Science Foundation Ireland sfi For what's next

How strategy has influenced the structure of the Irish eco-system for Innovation

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

Danish Council for Research and Innovation Policy World Class Innovation Conference

5th September 2017

Science Foundation Ireland
Key Information

Founded in
2000

€162m
annual
investment

€2.1bn
Spend and
€2.6bn
Committed
to date in
4,800
Awards

As at 31 December 2016
820 Live Awards
with future commitments totaling
€427m

What SFI Actually Does

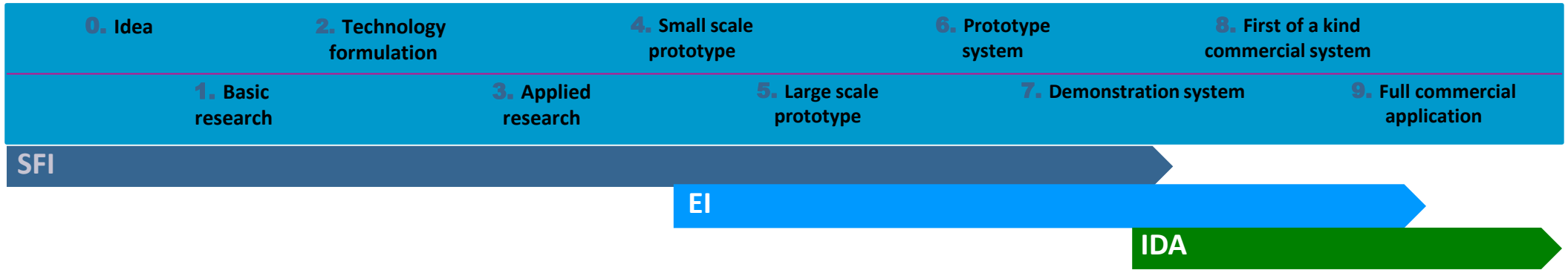
- Makes **grants** to Higher Education Institutes (HEIs) in Ireland
- Based on competitive, international merit review for scientific **excellence** and **impact**
- Trains **people**
- Builds **infrastructure**
- Produces **scientific results** and technology (Research Output)
- Transfer of the **Research 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

Position in the RDI Landscape

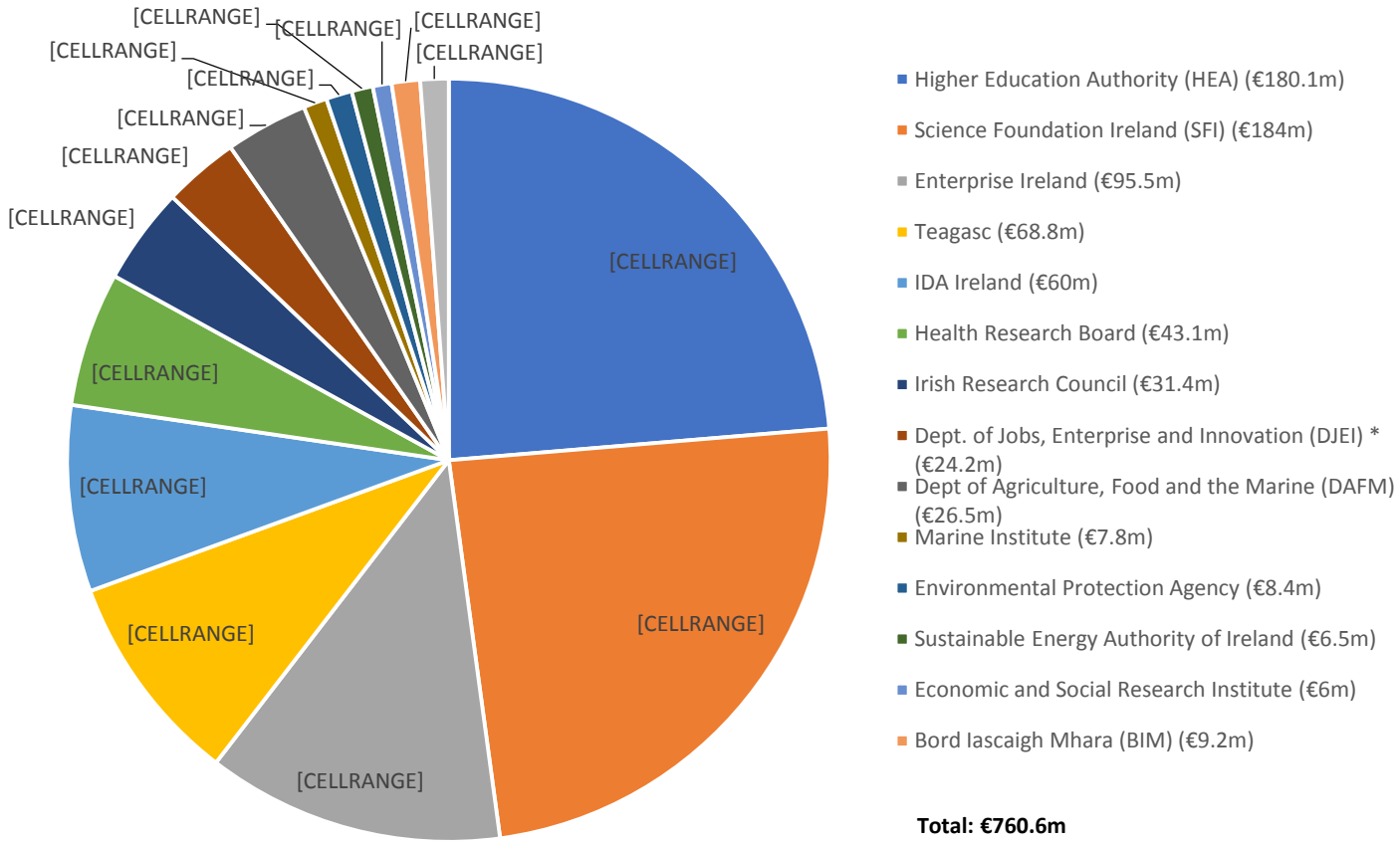
Department of Jobs, Enterprise & Innovation

