

**Sustaining and Growing the Delivery of
Strategically Oriented, Impact Focused
Research, Development and Innovation
in the Institutes of Technology**

A Strategic Position Paper Developed by the Heads of Research Group



Overview

The development path of Institutes of Technology (IoTs) began with their formation as regional technical colleges in 1970. From an initial foundation in technical training, the Institutes continued to build education and research offerings from certificate to undergraduate and postgraduate level, with the addition and expansion of Masters and PhD awards providing a full spectrum of technological provision. This was essential in providing a coordinated response to the emerging needs of the small and open Irish economy in maintaining and building its global competitiveness.

This philosophy of responsiveness has defined the development of IoTs, placing them at the forefront of change across the education sector. They have continually evolved their focus, operations and culture to anticipate and meet regional and national economic challenges and opportunities. Balancing their agility with a commitment to leadership and quality, a highly connected ecosystem has developed around the sector, ensuring that teaching, research and innovation remained focused on practical responses to economic and social need.

Now more than ever the Institutes are essential in providing a platform for the further development of Irish economy through research, development and innovation activities. To maximise this contribution, this position paper sets out the strategic direction required to bring this to the next level. It recognises the need to build a community of national and international researchers and leverage new and existing partnerships with industry and academia. This will require IoTs to plan for, invest in and deliver excellent, impact-focused research.

By setting out a series of guiding principles, we provide a blueprint for each Institute to position itself and plan development with other academic and external partners, allowing us to optimise our impact individually and collectively.

- 1. Working with all our stakeholders to define current and future priorities.**
- 2. Building on critical mass in specialist research areas.**
- 3. Delivering postgraduate provision at Level 9 and Level 10 which drives impact-focused research activity.**
- 4. Attracting high quality postgraduate and postdoctorate resources to our Institutes.**
- 5. Establishing and maintaining a research foundation funding programme which ensures a pipeline of postgraduate students in respective IoT specialist areas.**
- 6. Benchmarking research performance through establishment of strategic international partnerships.**
- 7. Complimenting national grants with EU funding wherever feasible.**
- 8. Embedding sufficient research and postgraduate management infrastructure.**

This is a strategy recognising that different institutions are at different points of evolution but that we are all moving towards similar ultimate goals. It will allow each institution to develop along its own trajectory while committing to the wider future direction of the sector as a whole. A final critical aspect of this paper involves the setting of targets in line with the unique contribution which can be made by IoTs in delivering regional, national and European RDI impacts.

Introduction

The Institutes of Technology (IoTs) have long been at the forefront of change across the education sector, evolving their focus, operations and culture to meet the needs of a rapidly changing economyⁱ. They have played an important role in developing research and innovation capability across Ireland and in realizing economic impact from such development, with their proximity to industry and particularly SMEs a key driver of activityⁱⁱ. Now, at a time of significant change in both the higher education sector and the wider economy, it is critical that the Institutes sustain and grow their delivery of strategically oriented, impact focused research, development and innovation (RDI) services.

This paper has been developed by the Heads of Research of the IoTs and sets out an overall strategy to achieve this and to deliver on Government objectives from its future research investment in this area. It provides a framework which will underpin the research strategies of all our Institutes of Technology and clearly sets out the impacts that can be achieved through its realisation. All of the content in this paper is underpinned by detailed analysis and strong evidence which is set out in a series of annexes in a separate accompanying document.

