Promotion of Research and its economic impact in Ireland

HUCBMS 2019
4th September 2019

Professor Mark Ferguson
Director General, Science Foundation Ireland
& Chief Scientific Adviser to the Government of Ireland
What Science Foundation Ireland Actually Does

- **Makes grants** to Higher Education Institutes (HEIs) in Ireland
- **Based on competitive, international merit review for scientific excellence and impact**
- **Trains people**
- **Builds infrastructure**
- **Produces scientific results and technology** (Research Output)
- **Transfer of the Research Output** to existing and new companies for **economic and societal impact**
- **Supply of appropriately trained people** along the entire **science and technology pipeline**
- **Significant industrial collaboration** attracting, anchoring and starting companies
- **Leverages** other research funding e.g. Industrial / EU / Charitable / Philanthropic / International
- **Fosters high levels of collaboration** between academia, industry, charity, disciplines, sectors, institutions, people and countries
- **Operates in an open, agile and engaged mode** with a willingness to **seize** new opportunities
- **Engages the public** to **grow scientific literacy** and citizenship
What Science Foundation Ireland delivers for its annual €188.25m budget

A research engine of 4,924 people led by 500 leading scientists

16 world leading research centres spanning several HEIs and industry

750 Active Research Projects

Generating Annually

39,823 jobs in Ireland supported directly or indirectly

1,715 collaborations with industry (including 712 MNCs, 1,003 SMEs in all regions)

4,881 scientific publications

12 spin out companies formed

53 licensed technologies

80 patent filings, 51 patents awarded

2,715 international collaborations in 74 countries

€230m in leveraged non-SFI funding

1,600 Smart Futures volunteers provided STEM careers advice to over 120,000 students

641 primary schools received Discover Primary Science and Maths Awards

2 million people reached in over 1,400 events during Science Week

Research, development, innovation and a highly educated workforce will be key points of differentiation for Ireland and key drivers of our future economic success
Ireland’s Standing in Global Research & Innovation

Ireland 12th place in global rankings for the overall quality of scientific research

Field specific global excellence:

- 1st for Immunology
- 2nd for Animal and Dairy
- 3rd for Nanotechnology
- 5th for Materials Sciences
- 7th for Microbiology
- 8th for Molecular Biology & Genetics
- 8th for Neuroscience and Behaviour
- 9th for Basic Medical Research
- 11th for Chemistry

Ireland ranked 10th in the world by the Global Innovation Index 2018
### % of publications in the top 1% as measured by citations

<table>
<thead>
<tr>
<th>Country</th>
<th>Funder</th>
<th># Documents in Web of Science</th>
<th>Documents in the Top 1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ireland</td>
<td>All</td>
<td>181,071</td>
<td>1.71</td>
</tr>
<tr>
<td>Ireland</td>
<td>Science Foundation Ireland</td>
<td>18,026</td>
<td>2.66</td>
</tr>
<tr>
<td>USA</td>
<td>All</td>
<td>9,659,152</td>
<td>1.78</td>
</tr>
<tr>
<td>USA</td>
<td>National Science Foundation</td>
<td>552,738</td>
<td>2.89</td>
</tr>
<tr>
<td>USA</td>
<td>National Institutes of Health</td>
<td>831,835</td>
<td>2.88</td>
</tr>
<tr>
<td>Switzerland</td>
<td>All</td>
<td>566,747</td>
<td>2.63</td>
</tr>
<tr>
<td>Denmark</td>
<td>All</td>
<td>313,829</td>
<td>2.47</td>
</tr>
<tr>
<td>Singapore</td>
<td>All</td>
<td>235,214</td>
<td>2.20</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>All</td>
<td>2,682,452</td>
<td>1.83</td>
</tr>
<tr>
<td>Finland</td>
<td>All</td>
<td>245,252</td>
<td>1.78</td>
</tr>
<tr>
<td>New Zealand</td>
<td>All</td>
<td>175,858</td>
<td>1.76</td>
</tr>
<tr>
<td>Israel</td>
<td>All</td>
<td>288,086</td>
<td>1.65</td>
</tr>
<tr>
<td>China</td>
<td>All</td>
<td>4,002,157</td>
<td>1.06</td>
</tr>
<tr>
<td>EU</td>
<td>All</td>
<td>11,258,058</td>
<td>1.26</td>
</tr>
<tr>
<td>EU</td>
<td>European Research Council</td>
<td>72,787</td>
<td>4.82</td>
</tr>
</tbody>
</table>

