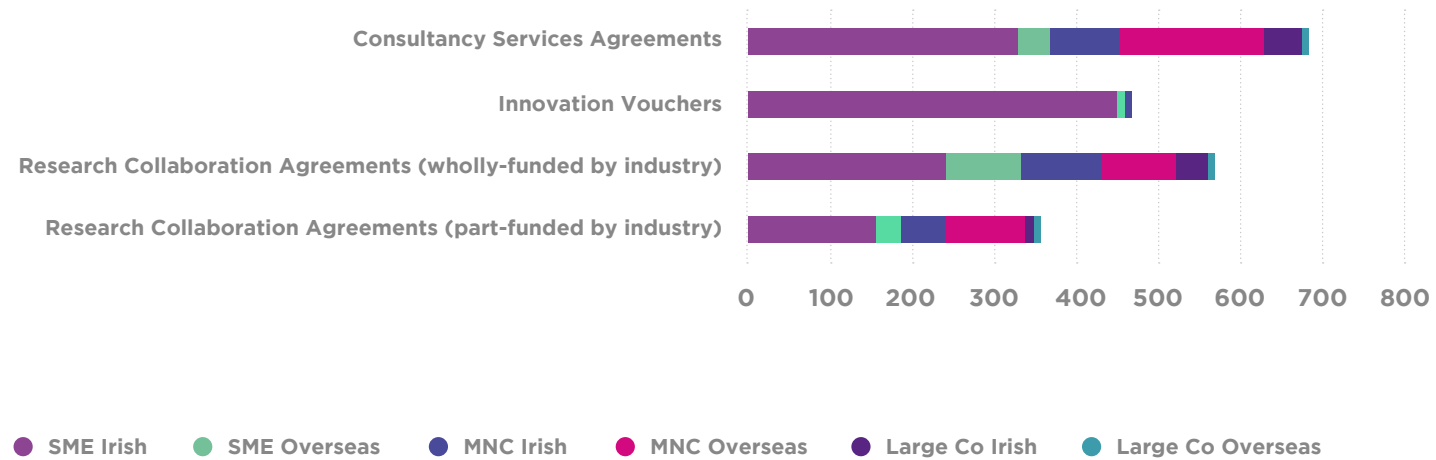



 **39%**


 **R&D and consultancy agreements signed with companies and non-commercial entities**



Locations of companies with whom the RPO has executed an R&D or consultancy services agreement in 2020, by number of agreements




1%
R&D agreements signed with Irish companies





10%



**R&D agreements
signed with companies**



17%



**Number of different
companies involved in
new R&D agreements**



20%



**Live R&D projects with
companies & non-commercial
entities at 31 December 2020**



11%



**Live R&D projects
with companies at
31 December 2020**



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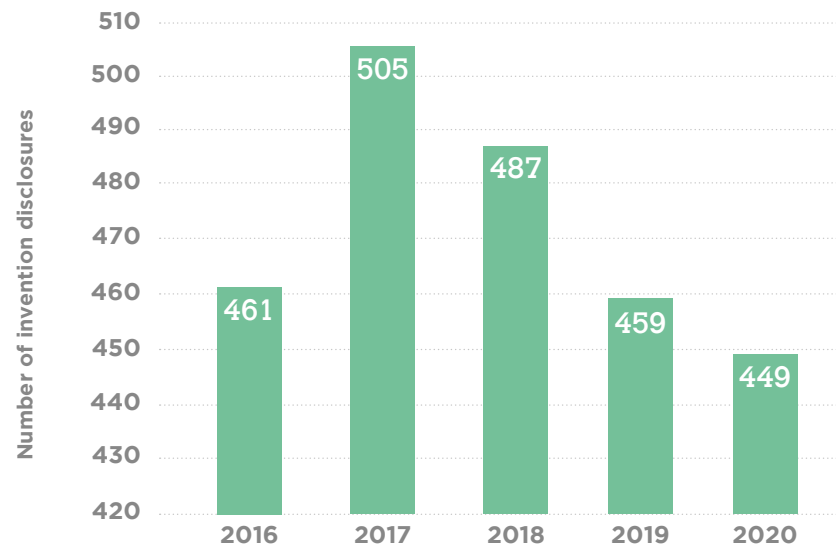
Inventions, Intellectual Property and Licensing

Invention Disclosures and Intellectual Property

The number of new inventions disclosed over the past five years was 2361, with an annual average of 472. The number of disclosures related to joint inventions from one or more RPO was 25% (114) in 2020 which was an increase of 10% on 2019. The trend in number of new patent filings is upwards, with an increase of 7% on the previous year. The UK IPO and EPO remain the filing offices of choice with 42% and 35% of initial priority filings respectively. Just one priority filing was made at the Irish IPO.

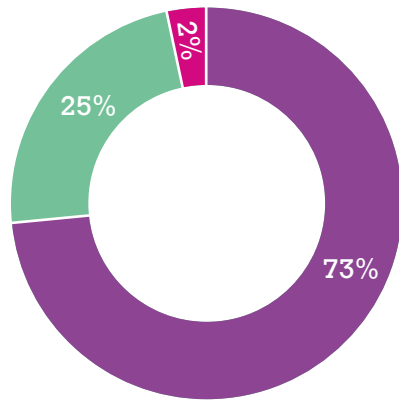
Of the 137 initial filings made in 2019, 86 (57%) were progressed to PCT applications in 2020. Of previous PCT applications, 52 entered the national phase (50, 2019). 93 patents, that were still held in the name of the RPO, were granted (75, 2019).