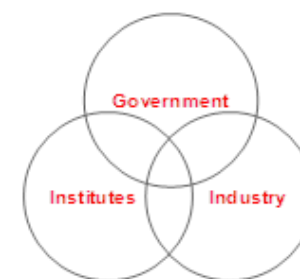
The drivers of our future strategy

With the economic downturn and fiscal crisis facing Ireland, decisions on the way in which future research, development and innovation investment should be channeled were brought into sharp focus. The generation of sustainable economic impact from such investment was deemed an over-riding priority. Ireland's development of RDI capability had led to recognition within the second tier of global innovation performers, but the ambition remained to move from its status as an innovation follower to that of an innovation leader. A number of recent policy developments underpin the future Irish RDI environment and these must drive the research strategies of all higher education institutions:

- The **National Strategy for Higher Education** has been set through to 2030ⁱⁱⁱ, emphasising the need to build on existing investment to maximize future impact and on rationalizing and consolidating RDI activity around key areas of expertise. It places a strong focus on regional clustering and provides for the creation of a new type of institution, the Technological University, which could potentially build on the skills and attributes of the existing IoTs with further partnership, development and prioritization.
- A **National Research Prioritisation Exercise**^{iv} was commissioned which has designated 14 areas around which future national STI funding would be prioritised, based on a combination of enterprise relevance and existing research strength.
- The **changing remit of Science Foundation Ireland** to reflect the need to fund applied as well as basic research activities, with its scope widening beyond ICT and biomedical research to the other priority areas.
- The **formation of a single Irish Research Council**, providing a platform which should facilitate multi-disciplinary research and funding for a greater variation of postgraduate provision including employment-based opportunities in industry.
- A Forfás study on sustainability of research centres^v noting a need to fill a significant gap in engagement between higher education institutions and SMEs around RDI and in stimulating and supporting innovation in indigenous companies via **'industry pull' research centre models**.
- The renewed **commitment by Enterprise Ireland** to funding the **start-up of innovative companies** through New Frontiers, **engagement in innovation by existing industry** through Technology Gateways and a more strategic **collaborative approach to technology transfer** through the Technology Transfer Strengthening Initiative 2.

The rapidly evolving research landscape over the last decade is thus entering a new phase of development, and the search for impact driven, industry focused RDI activity will underpin future national funding and support decisions. It is critical that the sector responds dynamically and with a clear sense of where its future impact can be greatest, and this must involve:

Developing a connected research and innovation ecosystem in which all elements of the triple helix benefit and inform each other. Interactions with industry often require rapid development of solutions, yet depend on longer-term investment in expertise by the institution to enable those rapid solutions to be developed. Educating the next generation of scientists, engineers and other future professionals, technologists and entrepreneurs will always require institutions to engage in



longer-term planning and students will benefit from being taught by staff involved in cutting-edge research. There must exist a proactive mechanism to encourage staff to become and remain research active, allied to a career path for contract researchers to (i) keep them in the system and (ii) ensure they become part of the teaching mission. Multi- and inter-disciplinary research are of increasing importance and IoTs could potentially take advantage by embedding a multi-disciplinary research and teaching ethos and effective implementation mechanisms.

Focusing on particular areas of expertise, commensurate with the size and vision of the institution, and aligned with national priorities^{vi}. These will be areas where IoTs can demonstrate and maintain excellence, impact and relevance in research, teaching and learning, and industry interaction. This focus will maximise regional and national relevance and allow effective deployment of targeted research support structures. Institutes must be dynamic and responsive, amending and reviewing their focus on a regular basis (e.g. every 5 years). They should not be seen as reacting to industry's needs, nor working for industry – rather they should be seen as providing world class education and research in association with industry and society.

Finding a balance between research and teaching that places research informed learning at the heart of delivery, supporting academics to become research active without undermining the efficiency of undergraduate provision. Contracts of IoT academic staff must reflect the prioritization of research and innovation within wider institutional strategy and there must be a seamless link between undergraduate and postgraduate provision.

Achieving this balance will also maintain an overriding focus on **delivery of industry ready graduates** as a key driver of research and innovation activity. IoTs which consider the only objectives of research as solving industry problems and generating IP will find such activities become increasingly disengaged from the general operation of the institution and therefore run the risk of being marginalised. The knowledge economy requires graduates with understanding of, and exposure to, innovation techniques and practices and all Level 9 and Level 10 students will find this engrained within provision. This will also extend into areas of social innovation where there is a unique opportunity to exploit the connectivity of IoTs with local communities and other stakeholders to address social as well as economic needs.