**IRELAND:** From 1980 - 2002, for any funder, the % of publications in the top 1% is **1.02%**.

Therefore the overall system has improved – with a disproportionate impact from high quality SFI-funded publications

26 SFI funded researchers are in the 2018 list of highly cited researchers (top 1% in the world) produced by Clarivate Analytics – 10 in the SFI APC Research Centre

Source: Incites Thomson Reuters 2003 - 2018
## 16 SFI Research Centres

<table>
<thead>
<tr>
<th>Centre</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADAPT</td>
<td>Centre for Global Digital Content and Engagement</td>
</tr>
<tr>
<td>AMBER</td>
<td>Advanced Materials and BioEngineering Research Centre</td>
</tr>
<tr>
<td>APC</td>
<td>APC Microbiome Institute</td>
</tr>
<tr>
<td>BEACON</td>
<td>Circular Bioeconomy Research Centre</td>
</tr>
<tr>
<td>CONNECT</td>
<td>Future Broadband, Cellular and Internet of Things networks</td>
</tr>
<tr>
<td>CONFIRM</td>
<td>Smart Manufacturing and Industrial Automation Research Centre</td>
</tr>
<tr>
<td>CÚRAM</td>
<td>Centre for Research in Medical Devices</td>
</tr>
<tr>
<td>Future Neuro</td>
<td>Neurological Diseases Research Centre</td>
</tr>
<tr>
<td>iCRAG</td>
<td>Irish Centre for Research in Applied Geosciences</td>
</tr>
<tr>
<td>I-Form</td>
<td>Advanced Manufacturing Research Centre</td>
</tr>
<tr>
<td>INSIGHT</td>
<td>Centre for Data Analytics</td>
</tr>
<tr>
<td>IPIC</td>
<td>Irish Photonic Integration Research Centre</td>
</tr>
<tr>
<td>LERO</td>
<td>Irish Software Research Centre</td>
</tr>
<tr>
<td>MaREI</td>
<td>Marine and Renewable Energy Ireland</td>
</tr>
<tr>
<td>SSPC</td>
<td>Synthesis &amp; Solid State Pharmaceutical Centre</td>
</tr>
<tr>
<td>VistaMilk</td>
<td>Precision (Smart) Agriculture Research for Dairy</td>
</tr>
</tbody>
</table>
SFI Research Centres are the epitome of SFI’s transformational effect on the national research system

- 16 world-leading SFI Research Centres of scale and excellence
- SFI commitment €434 million
- Industry commitment €235 million
- EU funding target of >€300 million
- 19 Research Bodies
  - All universities
  - Tyndall, RCSI, NIBRT Teagasc, Marine Institute, IOTs
- 360 Companies – 167 MNCs, 193 SMEs (736 collaborative research agreements)
- Collaboration with
  - Higher education institutions,
  - Industry
  - National and international funders
SFI Research Centres performing well
Cumulative reporting of first 12 Centres up to Dec 2018