Science Foundation Ireland For what's next	ENTERPRISE IRELAND where innovation means business	IDA Ireland
Supporting Research and Innovation for the Future	Supporting Indigenous Irish Companies	Supporting Multinational Companies in Ireland

RDI Funding Spectrum



Irish Government Expenditure on R&D 2016 (by funder)



Total: €760.6m

DJEI 48%, DES 28%, DAFM 12%, DH 6%,

EU 2017 Council Recommendations for Ireland highlight that Ireland ranks 25 out of 28 EU countries in public Research and Development investment as a percentage of GDP and recommends that this level of public expenditure be increased to ensure Ireland's economic future

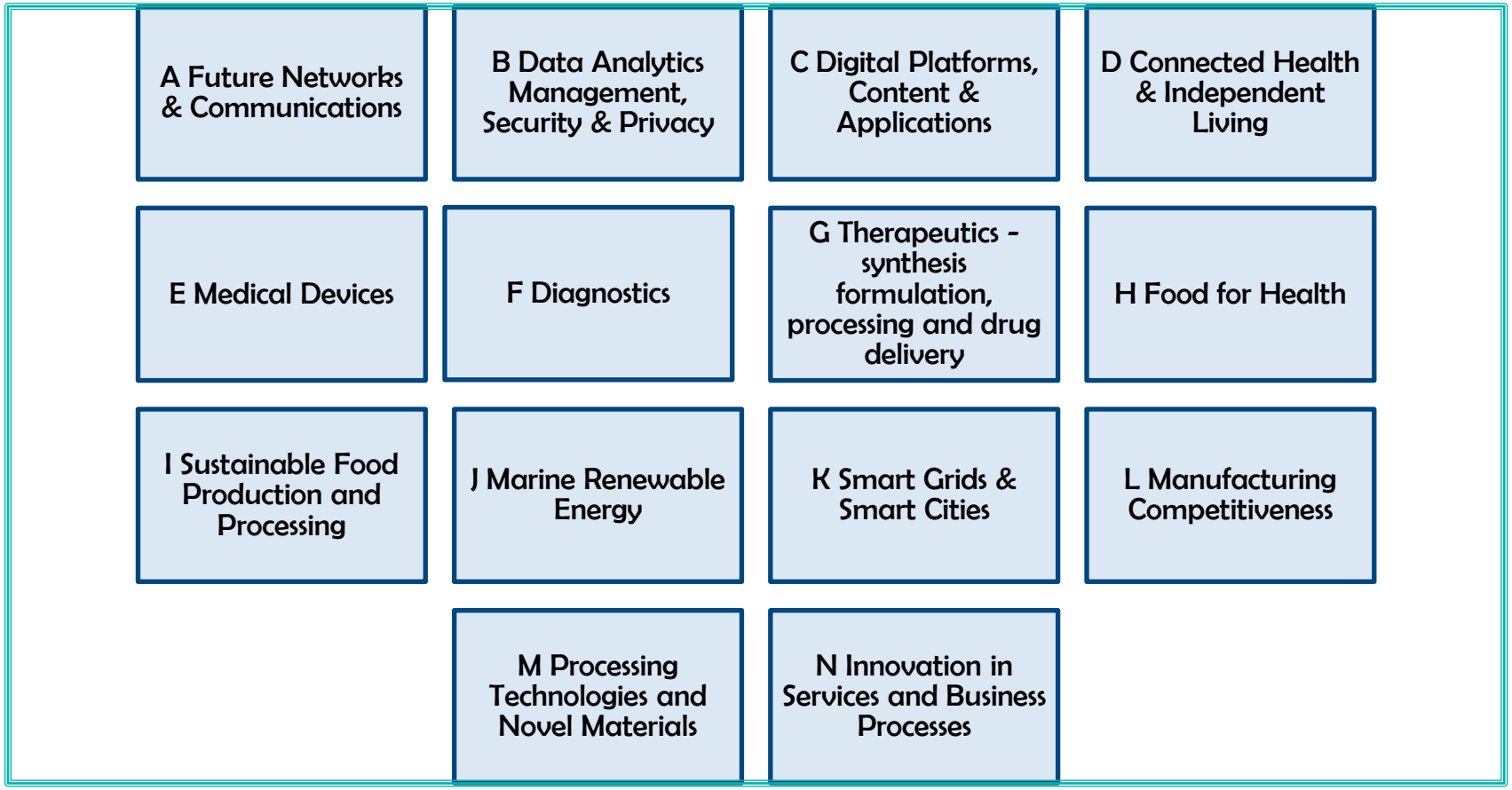
Research Prioritisation

Steering Group Report 2012

4 High-Level Criteria

1. The Priority Area is associated with a large global market in which Irish based enterprises compete or can realistically compete
2. Publicly performed R&D in Ireland is required to exploit the priority area and will complement private sector research and innovation in Ireland
3. Ireland has built or is building (objectively measured) strengths in research disciplines relevant to the priority area
4. The priority area represents an appropriate approach to a recognised national challenge and / or a global challenge to which Ireland should respond

14 Priority Areas



Platform Science & Technology Areas: Basic Biomedical Science, Nanotechnology, Advanced Materials, Microelectronics, Photonics, Software Engineering

Innovation 2020

Top Current Priorities for Science Foundation Ireland

- Ensuring that the commitment to increase public and private investment in research to reach Ireland's intensity target of 2.5% of GNP by 2020 as set down in Innovation 2020 is realised
- Engaging with partners in the UK to exploit all opportunities associated with BREXIT
- Attracting world leading researchers to Ireland
- Supporting the Irish research community to win and lead on H2020 projects
- Implementation of actions set out in Innovation 2020 and Agenda 2020 (subject to budget)
  - New PhD Programme
  - SFI Research Centres
  - Challenge Based Funding