Invention disclosures, 2016 - 2020



34%
New products and services launched

Patent Applications Filed in 2020 by RPO type



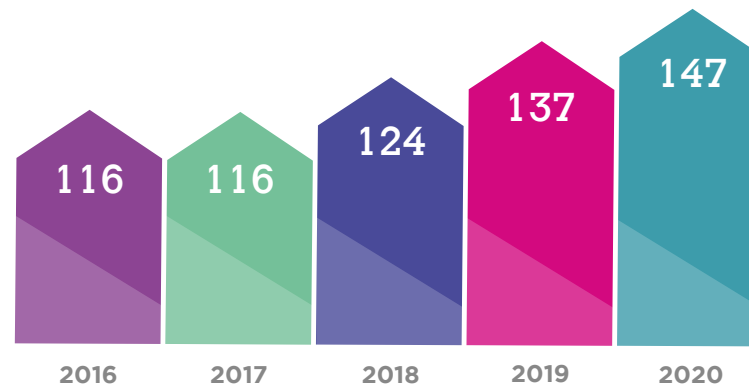
107 University

37 Technological Higher Education Sector

3 Colleges and State Research Body

147 Grand total

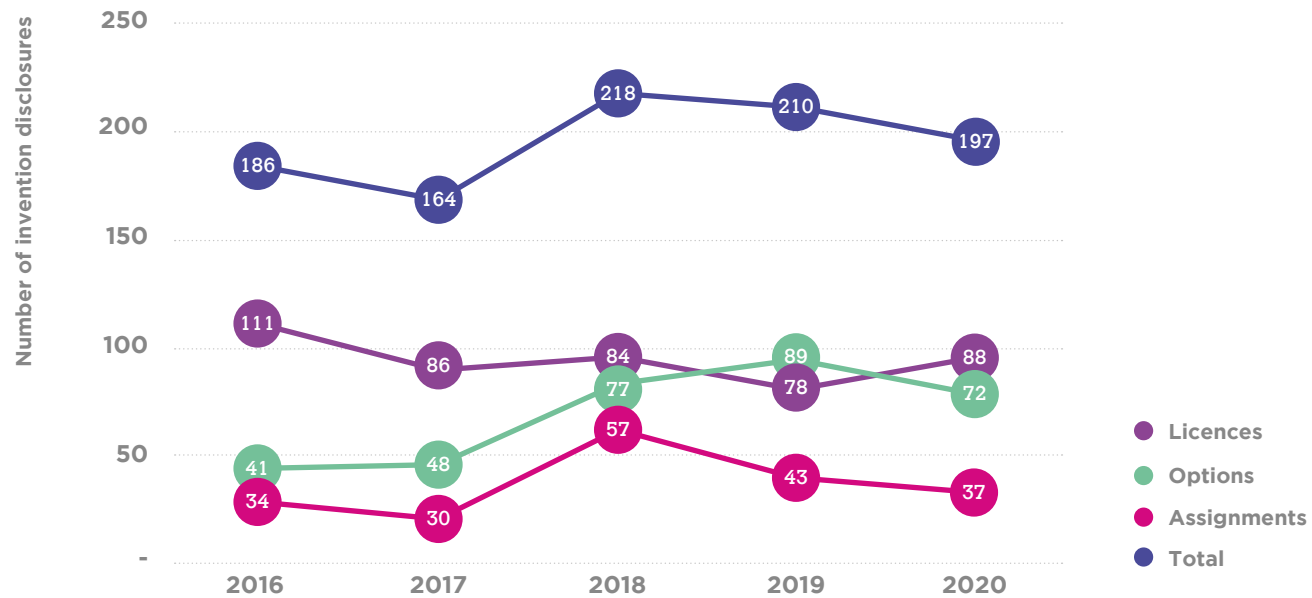
Number of priority patent applications, 2016-2020



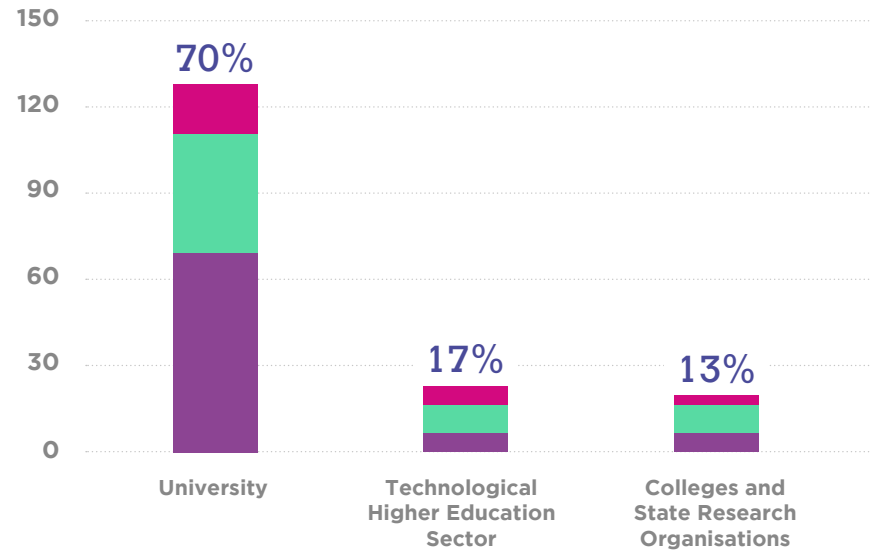
Licensing

Over the past five years, 975 licences, options and assignments have been issued. The total number of LOAs that were active at the end of 2020 was 844, a decrease of 14% on the previous year (980, 2019). Aggregate revenue from licensing was €2.3 million (€2.7 million, 2019). Of previous licences from the Irish RPOs to companies, 39 led to market launches of products or services in 2020 (26, 2019).

