KTI
Knowledge Transfer Ireland
Where Research & Business Connect

Annual Knowledge Transfer Survey 2013

The Annual Review of Business Interaction and Commercialisation from Publicly-Funded Research in Ireland

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Foreword

The Annual Knowledge Transfer Survey (AKTS) 2013 is the first review to be published of business engagement and commercialisation activity (together referred to as knowledge transfer) between the commercial sector and Ireland's State-funded Research Performing Organisations (RPOs). These RPOs comprise Universities, Institutes of Technology and specialist institutions. The purpose of knowledge transfer from the research base is to maximise the flow of technology, IP and ideas into companies and the public sector to bring products and services to the market for social and economic benefit.

The AKTS should not be interpreted as measuring the full economic and societal return from the State's €800 million investment in Higher Education Research and Development (HERD). Rather these data are a slice of the overall productivity of the State research system, the outputs of which include skilled graduates, researchers and international peer-reviewed publications, increased sales and exports from enterprise, resulting in maintenance and creation of jobs.

Overall, the results achieved in 2013 are positive, with upward or stabilising trends in all areas measured. Ireland's RPOs are actively capturing new ideas and technology opportunities, filing patents and executing licences. The number of new spin-out companies created appears healthy and the survey reveals that there are 80 company spin-outs remaining active three years post-incorporation. Collaboration with industry, captured through a range of formal contractual arrangements, is increasing and 87% of company partners are Irish based.

Whilst it is proper to capture data on revenue generation from licensing intellectual property and the realisation of spin-out equity, Ireland quite deliberately does not place emphasis on revenue return to the RPO as the primary measure of effectiveness in knowledge transfer. The objective of transferring IP into a company is to support business innovation which should drive competitive advantage. And the primary objective for the State of commercialisation is the creation of sustainable jobs in Ireland.

Many of the positive impacts of knowledge transfer cannot be captured by simple quantitative measures alone. This report contains some examples of business impact, more information is available in the Knowledge Transfer Ireland (KTI) Technology Transfer Strengthening Initiative – Phase 1 Report (May 2014) and in the KTI case studies – both of which may be found on the KTI website at: www.knowledgetransferireland.com.

KTI will build on the 2013 survey. Additional studies are planned, based on the data, to gain more granularity on the outcomes. The 2014 survey will involve greater clarity around certain definitions, as well as supplementary questions, which will provide a better understanding, in particular, of industry engagement through the mechanisms of collaboration, contracted research and consultancy, and of the range of support offered by technology transfer offices to emergent companies.

Dr. Alison Campbell OBE RTTP
Director, Knowledge Transfer Ireland

1 Executive summary

The Annual Knowledge Transfer Survey (AKTS) is a review of business engagement and commercialisation activity (knowledge transfer[1]) from Ireland's State-funded Research Performing Organisations[2] (RPOs). Whilst data have been collected over a number of years, this is the first time that this annual survey has been published. The survey captures activities relating to the flow of ideas, expertise and technologies from within the RPOs out to business.

The RPOs comprise Ireland's seven Universities and fourteen Institutes of Technology; three specialist research institutes: the Royal College of Surgeons; the National College of Art & Design (NCAD); the National College of Ireland (NCI), and the State Research Bodies: the Marine Institute and Teagasc. A complete list of RPOs is provided in Appendix 2.

The AKTS 2013 presents data for the period 1 January - 31 December 2013. Twenty-six RPOs responded to the survey, undertaken on behalf of Knowledge Transfer Ireland by Insight Statistical Consulting. The main contact at the RPO for the purpose of this survey was its technology transfer office (TTO)[3]. Where certain data were not provided by an RPO, this is flagged in the relevant sections of this report.

The information reported in this survey spans the process of intellectual property commercialisation from invention disclosure, through protection to licensing. It describes the level of business engagement with RPOs as evidenced through: collaborative research; contract services; consultancy and use of RPO facilities and equipment. The report looks at the volume of spin-out companies created and those surviving beyond their first three years. It captures outputs from knowledge transfer such as products on the market derived from licensing from an RPO and revenue returns to the RPO. And the report considers how the knowledge transfer infrastructure in Ireland is resourced.

Looking across the RPO data returned, performance in all areas has increased between 9%-26% in comparison to 2012.

1 See glossary at Appendix 1

2 Universities, Institutes of Technology, Specialist Research Institutes and State Research Bodies

3 See glossary at Appendix 1

In 2013

PRODUCTS ON THE MARKET

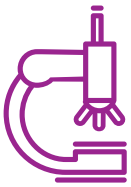
31 technologies

that had previously been licensed out by an RPO became available for consumer or commercial use.

LICENSE/OPTIONS/ASSIGNMENTS

There was a sharp increase in the number of LOAs signed,

up 60% from the previous year, at **139.**



RESEARCH AGREEMENTS

1,598 new agreements

(collaborative, formal contract research and consultancy) were signed with companies, representing a 9% increase from 2012.

BUSINESSES ENGAGED

There was a **15%** increase

over the previous year in the number of external clients with whom the TTOs worked.

COMPANY LOCATION

The majority (87%) of companies with which the RPOs worked were

based in **Ireland.**

SPIN-OUTS

The number of spin-outs more than doubled in 2013 vs. 2012 with

37 new companies created.

ACTIVE SPIN-OUTS

There were **80** active spin-outs

that were at least three years post-incorporation at the end of 2013.

PRIORITY PATENT APPLICATIONS

123 applications

were filed, an increase of 9% on the previous year.

INVENTION DISCLOSURES

The number of invention disclosures

increased 24% from 2012.

INTERNAL ENGAGEMENT

TTOs reported a **21% increase,**

over 2012, in the number of internal researchers with whom they worked.

2 Research funding in Ireland

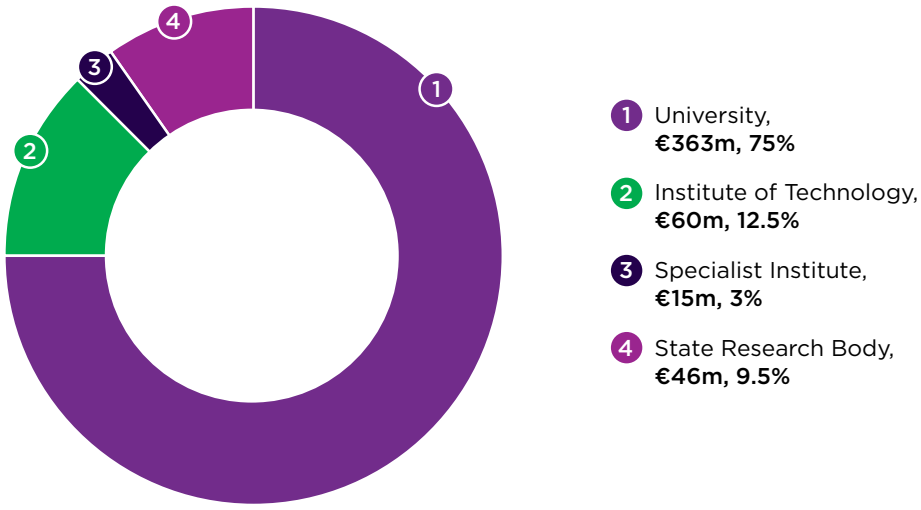
Ireland's total investment in Higher Education R&D (HERD) is published by Forfás, Ireland's policy advisory board for enterprise, trade, science, technology and innovation. The published data run two years behind and the latest (provisional) figure available for HERD is in respect of 2011 and is €732 million.

The total research expenditure (less block grant) for 2013 was provided by the RPOs from their Finance Departments. It is approximately €484 million. 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.

From Figure 2.1, the University sector accounts for the majority of all research expenditure at 75% (€363m). The Institutes of Technology sector account for 12.5% (€60m) of the State's expenditure on research. The Specialist Institute sector (RCSI, NCAD and NCI) spend €15 million on research (3%) and the State Research Bodies (Marine Institute and Teagasc) expend 9.5% (€46m) on research.

On average, approximately 8% of research expenditure by universities is derived from private sector sources and relates to collaborative and contract research as well as to consultancy activity. Whereas the Institutes of Technology average 7.2% of research expenditure related to private sector sources. The range of private sector funding in the university sector is between 5%-17% and 0-13% in the IoT sector (excluding IADT).

Figure 2.1
Research expenditures by type of RPO, 2013



3 Engagement

Technology transfer offices (TTOs) work with a diverse "client" base including: academic researchers, company researchers, business people and investors (nationally and internationally). In 2013, TTOs[4] worked with nearly 3,000 external clients (businesses or other external organisations) involved in research collaboration, contracts or consultancy, and over 2,500 researchers within the RPOs. External clients served were up 7% on 2012. Some 59% of external clients served in 2013 were by the seven universities and 37% by eleven of the fourteen IoTs[5]. Looking at the internal client community, the number of researchers served by the TTO was relatively similar (an increase of 1%) to the previous year[6].