The **correct balance in the nature of research undertaken** is a final critical feature. An over-reliance on what is termed as 'applied' research will harm the capacity of research groups to be competitive over time, despite pressure for immediate RDI impact due to the present economic situation. Excellence in the fundamentals of any discipline is the best way to secure flexibility and responsiveness – being a leader and not merely a follower. However the traditional linear model of innovation (based on the premise that basic research leads to applied research leads to pre-product development and to commercialization) can no longer be assumed. Thus delivering effectively on industry and society needs requires a complex array of stakeholder relationships, including across IoTs and in deepening ties with universities where relevant.

These core drivers of institutional strategy will ensure an impact focused approach to all of our RDI activities. They will be reflected in every aspect of delivery, with such mechanisms further outlined in the next section.

Shaping our delivery mechanisms

The rapidly evolving landscape and the need for strategic change will continue to impact significantly on all IoT operations. We must ensure that all RDI activities are fully integrated within the wider delivery of services, reinforcing the overall strategy and culture of our Institutes and underpinning the learning and third mission activities undertaken. Mechanisms to achieve this will include:

Embedding the link between research and the undergraduate teaching programme. There is no doubt as to the critical importance of Level 9 and Level 10 provision in meeting the needs of Ireland's knowledge economy and an integrated approach between the research agenda of IoTs and the undergraduate teaching programme will be essential for success. Our institutes have always recognised the significance of exposing undergraduate degree students to a research environment via research centre internships, research seminars, lecturing by research-active staff and undergraduate projects linked to wider research programmes. Many IoTs also now provide seed funding to encourage graduate progression from degree level right through to PhD. We will build on these mechanisms to ensure a seamless pathway from level 6 to 10 across our key specialist disciplines.

New forms of education and training delivery up to Level 10. Lifelong learning and distance learning have always been key components of postgraduate offerings by IoTs. This facilitates industry engagement by offering more flexible access to Masters and PhD research opportunities for employees and by ensuring that postgraduate students conduct industrial-relevant research to facilitate knowledge transfer to industrial partners. Industry will exert greater influence on our postgraduate provision and research programmes in line with a growing contribution to funding. We will also use mechanisms such as the IRC employment-based postgraduate scheme and IOTI sectoral postgraduate investment initiative to ensure new forms of education and training delivery are put in place to meet the economy's needs.

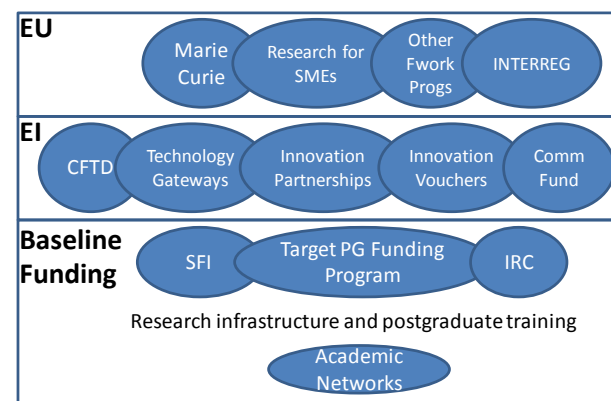
Building critical mass around research specialisms to meet the key needs of industry and other stakeholders. Sustaining an effective research centre requires support for a base of key operational personnel and a sustainable technology base (equipment, operating costs, maintenance costs, and ongoing renewal) to facilitate research activity. Unlike the university sector, IoTs do not have access to a specific allocation of core funding to support research. Thus our research centres, though funded initially for setup costs under programmes like PRTL or the ARE scheme^{vii}, have to rely on an Institute's own resources and leveraged funding if they are to act strategically to deliver on their objectives. This means ensuring that the limited resources available are invested in areas of core capability, building further critical mass through collaboration^{viii} and targeted support.

