KTI
Knowledge Transfer Ireland
Where Research & Business Connect

IP PRAGMATICS

KTI AKTS IMPACT STUDY 2014

A review of the outcomes reported in the

Annual Knowledge Transfer Survey (AKTS) 2014

CONTENTS

1 BACKGROUND

Knowledge Transfer Ireland (KTI) published the Annual Knowledge Transfer Survey (AKTS) 2014[1] as part of its Annual Report 2014. This annual survey studies business engagement and commercialisation activity from Ireland's State-funded Research Performing Organisations (RPOs). Amongst other data, the AKTS 2014 details the following outcomes derived from academic opportunities in Irish RPOs:

1. the number of products and services based on licensed technologies which were brought to market in 2014; and
2. the number of spin-out companies from HEIs which continued to be active in 2014 and are at least three years post formation.

The Annual Report and Annual Knowledge Transfer Survey 2014 also includes a summary of a deeper review which IP Pragmatics undertook on behalf of KTI, to examine active spin-outs and new products and services that were reported the previous year in the AKTS 2013.

KTI commissioned IP Pragmatics Ltd (IPP) to repeat this review for the outcomes reported in the AKTS 2014, to give a rich picture of these products and services, and the active spin-out companies. Our aim was to collate comprehensive information on the impacts of these outputs from the technology transfer offices (TTOs) and to identify case studies which exemplify the knowledge transfer outcomes from the RPOs.

This report details IP Pragmatics' findings from this assignment.

[1] http://www.knowledgetransferireland.com/About_KTI/Reports-Publications/KTI-Annual-Report-and-Annual-Knowledge-Transfer-Survey-2014.pdf

2 METHODOLOGY

For this project, detailed and comprehensive information has been gathered for each of the outcomes. The information for these outcomes has been gathered from a number of sources:

- AKTS data
- Data already held by KTI or Enterprise Ireland
- Public sources, including websites, press releases, databases (IP, market, technical)
- Existing case studies and overviews on the companies and technologies
- Previous reports and documents on Impact from research in Irish RPOs
- The originating TTO / RPO
- The licensor of the technology and/or the spin-out company

IP Pragmatics would like to thank all the Technology Transfer Officers contacted for their help with provision of information and advice to allow us to build this rich picture of the impact arising from the research in their organisations.

2.1 DATA DEFINITIONS

Active spin-outs have at least one paid employee and have raised investment and/or have 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 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 may or may not hold equity in the spin-out. Active spin-outs exclude start-ups and spin-ins. In this study, we examined in more detail the active spin-outs that were reported in the AKTS data to be at least three years old at the end of 2014, and so had been founded during 2011 or earlier.

The research also considers previous licences from the Irish RPOs which have led to the market launch of **products or services** during 2014.

There remains some inconsistency in data reporting between the RPOs, mostly around reporting of the older spin-outs and of some acquisitions and exits, particularly where they retain an equity interest in the ongoing company. However, there is now a clear definition which is used by KTI and within the RPOs, and an additional category of data added to collect information on mergers and acquisitions, which should lead to more consistent data.

Not all RPOs have the same approach to taking equity in the spin-outs, and the approach taken by a specific RPO may also change over time. For example, before the TTO structure within Ireland was strengthened, a spin-out may have been less likely to have University-held equity. Teagasc is currently unable to take equity in any spin-out companies. For the other RPOs, their position will depend on the specific circumstances of the spin-out, and on the company and RPO relationship to the founding intellectual property. Sometimes the RPO will take equity, sometimes it will take an alternative revenue share and sometimes it does not have any ongoing potential to receive revenue from the spin-out. Where an RPO has an equity stake in the spin-out, it tend to be more able to gather detailed information about the ongoing company status, than when a company has weaker ties to its parent RPO.

3 OUTCOMES AND TRENDS

3.1 OPPORTUNITIES EXAMINED

In the AKTS 2014, 13 RPOs reported active spin-outs and/or products brought to market in 2014 based on a licence from the RPO. The data provided show 97 Active Spin-outs and 30 licensed technologies brought to market in 2014. As expected, the longer established and more research-intensive organisations tended to report more active spin-outs and licensed products than some of the newer and less research-intensive organisations:

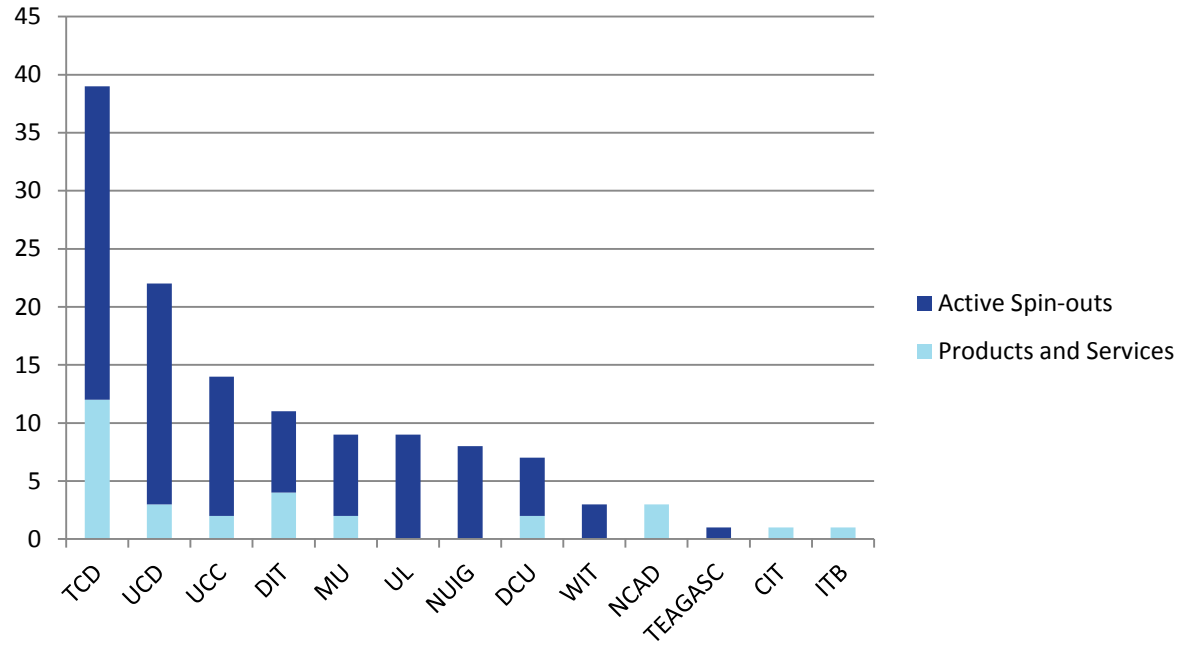


Figure 1: Number of active spin-outs and products/services brought to market in 2014

Of the 78 active companies examined in detail from the AKTS 2013 survey, 3 companies which were included in the previous report no longer meet the "active" criteria and have been removed from the survey, and one was successfully bought out during 2014, and is no longer classed as an active spin-out. Five companies were added to the list due to changes in the interpretation of the criteria for the category. Overall there is an increase of 19 active spin-outs, which is mainly due to a new cohort of 18 companies which were established during 2011 and so now meet the criterion of being active for 3 or more years by the end of 2014.

In terms of products and services, 30 were reported as launched during 2014, a slight increase on the 26 that were reported as launched during 2013. For reasons that will be discussed further in Section 3.3, this is likely to represent an underestimate of the actual number of new products and services reaching the market during the year.

For some of the detailed data which were sought in this study it has not been possible to collect comprehensive information. This is usually because the RPOs either do not collect the data at all, or are reluctant to share data that are not in the public domain. Where the data may not be complete, this has been highlighted in the relevant sections to follow.

3.2 ACTIVE SPIN-OUTS

There were 97 active spin-outs reported at the end of 2014. One of the companies was a collaborative spin-out based on technologies which were developed at both UCC and DCU. This company has been credited to both universities in the graph in the previous section (which therefore shows 98 companies), but has only been included once in the analysis of the spin-out characteristics which follows to avoid double counting.