One of the principal ways that business benefits from working with RPOs is through access to research and expertise. This is most frequently through:

1. **Collaborative research programmes** are where the company and RPO undertake a programme of work, the results of which are not known at the outset. The RPO and company will jointly develop the work plan. The company will commit funding and/or materials, access to equipment or facilities and know-how. Generally all foreground IP generated in the project resides with the RPO.

2. **Contract research projects** ("contract service" projects) are where the company specifies the work to be undertaken and where it pays fully for this work the company will own the foreground IP generated in the project.

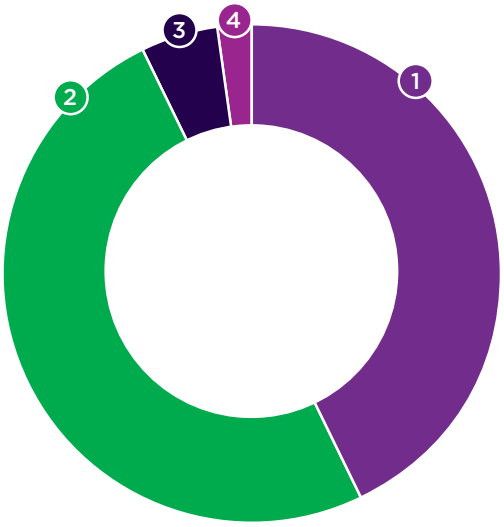
3. **Consultancy** through which the RPO provides advice and assistance to enterprise; this work does not involve the performance of new research. The work is usually fully funded by the company which would expect to own foreground IP generated.

4 Data not provided by IT Sligo, IT Tallaght, IT Tralee, Teagasc
5 Data not provided by IT Sligo, IT Tallaght, IT Tralee
6 Data not provided by IT Sligo, IT Tallaght, IT Tralee, Teagasc, University of Limerick

3.1 Volume

A total of 1,598 engagement agreements were entered into in 2013 and this represented a 9% increase from 2012. These agreements were with 939 different companies. As can be seen from Figure 3.1, the Institute of Technology sector executed engagement agreements with a greater number of individual companies than the University sector. This may reflect the nature of the interactions, a focus on local community engagement and the nature of the business base served. When interpreting these data, repeat business with the same companies also need to be considered.

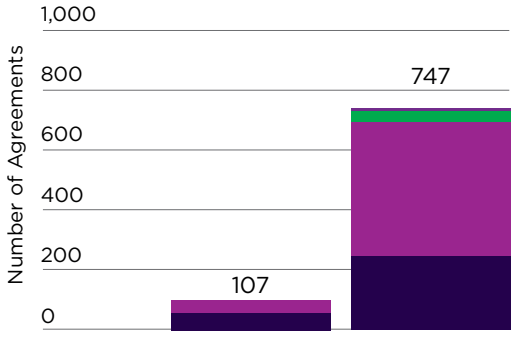
Figure 3.1
Number of different companies with whom an engagement agreement has been executed 2013



1. University, **404, 43%**
2. Institute of Technology, **473, 50%**
3. Specialist Institute, **49, 5%**
4. State Research Body, **13, 2%**

From the information provided on company location[7], the majority (87%) of companies with whom the RPOs have executed an engagement agreement are based in Ireland.

Figure 3.2
Location of companies with whom the RPO has executed an engagement agreement 2013



	Overseas	Ireland
State Research Body	5	8
Specialist Institute	1	48
Institute of Technology	37	436
University	64	255

The proportion of collaboration, contract services and consultancy work in which the University sector[8] engaged with overseas companies was 20% of their total activity in this area, whilst for the Institute of Technology sector[9] it was 8%.

1,598 collaboration agreements

87% of companies with which the RPOs worked were based in Ireland

7 Data not provided by University College Cork (UCC)
8 Data not provided by University College Cork (UCC)
9 Data not provided by Letterkenny Institute of Technology (LYIT)

3.2 Collaborative programmes with business

The total number of collaborative agreements executed by the RPOs in 2013 was 336 and this is mainly accounted for by the University sector (excluding UL[10]) with 211 agreements (63%).

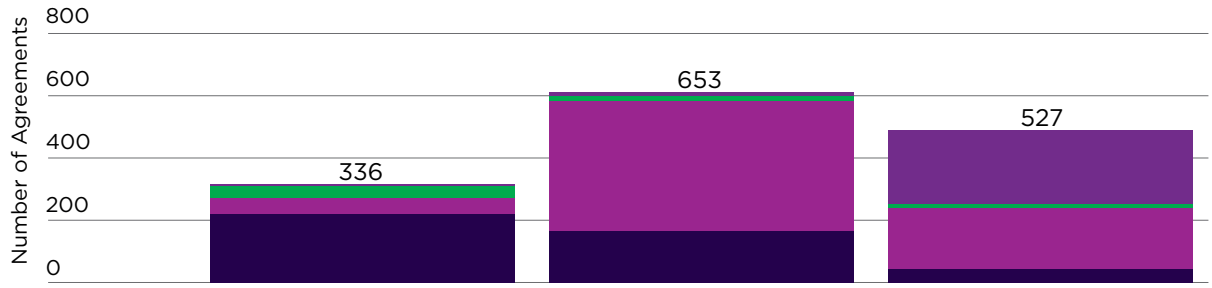
3.3 Contract research projects

Contracted research has increased by approximately 15% from 2012. There are nearly twice as many contract research projects (653) as research collaborations (336) undertaken by RPOs and it is primarily the Institute of Technology sector that undertakes these type of arrangements (449 agreements, 69%).

3.4 Consultancy

Surprisingly, the number of consultancy agreements has remained relatively static since 2010 with 527 being concluded in 2013 by 14 of the 26 RPOs[11]. Six IoTs and two universities reported no consultancy activity. The Institutes of Technology accounted for 31% of consultancy agreements (203) with the number of consultancy contracts reported across the 14 IoTs ranging between 0 to 75. The University sector formally contracted just 46 agreements (7%) of which 41 were undertaken by one university. Within the specialist research organisations there was a marked difference in consultancy activity with two institutions recording no activity and another executing 260 consultancy contracts. As consultancy is a popular way for business to access expertise the data suggest that the RPOs are not capturing the inherent value and impact achievable through consultancy activity.

Figure 3.3
Number of engagement agreements in 2013



	Collaborative research agreements	Contract research agreements	Consultancy agreements
State Research Body	5	9	260
Specialist Institute	41	20	18
Institute of Technology	79	449	203
University	211	175	46

10 Breakdown of engagement by type not provided by University of Limerick (UL) so Figure 3.3 does not represent the total number of engagement agreements

11 Data not provided by University of Limerick (UL)

Allsop Europe and Waterford Institute of Technology

Allsop Europe, located in Waterford, turned to its neighbour Waterford Institute of Technology (WIT) for help to reintroduce innovative thinking and practices into the company and to improve the management of new product development.

A straightforward consultancy agreement was provided by the RIKON Group at WIT. This group conducts research into small business innovation and knowledge management.

The group spent time with the company and designed and implemented a structured new product development process and a shared information system that supports and manages people, time and expertise across all departments of the organisation.

The collaboration has enabled the company to update, track, monitor and manage the status and timely flow of new product concepts. It has also led to a more effective collaborative environment and improved new product development process within the company.

4 Invention disclosures

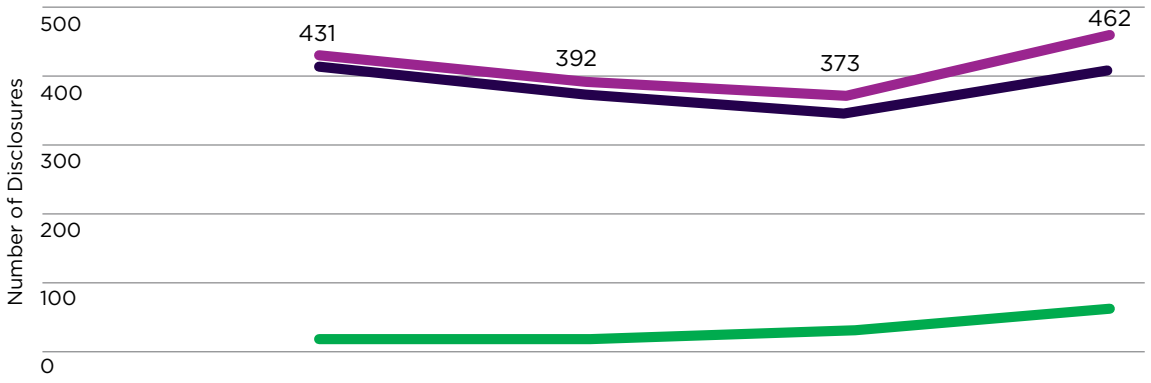
The first step in the process of commercialising a new piece of technology takes the form of an invention disclosure. The researcher(s) will discuss with the TTO a tangible discovery or development that they have made and, if merited, this will be submitted in writing. The TTO will undertake a preliminary commercial assessment of the invention and if accepted into the TTO system for further development this will be recorded on an Invention Disclosure Form (IDF). The IDF contains the basic information needed to evaluate the intellectual property associated with the invention and, where appropriate, to protect and commercialise it.