Total number of licences, options and assignments executed, 2016 - 2020



Licences, options and assignments executed in 2020 by RPO type



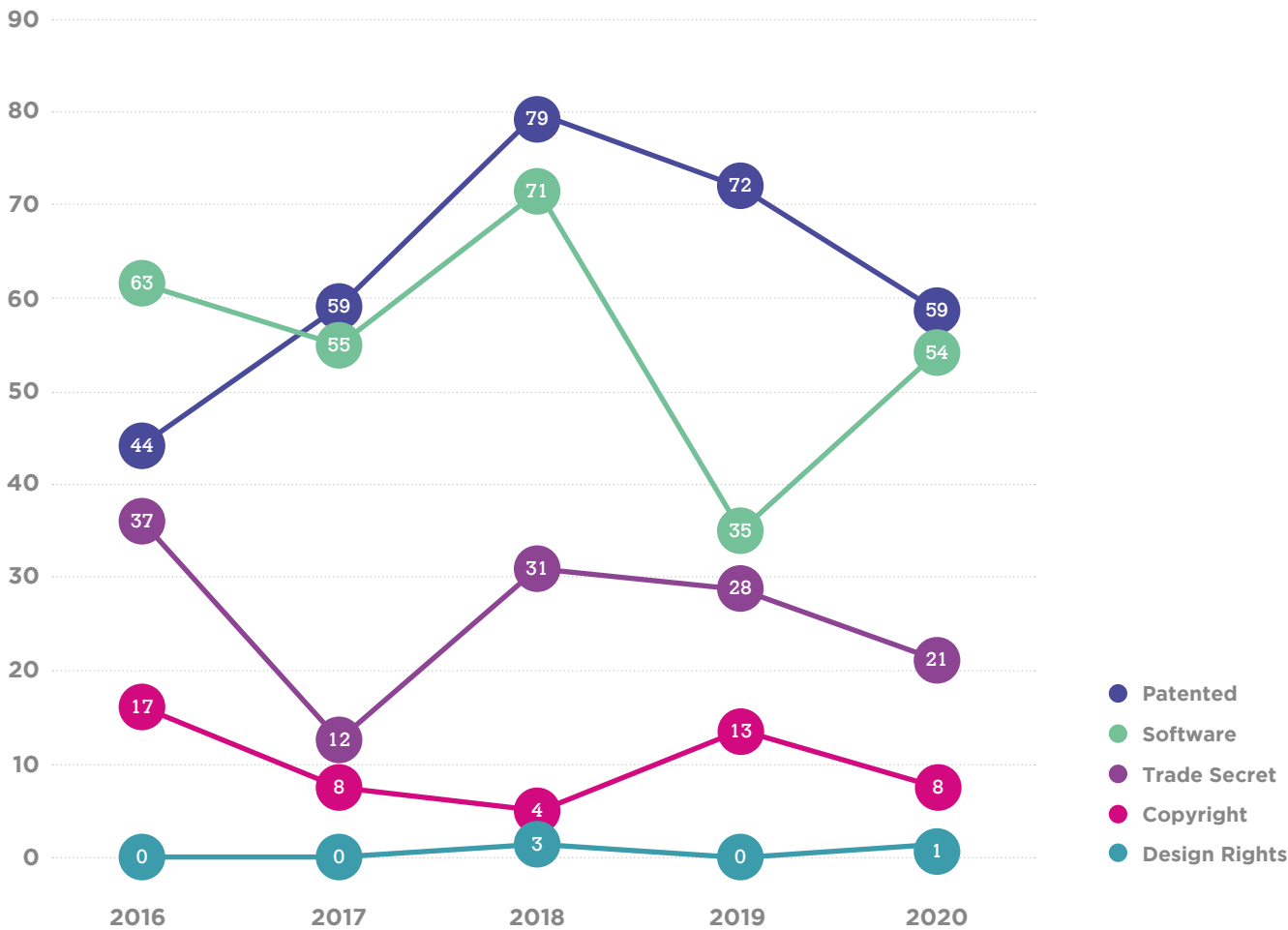
Breakdown of figures is shown in the table below.

Licences	68	10	10
Options	45	13	14
Assignments	25	10	2
Total	138	33	26

6%

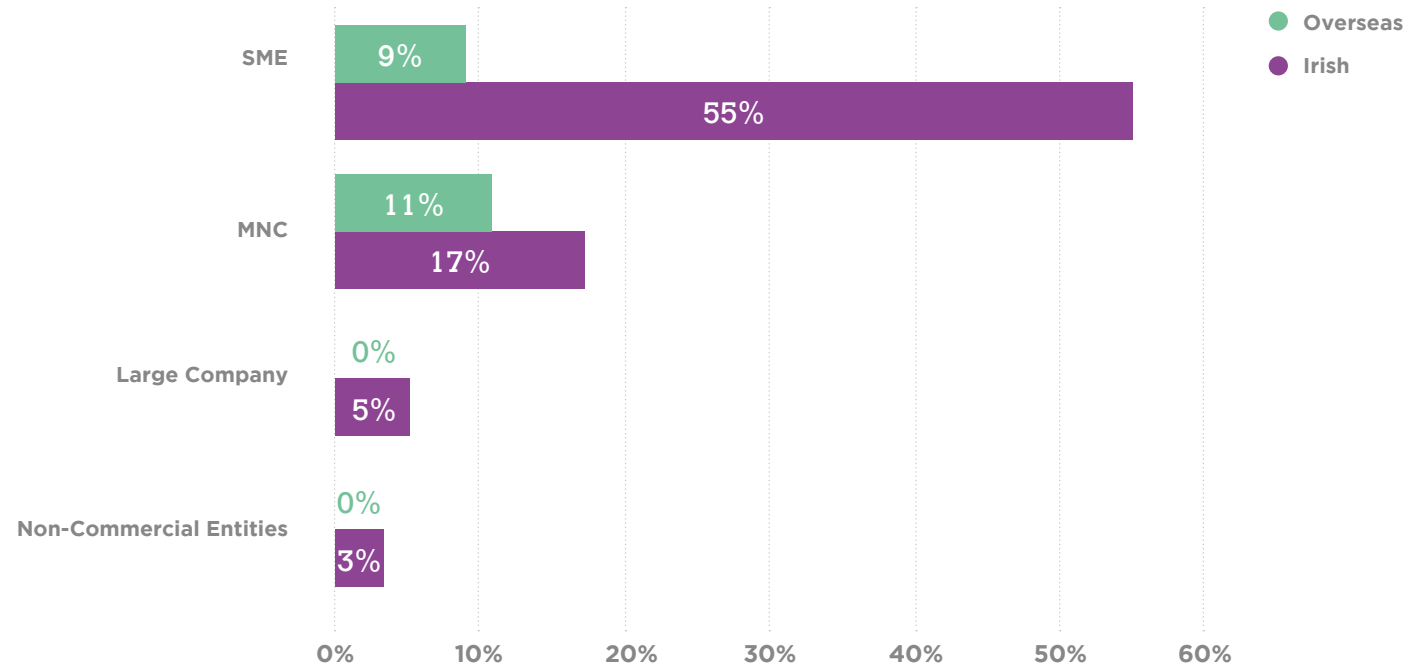
Licence, option & assignment agreements

Main types of intellectual property in LOAs, 2016 - 2020



Other, less prevalent, forms of IP transacted include research materials and know-how.