Strong and focused research management infrastructure. Successfully establishing and managing research projects typically requires extensive support in grant application and management, in negotiating complex academic arrangements, and in maintaining collaborative relationships. To have a credible and effective research ecosystem in a higher education institution, there must be a realistic management infrastructure which co-ordinates the many and disparate activities involved, leads on capacity building, and communicates the value and impact of research activities and outputs to internal and external stakeholders. The initial focus of IoTs on delivery of Level 6-8 programmes left a legacy of insufficient infrastructure to build and support research activities. Although significant progress has been made in recent years there remains work to be done in ensuring that adequate support functions exist across all our institutes^{ix}.

Putting systems in place to ensure excellence and relevance across every aspect of research, development and innovation. With clear institutional research strategies, monitoring at a sectoral level, and international benchmarking of standards and best practice, the IoTs are committed to producing Masters and PhD graduates of the highest possible quality. There must remain an overriding focus on excellence further assured through upskilling and training programmes for both supervisor and postgraduate learners. The focus on inter-institutional and international co-supervision will continue through leverage of international relationships fostered via EU research projects. Masters and PhD education provided by the IoTs will conform to EU guidelines on 4th level education and career path development of all researchers will be a priority in accordance with the EU charter for researchers. As part of the development path towards Technological University status, this will all be formalised within an overall TU quality assurance framework embedded across all IoTs. This will aim to establish us as leaders in delivering on what society needs, with activity driven by excellence and relevance across a number of features.



Balanced set of funding and engagement mechanisms which meet the needs of industry. Our IoTs have well established relationships with SMEs and multinational companies through research projects primarily focused on stimulating new business. Meeting industry research needs ensured a very flexible approach in the nature of research provision with the modern economic climate demanding shorter lead-in times and quicker results from research engagements. There has been significant success in leveraging Enterprise Ireland support for such activity, but moving forward, we must ensure a greater focus on a balanced portfolio of funding streams incorporating national Exchequer, EU and private funding sources. There is a pressing need for a sustainable funding base for postgraduate education to provide a pipeline of expertise around specialist capabilities to meet the needs of the knowledge economy. This will ensure a whole system approach to the way in which RDI activity in Institutes is funded, supported and maintained^x. An overview of the desired balanced funding portfolio is shown opposite.