In 2013, there were 462 invention disclosures of which 64% (297) were in the University sector, 28% (131) were in the Institute of Technology sector. The total number of invention disclosures represented an increase of 24% from 2012 and, having dipped a little over the past four years, is now at a level previously recorded in 2009.

For the purpose of this survey, sole invention disclosures are those made by researchers working in only one institution and submitted only to that RPO. Joint invention disclosures are disclosures relating 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. Figure 4.1 shows the number of sole and joint invention disclosures received in 2013.

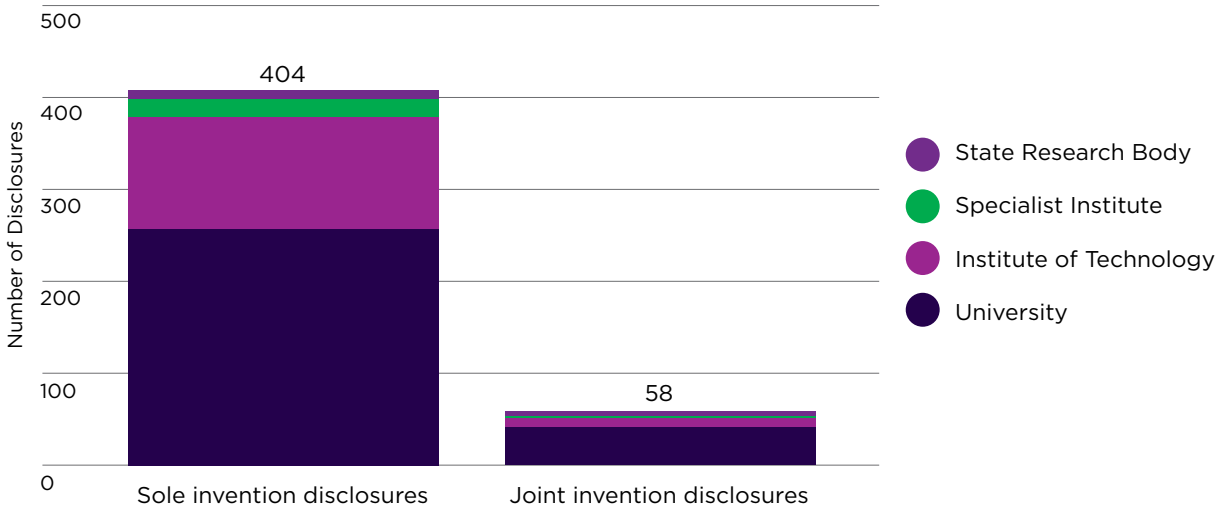
As shown in Figure 4.1, 87% of disclosures were sole disclosures (404) and 13% of disclosures were joint (58). Joint disclosures might be expected to rise over time as more collaborative research is now undertaken across RPOs and more inter-institutional research centres established, which should give rise to more joint IP. Nearly two-thirds (63%) of sole IDFs were submitted in the University sector and, of the joint IDFs, nearly three-quarters (72%) were in the University sector, suggesting there may be greater collaborations leading to more IP amongst University research.

Figure 4.1
Invention disclosures, 2010 – 2013



	2010	2011	2012	2013
Sole	411	376	346	404
Joint	20	16	27	58
Total	431	392	373	462

Figure 4.2
Invention disclosures in 2013



5 Patenting 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.

5.1 RPO patent portfolio

The total number of patents and applications under management across the RPO sector in 2013 is 1,201. Of this there are 968 patent applications and 233 granted patents. The majority of the patent portfolio (85%) is managed in the University sector.

5.2 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 2013 was 123. The average total number of priority patent applications each year over the past four years has been 120 and the 2013 data suggest that the number of priority filings is reaching a steady state.

The choice of initial patent filing territories is diverse. The majority of first filings are made direct at the UK IPO (41%), followed by EPO (29%) and USPTO (23%). Only 3% of first filings are direct in Ireland.

Figure 5.1
Priority patent applications over the past four years

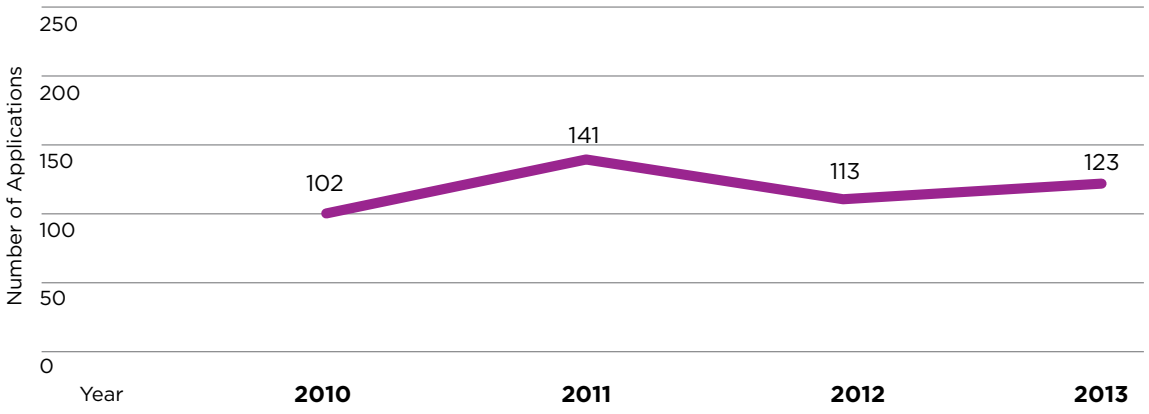
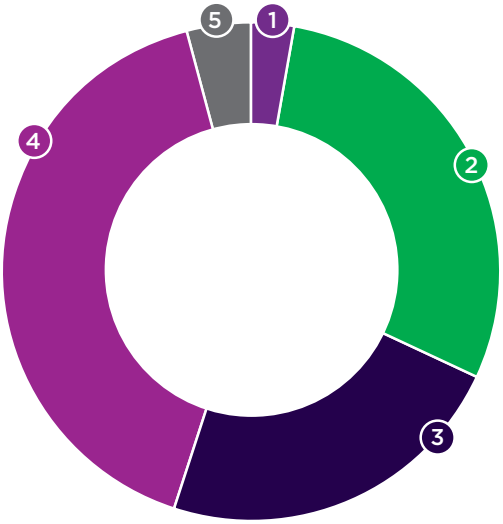
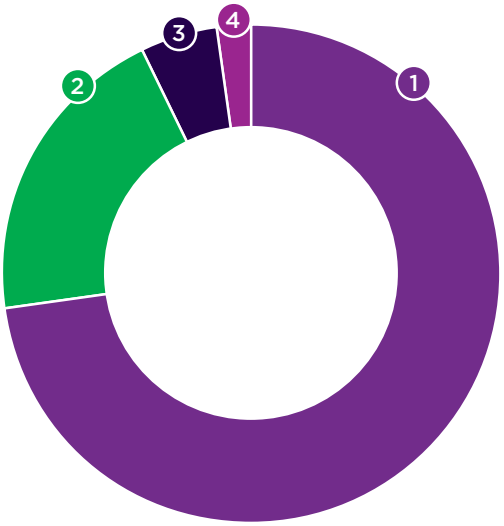


Figure 5.2
Initial patent filing jurisdictions



1. Irish Patents Office, **3%**
2. EPO, **29%**
3. USPTO, **23%**
4. UK IPO, **41%**
5. Other (including PCT direct), **4%**

Figure 5.3
Number of priority patent applications in 2013



1. University, **90, 73%**
2. Institute of Technology, **24, 20%**
3. Specialist Institute, **6, 5%**
4. State Research Body, **3, 2%**

The University sector accounts for nearly three-quarters (73%) of all priority patent applications made by RPOs, with the IoTs accounting for 19% of the filings made, with the remainder coming from Specialist Institutes (6%) and State Research Bodies (2%).