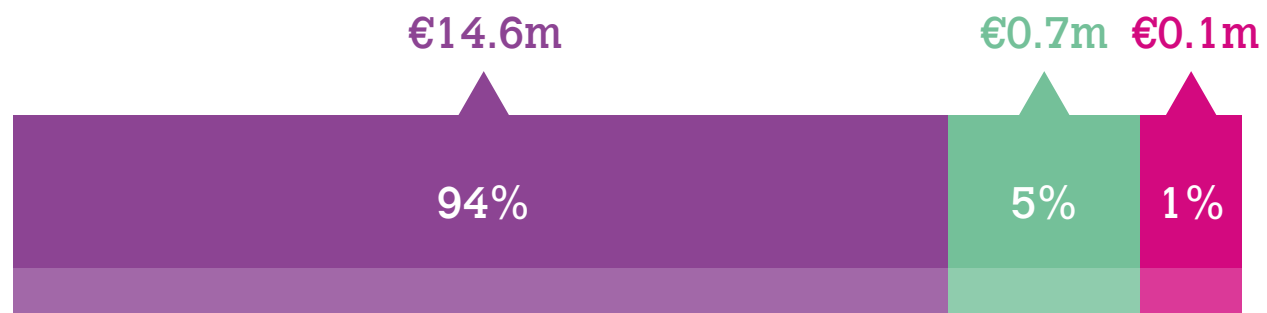
Licensee/assignee by company type 2020



Licence, option & assignment agreements with Irish companies



Licence revenue by RPO sector 2020



- Universities
- Colleges and State Research Body
- Technological Higher Education Sector



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New Company Creation

New Company Creation

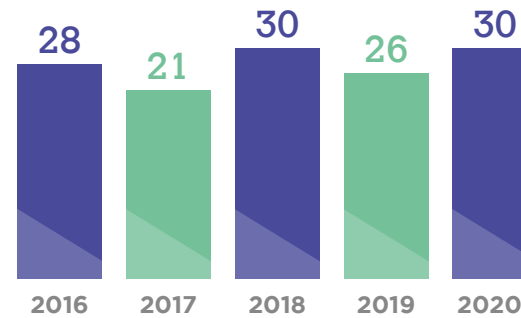
A total of 30 new companies were spun-out from 8 of the RPOs (26, 2019), of which 83% were created in the university sector. This brings the total of new spin-outs created in the past five years to 140. Nine spin-outs, that originated in five universities, were acquired. The total revenue realised from the sale of equity was €7.8 million.

At the end of 2020, the aggregate number of new spin-out companies across the RPO sector (where the RPO holds equity or share options) was 201 (191, 2019) and there were 128 Active Spin-outs (at least three years post-incorporation).

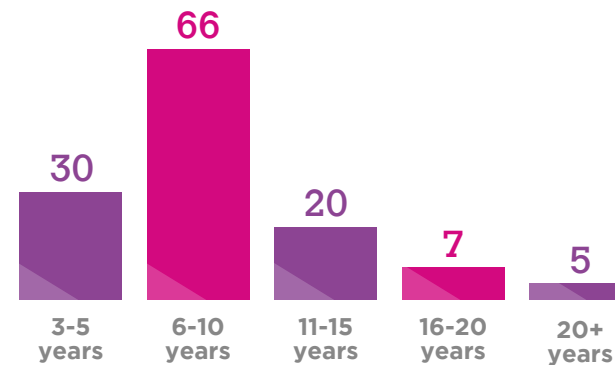
It is estimated by the TTOs that the Active Spin-outs employ about 1,112 people. These estimates do not take into account the number of people employed over the lifetime of the spin-outs and do not include spin-out companies that are less than three years old or that have gone on to be acquired.

There were 32 start-ups reported. However, as start-ups are created independently from the RPOs, the numbers provided are estimated and are under-reported in this survey.

Spin-outs established, 2016 - 2020



Active Spin-outs - # of Years Incorporated





8

Success Stories



CONSULTANCY

Boston Scientific (University of Limerick)

Boston Scientific is a world leading provider of medical devices. In 2020, the company engaged UL on a piece of consultancy to research gas barrier coatings used in the production of medical instruments. The research resulted in a new technology being developed which has directly led to Boston Scientific Clonmel establishing a nanotechnology coating lab on site with a view to commercialising the technology on multiple product platforms. The consultancy has also evolved into an Innovation Partnership and the project positioned UL and Boston Scientific to collaboration on a submission to Horizon Europe.

• ENTERPRISE IRELAND - INNOVATION PARTNERSHIP PROGRAMME



This has been thoroughly ground-breaking work and was a key input into product development strategy.

Boston Scientific Manager Urology and Pelvic Health R&D - Sean Cooney



CONSULTANCY

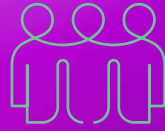
8 West (University College Cork)

8 West is a software development and business consultancy based in Cork. The company sought to re-purpose existing technology to build a Covid-19 early warning system for front-line workers. To do this the company worked with a team that included Sony, Cambridge Wireless, researchers from UCC's ASSERT Centre, medical researchers and emergency medical clinicians. The research gave rise to a quarantine management platform that allows remote identification of healthcare staff who may be developing a temperature that may be an early sign of Covid-19 and therefore should not present for work. 8 West is currently working on a European roll out of the technology and looking at global adoption by Huawei Technologies Co Ltd which will bring the technology into the consumer wearables sector.

“

This extremely important and urgent project was a high-profile test of the agility and responsiveness of the newly established UCC Consultancy team. By delivering comprehensively, the team has made a significant contribution to the success of the relationship with 8 West and to the growing positive reputation of UCC Innovation.

CEO of 8 West - John Murphy



COLLABORATION

EJ

(University of Limerick)

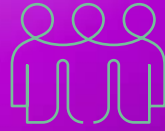
EJ is the global leader in the design and manufacture of infrastructure access solutions which include covers and frames for water, sewer, drainage and telecommunications distributed to over 140 countries. The company was a founding member of iComp, the Irish Composites Centres at UL and have been active as board members and collaborators. In 2012, EJ began a research project under an EI Innovation Partnership with iComp to develop an access cover made from composite materials that could replace existing covers made from cast iron in certain applications. The project repurposed existing aerospace technology to deliver a full development cycle from concept to production and included market analysis, selection of polymer and fibre, computer-aided design and simulation as well as manufacture and testing. The project has resulted in a novel production process and new lightweight, superior product that performs better, has an extended product lifetime and is more cost efficient to transport. EJ continues close relations with UL and is in discussion with them on future opportunities.

- ENTERPRISE IRELAND INNOVATION PARTNERSHIP



Our projects with iComp have provided us with access to knowledge and expertise which has helped EJ in Ireland become the centre for composite product development and supply to our European customer base.

EJ Composite Product Manager - Dr Vincent Cooper



COLLABORATION

PMS Pavement Management Services Ltd (Maynooth University)

PMS Pavement Management Services is a civil engineering consultancy firm specialising in testing, evaluation and management of roads, airports and ports. With a history of collaborating with Maynooth University, the company engaged on a LERO-led SFI funding spoke programme on driverless autonomous vehicles in the development of a cloud-based AI platform for classification of road surface images to identify possible surface defects. The project has delivered initial technologies, techniques and methodologies that have positioned the company for new product development. PMS Pavement Management Solutions is building on this research having acquired additional funding for a follow on project to develop the initial findings and build a longer term strategic partnership with the university.