3.2.1 YEAR OF REGISTRATION

The AKTS 2014 survey examined spin-outs which were still active, more than three years after they were founded. This therefore included companies which were registered in 2011 or earlier. The following graph shows the dates of registration of the companies we examined:

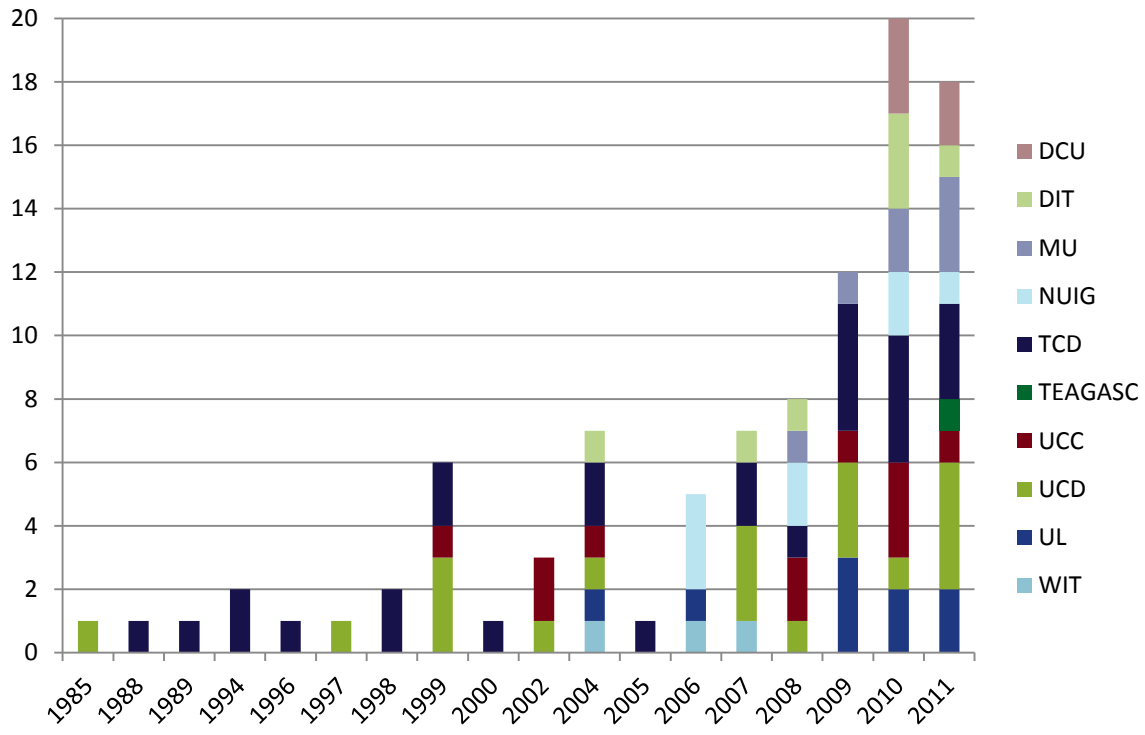


Figure 2: Active spin-outs by RPO and year of foundation

The graph shows two step changes in activity. Before the late 1990s, the only Universities founding spin-outs which have continued until today were UCD and TCD. In the early 2000s, other RPOs became more active, and since the introduction of the Technology Transfer Strengthening Initiative programme (TTSI1) in 2007, there has been a second step change with more organisations forming more spin-outs. The graph also shows the longevity of companies considered 'Active' by the end of 2014. Over half of the companies have been active for 3-5 years, as shown in the graph below:

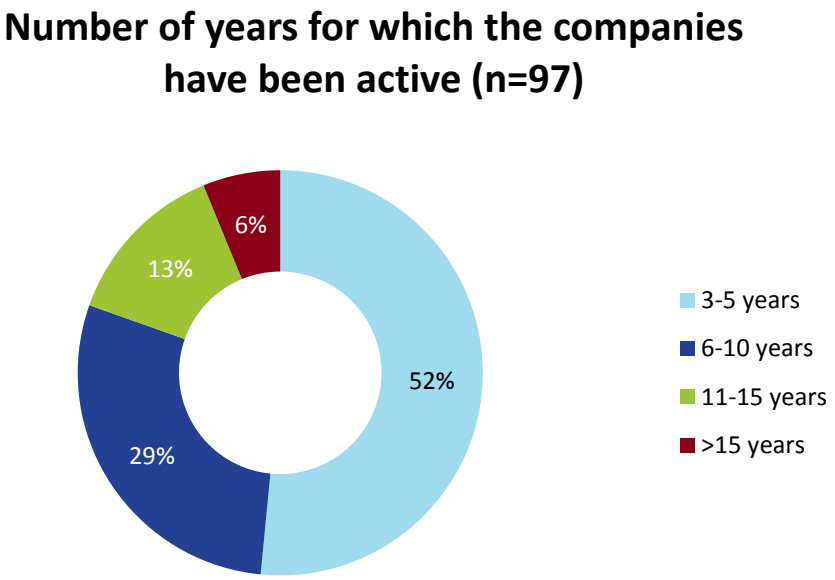


Figure 3: Percentage of companies which have been active for different lengths of time.

3.2.2 LOCATION

All but one (99%) of the active spin-outs are still located in Ireland, often remaining near their founding institution. Almost 65% of the spin-outs are based in the capital, Dublin. The table below shows the current location of the active spin-outs from each of the founding RPOs, with the home location for each RPO highlighted by the blue cells.

Location /RPO	DCU	DIT	MU	NUIG	TCD	UCC	UCD	UL	WIT	Teagasc	Total
Dublin	4	5	4	1	26	3	17	2		1	**63**
Cork					1	7		1			**9**
Galway				6				1			**7**
Limerick						1		4			**5**
Waterford									2		**2**
Maynooth			1								**1**
Tralee, Co Kerry								1			**1**
Ballybrittas, Co Laois	1										**1**
Omeath, Co Louth			1								**1**
Leixlip, Co Kildare			1								**1**
Ballindine, Co Mayo				1							**1**
Summerhill, Co Meath							1				**1**
Dunmore East, Co Waterford									1		**1**
Arklow, Co Wicklow		1									**1**
Greystones, Co Wicklow							1				**1**
Bournemouth, UK		1									**1**

Table 1: Current location of active spin-outs from each founding RPO.

The continued presence of these companies within Ireland does not necessarily indicate a lack of global ambition. Of these 97 companies, we found that 32 (33%) have established offices and/or appointed distribution agents in at least one overseas territory. This is an increase on last year, when 23 (29%) had an overseas presence. Five of the companies founded in 2011 are working overseas. Many of the other Active Spin-outs are trading abroad directly from their base in Ireland.

3.2.3 EMPLOYMENT

Accurate figures on employment are difficult to obtain as the RPOs generally do not have mechanisms in place to monitor headcount routinely, although some are beginning to request this information on an annual basis. Most of the companies are below the size where they have to include headcount data in their public annual returns, and they may not be willing to share this information with the RPO. The tendency for headcount to fluctuate, particularly for early stage companies which are taking on temporary student placements as well as seasonal variations and natural turnover can also skew figures. We have made a best estimate of headcount data (number of FTEs on 31 December 2014), based on RPO information and public data, and used this to assign the companies to a headcount bracket to give an idea of their size. We were unable to identify headcount estimates for 5 of the 97 companies.

We can get a feel for the size of the 97 spin-out companies from the graph below. The labelled numbers refer to the percentage of companies which have that range of employee numbers.