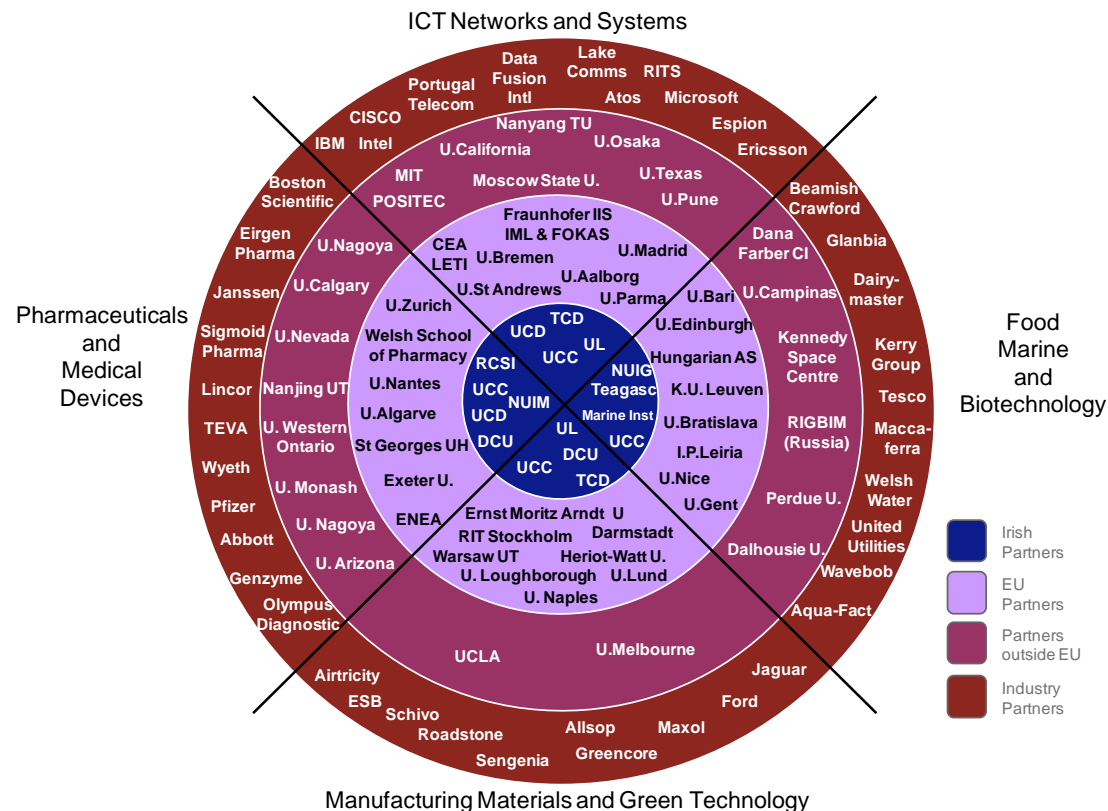


A commitment to partnership across every aspect of delivery. All aspects of future delivery must be reinforced by strong national and international partnerships. It is only by leveraging the knowledge, expertise and resources of our partners that the needs of the knowledge economy will be met in an efficient and effective manner. The next section sets out a clear agenda on how the strong legacy of IoT engagement with the external environment will be further deepened and developed via an open and integrated approach.

Engaging with the external environment

The growing collaborative and international characteristics of sustaining specialist research capacity are clear^{xi} and are formalized within national higher education strategy^{xii}. This strategy emphasised the need for the institute of technology sector to commence a process of evolution and consolidation, with potential for re-designation of amalgamated institutions. It also flagged the need to enhance regional clusters to ensure that individual, enterprise and societal needs are addressed in a planned, coherent and efficient way. This is a process which should build naturally on the development path of IoTs in recent years, with a unique partnership ecosystem established based on regional and national needs. At an academic level, this has involved close working relationships with universities and across IoTs, with strong research collaborations in specialist areas with partners in the EU and beyond. An indication of the nature of these relationships is provided in the diagram opposite.

The Extensive International Network of IoT Research Collaborations



How we continue to deepen our engagement with each other and with the wider external environment is critical to future success and deserves dedicated attention within our institutional strategies. This will mean:

- **Working with other regionally-based institutions** (schools, universities, local authorities, public service providers, policy and development bodies, industry and the general public). By 2030 IoTs should have an even stronger influence on, and interaction with, the region in which they are located.
- **Collaborations with commercial bodies and industry** becoming more evident and accompanied by enhanced mobility of staff and researchers between institutions and commercial sector.
- Funding through Horizon 2020 becoming a critical element in the sustainability of IOT research. Effective engagement in this framework will require **embedded networks of research centres with complimentary expertise across European institutions**. This will include collaborations at project level but must also involve researcher mobility as a core component.^{xiii}
- Moving the focus of research collaboration beyond Europe and the US to **acknowledge the emergence of BRIC countries** with substantial research and technological development capacity and how this complements our own offerings.

New models of engagement between IoTs and regional, national and international stakeholders are therefore essential. There must be clear understanding of the distinctiveness, role and value of each IoT in working with such partners. Research has always had an international dimension, but this will only strengthen over time and our institutes need to establish structures, expertise and contacts if they are not to be left behind.