123 priority patent applications filed

5.3 PCT applications

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

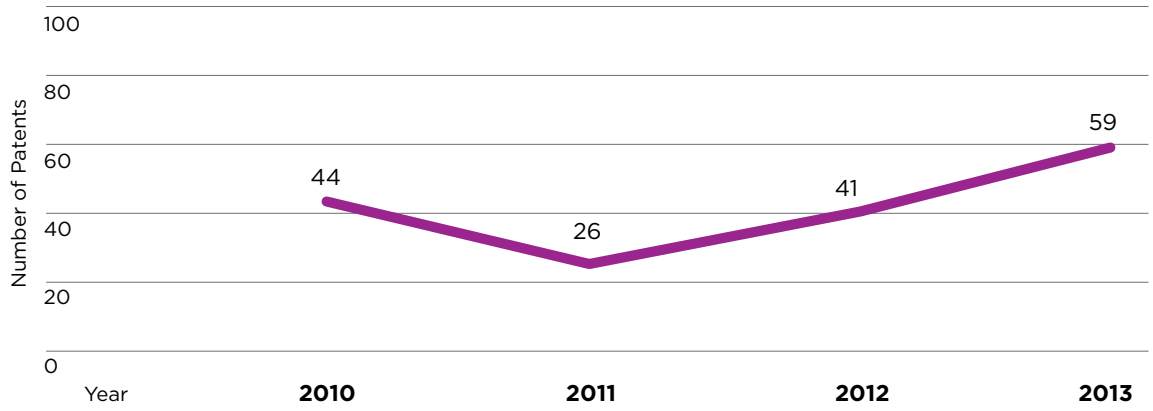
In 2013, of the 113 initial filings made in 2012, 41 (36%) were progressed to PCT applications. This however does not represent a simple conversion rate. As Figure 5.2 shows, many patent applications are filed direct in target jurisdictions. For example, in 2013 over half of new patent applications were filed direct in the USA and EPO. In fact, PCT filings have halved from 81 in 2012 to 41 in 2013. As well as the direct filings considerations, this drop might also be accounted for by a more stringent decision-making process about which applications merit being carried into the next phase of prosecution.

18 months after a PCT application has been filed, it must be nationalised in individual countries and regions selected from those which were 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 2013, 36 PCT applications entered the national phase and the majority of these applications (81%) originated from the University sector.

5.3 Patents granted

The total number of patents granted in 2013 has increased by 44% over the previous year to 59 and the majority of these patents (83%) were granted to inventions from the University sector. The timescale for grant of a patent depends on the complexity of the patent prosecution and the time taken within each national office. The data as gathered therefore 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. There is an upward trend in the number of patents granted from 2011 to 2013, as shown in Figure 5.4.

Figure 5.4
Number of patents granted each year, 2010 – 2013



6 Licensing of rights

Information was sought on all licences, options and assignments (LOAs) for all types of intellectual property generated in the institutions, including copyright, know-how, patents and trademarks. For this purpose, the terms were defined as follows:

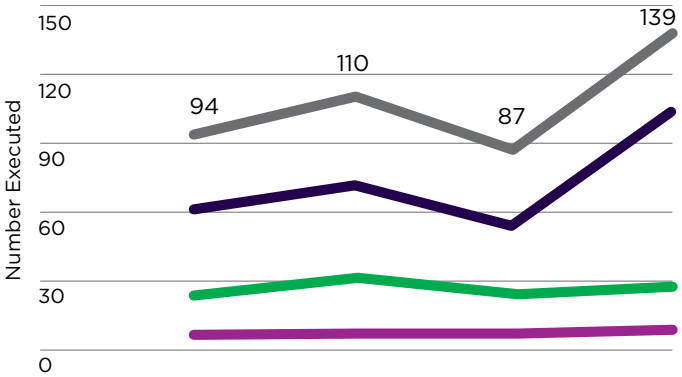
- A **licence** is an agreement between a RPO and one or more third parties, whereby intellectual property rights are transferred for the purpose of commercialisation. The RPO retains ownership of the intellectual property but permits the licensee to exploit it in accordance with contractual terms and conditions.
- An **option** agreement is one 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 may be called an Option & Evaluation agreement.
- An **assignment** is an agreement transferring ownership of intellectual property rights from the RPO to a third party.

139 Licences, Options and Assignments (LOAs)

6.1 Licences, Options and Assignments (LOAs)

There has been a sharp growth in the total number of licences, options and assignments executed by RPOs[12] in 2013 from 87 to 139, i.e. an increase of 60%. Licensing tends to be the dominant activity, at 74%. The growth in the number of licences executed in 2013 (from 55 to 103 licences, 87%) was the main contributor towards the overall growth. The majority of LOAs executed were exclusive (78%). Trends across licensing, options and assignments can be seen in Figure 6.1. A breakdown of licensing type by RPOs in Figure 6.2, shows that the University sector executed the majority of LOAs (68%) in 2013.

Figure 6.1
Total number of licences, options and assignments executed, 2010 – 2013



	2010	2011	2012	2013
Licences	61	72	55	103
Options	25	31	24	27
Assignments	8	7	8	9
Total	94	110	87	139

12 Data not provided by IT Sligo or the Marine Institute

TE Laboratories and Dublin City University

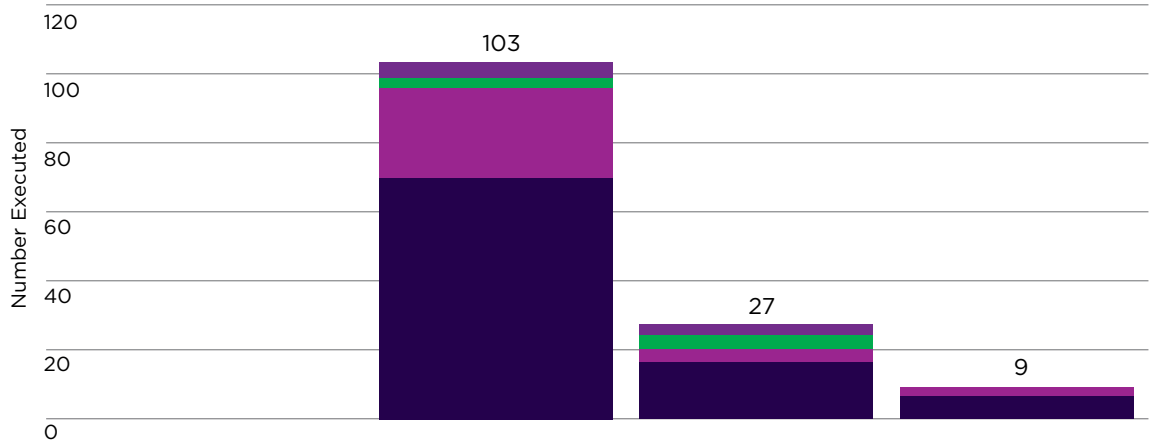
TE Laboratories of Tullow, Co. Carlow, sells its products and services in both domestic and export markets.

In recent years it has expanded its business from lab-based testing into the autonomous sensing market. In doing so, it has focused on developing simple, reliable and cost-effective sensors rather than replicating more complicated and expensive laboratory-based approaches in the field. One of these is a portable, easy-to-use monitor for surface water and industrial waste water.

The initial technology for this was obtained under licence from Dublin City University and TE Laboratories subsequently collaborated with a research team there led by Professor Dermot Diamond to develop a range of water monitors.

TE Labs Managing Director Mark Bowkett says the ongoing collaborative relationship with DCU accelerates the R&D process and speeds up time-to-market. "It means we're able to expand the product development funnel because we're not starting from scratch every time," he says. The university's technology transfer company, DCU Invent, made the initial licensing experience "pretty painless" says Bowkett.

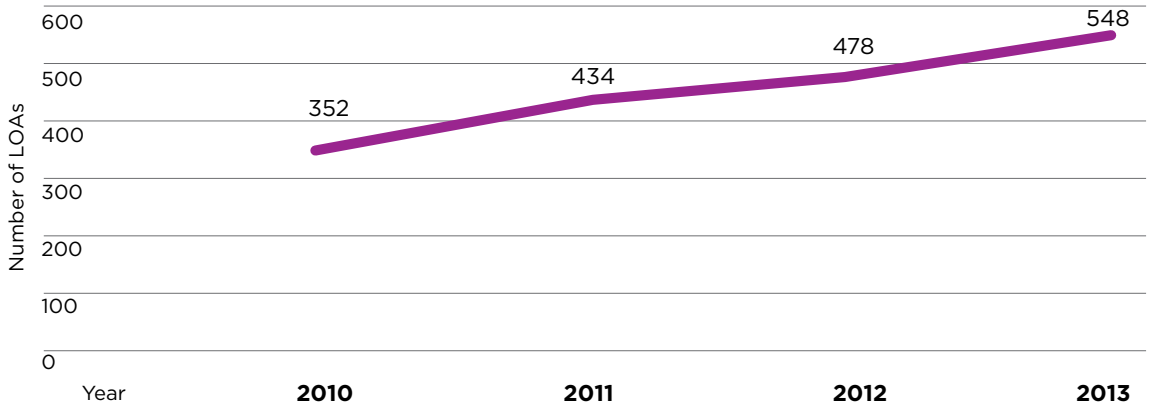
Figure 6.2
Type and number of licences, options and assignments executed in 2013 by RPO



	Licences	Options	Assignments
State Research Body	5	3	0
Specialist Institute	2	4	0
Institute of Technology	26	3	2
University	70	17	7

The total number of licence, option and assignment agreements active at year-end in 2013 was 548 of which 78% were from the University sector. Figure 6.3 shows how the cumulative portfolio of active agreements has been steadily increasing over the past four years. The current figure of 548 in 2013 represents a 15% increase from 478 in 2012.