<table>
<thead>
<tr>
<th>SFI Research Centre Outputs</th>
<th>Cumulative to DEC-2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Target</td>
</tr>
<tr>
<td>Journal publications</td>
<td>4,090</td>
</tr>
<tr>
<td>Conference publications</td>
<td>3,306</td>
</tr>
<tr>
<td>MSc/MEng graduates</td>
<td>163</td>
</tr>
<tr>
<td>PhD graduates</td>
<td>484</td>
</tr>
<tr>
<td>% Trainee departures with industry as first destination</td>
<td>28%</td>
</tr>
<tr>
<td>Participations in major EU initiatives</td>
<td>285</td>
</tr>
<tr>
<td>Coordinations in major EU initiatives</td>
<td>88</td>
</tr>
<tr>
<td>ERC awards granted</td>
<td>29</td>
</tr>
<tr>
<td>Funding from non-exchequer, non-commercial sources</td>
<td>€196,726,732</td>
</tr>
<tr>
<td>Cash in bank (minimum target)</td>
<td>€35,042,853</td>
</tr>
<tr>
<td>% Industry cost share (cash)</td>
<td>9%</td>
</tr>
<tr>
<td>% Industry cost share (total)</td>
<td>29%</td>
</tr>
<tr>
<td>EI Commercialisation Awards</td>
<td>193</td>
</tr>
<tr>
<td>Licence agreements</td>
<td>145</td>
</tr>
<tr>
<td>Spin-out companies formed</td>
<td>31</td>
</tr>
</tbody>
</table>

An economic impact report on the AMBER SFI Research Centre for Advanced Materials, led by TCD, found that for €100 million State investment €505 million was generated in gross national output.

A ‘15 Years of Impact’ report found that APC Microbiome Ireland SFI Research Centre helps to generate €1.2 million for the Irish economy each week including expenditure and taxation impact.

Funding Input: 1/3 SFI, 1/3 Industry, 1/3 EU. Productivity: for €1 Euro invested, €5 returned to economy.
Collaborations with Industry (legal contracts)

776 CRAs to date, worth €90.1 million in cash commitments
Spoke and Partnership awards with Industry

**Examples**

**Smart Cities - ENABLE**
Connect communities to smart urban environments through the Internet of Things – involves 3 SFI Research Centres (Lero, Adapt, Insight), Dublin City Council and 25 companies including large MNC’s, e.g. Intel, Huawei, and SME’s e.g. Accuflow

*Value €14.5 million*

**Artificial Intelligence & Machine Learning for the Dairy Industry**
Dairymaster and Lero (SFI Software Research Centre) Intelligent autonomous systems and Internet of Things technology for farms - to boost farm productivity, milk quality and animal health

*Value €2 million*

**U-Flyte Flight Control for Drones**
Tackle global management of increased drone operation. Maynooth University with aviation industry partners Airbus, Irelandia Aviation, Ryanair, Intel and 15 other companies, including testbed facilities at Waterford Airport

*Value €6.3 million*

**Shire / I-Path**
Develop personalised treatment approaches for patients with haemophilia Partnership between the National Coagulation Centre, St James Hospital, Our Lady’s Children’s Hospital in Crumlin, the Irish Haemophilia Society, RCSI, TCD and Shire

*Value €4 million*
SFI Industry Fellowships

- Movement of researchers between industry & academia
- Focus on collaborative research
- Must be a research-active company
- Maximum budget of €100,000 - SFI provides salary and travel support & the company supports research costs
- Up to 12 months full-time or 24 months part-time
- Work on company research project
- Can be a company anywhere in the world
- No restrictions at the end e.g. Company can hire the Fellow, Fellow can stay overseas, Fellow can return to university etc

SFI Industry Fellowship Group https://www.linkedin.com/groups/8201626
SFI Industry Fellowships

192 awards made to date
INCLUDING 41 international fellowships

50% of awards made to date have SME industry partners

>€12m in awards made to date
SFI Research Professors
Attracting ‘star’ global research talent

- €5M research funding from SFI for 5 year
- University pays the salary – up to €250K pa
- In strategically-important research areas for Ireland

Chemistry (pharma/energy)
Prof. Mike Zaworotko
University of Limerick (UL)
Moved to Ireland from the U.S.