Key principles of our future research strategy

In this short paper we have set out the recent development path of the IoTs and drivers of future strategy in a rapidly evolving landscape. This provides the context in which we must shape our delivery mechanisms and engage with external stakeholders to ensure excellence and impact across all of our RDI activities. We are at a crossroads in terms of the development of RDI capability in IoTs and if the full potential impact of the significant investment to date is to be realised, we believe there are 7 key principles around which our future research strategies must be based:

1. **Working with all our stakeholders to define current and future priorities.** As has been set out, the focus of all of our RDI activities must be the generation of impact. Impact is realized through our stakeholders – in **industry** from deployment of postgraduates and exploitation of research; in **academia** by working collaboratively with national and international partners to ensure complementarity and maximum value; in **Government** through clear definition of our role in meeting economic and social objectives^{xiv}; and in the **region** by embedding our role in generating local economic activity which is driven by internationally recognized specialist expertise. All research priorities will be underpinned by strong stakeholder support which is monitored on an ongoing basis.
2. **Building on critical mass in specialist research areas.** We recognize the need to consolidate and rationalize our RDI activities to ensure that focus remains on those with the greatest impact potential. Resources in each IoT will be concentrated on those areas of greatest strength and critical mass will be further built up by working more collaboratively with other IoTs and wider partners in key thematic research areas.
3. **Delivering postgraduate provision at Level 9 and Level 10 which drives impact-focused research activity.** We understand that generation of high quality postgraduates is central to effective delivery of all research, development and innovation activities. It is critical that IoTs focus on growing and adapting postgraduate provision to ensure that it reflects the needs of the economy and that funding agencies recognise that it is such a base of Level 9 and Level 10 expertise which drives the impact-focused research they seek to support.
4. **Establishing and maintaining a research foundation funding programme which ensures a pipeline of postgraduate students in respective IoT specialist areas.** There is a major gap in the existing funding of research, development and innovation activity across the IoTs. An absence of foundation funding to supply a base of postgraduate researchers which underpin the maintenance and development of specialist capability must be addressed. In this regard a new funding programme for this purpose must be established, focused on the needs of industry and awarded on the basis of excellence, or else the RDI impact from the sector will prove unsustainable.
5. **Attracting high quality postgraduate and postdoctorate resources to our Institutes.** We will focus investment on supporting postgraduate and postdoctorate expertise in specialist areas, working at both institutional and sectoral level to maximise impact and leveraging external funding wherever appropriate. Securing international expertise of this nature is critical to future success and we will actively pursue opportunities to support and attract key researchers from overseas.
6. **Benchmarking research performance through establishment of strategic international partnerships.** To ensure the excellence and impact of our research it is imperative that standards are in place which are internationally benchmarked and peer reviewed. This will require the

continued building of strategic international partnerships with higher education institutions to facilitate mutual learning, ongoing validation and collaboration around specialist expertise (through joint projects, student/staff exchange, thematic groups, shared colloquiums, etc).

7. **Complimenting national grants with EU funding wherever feasible.** It is clear that the future national funding agenda will be dictated by a narrower list of specialist priorities and that support will increasingly be expected to be underpinned by the demonstration of ability to lever international funding within a particular specialist area. We must target a much greater contribution of both EU and industry funding in support of our research. From 2006-2010, 74% of IoT research funding was sourced from the Exchequer^{xv}. Over the period 2013-2016 we will strive to move to a sectoral funding profile of 40% Exchequer, 30% Industry and 30% EU.
8. **Embedding sufficient research and postgraduate management infrastructure.** All IoTs recognise the importance of central research management and support functions but, because of funding and staffing restrictions, only a small number have been able to establish adequate support structures to facilitate RDI growth. It is crucial that core funding be provided to allow the Institutes to establish such structures and a framework for supporting researcher development in specialist areas. Where funding has been provided to date in similar areas, such as technology transfer, the effect has far outweighed the relatively small investment.