Figure 6.3
Total current licence portfolio, 2010 – 2013

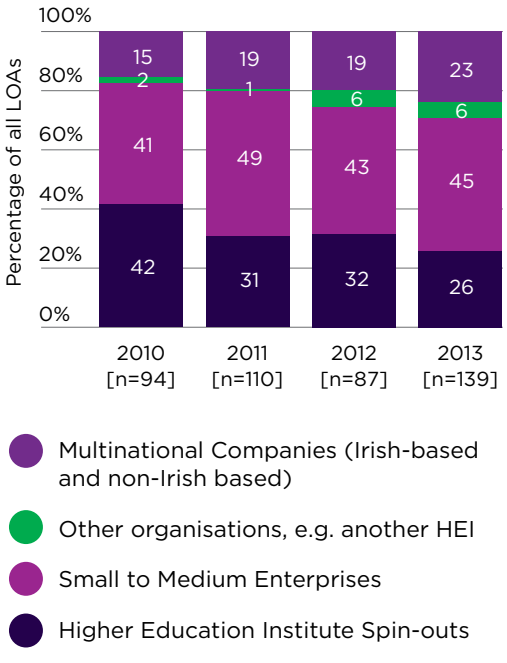


6.2 Licensees

Figure 6.4 shows the nature of the organisations with which the agreements were made during the years 2010 to 2013. The majority of LOAs are transacted with SMEs (45% in 2013). The percentage of LOAs signed with multi-national companies (Irish-based and non-Irish based) has increased over the four year period from 15 in 2010 to 23 in 2013.

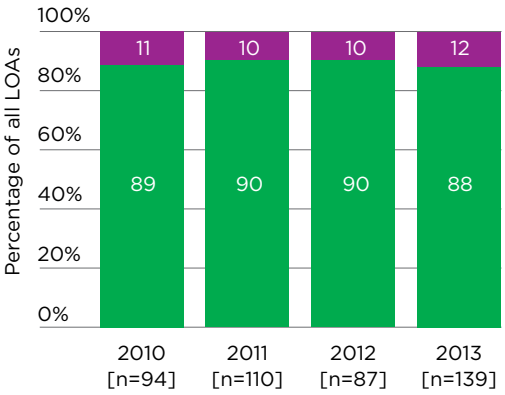
Considering the split of contracts between companies based in Ireland and those based elsewhere, Figure 6.5 shows that the proportion of LOAs signed with industry based in Ireland is relatively consistent over the past four years at around 89%.

Figure 6.4
Size of organisations with which LOAs were made, 2010 – 2013 (percentage distribution)



- Multinational Companies (Irish-based and non-Irish based)
- Other organisations, e.g. another HEI
- Small to Medium Enterprises
- Higher Education Institute Spin-outs

Figure 6.5
LOAs made with Ireland-based and overseas-based industry, 2010 – 2013



- Industry with no activity in Ireland, i.e. based overseas
- Industry based in Ireland

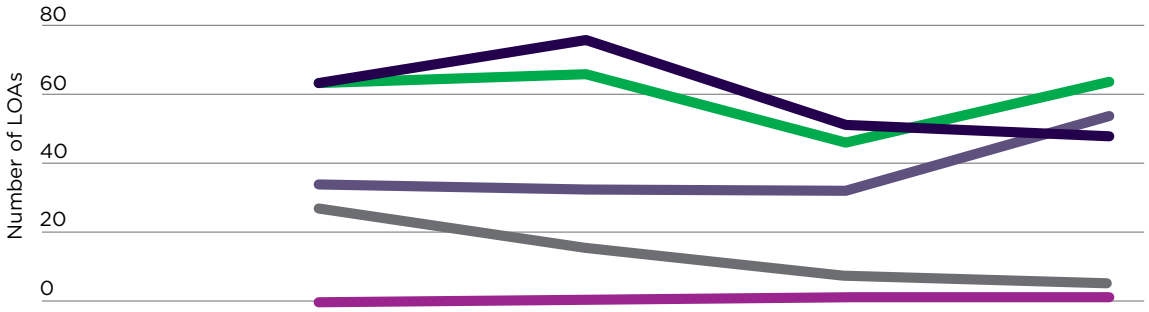
6.3 Types of IP licensed

Figure 6.6 shows the types of intellectual property that were the subject of the agreements. The number of LOAs involving know-how and software has increased sharply in 2013. The number of LOAs involving Copyright and Patented IP has decreased in recent years. Note: one or more types of IP can be licensed, optioned or assigned within the one agreement, e.g. on many occasions Patented IP is licensed along with know-how.

6.4 Evaluation Agreements

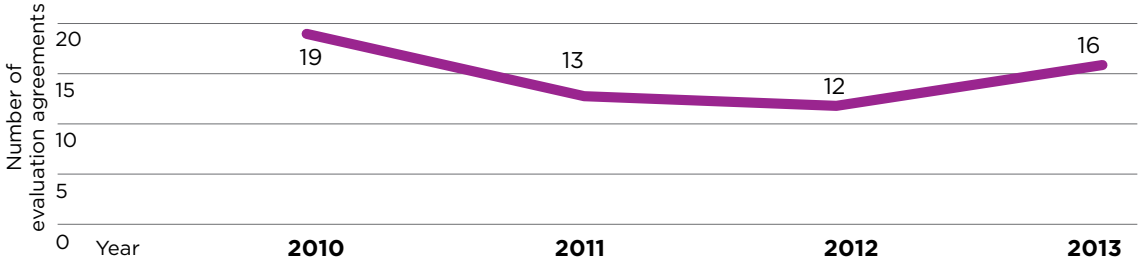
An evaluation agreement is one in which a potential licensee or partner is given the opportunity to evaluate a technology or some IP for an agreed period of time. The evaluation may be undertaken by the RPO for the interested licensee. After the evaluation, the third party may elect to enter into a licence agreement and/or some sort of research agreement with the RPO. Evaluation agreements that include options are not counted in this category – they are counted as Options. The total number of evaluation agreements has remained relatively static in the past few years. Figure 6.7 shows the number of such agreements in place at year-end over the past four years 2010 to 2013.

Figure 6.6
Type of intellectual property in LOAs, 2010 – 2013



	2010	2011	2012	2013
Patented IP	63	76	52	49
Know-how	64	66	46	64
Software	34	33	32	53
Design rights	0	1	2	2
Copyright	27	16	8	5

Figure 6.7
Number of evaluation agreements at year end, 2010 – 2013



6.5 Material Transfer Agreements (MTA)

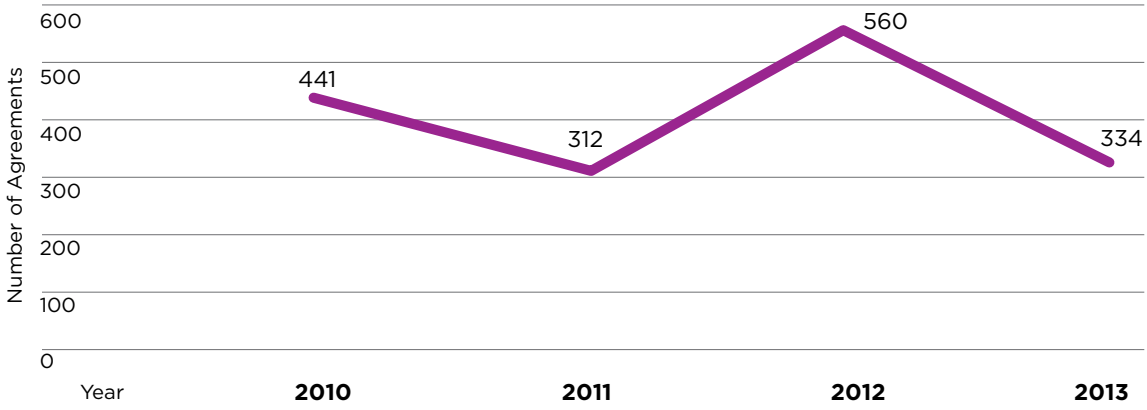
A further type of agreement is a material transfer agreement, under which the institution transfers tangible research materials to another entity, and the recipient uses the materials for their own research purposes. The agreement specifies the rights of the provider and the recipient with respect to the materials and any derivatives. MTAs may be to or from a commercial entity or another research organisation. Frequently, the transfer is out to a company by way of a licence agreement. Figure 6.8 shows the number of such agreements in place at year-end 2009 to 2013 and illustrates the unpredictable nature of material transfer.