• SFI SPOKES PROGRAMME



The strong relationship with Prof McCarthy and his team of expert researchers at MU keeps PMS coming back, a partnership built on an ability to collaborate effectively on focused, applied solutions to challenging problems. The net outcome of this partnership is that PMS now plans to introduce AI / Machine Learning into several other road network data processing and give the company an extra edge when competitive for contracts internationally.

MD at PMS Pavement Management Services - Dr Kieran Feighan



COLLABORATION

Inferneco Ltd (Institute of Technology Carlow)

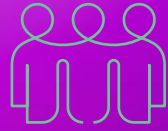
Inferneco is an innovative Irish company that identified a new means of sanitising glass neck drinking bottles within the hospitality industry. These bottles are usually visually clean but not sanitised and the only way to completely sanitise bottles is by removing the cap fully. Inferneco identified a novel solution to sanitising the bottles using UV light and worked with the Enterprise Ireland Technology Gateway, Design+ based at IT Carlow to explore how this might be brought to market. The team examined other possible solutions to sanitising bottles and developed a clear research roadmap to design, test and validate the new concept that would be able to sanitise a bottle within two seconds and include a safe sealing system so as not to expose the user to UV light. The project worked across a number of other Technology Gateways with the prototype being sent to CAPPA Gateway in MTU - Cork Campus and the TSSG Gateway at Waterford IT to develop functionality of the device. The company licensed the technology in 2020 and now has 8 prototypes that are being used to approach multiple international breweries in order to raise funding to bring the research to the next phase which is currently underway.

- ENTERPRISE IRELAND INNOVATION PARTNERSHIP PROGRAMME

“

The research undertaken by IT Carlow went above and beyond the original plan and we are truly grateful for this. The team were great to deal with and did everything to make this project a success for us all. We will be working with IT Carlow again on this journey as we seek to get every pub on the planet to embrace PureNeck. We would strongly recommend IT Carlow and the Innovation Partnership to other companies.

MD at Inferneco - Emmett Hedigan



COLLABORATION

Grian Water Ltd (Letterkenny Institute of Technology)

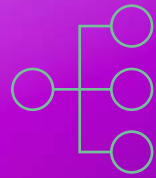
Grian Water Ltd has developed MyGug, a micro-scale anaerobic digester for the treatment of water. It operates by turning organic matter into renewable fuel, including cooked and uncooked food waste as well as all types of liquid and semi liquid waste. There are two by-products from MyGug - biogas for cooking and liquid fertiliser. MyGug can be integrated into domestic / small business settings and operates in all weather conditions. In 2020, the company approached WiSAR at Letterkenny IT to develop a new prototype that would include a more cost-effective microcontroller that would include wireless technology and monitor the product's performance. A new prototype was developed and will be installed in domestic applications for longer term testing. There are plans to apply for additional funding for further refinement of the product and development of a compatible mobile phone app.

- ENTERPRISE IRELAND INNOVATION VOUCHER



Our collaboration with the WiSAR Technology Gateway enabled us to refine and advance our MyGug prototype through a specialised research centre, resulting in a more cost-efficient product with connectivity feature thus increasing our value proposition and competitiveness.

CTO at Grian Water Ltd - Kieran Coffey



SPIN-OUT

IlluminAI (University College Dublin)

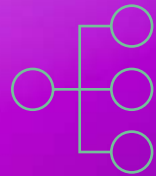
IlluminAI designs and manufactures human-centric lighting technologies that promote cognitive capacity and wellness by assisting the natural circadian rhythm. Active since 2017, the company was founded in August 2020 by two architects based on technology arising from their research at UCD. IlluminAI recently obtained CSF funding from Enterprise Ireland and is about to launch a crowd funding initiative to raise finance for the manufacture of its devices – currently the prototype is a desk based device for the individual consumer with plans to develop a wall mounted version for use across the hospitality sector, medical centres and hospitals and other workplaces.

- ENTERPRISE IRELAND – COMPETITIVE START FUND

“

The TTO at Nova guided us throughout the process [and] helped with drafting the commercialisation fund, managing our IP and the licence and shareholder agreement for the company. The Bootcamp and VentureLaunch programmes [run by the TTO] helped us to focus on our market and business strategy.

Co-Founder IlluminAI - Mortenza Matkan



SPIN-OUT

OneProjects

(Trinity College Dublin & NUI Galway)

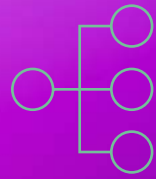
OneProjects Design & Innovation Ltd was established in 2017 as a joint spin-out company from NUIG and TCD. The company, with its HQ in Dublin and a second office in Munich, has developed a connected platform technology called Verafeye that is set to revolutionise the treatment of AFib and cardiac arrhythmias. Verafeye is a sensor-based technology that gathers unprecedented data from the heart in real-time. In June 2020, OneProjects closed a Series A funding round of €11 million co-led by Life Sciences Partners and the Atlantic Bridge University Fund with additional participation from Enterprise Ireland and several medtech entrepreneurs and investors.

- BIOINNOVATE
- EIT HEALTH
- ENTERPRISE IRELAND - BIOINNOVATE PROGRAMME
- ENTERPRISE IRELAND - COMMERCIALISATION FUND
- EUROPEAN INNOVATION COUNCIL

“

Trinity and NUIG provided access to excellent technical infrastructure, expertise and IP management. Start-up Development Manager, Licensing Manager and TTO Case Manager supported the campus company formation process and in particular were very involved in negotiating complex IP licensing arrangements.

CEO & Co-Founder - Fionn Lahart



SPIN-OUT

Ocumetra Ltd

(TU Dublin)

Ocumetra Ltd delivers personalised myopia care solutions and vital decision support to practitioners through its pioneering monitoring tool, Refractogram, that can distinguish between normal and abnormal (myopic) eye growth. The company spun out on technology that was developed at the Centre for Eye Research Ireland (CERI) based at TU Dublin. A prototype of the Refractogram monitoring tool has already been developed and the company achieved Enterprise Ireland HPSU status at the end of 2020 – just 6 months after foundation – and leading multinational healthcare companies are now contracting Ocumetra Ltd to develop customised products to suit their business needs.