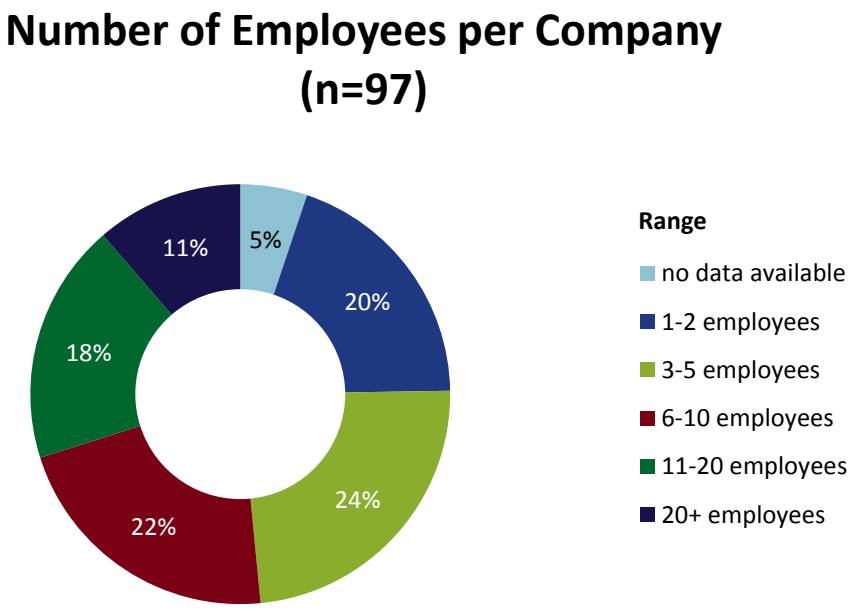


Figure 4: Percentage of active spin-outs within each range of employee numbers

As may be expected, many of the spin-outs remain small, but a significant number have grown well beyond their founding teams and a few are now substantial employers. Of the 11 companies employing more than 20 people, 5 are in the range of 20-30 staff, 2 are in the range 31-40 staff, 2 are in the range 50-60 staff, and 2 employ 100-130 people. Of the 18 companies founded in 2011,

many remain small, but some are starting to employ more people, and one already has more than 20 employees. Overall the distribution for this group is very similar to that of the overall sample.

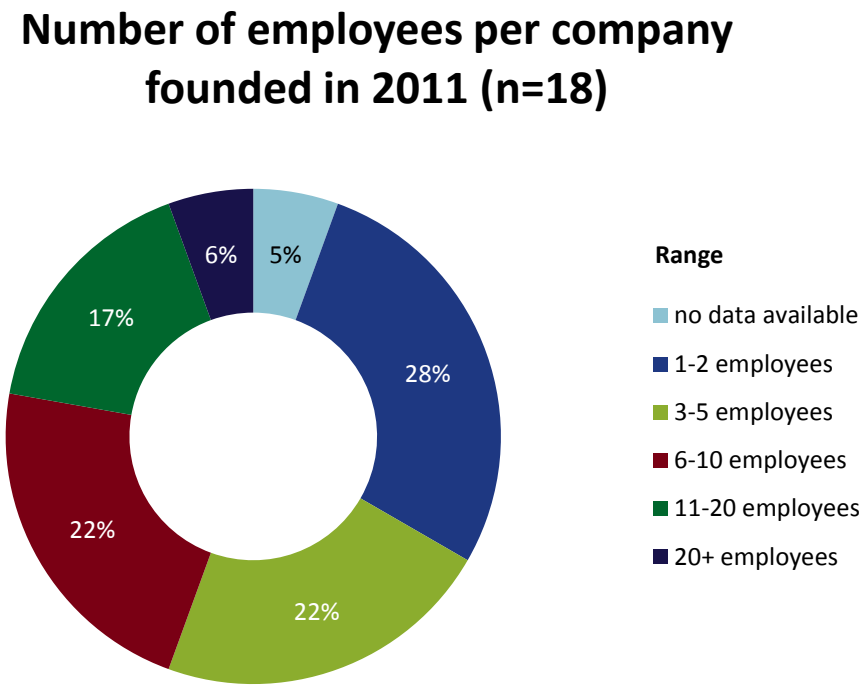


Figure 5: Percentage of companies within each range of employee numbers for active spin-outs founded in 2011.

As a group, the active spin-out companies currently provide employment for more than 930 people, a significant increase on last year's reported total of 660. Some of this increase is due to growth in the companies, but some may also be due to improved and increased reporting mechanisms, so we are reluctant to state that there has been a 30% increase in employment in active spin-outs between 2013 and 2014.

3.2.4 PHASE OF GROWTH

A small number (9%) of the active spin-out companies have either ceased trading since the AKTS data were collected, or were in the process of closing down but still met the definition of "active" at the end of the year. Of the remaining 88 companies, the majority (85%) are now trading and bringing in income.

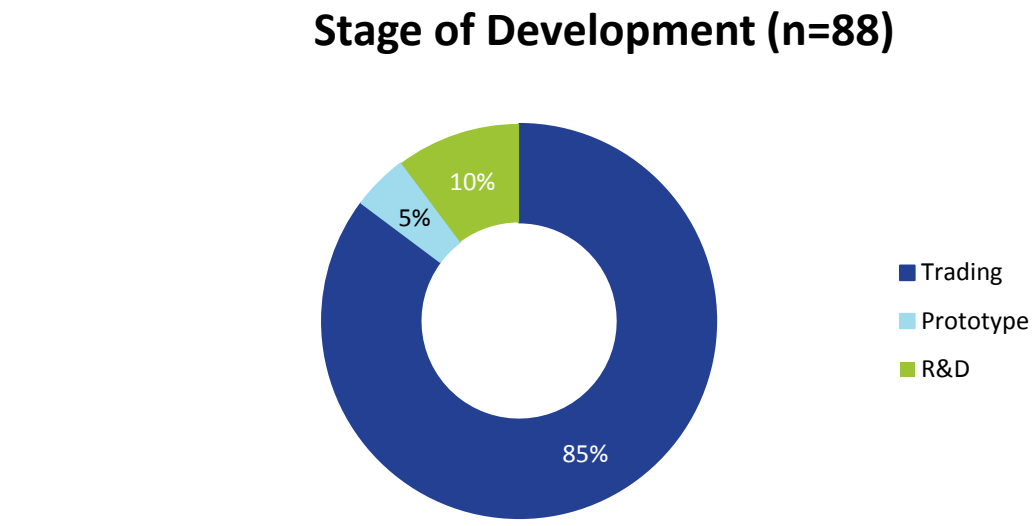


Figure 6: Stage of development of the active spin-outs that are not dormant or closing down

Those which are still in the research phase are almost all in the Therapeutics sector, where it is well known that time to market is long. It can often take over 10 years to bring a Therapeutic to market.

The status of the 88 companies in development and trading phases by originating RPO is shown in the following graph:

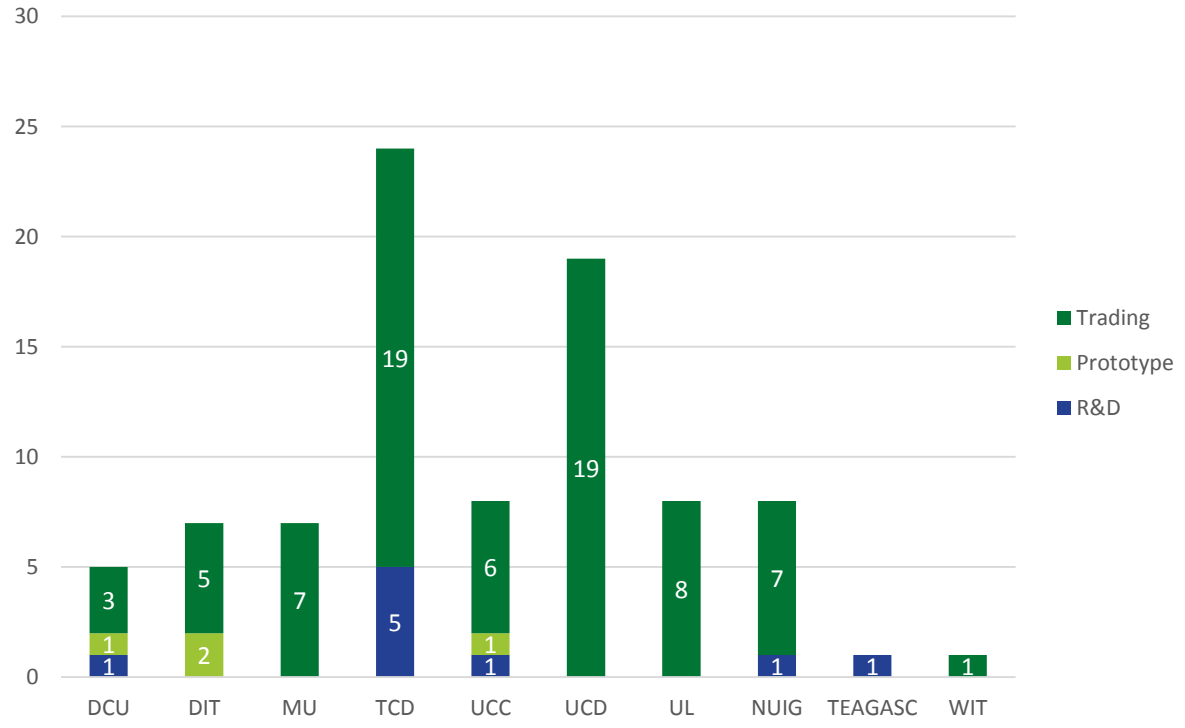


Figure 7: Number of active companies by founding RPO and phase of development

3.2.5 FUNDING

The funding and investment data gathered are incomplete. Investment amounts are not always made public, particularly for smaller companies raising smaller amounts of angel investment or loans. In this study we obtained investment status data for 84 companies, and for 67 of these we also obtained detailed information about the amount raised. We were unable to gather any data about funding or investment into 13% (13) of the companies.

We looked at the sources of funding for the 97 active spin-outs and the largest category appears to be Venture Capital and corporate funding. However companies backed by Venture Capital investors will be more likely to disclose their funds raised, as this is viewed as a measure of their success, particularly where large sums have been raised. Whilst high growth start-ups tend to announce the investment that they receive, more organic growth companies do not tend to release such commercially sensitive data. The information we have gathered will therefore be skewed towards the 28 companies which have raised larger amounts of money through these sources. Another 14 companies are known to have funded themselves using trading income.

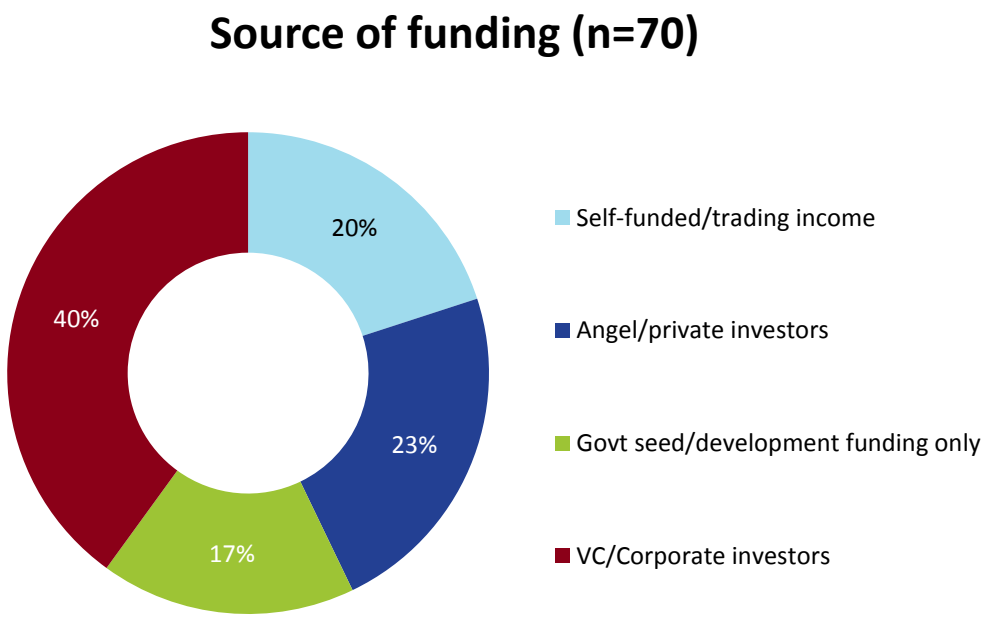


Figure 8: Sources of funding for companies which have disclosed this data

Of the 67 companies with detailed monetary data, 23 (34%) reported that no investment had been raised, most likely due to their business model. 17 of the companies are known to have raised some investment, but have not made public the amount that was raised. From the investment data which have been found, we can say that 44 active spin-out companies have raised in excess of € 244,936,000 (€245M) amongst them. Of these 44 companies that have published the amounts of investment received or were willing to disclose it, the lifetime investment raised is shown in the chart below. Nearly half of these have raised between € 1-10 million.

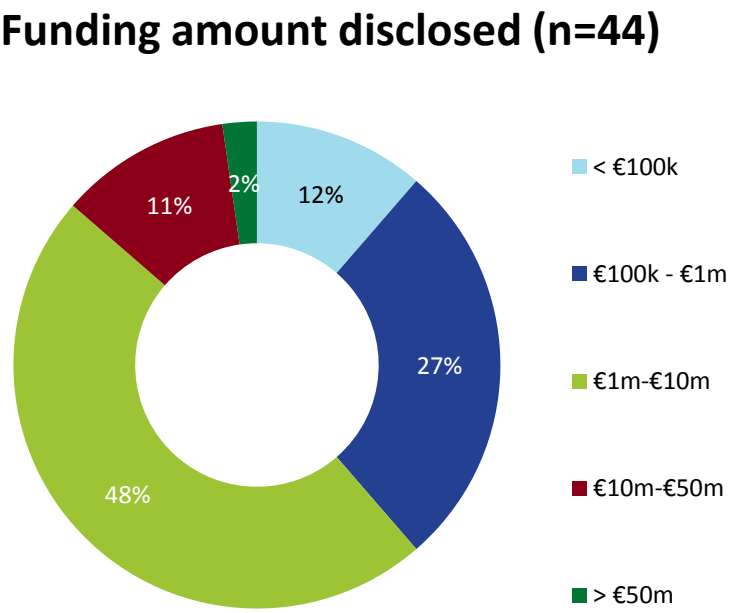


Figure 9: Lifetime amount of funding received by the companies which have disclosed this information

3.2.6 TYPES OF INTELLECTUAL PROPERTY

Information about the type of intellectual property which was transferred from the RPO to the spin-out is not available in all cases. This is particularly true for some of the older spin-outs, or where the IP foundation of a company is particularly commercially sensitive. We have obtained information about the IP basis for 92 of the 97 spin-outs; in some of these cases, it is thought that no formal IP transfer occurred, and the spin-out was based on the expertise of the founding academic. This will also be the case for some of the companies which are based on know-how alone, where it is unusual for a pure know-how licence to be put in place. Formally registered IP is not always the most suitable way to protect some types of knowledge, which is commercially better protected by keeping the details secret. For example, these companies may be based on processing techniques or proprietary assays, or have service provision as their business model. Most of these companies will still have their founding RPO as a shareholder, however.

About half of the spin-outs are based on patents originally filed by the RPO. This is usually licensed to the company in the first instance, but in some cases may later be assigned once the company is secure or has raised suitable levels of external funding to allow it to support itself. A smaller number of the spin-outs are based on software code and algorithms. Other types of intellectual property, such as designs, copyright, trade secrets or materials are involved less often in the spin-outs, but are used where appropriate. In almost all cases, know-how from the founding academics will be used to inform the company business, even if it is not formally transferred from the RPO or included in a licence agreement. The overall contribution of the different types of IP to the formation of these active spin-outs is shown in the graph below:

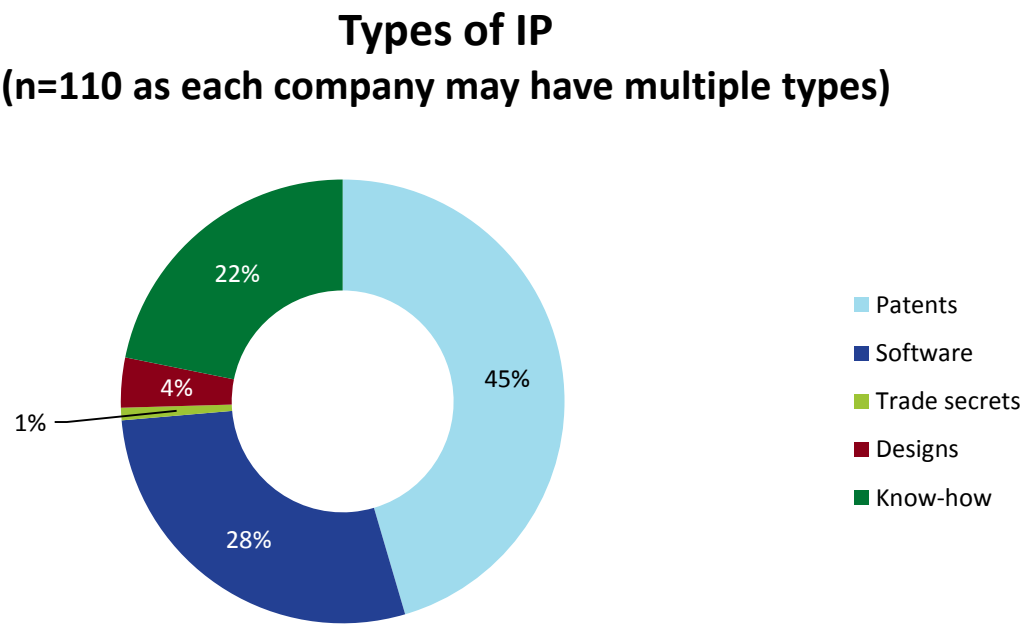


Figure 10: Types of intellectual property transferred to the active spin-outs

The graph above is based on the number of times that a particular type of IP has been used as the foundation for the active spin-out cohort. Each spin-out may involve multiple different types of IP, as illustrated in the following graph, which shows the number of companies receiving 1, 2 or 3 different types of IP, for companies where we have received this information:

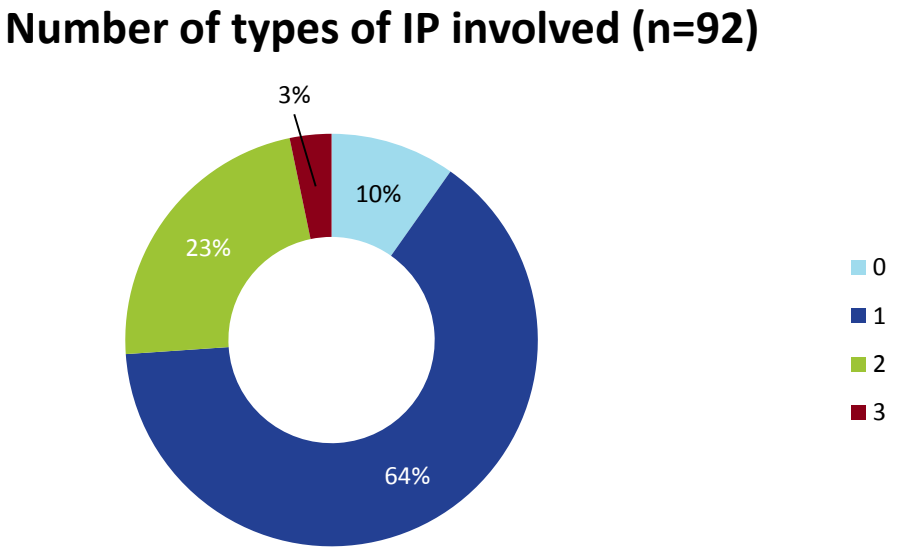


Figure 11: Number of companies with the specified number of different types of IP transferred from the RPO

Of the 92 companies reporting transfer of IPR from the founding RPO, 3% were based on 3 different types of IPR, 23% of 2 different types of and 64% were founded on one type of IPR only.

The cases with zero types of IP either have not provided any specific information, or are based on the expertise of the founding academic, with no formal transfer of IP from the RPO.

3.2.7 SECTORS

In 2012, a report from the Research Prioritisation Steering Group[2] identified 14 priority areas that will become the focus of future State investment in research and innovation. The priority areas build on existing research strengths and investments and target public investment towards areas which will ensure that Ireland is a top-tier location for knowledge and innovation intensive enterprises and jobs for the future. The 14 priority areas span all fields of science from natural sciences and engineering to humanities and social sciences, and are grouped into Themes of related areas, as shown in the Research Centre Directory Ireland[3].

We have mapped the active spin-outs to these Priority Areas. Where a company is active in more than one area, it has been assigned to the one which we feel most closely fits their commercial focus. The following charts show the active spin-outs from each of the RPOs, organised into Themes and then split into Priority Areas.

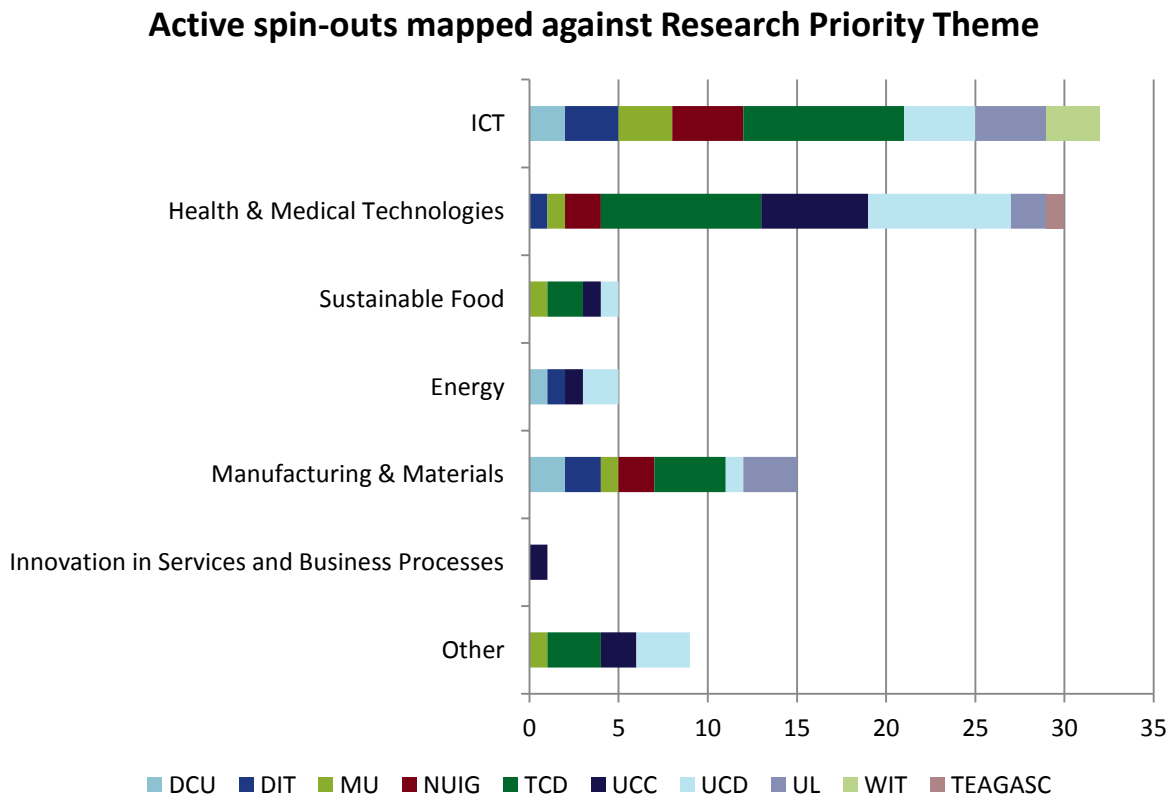


Figure 12: Active spin-outs by RPO, mapped against research priority themes

[2] http://www.forfas.ie/media/ffs20120301-Research_Prioritisation_Exercise_Report.pdf

[3] http://www.knowledgetransferireland.com/Research_in_Ireland/Research-Centre-Directory/

The two most active sectors are ICT and Health & Medical Technologies, which between them represent 62 (64%) of the active spin-outs.