The majority of MTAs in 2013 were reported by the University sector (78%) with one Specialist Institute and one State Research Body also transferring materials.

6.6 Products on the market

In 2013, 31 technologies that had previously been licensed out by an RPO became available for consumer (public) or commercial use. 19 of these (61%) were from 4 Universities[13] and eight were from three IoTs[14]. One of the two State Research Bodies was responsible for generating IP that led to three technologies that came to market.

Figure 6.8
Number of material transfer agreements at year end, 2010 – 2013



13 Data not provided by University of Limerick (UL)

14 Data not provided by IT Sligo, IT Tralee

7 New companies

Information was sought on the numbers of spin-out and start-up companies established from RPOs. Sustainability of spin-out companies was also studied. For this purpose, terms were defined as follows:

- A **spin-out** is a new company created with the assistance of the TTO whose business model and technology are based primarily on intellectual property generated in the institution. Some of these have formal licence agreements and/or equity participation agreements with the institution.
- A **start-up** is a company formed by university entrepreneurs (e.g. staff or students) whose business is not based on intellectual property generated in the institution.

7.1 Company creation

37 new companies were spun-out from 14 of the RPOs[15] in 2013. 27 of these (73%) were from the University sector and 10 (27%) from the IoT sector. Of those companies spun-out, the originating RPOs hold equity in 26. Figure 7.1 shows the number of spin-outs established in the four year period from 2010 to 2013 which have a licence agreement from the RPO and/or an equity share.

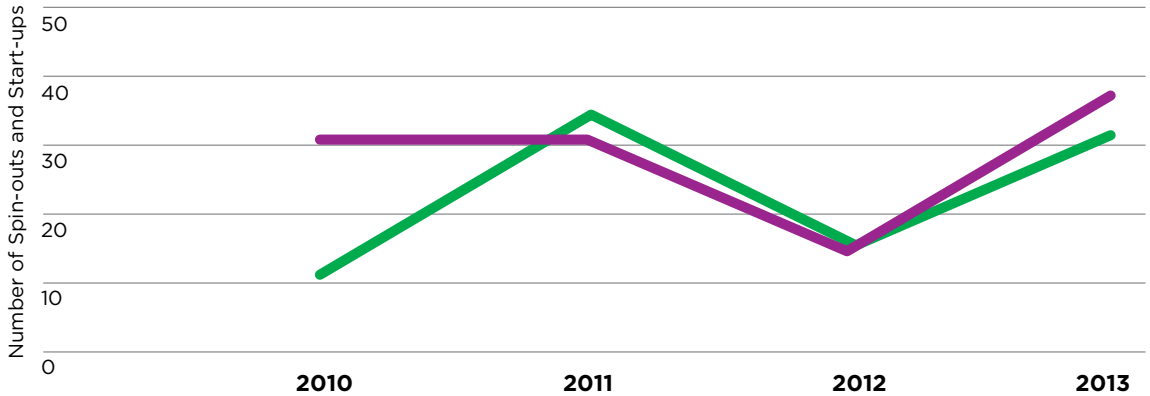
32 new start-up companies were reported in 2013, arising in eight of the RPOs[16].

Trends over the past four years are shown in Figure 7.1.

During the year, 13 licence agreements with spin-outs were terminated and one equity investment was liquidated. This is the same as for 2012.

The aggregate number of spin-out companies in which an RPO holds equity of share options, at the end of 2013, was 148. And 90% of this portfolio is associated with the University sector.

Figure 7.1
Spin-outs and start-ups established, 2010 – 2013



	2010	2011	2012	2013
Spin-outs	31	31	15	37
Start-ups	11	35	16	32

15 Data not provided by IT Sligo

16 Data not provided by University of Limerick (UL) or IT Sligo

Equilume

It is hard to believe that a small blue light could have such a large impact upon the multi-million euro Irish equine industry. Yet UCD researcher and co-founder Dr. Barbara Murphy's Equilume light mask is testament to how a simple idea can make such a market breakthrough.

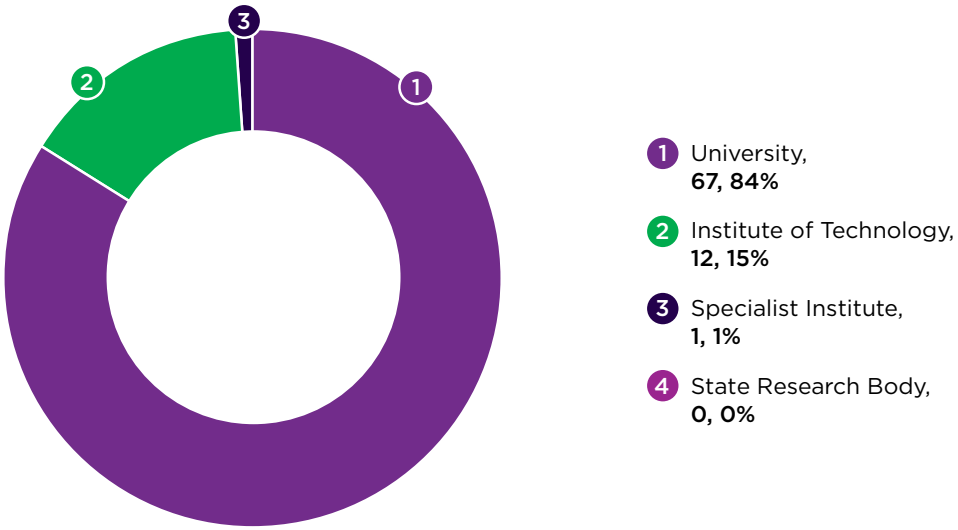
Supported by Enterprise Ireland and NovaUCD, the commercialisation arm of UCD, Equilume was spun-out of UCD in 2013. It now employs four people and plans to increase staff numbers to 10 by the end of 2016. The 'Light Mask' is entirely manufactured in Ireland and the company has had traction, achieving sales of approx €250,000 in Ireland, UK, US and Australia.

7.2 Active spin-out companies

An active spin-out is defined as having at least one paid employee and has raised investment and/or it has booked sales revenue. It will have spun-out of the RPO as an incorporated entity with a business plan and be dependent on the exploitation of specific intellectual property rights of the RPO. The RPO holds equity in the company.

There were 80 active spin-outs at the end of 2013 that were at least three years post-incorporation. Of these, 67 were from the University sector (84%) with the remainder coming from the Institutes of Technology sector (12 spin-outs, 15% of total) and one Specialist Institute (1%). This is shown in Figure 7.2.

Figure 7.2
Active spin-outs at end of 2013 that are 3 or more years post-incorporation

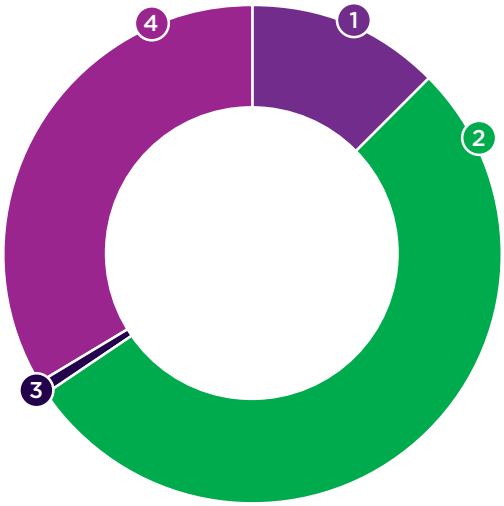


80 active spin-out companies three years post-incorporation

8 Use of facilities and equipment

The survey asked for information on the use of RPO facilities and equipment. Four RPOs were unable to respond to this request. Of the 22 RPOs that submitted a return, eight RPOs had no contracts in place with business for use of facilities and equipment. A total of 447 contracts were recorded by 14 RPOs. The majority of access to facilities and equipment appears to be through the IoTs with one IoT signing 165 such contracts with business in 2013.

Figure 8.1
Use of RPO facilities and equipment by business, 2013



1. University, **(n=5), 56**
2. Institute of Technology, **(n=13), 238**
3. Specialist Institute, **(n=2), 3**
4. State Research Body, **(n=1), 150**

9 Revenue generation

Ireland quite deliberately does not place emphasis on revenue generation from licensing IP or from the realisation of spin-out equity as a measure of effectiveness in performance by RPOs. The objective of transferring IP into a company 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 by the nature of the other interactions that businesses have with the RPOs, such as access to expertise through research contracts and consultancy.

Aerogen

Aerogen knew that to achieve a corner in the market they needed to improve and scale up the technology associated with their nebulisers. To address this issue they turned to Dr. Mark Southern and his research team at the University of Limerick.