- 100% COMPANY FUNDED

“

The link with TU Dublin and CERI is vital for the success of Ocumetra. The technology and profile that comes from the link has helped with investment and customer acquisition. [The TTO] helped throughout the spin-out process and took early action in filing crucial patent on which the technology is founded.

Co-Founder of Ocumetra - James Loughman



LICENCE

Alcon

(Munster TU – Cork Campus)

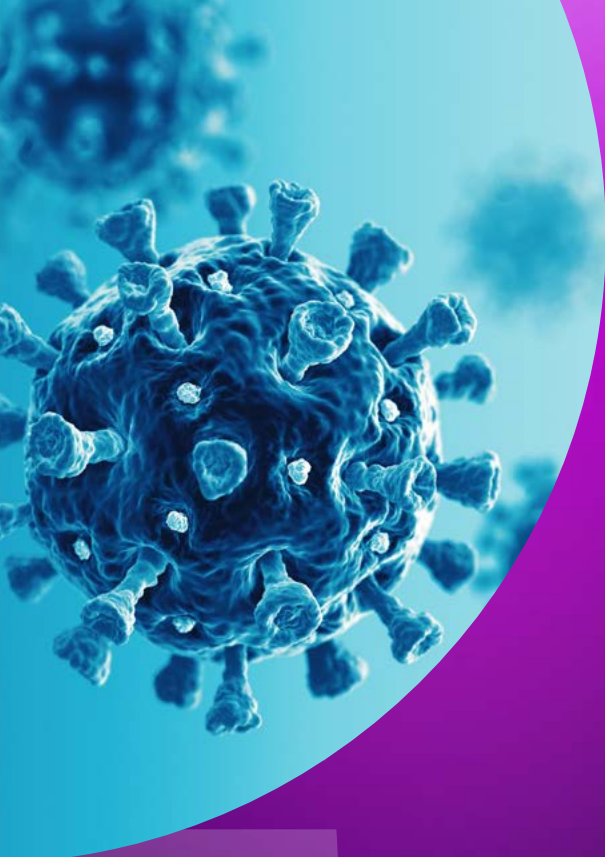
Alcon is the world's largest ophthalmic company specialising in innovative life-changing vision and eye care. The company sought to improve the manufacturing line process for an instrument called the IOL nozzle injector and worked with the Enterprise Ireland Technology Gateway CAPPa, based at MTU, to develop a new, early-automated software system that can predict the quality of products and remove reject injectors. The underpinning software was licensed to Alcon and meant significant improvements in manufacture and production line-testing for the company. It also provided valuable new information on company products and manufacturing process. This was the first time Alcon developed a process improvement outside of the US and Alcon Ireland is now seeking approval to deploy a second system at the Cork plant for use on another production line. Alcon and MTU are currently reviewing options for a follow-on process improvement project.

- ENTERPRISE IRELAND FEASIBILITY
- ENTERPRISE IRELAND INNOVATION PARTNERSHIP PROGRAMME



All aspects of the project went well with great collaboration and communication between the teams... The project management was excellent, negotiation of the licence was very smooth and was concluded in good time. The technology will make a huge difference [and] has further cemented the already strong relationship between Alcon and CAPPa, which will no doubt lead to more collaboration in the future.

MS&T Tech Transfer Lead / Chief Scientific Officer - Barry Walsh



LICENCE

Aquila Bioscience (NUI Galway)

Aquila Bioscience spun out from NUIG in 2012 and specialises in an innovative Pathogen Capturing Technology (PCT) that safely removes harmful pathogens, including Covid-19, from skin and other surfaces. Following research on detection and decontamination funded by the EU, Aquila Bioscience licensed know-how from NUIG in 2020 that positioned the company to develop a range of products based on its technology. As a result, in 2020 Aquila also launched its first product - Anti Bioagent Wipes - which are in use across frontline services in Ireland including the Irish Defence Force, the HSE and An Post and serve as a safe and effective decontamination wipe for first responders, healthcare workers and postal workers to reduce the spread of Covid-19. Anti Bioagent wipes are registered with US FDA as a Class I medical device. The company has launched its second pilot product, ProShield Mask Spray and continues to work with NUIG.

- HORIZON 2020
- EIC ACCELERATOR
- European Defence Agency

“

NUI Galway's licence has enabled Aquila Bioscience to advance ground-breaking technology and the TTO at NUI Galway has provided excellent support through an expert approach to licensing, professional mentoring and by providing practical support and guidance which is essential for start-ups to succeed.

Founder Aquila Bioscience - Prof Lokesh Joshi



LICENCE

Irish Cattle Breeding Federation Society Ltd (Teagasc)

The Irish Cattle Breeding Federation (ICBF) provides a range of cattle breeding services to farmers, the cattle breeding industry and dairy and meat processors. In 2020, ICBF licensed technology that had been co-developed through research carried out between ICBF and Teagasc within the Enterprise Ireland-funded technology centre, Meat Technology Ireland (MTI). The technology licensed has allowed ICBF to develop and launch the Beef Eating Quality Index – the world’s first national multi-breed genomic evaluation for sensory-based meat-eating quality. Use of this Index means that meat-eating quality of the Irish national herd will systematically improve through genetic improvement without sacrificing breeding traits, ensuring consumers of Irish beef around the world can expect the very best and safeguarding the best export outlets for Irish beef. ICBF continues to collaborate on research with partners at Teagasc and Meat Technology Ireland.



The launch of this Beef Eating Quality Index is a significant occasion realised through strong collaboration between the meat industry, Enterprise Ireland, the Irish Cattle Breeding Federation and Teagasc in the delivery of the world’s first national multi-breed genomic evaluation for sensory-based meat-eating quality.

ICBF Technical Director - Andrew Cromie



Appendices

APPENDIX 1. SUMMARY DATA BY RPO

Selected data relating to the returns made by the 24 RPOs are presented in tables A1-C2.