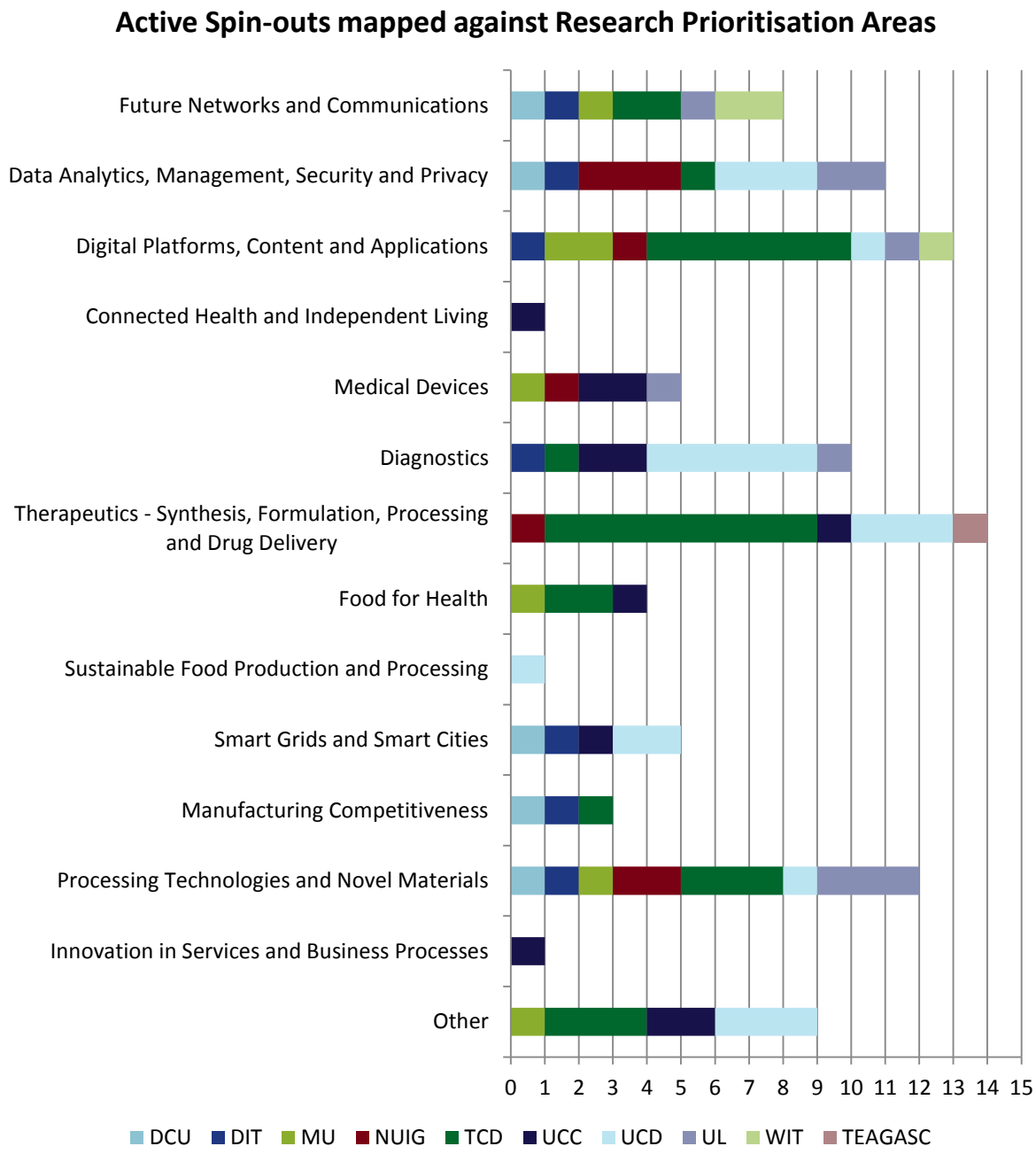


Figure 13: Active spin-outs by RPO, mapped against research prioritisation areas

The spin-outs which do not fit into one of the Priority Areas have been shown in the "Other" category. These are active in the following sectors:

- Electronic Circuit Design
- Environmental Services

- Hand-wash monitor
- Instrumentation
- LEDs
- Light detection instruments
- On-line genealogy
- Policy consultancy
- Road-noise monitoring

Case Study – Active Spin-out Sonic Ladder spun out of DIT 5 years ago, based on a licence to proprietary IP from DIT, the company has recently been acquired by Fender.

Riffstation

For aspiring guitarists everywhere, Riffstation from Sonic Ladder is the ultimate practice app. It can take any music track from any audio format, even a new track that has never been heard before, and teach the guitarist how to play the chords by showing where each finger should be at the right time in the track. It does all this in real time to the music as it plays. Or it can remove the guitar track from the playback altogether, so that you can play along.

Sonic Ladder is a music software company spun out from the Audio Research Group at Dublin Institute of Technology (DIT). The company was founded by Dan Barry, Mikel Gainza and Martin Gallagher in 2010. They are keen guitar players as well as software programmers, which they say is the genius behind the product. Riffstation came about because they wanted to create a product that they would have loved when they were starting out on the guitar.

The core technology in Riffstation is Audio DSP, and the research behind the product began with Dan Barry and Mikel Gainza's PhD work at DIT. Dan and Mikel along with others set up the Audio Research Group in 2006, which 13 researchers and worked on several research projects around audio processing.

The group developed several audio technologies that DIT licensed to various companies including Sony Computer Entertainment. They subsequently went on to form Sonic Ladder. The team has worked very closely with Tom Flanagan who leads DIT Hothouse, the Innovation and Technology Transfer Centre at DIT. Tom supported the initial patent application which provides the foundation of the commercialisation activities of the group and led the licence discussions with large companies and into the Sonic Ladder spin-out.

Since launching, Riffstation has become so popular with guitarists that the company was recently acquired by the iconic guitar maker Fender. The research group will remain in Dublin, and have just moved into new offices to accommodate their growing workforce.

Added value from the university: Intellectual property, commercialisation route advice, licensing, spin-out support

3.3 PRODUCTS AND SERVICES LAUNCHED IN 2014

There are some challenges associated with studying the impact from licensing from RPOs. For example, there may be commercial sensitivity surrounding licence deals, which the licensee company does not always wish to make public. Once the technology has been transferred, the RPO may not always be aware of the contribution of their intellectual property to the products and services offered by the licensee, particularly where the licence leads to an improvement in existing products, rather than the development of a completely new product line. Monitoring of licences by an RPO may not be routine and in some cases is not made possible by the licensee. Sometimes an RPO may only become aware of a new product once royalties start to be paid, which can be delayed one or more years after the product launch. The 30 products and services identified in this study will therefore be an underestimate of the actual number of new launches.

The data set for licensed products and services considers new products and services which were launched during 2014 only (although the licence itself may have been signed earlier). The majority of these were products, but four were services or included a service element

3.3.1 LICENSEE

The type of companies which have licensed technologies from the Irish RPOs ranges from small start-ups to multinational corporations. About 70% of the licences are to spin-out companies from the same RPO. All these spin-out licensees were SMEs, whilst some of the non-spin-out licensees were larger companies.

The chart below categorises the licensee companies according to size.