Delivering impact and measuring success

The impact of public investment in RDI on national economic performance is well documented^{xvi}. The EU targets public investment in research and development of 3.6% of national GDP, while it is the one area of Irish exchequer expenditure which has largely been sustained in the midst of a fiscal crisis. Support for inward investment has shifted towards incentives for knowledge-based activity, aimed at increasing the level of research activity of the FDI companies and supporting the establishment of export driven indigenous companies. In such an environment regional social and economic development increasingly depends on access to third level research capability and research literate graduates.

There is no doubt that future public investment for research at national and indeed European level will be driven by the potential for funded activity to deliver impact. There will be a strong emphasis on the ability of such research to penetrate industry and particularly SMEs, with the leveraging of contributions from such private sector sources a key driver of success. The IoTs should be in a good position to build their collective contribution in such an impact-driven environment, with their proximity to industry and track record of using non-Exchequer resources to support the delivery of innovation solutions^{xvii}. This is apparent in the recent success of the Enterprise Ireland sponsored IoT Applied Research Enhancement model. As the diagram below

illustrates, since roll-out in 2008, this has facilitated a rapid expansion of academia/industry collaboration, a deepening of the research engagement between such partners and a significant industry contribution to drive activity which outstrips more 'traditional' research centres in Ireland and involves a large growing base of directly funded projects.

Industry Impact from IoT Applied Research Enhancement Centres

| | 2008 | 2009 | 2010 | 2011 | Total |
|---------------------------------------|----------|----------|------------|------------|-------------------|
| Industrial Collaborations | 36 | 69 | 117 | 150 | 372 |
| Innovation Voucher Projects | 20 | 45 | 70 | 52 | 187 |
| Innovation Partnership Projects | 2 | 7 | 13 | 19 | 41 |
| Projects Directly Funded by Industry | 14 | 17 | 34 | 79 | 144 |
| Income from Collaborative Projects | €570,000 | €451,000 | €1,550,000 | €3,200,000 | €5,771,000 |
| Collaborative Projects Industry Cont. | €226,000 | €102,000 | €615,000 | €1,500,000 | €2,443,000 |
| Industry Contribution % | 39.7% | 22.2% | 39.7% | 46.7% | 42.3% |

Source: Enterprise Ireland

There are many examples of how significant impact has been generated through industry engagement of this kind. The evidence of industry outcomes and impacts noted above must become an intrinsic part of how HEIs are judged in order to ensure that research and teaching agendas are progressed which maximize value for the economy. For RDI, this means that the traditional focus on researcher publications and patents must be built upon with real in-depth analysis of the scale and nature of and the benefits from engaging with industry. Only this will provide an accurate representation of the unique contribution made by IoTs and the type of market-focused organization envisaged in the establishment of future technological universities.

There is therefore a need to define a new set of indicators, and most critically a new set of targets, where the involvement and stimulation of enterprise alongside research and innovation activities is equally critical. This will mean tracking engagement and the development of relationships and up-scaling of collaborative activities. It will involve tracking the relationships between the inputs, outputs, outcomes and impacts of research activity and in this regard we propose the following KPI framework. We have already built up some monitoring of performance in line with each of the

prioritized specialist research capabilities^{xviii} and this will be expanded to ensure comprehensive profiling across every relevant aspect of RDI performance moving forward. **These indicators will now define the future success and impact of our RDI activity and the ambitious targets set represent a continuation of the journey to ensure strategically oriented, impact-focused research across the IoTs.**