A1: Research Expenditure, research agreements and consultancy with Industry 2020 – University & Colleges and State Research Organisations

	Research expenditures (€) (less block grant) in the reference year	Research Expenditure derived directly from 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	€32,772,746	€2,969,211	41	13	2	56
Maynooth University	€37,881,424	€382,602	8	5	8	21
NUI Galway	€57,030,516	€1,710,915	46	4	4	54
Royal College of Surgeons in Ireland	€21,644,502	€1,969,650	28	0	3	31
Trinity College Dublin	€100,962,929	€5,149,109	87	23	21	131
University College Cork	€100,136,418	€10,213,915	76	14	20	110
University College Dublin	€95,990,000	€6,536,919	185	11	20	216
University of Limerick	€37,595,123	€4,549,010	60	3	3	66
Total	€484,013,658	€33,481,331	531	73	81	685
College & State Research Organisations						
Irish Manufacturing Research (IMR)	€9,063,728	€543,824	92	1	10	103
National College of Art and Design	€146,772	€51,370	14	13	15	42
National College of Ireland	€221,000	€24,310	1	0	0	1
Marine Institute	€8,600,000	€0	0	0	0	0
Teagasc	€50,100,000	€8,016,000	36	21	285	342
Total	€68,131,500	€8,635,504	143	35	310	488

A2: Research Expenditure, research agreements and consultancy with Industry 2020 – Technological Higher Education sector

	Research expenditures (€) (less block grant) in the reference year	Research Expenditure derived directly from 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
Technological University						
TU Dublin	€17,990,137	€701,615	16	15	34	65
Munster TU	€22,373,425	€2,309,382	26	85	75	186
Total	€40,363,562	€3,010,997	42	100	109	251
Institutes of Technology						
Athlone Institute of Technology	€5,324,500	€585,695	11	38	109	158
Dundalk Institute of Technology	€4,570,000	€457,000	29	14	0	43
Galway-Mayo Institute of Technology	€3,502,358	€245,165	7	8	0	15
Dun Laoghaire IADT	€446,984	€0	0	13	0	13
Institute of Technology Carlow	€3,397,855	€186,882	3	77	17	97
Institute of Technology Sligo	€5,009,000	€150,270	100	17	0	117
Letterkenny Institute of Technology	€1,379,930	€27,599	16	14	17	47
Limerick Institute of Technology	€3,064,831	€643,615	25	17	0	42
Waterford Institute of Technology	€16,456,523	€822,826	14	59	37	110
Total	€43,151,981	€3,119,051	205	257	180	642
Grand Total A1 & A2	€635,660,701	€48,246,884	921	465	680	2,066

A3: Research Expenditure, research agreements and consultancy with non-commercial entities 2020: University, Colleges & 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	€32,772,746	€3,883,570	2	2	4
Maynooth University	€37,881,424	€587,162	2	24	26
NUI Galway	€57,030,516	€285,153	7	1	8
Royal College of Surgeons in Ireland	€21,644,502	€3,917,655	2	0	2
Trinity College Dublin	€100,962,929	€4,745,258	86	12	98
University College Cork	€100,136,418	€13,618,553	56	5	61
University College Dublin	€95,990,000	€4,578,723	120	19	139
University of Limerick	€37,595,123	€1,428,615	15	2	17
Total	€484,013,658	€33,044,688	290	65	355
College & State Research Organisations					
Irish Manufacturing Research (IMR)	€9,063,728	€0	2	0	2
National College of Art and Design	€146,772	€11,742	2	11	13
National College of Ireland	€221,000	€0	0	0	0
Marine Institute	€8,600,000	€0	0	0	0
Teagasc	€50,100,000	€4,008,000	1	1011	1012
Total	€68,131,500	€4,019,742	5	1,022	1,027

A4: Research Expenditure, research agreements and consultancy with non-commercial entities 2020: Technological University & 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
Technological University					
TU Dublin	€17,990,137	€0	2	1	3
Munster TU	€22,373,425	€0	0	20	20
Total	€40,363,562	€0	2	21	23
Institutes of Technology					
Athlone Institute of Technology	€5,324,500	€0	6	8	14
Dundalk Institute of Technology	€4,570,000	€0	0	0	0
Galway-Mayo Institute of Technology	€3,502,358	€0	9	14	23
Dun Laoghaire IADT	€446,984	€0	2	0	2
Institute of Technology Carlow	€3,397,855	€220,861	3	1	4
Institute of Technology Sligo	€5,009,000	€150,270	142	0	142
Letterkenny Institute of Technology	€1,379,930	€0	0	0	0
Limerick Institute of Technology	€3,064,831	€0	16	4	20
Waterford Institute of Technology	€16,456,523	€164,565	2	3	5
Total	€43,151,981	€535,696	180	30	210
Grand Total A3 & A4	€635,660,701	€37,600,126	477	1,138	1,615

B1: IP and IP Transactions 2020: University, Colleges & 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 applications filed 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
University							
Dublin City University	31	6	3	9	53	23	1
Maynooth University	7	4	1	7	24	4	0
NUI Galway	32	12	9	6	118	9	3
Royal College of Surgeons in Ireland	14	4	4	0	26	10	2
Trinity College Dublin	66	30	10	20	145	29	8
University College Cork	76	17	16	17	94	30	9
University College Dublin	78	21	11	11	126	27	3
University of Limerick	22	13	10	14	66	6	1
Total	326	107	64	84	652	138	27
College & State Research Organisations							
Irish Manufacturing Research (IMR)	0	0	0	0	0	0	0
National College of Art and Design	6	1	1	0	0	0	0
National College of Ireland	3	0	0	0	0	2	0
Marine Institute	0	0	0	0	0	0	0
Teagasc	24	2	5	1	24	24	6
Total	33	3	6	1	24	26	6

B2: IP and IP Transactions 2020: Technological University & Institutes of Technology

	Total number of qualified invention/software disclosures received during the year (sole and joint)	Total number of new patent applications filed during the year	Previously filed priority patent applications 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
Technological University							
TU Dublin	45	17	6	5	44	14	1
Munster TU	16	3	3	3	13	7	3
Total	61	20	9	8	57	21	4
Institutes of Technology							
Athlone Institute of Technology	5	1	0	0	0	4	0
Dundalk Institute of Technology	9	0	0	0	1	3	0
Galway-Mayo Institute of Technology	0	1	0	0	0	0	1
Dun Laoghaire IADT	1	0	0	0	0	1	0
Institute of Technology Carlow	4	1	1	0	1	2	0
Institute of Technology Sligo	1	11	2	0	8	0	1
Letterkenny Institute of Technology	0	0	0	0	0	0	0
Limerick Institute of Technology	2	1	0	0	0	0	0
Waterford Institute of Technology	7	2	4	0	17	2	0
Total	29	17	7	0	27	12	2
Grand Total B1 & B2	449	147	86	93	760	197	39