Following two years of co-development between Dr. Southern's team and the company's R&D teams, Aerogen developed a significant technological enhancement to its acute care aerosol drug delivery nebulisers. The enhancement wastes no drugs in delivery and is four times more efficient than its nearest competitor. The collaboration was also a success from UL's perspective, resulting in a technology license, patent filed and royalties back to the university.

The impact of the collaboration has been considerable. As a result of the technology development, Aerogen's complete 'design and delivery' supply-chain has now been gathered in from five different countries and efficiently consolidated in two Irish companies, making it the most cost-efficient nebuliser available today. And generating new jobs for Ireland.

The new nebulising technology has gone global immediately and has been adopted by Philips, Siemens and GE Medical. It is also on the front-line of worldwide healthcare, ready to play a key role in nebulising the measles vaccine.

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 license issue fees, annual fees, royalties, option fees and milestones, termination and cash-in payments.

The total number of patents (or patent families) that were generating income to the RPOs[17] in 2013 was 37. The aggregate revenue from licensing in 2013 was over €1.5 million (€1,513,456). The majority of licence income in 2013 was due to one RPO. Five of the seven Universities reported revenue from licensing whilst two out of twelve IoTs[18] generated licence income. Of the State Research Bodies, one earned €929,240 from licensing. Only one of the Specialist Institutes returned data.

The breakdown of revenue by RPO sector is shown in Figure 9.1.

9.2 Reimbursement of patent costs

Seven of the 26 RPOs surveyed achieved some reimbursement of patent costs from licensees in 2013. This ranged from €5 to €25,715. Four RPOs[19] were unable to provide information on patent reimbursement.

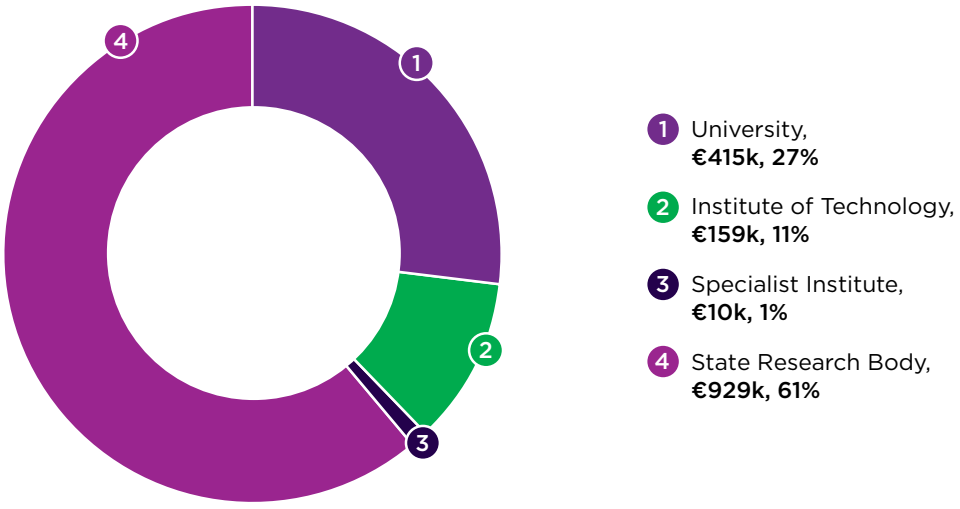
9.3 Revenue from equity sale

The realisation of equity is naturally unpredictable, depending as it does on external factors such as maturity of the spin-out and markets. Two RPOs (University sector) realised revenue from sale of spin-out company equity in 2013. The total revenue was €73,135 (coming almost entirely from one University).

9.4 Total private sector income from collaborative research, contract research and consultancy

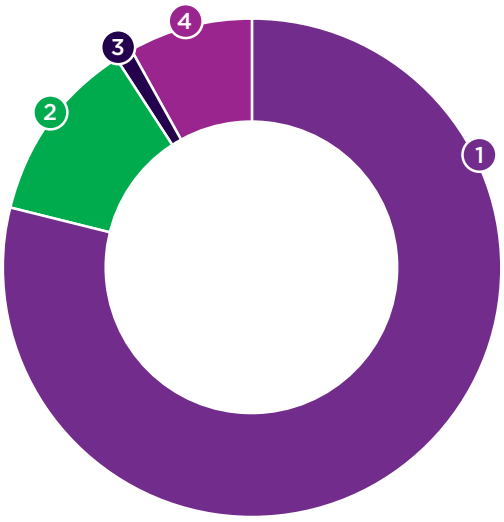
The total expenditure within RPOs that was related to funding from the private sector during 2013 was €36,416,872 which represents approximately 7.5% of total research expenditure by the 26 RPOs. Of this, 79% (€28,668,360) was in the University sector, 12% (€4,355,840) in the IoT sector, 8% (€3,077,000) in the State Research Bodies and 1% (€315,672) in Specialist Institutes.

Figure 9.1
Licence revenue by RPO sector



17 Data not provided by IT Sligo
18 Data not provided by IT Sligo or IT Tralee
19 Data not provided by IT Sligo, IT Tralee, NCI, NCAD

Figure 9.2
Collaborative and contract research and consultancy expenditure related to private sector revenue



1. University, **€28.7m, 79%**
2. Institute of Technology, **€4.4m, 12%**
3. Specialist Institute, **€0.3m, 1%**
4. State Research Body, **€3.1m, 8%**

9.5 Revenue from access to facilities and equipment

Of the 22 RPOs that returned information on use of facilities and equipment by business, nine generated revenue of €1,234,177 from providing this access, in 2013. Of the nine, two were in the University sector, six in the IoT sector and one was a Specialist Institute.

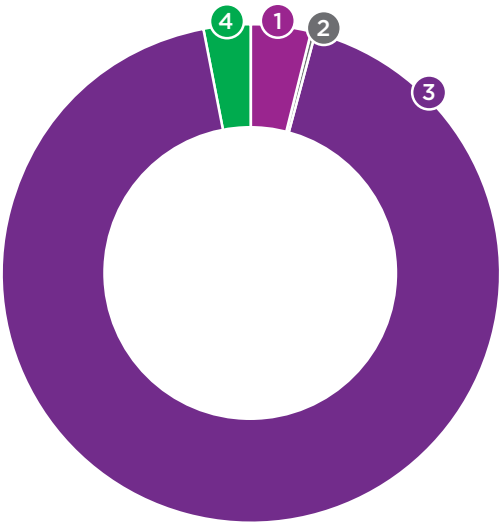
9.6 Summary of commercialisation revenue

The percentage of revenue achieved in 2013 from licensing and equity sale at 4.1% is in the same order as that seen in the UK at 2.4% (HEBCIS Report[20]). However, this may be due to revenue for Irish RPOs from other sources being lower. Importantly these figures indicate the kind of expectations that should be placed in respect of revenue from licensing and spin-out equity sale.

The data presented below exclude research income from State or other non-profit funding sources e.g. research funding agencies, charities.

Revenue source	€	% of total
Licensing income	1,513,456	3.9
Equity sale	73,135	0.2
Collaborative & contract research and consultancy	36,416,872	92.8
Use of facilities and equipment	1,234,177	3.1
TOTAL	39,237,640	100

Figure 9.3
Revenue from commercialisation activities



1. Licensing income, **4%**
2. Equity sale, **0.2%**
3. Collaborative & contract research and consultancy, **93%**
4. Use of facilities and equipment, **3%**

20 UK Higher Education Business & Community Interaction Survey 2012-13 http://www.hefce.ac.uk/media/hefce/content/pubs/2014/201410/HEFCE2014_10.pdf