Biophotonics / Med devices
Prof. Stefan Andersson-Engels
University College Cork (UCC)/ Tyndall
Moved to Ireland from Sweden

Manufacturing
Prof. Fengzhou Fang
University College Dublin (UCD)
Moved to Ireland from China

Medical devices / Clinical trials
Prof. William Wijns
National University of Ireland, Galway (NUIG)
Moved to Ireland from Belgium

Digital Platforms and Content
Prof. Dr. Aljoša Smolić
Trinity College Dublin (TCD)
Moved to Ireland from Switzerland

Quantum Materials / Quantum Technology
Prof. Séamus Davis
University College Cork (UCC)/ University of Oxford
Moved to Ireland from USA

Infectious Diseases
Prof. John Dalton
National University of Ireland, Galway
Moved to Ireland from Queen's University Belfast.

Mining and Mineral Resources
Prof. Murray Hitzman – iCRAG/UCD
Moved to Ireland from USA (Associate Director for Energy & Minerals, US Geological Survey)

Energy Technologies
Prof. Piet Lens
National University of Ireland, Galway (NUIG)
Moved to Ireland from the Netherlands

Electrical Eng. / Internet of Things
Prof. Bogdan Staszewski
University College Dublin (UCD)
Moved to Ireland from the Netherlands

Manufacturing
Prof. Paul Michael Weaver
University of Limerick (UL)
Moved to Ireland from the U.K.
SFI Centres for Research Training (CRT)

- €100M investment in training of approx. 700 postgraduate research students to create **talent pipeline for the research and innovation sector** in Ireland
- Thematic area: **Data, Digital and ICT Skills for the Future**
- 6 new **Centres for Research Training** will build on research excellence to train **cohorts of future research leaders** with the skills and knowledge required to address the challenges of an ever-changing work environment
- **Cohort based** involving collaboration across all HEI’s in Ireland and international partners
- **Enterprise engagement** in design and delivery of training programmes (over 100 companies signed up to date)
- **World-class training programmes** will include enterprise-relevant discipline-specific and transversal skills
- **Student co-supervision and placements** in enterprise, other non-academic establishments, or in the groups of international collaborators
- First PhD Student intake – September 2019
6 SFI Centres for Research Training in:

- Machine Learning
- Digitally Enhanced Reality
- Foundations of Data Science
- Artificial Intelligence
- Advanced Networks for Sustainable Societies
- Genomics Data Science

**Objective:** To be the best research training programme in the world, providing major opportunities for PhD students in Ireland and a rich source of outstanding graduates, who will be sought by the private and public sectors.
7 UK (EPSRC) / Ireland (SFI) Centres for Doctoral Training (CDT’s)

- Partnership and Collaboration between EPSRC (UKRI) and SFI
- SFI co-funding of €39m for approx. 200 Irish PhD students
- Linking SFI Research Centres and leading UK Universities
- Enterprise Collaboration
7 UK (EPSRC) / Ireland (SFI) Centres for Doctoral Training in:

- Photonic Integration and Advanced Data Storage
- Advanced Metallic Systems: Metallurgical Challenges for the Digital Manufacturing Environment
- Engineered Tissues for Discovery, Industry and Medicine
- Transformative Pharmaceutical Technologies
- Energy Resilience and the Built Environment
- Advanced Characterisation of Materials
- Atoms to Products, an Integrated Approach to Sustainable Chemistry
Challenge Based Funding

**Top Down**

- Consultation with industry, government departments, international funders (NESTA, DARPA, Gates Foundation)
- Challenge identification and curation
- Co-funding from industry / charity/ other government departments
- Prize:  - Money (blended finance: Grant plus loan / equity investment to rapidly scale commercialisation / deployment)
  - Change in law, provisional licence, tariff, subsidy, procurement
- Launch 2019 / 2020
- Topic – Disruptive Technologies to address Climate Change