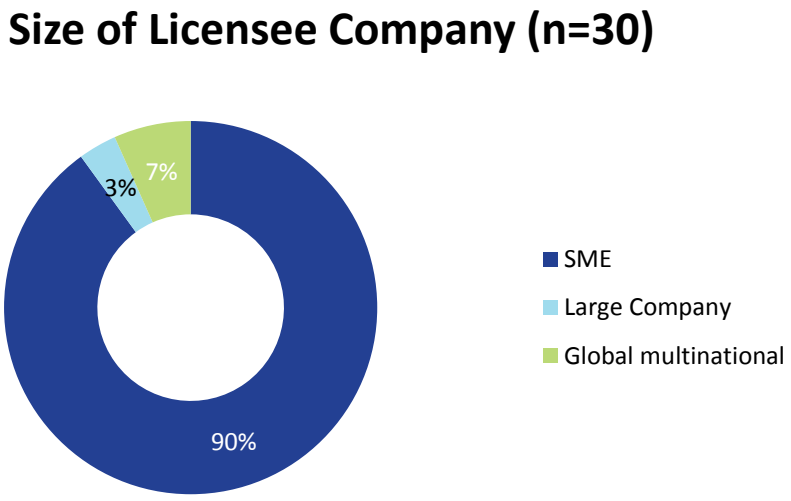
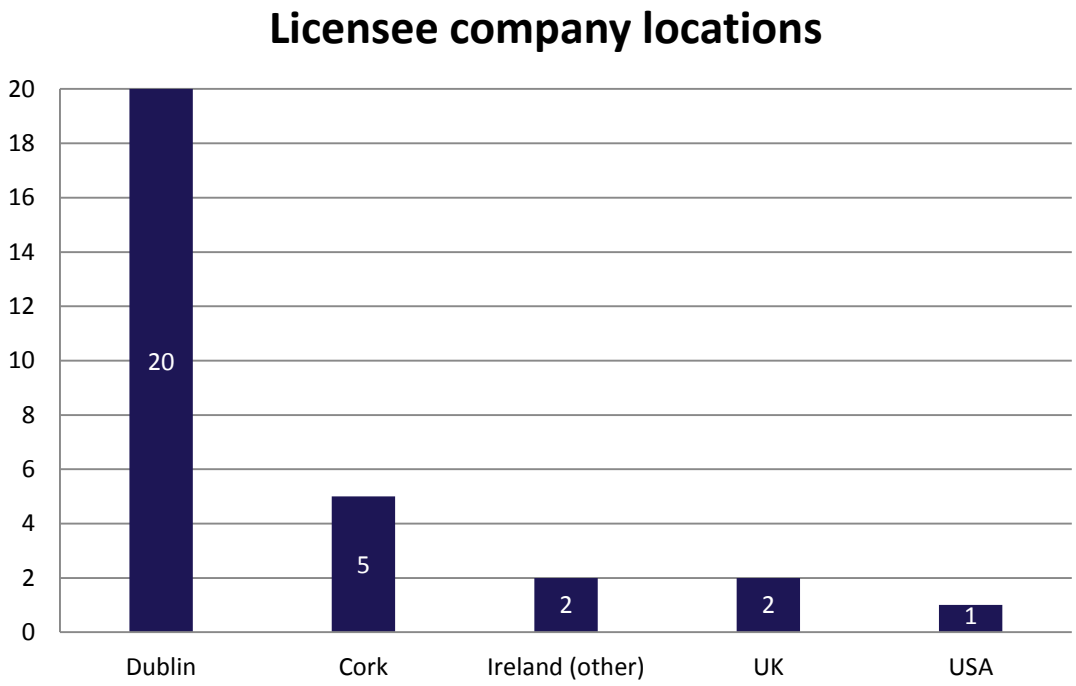


Figure 14: Licenses by size of licensee company

3.3.2 LOCATION



The majority (90%) of the licensee companies are based in Ireland, with a heavy concentration in Dublin.

3.3.3 TYPES OF INTELLECTUAL PROPERTY

We have obtained information about the IP basis for all of the licences. This information can be commercially sensitive, particularly when linked to a particular product, but some information has been gleaned from public announcements and data sources, as well as directly from the RPOs.

The type of intellectual property which is included in the licence varies depending on the technology that is being transferred. About a third of the licences are based on patents originally filed by the RPO. A similar number of the licences are based on software code and algorithms. Other types of intellectual property, such as designs, copyright or materials are again used less often, but are used where appropriate. There were no licences based on know-how alone, although one covered know-how and certification, with no formally registered IP. Know-how will often be licensed in conjunction with another form of IP e.g. to support patent or software licence. The overall contribution of the different types of IP in the licences which lead to products and services is shown below:

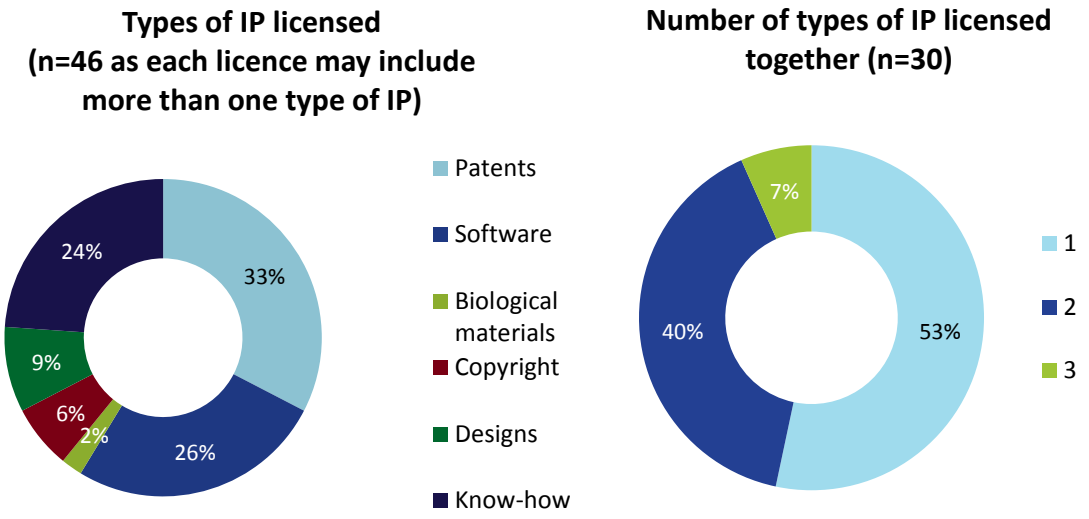


Figure 15: Types of IP licensed, and number of types of IP licensed together for the 30 licensed technologies

3.3.4 SECTORS

We have classified the licensed technologies according to the National Research Prioritisation Themes and Research Priority Areas. Where a product could fit into more than one area, it has been assigned to the one which most closely fits the licensee's commercial focus. As with the active spin-outs results, ICT and Health & Medical Technologies are the most active sectors.