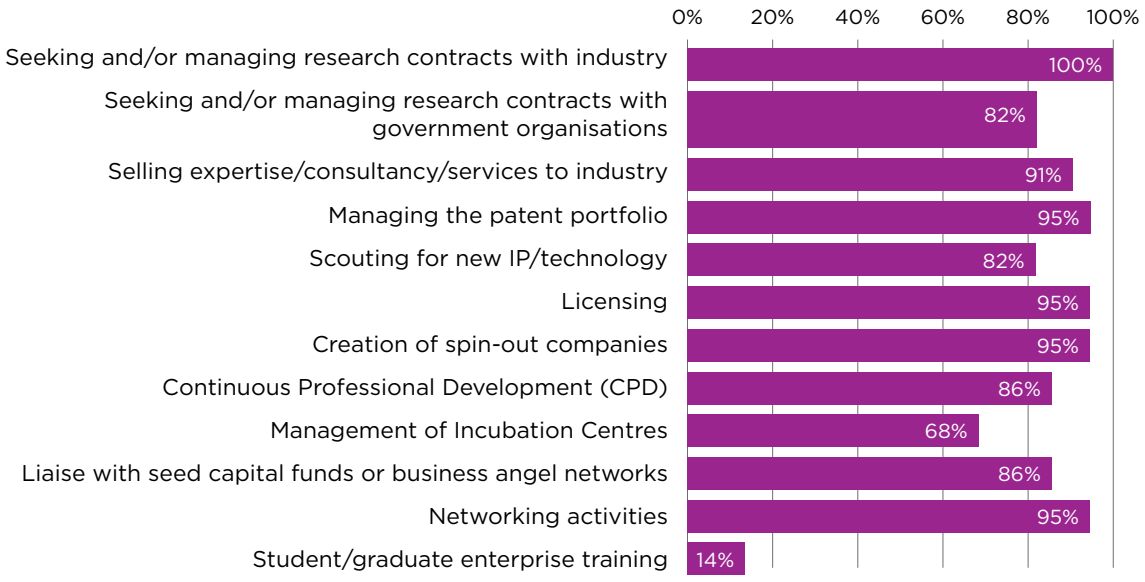
10 Knowledge transfer infrastructure

Knowledge transfer is supported within RPOs through dedicated teams. These may range from a full technology transfer office (TTO) within a larger institution to an individual part-time in a smaller institution. The functions are referred to differently. For example: "Technology Transfer"; "Industrial Liaison"; Knowledge Exchange"; "Innovation Office" etc. The remits are broadly the same. They are actively involved in supporting the transfer of technology, IP and knowledge between business and the RPO through related activities such as intellectual property management, licensing, partnering with industry, consultancy and the creation of new companies.

10.1 Knowledge transfer activity through the TTO (or similar office)

Of the 26 RPOs surveyed, 22 returned information on their infrastructure[21] (dedicated staff/teams). The range of activities in which the RPOs engaged through their technology transfer/ knowledge transfer office is shown in Figure 10.1. It is worth noting that one RPO, new to technology transfer, filed no patents in year and another similar institute did not execute any licences in year. One State Research Body is currently prevented from creating spin-outs by its governance policy. The two largest universities reported that seeking and/or managing research contracts from government organisations is undertaken by the research support office in the university.

Figure 10.1
Relative split of activity



[n=22]

21 Data not provided by IT Sligo, IT Tallaght, the Marine Institute

The data show that all the RPOs undertake contracting with industry and that the majority (95%) are involved in IP management, licensing and spin-out company creation. The majority are involved in the sale of Consultancy services externally (91%) and in supporting Continuous Professional Development (CPD) services (86%). 82% of TTOs are involved in seeking and/or managing research contracts from government organisations.

The majority of HEIs have incubation centres on site and in 71% of cases (excluding State Research Bodies) the TTO is responsible for the management of these centres.

Three of the 22 RPOs stated that they are involved in student (undergraduate, postgraduate) enterprise training.

Seven[22] of the RPOs (six Universities and one IoT) serve other RPOs under the Enterprise Ireland Technology Transfer Strengthening Initiative (TTSI2) programme[23]. In addition, RCSI serves the Beaumont Hospital.

10.2 Knowledge transfer policies

The survey asked whether the RPOs had an IP policy and/or associated documents that include written policies or guidelines on IP and related issues. Of the 21 RPOs that were able to respond to this, all have written policies or guidelines in place on the ownership of IP and on the identification, disclosure and evaluation of Intellectual Property and confidentiality obligations. And, except for one IoT, all 21 RPOs have policy/guidelines in place for the licensing and division of royalty and other income (staff and student).

Nine of the 14 IoTs that responded on policy have written policy or guidelines on conflict of interest and on the creation of spin-outs and equity shares.

Service level agreements with academic clients were in place for 11 of the 21 responding RPOs.

10.3 Resourcing

In 2013, 84.4 full-time equivalent (FTE) staff were employed in dedicated (in whole or in part) functions to support knowledge transfer (or technology transfer). The total number of staff in such roles has remained fairly static over the last three years.

22 Trinity College Dublin is not a part of a consortium

23 The Technology Transfer Strengthening Initiative (TTSI2, 2013-2016) is a €22 million programme managed through Enterprise Ireland which contributes to the operational and staff costs in 24 of the RPOs (RCSI and the Marine Institute are not recipients of TTSI2 funding).

11 Conclusion

The Annual Knowledge Transfer Survey 2013 illustrates the many diverse ways through which Ireland's publicly-funded research base engages with business to support innovation. It provides evidence of the level of knowledge transfer activity across Ireland's State-funded research sector.

There is a time lag between licensing by an RPO and the licensee companies bringing new products and services to the market. In 2013, 31 new technologies that had previously been licensed out by an RPO became available for consumer or commercial use.

Ireland's RPOs reported expenditure on research in 2013 of €484 million. The sector engaged with around 1,000 different companies during the year and executed 1,598 new collaborative research, contract research and consultancy agreements, and 139 LOAs.

During 2013, 37 new spin-out companies from RPOs were created. The report begins to look at the longer term viability of spin-out companies. In 2013, the sector reported 80 active spin-outs from RPOs that are at least three years post-incorporation and which have at least one paid employee and have raised investment and/or have booked sales revenue. Further studies will be undertaken on the sustainability of spin-outs companies.

Whilst the role of the TTOs is broad, the resources to support these have remained static over the past few years. TTOs support the RPO across a wide range of activities including seeking and/or managing research contracts from government organisations, negotiating contracts (collaboration, consultancy, contract services, CPD) with industry, evaluating new intellectual property, IP protection and management, licensing, spin-out company creation, managing incubation facilities, student enterprise training and building knowledge transfer networks.

Appendix 1:
Glossary

Agreements - Collaborative Research	Agreements where the academic and company jointly develop the work plan.
Agreements - Consultancy	Agreements where the RPO provides expert advice without performing new research. Accurate data provided for the Annual Knowledge Transfer Survey are only available where the funds flow directly to the HEI. Where details are not known, a best estimate is provided.
Agreements - Contract Research (Contracted services)	Agreements where the company specifies the work to be undertaken.
Agreement – Evaluation	Agreement in which a potential licensee or partner is given the opportunity to evaluate a technology for an agreed period of time.
Agreements – Material Transfer (MTA)	An agreement that governs the transfer of tangible research materials between two organisations, where the recipient intends to use it for his or her own research purposes.
Agreements - Options	An agreement in which the RPO grants a potential licensee a period of exclusivity during which it can decide whether it wishes to take a licence to the intellectual property.
Invention disclosures	Descriptions of inventions that are evaluated by the TTO staff or other technology experts to assess their commercial application. Sole invention disclosures are reported to one institution due to inventors being employed by a single RPO. Joint disclosures occur when the inventors are from more than one institution and each discloses to their TTO.
IDF	Invention disclosure form. The formal process through which a new invention of technology is accepted for development by the TTO.
IoT	Institute of Technology.

Knowledge transfer	The way in which businesses and RPOs work together to enable research discoveries to be used by companies for translation into new products, services or technologies. It includes: licensing of intellectual property (IP), technology, prototype; transferring materials and other assets; undertaking collaborative research projects; commissioning contract research or consultancy advice designed to solve a business problem; creating a new spin-out company. One type of interaction may include or lead to another. For example, a collaboration project may give rise to new IP that is licensed to the company or a license to IP may be supported by some consultancy work.
KTO	Knowledge transfer office. Sometimes called: innovation office, industry liaison office, technology transfer office, partnerships office, knowledge exchange office.
LOA	Licence, Option and Assignment. The types of contract used to pass rights to IP and technology to a third party.
Priority patent application	The first filing of a patent application from which it can take a priority date of invention.
Patent portfolio	All patent applications at the various stages of examination and all granted/issued patents owned/co-owned by the HEI. Abandoned patents/applications are excluded.
PCT	Patent Cooperation Treaty. The route to filing an international patent.
RPO	Research Performing Organisation. University, Institute of Technology, State Research Body, Specialist research institute.
TTO	Technology Transfer Office.

Appendix 2:
List of Research Performing Organisations (RPOs)

Reporting Sector	Institution
University	University College Dublin
	Dublin City University
	University College Cork
	National University of Ireland Galway
	Maynooth University
	Trinity College Dublin
	University of Limerick
Institute of Technology	Dublin Institute of Technology
	Waterford Institute of Technology
	Cork Institute of Technology
	Athlone Institute of Technology
	Institute of Technology Blanchardstown
	Institute of Technology Carlow
	Dundalk Institute of Technology
	Dun Laoghaire Institute of Art, Design & Technology
	Galway-Mayo Institute of Technology
	Letterkenny Institute of Technology
	Limerick Institute of Technology
	Institute of Technology Sligo
	Institute of Technology Tallaght
	Institute of Technology Tralee
Specialist Institute	National College of Ireland
	National College of Art and Design
	Royal College of Surgeons in Ireland
State Body Sector	Marine Institute
	Teagasc

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