15 Indicators of Strategically Oriented Impact Focused RDI in the IoTs

| No | Indicator Title | Indicator Description | Current (2011) | Target (2016) |
|----|--------------------------|---|------------------------------|------------------------------|
| 1 | Overall RDI Funding | Overall level of RDI funding from all external sources | €38.8 million | €50 million |
| 2 | RDI Funding Profile | RDI funding profile which is more balanced towards EU and industry investment | 76% Nat'l; 11% EU; 13% Other | 40% Nat'l; 30% EU; 30% Other |
| 3 | Industry RDI Investment | Proportion of the costs of running IoT specialist research centres which are met by direct industry investment | 42% | 50% |
| 4 | RDI Expertise | No of staff engaged directly in delivery of RDI activities in IoTs | 520 | 800 |
| 5 | RDI Postgrad Base | No of postgraduate students undertaking research at Level 9 & Level 10 in IoTs | 1,018 | 1,500 |
| 6 | Industry Engagement | No of industry partners involved in a research or innovation project in partnership with an IoT supported by Exchequer, EU or direct industry funding | 150 | 300 |
| 7 | SME Penetration | Number of SMEs involved in a research or innovation project in partnership with an IoT which is supported by Exchequer, EU or direct industry funding | 80 | 200 |
| 8 | Industry Ready PGs | Proportion of Level 9/10 provision involving direct innovation placement with industry | 20% | 50% |
| 9 | Staff Industry Expertise | Proportion of staff working on RDI projects with direct industry experience | 20% | 30% |
| 10 | Postgrad Employment | Proportion of IoT research postgraduates working in industry 3 years after graduation | 15% | 50% |
| 11 | Research Publications | Number of peer-reviewed publications generated by IoTs as recorded by Scopus | 385 | 700 |
| 12 | Research Impact | Number of citations generated by research publications by IoTs as recorded by Scopus | 4,022 | 10,000 |
| 13 | Licenses and Patents | No of licenses generated or patents issued as a result of the generation of IP by IoTs | 20 | 40 |
| 14 | Spin-outs & Spin-ins | Number of innovative spin-out or spin-in companies supported by IoTs | 300 | 400 |
| 15 | New Jobs Created | Number of new jobs created with support of the RDI activities of all IoTs | 500 | 1,000 |

ⁱ See Annex 1 for a detailed overview of the development of RDI activities across the IoTs

ⁱⁱ See Annex 2 for examples of how impact-focused research capability has developed around specialist research centres in IoTs

ⁱⁱⁱ 'National Strategy for Higher Education to 2030: Report of the Strategy Group', Department of Education and Skills, January 2011

^{iv} 'Report of the Research Prioritisation Steering Group', Forfás, February 2012

^v 'Sustainability of Research Councils', Advisory Council for Science, Technology and Innovation and Forfás, June 2012

^{vi} Annex 3 demonstrates alignment of key existing research centres across IoTs with designated national research priorities

^{vii} Annex 4 provides examples of some of these Exchequer research centre investments across the IoTs

^{viii} Annex 5 provides an overview of potential RDI thematic clustering and collaboration across the IoTs

^{ix} Annex 6 sets out a range of functions which together provide the necessary infrastructure to facilitate the development of credible research capacity

^x See Annex 7 for an overview of the framework for development of a whole system approach to supporting RDI across the IoTs

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- ^{xi} Annex 8 sets out analysis of the growing collaborative and international characteristics of sustaining specialist research capacity
- ^{xii} The National Strategy for Higher Education to 2030 stated that the future approach must “insist on collaboration as a key operational value across the sector, structured into the system and rewarded accordingly”
- ^{xiii} This should include accessing programmes such as COST actions, Marie Curie Research Fellowships and International Research Staff Exchange Schemes (IRSES) as ideal vehicles for such activity. Access to the larger framework programmes can be grown from such collaborations
- ^{xiv} IoTs will continue the strong alignment between RDI strategy and national policy, as set out in Annex 9
- ^{xv} Source: ‘Directory and Profile of Research, Development and Innovation in Ireland’s Institutes of Technology’, Institutes of Technology Ireland, June 2011
- ^{xvi} Annex 10 provides an analysis of the role of research in economic development
- ^{xvii} Annex 11 provides some examples of industry impact from IoT RDI Activities
- ^{xviii} Annex 12 sets out some key indicators with regard to prioritised specialist research capabilities across the Institutes of Technology