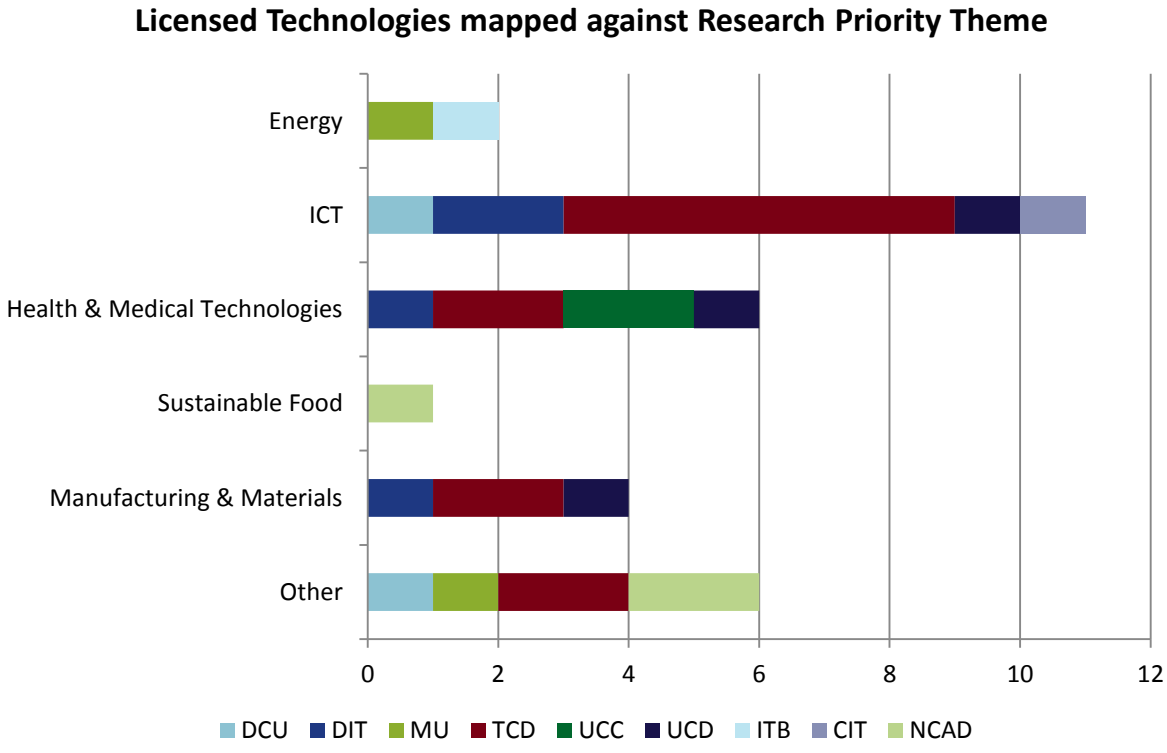


Figure 16: Licensed technologies by RPO, mapped against research priority themes

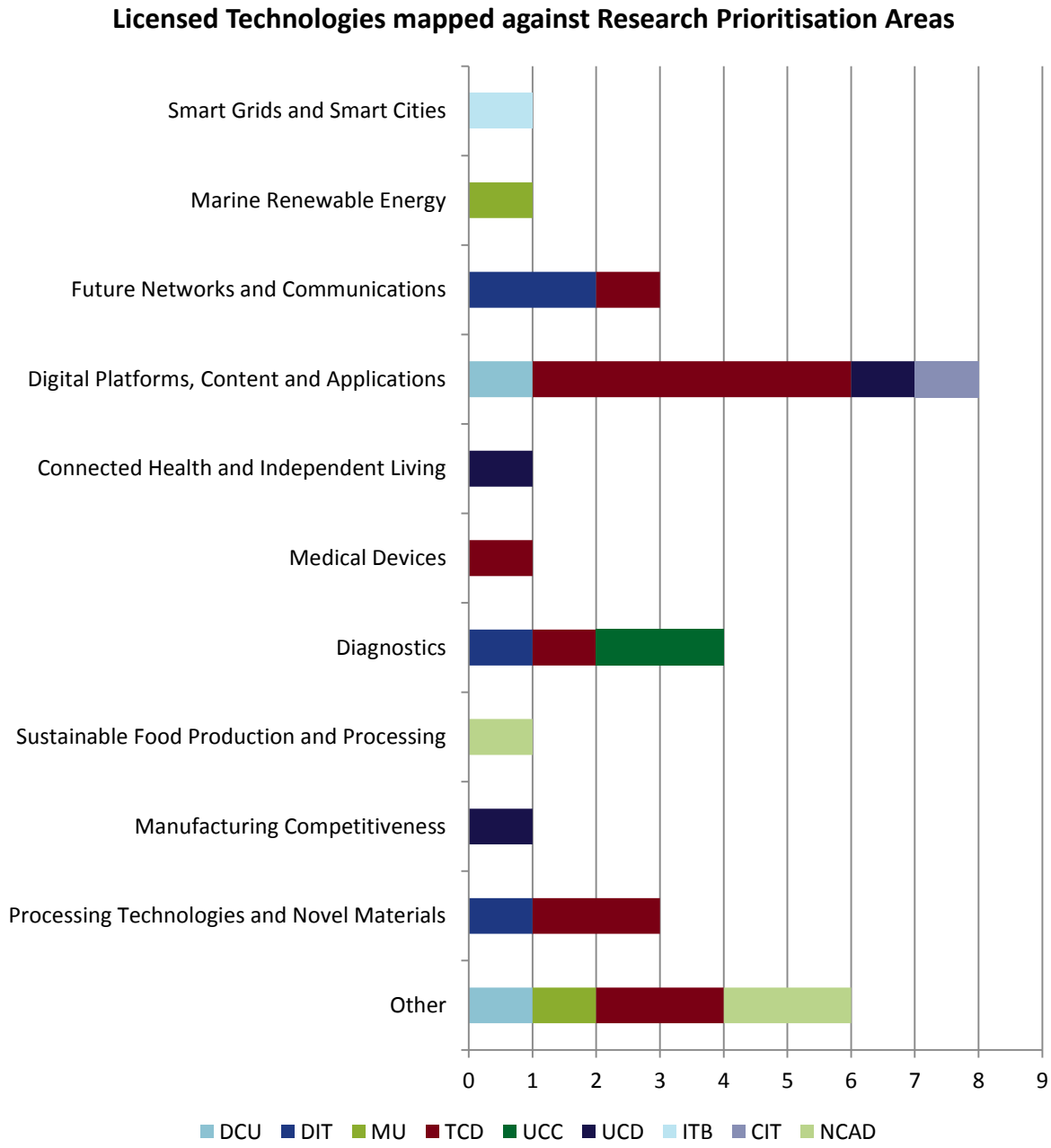


Figure 17: Licensed technologies by RPO, mapped against research prioritisation areas

The licences in the "Other" category fall into the following technology sectors:

- Instrumentation
- Reagents
- Consumer products

Case Study –Electrospraying technology licensed from Maynooth University to Avectas, which has been incorporated into equipment and services launched in 2014. The technology enables the introduction of materials directly into living cells.

The core technology used within Avectas is based on 8 years of research led by the company founders Dr Michael Maguire and Dr Shirley O'Dea at Maynooth University. This platform technology was licensed to the company when it span out from Maynooth University and has subsequently been further developed within the company.

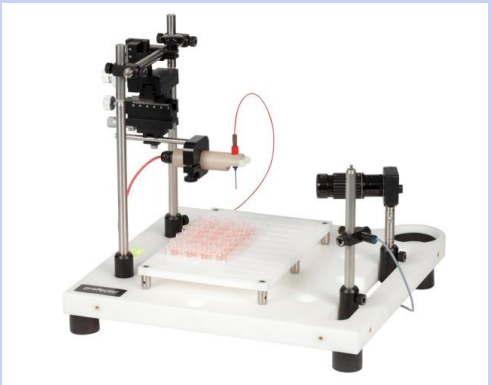
The first products that Avectas developed were instruments from their electrospinning and electrospraying brand Spraybase®, which can be used for research in many industries including cosmetics, food science, medicine and pharmaceuticals. Spraybase® is a CE marked, customisable benchtop instrument that can be used for electrospraying and electrospinning of a wide range of polymers, proteins, biologics and more. Spraybase® devices can now be found in hundreds of academic and industry research labs around the world.

During 2014, the team expanded their offering by launching products, services and partnership opportunities relating to their proprietary delivery technologies, and has continued to refine these since then. Whilst the Spraybase® equipment enables the custom building of materials which are compatible with the human body, Avectas have now advanced their technology to enable introduction of materials directly into the cells themselves. This offers the potential not just to treat, but to cure some rare and neglected diseases. Avectas is entering phase I clinical trials in man which aim to demonstrate the safety and feasibility of this approach.

Avectas' business headquarters are still in Maynooth, where they are now the anchor tenant in the new MaynoothWorks Business Incubator. They have a research team of 18 in Ireland, and also have US offices in Cambridge, Massachusetts. The commercialisation of the technology has been supported by Irish Government and EU grants, Enterprise Ireland and the EU FP7 Programme, as well as the University by means of patent and spin-out support.

The company benefitted from the sensible business approach taken by the University during the spin-out and technology licensing process. "Our ongoing relationship with the University has helped us in several ways" adds CEO and co-founder, Michael Maguire. "Several of our excellent staff have come from the University talent pool, and our migration into the flexible new facilities in MaynoothWorks is giving us a terrific competitive edge."

Avectas' research is beginning to attract the interest of the pharmaceutical industry, and the Avectas technology is now being tested in the labs of some of the largest pharmaceutical companies. Another example of their success is their recent multi-million euro collaboration and investment from Adapt Pharma which will support the continued development of the technology platform with the aim of advancing therapeutics across a number of disease areas.



APPENDIX: ABBREVIATIONS

CIT	Cork Institute of Technology
DCU	Dublin City University
DIT	Dublin Institute of Technology
EI	Enterprise Ireland
IPP	IP Pragmatics Ltd
ITB	Institute of Technology Blanchardstown
KTI	Knowledge Transfer Ireland
MU	Maynooth University
NCAD	National College of Art and Design
NUIG	National University of Ireland Galway
RPO	Research Performing Organisation
TCD	Trinity College Dublin
TEAGASC	Teagasc, Oakpark, Carlow
TTO	Technology Transfer Office/Officer
UCC	University College Cork
UCD	University College Dublin
UL	University of Limerick
WIT	Waterford Institute of Technology