**Bottom Up**

- SFI Future Innovator Prize - launched September 2018 - €1m
- Artificial Intelligence for Societal Good Challenge - launched June 2019 - €1m
- Zero emissions - launched June 2019 - €3m
10 Strategic Outcomes

1. Compact Growth
2. Enhanced Regional Accessibility
3. Strengthened Rural Economies and Communities
4. Sustainable Mobility
5. A Strong Economy, supported by Enterprise, Innovation and Skills
6. High-Quality International Connectivity
7. Enhanced Amenity and Heritage
8. Transition to a Low Carbon and Climate Resilient Society
9. Sustainable Management of Water and other Environmental Resources
10. Access to Quality Childcare, Education and Health Services
National Development Plan 2018-2027

Research Focus

● €500m challenge based disruptive technologies innovation fund
● 20 SFI Research Centres
● 500 additional PhD/MSc researcher enrolments to be delivered by SFI by 2020
● Upgrade and expand Tyndall Research Centre
● Implement Innovation 2020 actions
● Strengthen international collaborations
SFI’s Brexit Strategy

1. Strengthen bilateral links with UK
   • joint funding with UKRI (EPSRC, BBSRC), Royal Society, Wellcome Trust
   • joint appointments with leading UK Universities, e.g. Prof. Séamus Davis, University of Oxford/UCC
   • co-supervised PhD students (CRT’s and CDT’s)

2. For those excellent people who are thinking of leaving, encourage their relocation to Ireland – full time or joint appointments

3. Widen and deepen links with other EU countries
   • joint SFI / Fraunhofer centre in Microfluidics

4. All-Ireland initiatives, e.g. research centres – ongoing discussions
Ireland and Horizon 2020

Total draw down to date:
€760m
1.88% of total H2020 drawdown to date (up from 1.67% last year)
Target: 1.56%; juste retour: 1.2%

Sector Success
- Higher Education 55%
- Companies 34%
- Public sector, etc. 11%

Success rates
- Finland 12.9%
- Denmark 15.2%
- Ireland 15.5%
- UK 14.5%
- EU av. 11.9%
Irish researchers from academia and industry continue to excel

- 5 Projects
  - Over €6m each
  - 23 Irish partners
  - Wins to date > €1m
  - 230 projects
  - 448 IE participants

- 2 Projects
  - Over €10m each
  - 7 Irish partners
EUROPEAN INNOVATION COUNCIL (eic)

**One stop shop** for breakthrough & disruptive innovators

**Open** to all innovators, in any field, at any time

**Highest potential** innovators selected on basis of ideas and team

**Agile funding** from idea to investment

**Pathfinder grants** for advanced research on emerging technologies

**Accelerator funding** for innovative start-ups (<€2.5 million grant, <€15 million equity)

**Crowding in private investment** (VC, Invest EU)

**Building ecosystems** and communities

**Access** to mentoring and advisory services and to knowledge partners (e.g EIT)

**Expert Programme Managers** to engage with projects and communities

**Prizes** for breakthrough technologies
Second phase launched in 2019

- Increased budget of €2.2 billion (€1.0bn in 2019; €1.2bn in 2020)
- Introduction of pilot pathfinder, with 6 strategic emerging technologies targeted (human-centric AI, novel medical devices, zero-emission energy generation, etc)
- Introduction of pilot accelerator with option to apply for blended finance (combined grant and equity)
- New EIC Advisory Board to bring in leading innovators for ongoing design & implementation
- First EIC programme managers recruited to actively engage with pathfinder projects
Full EIC under Horizon Europe (2021-27)

- Proposed budget of €10 billion
- Dedicated governance with EIC President and Advisory board
- More flexible rules for funding (ability to stop or reorient, links to Invest EU) with increased role for expert programme managers
- Full accelerator funding with both grant and blended finance
- Full pathfinder scheme for grants in advanced research and transition activities
- Fast track access for Horizon grant holders (incl. European Research Council) and certified national schemes
- Creation of EIC Forum with Member States innovation agencies
Thank You