C1: Spin-out companies, incubation and use of facilities 2020: University, Colleges & 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 the year	Number of contracts with companies for use of facilities and equipment at the RPO
University						
Dublin City University	3	10	9	2	33	16
Maynooth University	0	0	7	0	26	10
NUI Galway	4	0	14	0	31	0
Royal College of Surgeons in Ireland	0	0	1	0	0	0
Trinity College Dublin	5	8	28	2	44	6
University College Cork	5	8	13	1	13	0
University College Dublin	6	1	18	2	50	0
University of Limerick	2	0	15	2	17	167
Total	25	27	105	9	214	199
College & State Research Organisations						
Irish Manufacturing Research (IMR)	0	0	0	0	0	11
National College of Art and Design	0	0	1	0	0	0
National College of Ireland	2	0	0	0	2	0
Marine Institute	0	0	0	0	0	0
Teagasc	0	0	3	0	1	21
Total	2	0	4	0	3	32

C2: Spin-out companies, incubation and use of facilities 2020: Technological University & 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 merged or acquired during the year	Number of companies supported within the incubator in the year	Number of contracts with companies for use of facilities and equipment at the RPO
Technological University						
TU Dublin	3	0	6	0	173	0
Munster TU	0	2	5	0	129	54
Total	3	2	11	0	302	54
Institutes of Technology						
Athlone Institute of Technology	0	0	0	0	30	13
Dundalk Institute of Technology	0	0	2	0	40	0
Galway-Mayo Institute of Technology	0	0	0	0	85	58
Dun Laoghaire IADT	0	3	0	0	44	0
Institute of Technology Carlow	0	0	1	0	28	2
Institute of Technology Sligo	0	0	1	0	62	20
Letterkenny Institute of Technology	0	0	0	0	65	0
Limerick Institute of Technology	0	0	0	0	75	18
Waterford Institute of Technology	0	0	4	0	30	44
Total	0	3	8	0	459	155
Grand Total C1 & C2	30	32	128	9	978	440

APPENDIX 2. LIST OF RESEARCH PERFORMING ORGANISATIONS (RPOs)

Reporting Sector	Institution	Year of foundation of TTO /Innovation Office
University		
	Dublin City University	2007
	Maynooth University	2005
	National University of Ireland Galway	2005
	Royal College of Surgeons in Ireland	2007
	Trinity College Dublin	1987
	University College Cork	1982
	University College Dublin	2003
	University of Limerick	2005
Technological University		
	Munster Technological University	2009
	Technological University Dublin	2000
Institute Of Technology		
	Athlone Institute of Technology	2008
	Dundalk Institute of Technology	2012
	Dún Laoghaire Institute of Art, Design and Technology	2012
	Galway-Mayo Institute of Technology	2008
	Institute of Technology Carlow	2008
	Institute of Technology Sligo	NA
	Letterkenny Institute of Technology	1998
	Limerick Institute of Technology	2008
	Waterford Institute of Technology	2008
College and State Research Organisations		
	Irish Manufacturing Research (IMR)	N/A
	National College of Art and Design	2013
	National College of Ireland	2011
	Marine Institute	N/A
	Teagasc	2011

APPENDIX 3. IRELAND'S INTERNATIONALLY RECOGNISED TECHNOLOGY TRANSFER PROFESSIONALS

2010	Dr Alison Campbell	Knowledge Transfer Ireland	2016	Dr Aoife Gallagher	Royal College of Surgeons in Ireland
2012	Mr Tom Flanagan	University College Dublin	2016	Mr John Gleeson	University of Limerick
2015	Mr Ronan Coleman	Munster Technological University	2016	Dr Derek John	Royal College of Surgeons in Ireland
2015	Dr David Corkery	University College Cork	2016	Dr Margaret Lawlor	University of Limerick
2015	Mr Kevin Dalton	University College Cork	2016	Ms Breda Lynch	Athlone Institute of Technology
2015	Mr Paul Dillon	University of Limerick	2016	Mr Neil McLoughlin	Dundalk Institute of Technology
2015	Dr Gordon Elliott	Trinity College Dublin	2016	Mr Conor Morris	University of Limerick
2015	Dr Carolyn Hughes	Dublin City University	2016	Mr Kieran O'Connell	TU Dublin
2015	Dr Andrew Marsh	TU Dublin	2016	Dr Miriam Walsh	Teagasc
2015	Dr Graham McMullin	Trinity College Dublin	2017	Dr Stacey Kelly	University College Dublin
2015	Dr Anthony Morrissey	University College Cork	2017	Dr Paul Maguire	TU Dublin
2015	Mr Patrick O'Boyle	Dublin City University	2017	Dr Kieran Ryan	NUI Galway
2015	Dr Peter Olwell	Dublin City University	2017	Dr Siobhan Mac Sweeney	Munster Technological University
2015	Ms Emma O'Neill	Trinity College Dublin	2018	Mr David Murphy	NUI Galway
2015	Dr James O'Sullivan	Waterford Institute of Technology	2018	Dr Joan O'Sullivan	University of Limerick
2015	Dr Karl Quinn	Genomics Medicine Ireland ex. University College Dublin	2019	Mr Aidan Browne	Dundalk Institute of Technology
2015	Dr Tim Roche	Formium ex. University College Cork	2019	Mr Ian Gallivan	NUI Galway
2015	Mr Richard Stokes	Dublin City University	2019	Mr Brian Ogilvie	Institute of Technology Carlow
2015	Dr Jacinta Thornton	NUI Galway	2020	Dr Samantha Williams	Trinity College Dublin
2015	Dr Paul Tyndall	Maynooth University	2020	Ms Josette O'Mullane	Munster Technological University
2015	Dr Emily Vereker	Health Research Board ex. Trinity College Dublin	2020	Dr Stephen Donoghue	University College Dublin
2015	Dr Ena Walsh	University College Dublin	2020	Mr David Gardiner	TU Dublin
2016	Dr Seamus Browne	Royal College of Surgeons in Ireland	2021	Brian Callaghy	Trinity College Dublin
2016	Mr Peter Conlon	Maynooth University			

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 Equivalents - 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. Knowledge Transfer Ireland.

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.

Licence

Contract transferring intellectual property rights for the purpose of commercialisation in accordance with contractual terms and conditions.

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 (NCE)

Public sector organisation or charity.

Option

A contract under which a potential licensee is granted 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.

R&D Agreements

Research Collaboration Agreements (wholly and part-funded) plus Innovation Vouchers.

R&D&C Agreements

Research Collaboration Agreements (wholly and part-funded), Innovation Vouchers and Consultancy Agreements.

Reference Year

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

Research Expenditure

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.

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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