Agenda 2020 – SFI's Strategic Plan

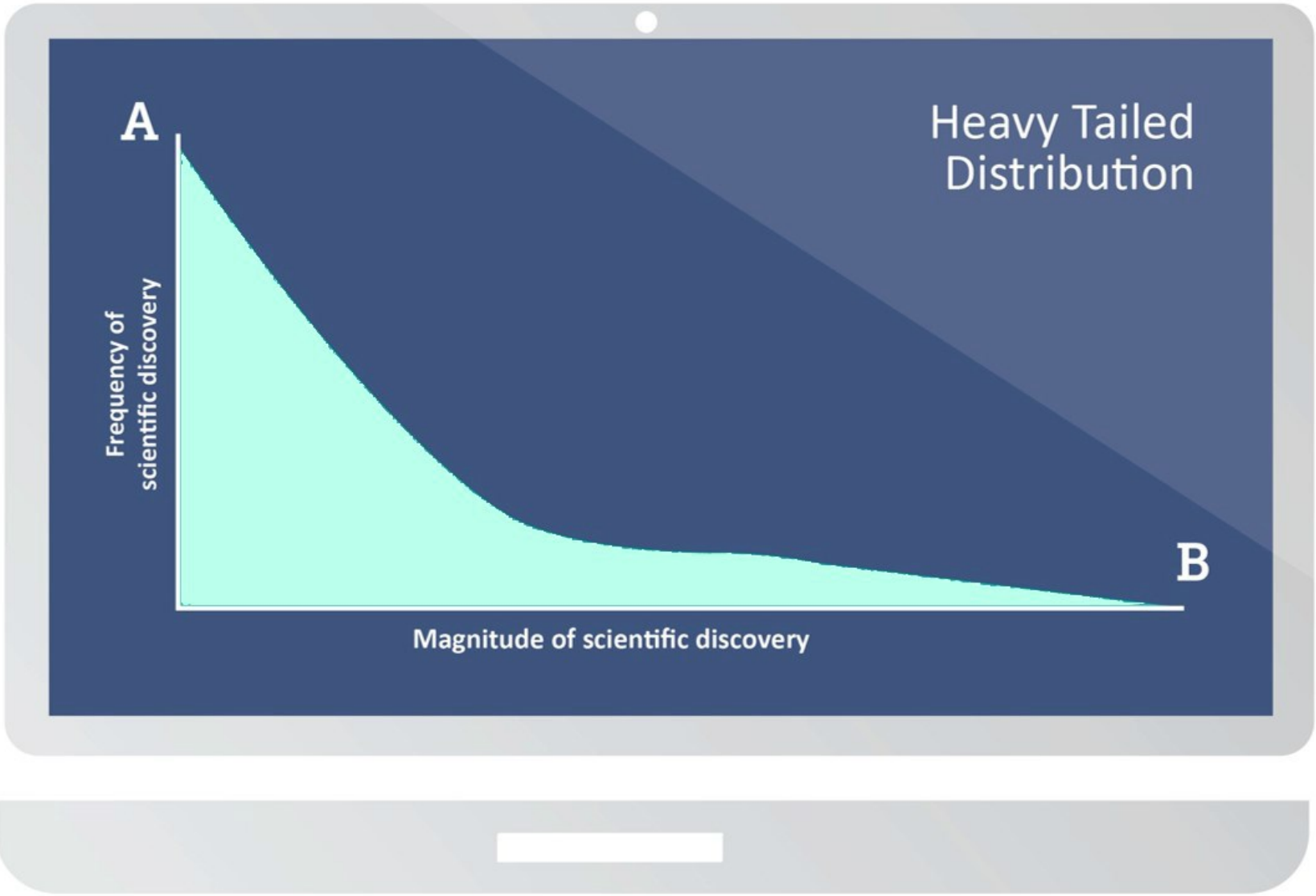
Agenda 2020

1. To be the best science funding agency in the world at creating impact from excellent research and demonstrating clear value for money invested.
2. To be the exemplar in building partnerships that fund excellent science and drive it out into the market and society.
3. To have the most engaged and scientifically informed public.
4. To represent the ideal modern public service organisation, staffed in a lean and flexible manner, with efficient and effective management.

Science and Innovation Funding

- Excellence is required but is not sufficient, need impact
- Diverse Portfolio of uncorrelated risk
- Intelligent mix between scientists choosing what to research and being told where they should be looking
- The folly of rewarding A whilst hoping for B
- What you Measure is what you Get
- Support for outstanding people, projects, centres, infrastructure, movement, collaboration, exchange, partnership
- Themes

Frequency versus Magnitude of Scientific Discovery



What environments promote disruptive innovation?

- War
- Engaging national challenges, e.g. putting a man on the moon
- Competition
- New markets
- Crises
- Serendipity (chance favours the prepared mind)
- ?? Free, unfettered thinking / experimentation of scientists

The challenge: Science and Innovation to create more jobs than they destroy (and improve competitiveness)

- Incremental innovation improves competitiveness but destroys jobs
- Disruptive innovation creates more jobs than it destroys but can cause huge shifts / displacement of employment
- Policy principles:
  - Foster market creating disruptive innovation
  - Continually upskill, retrain, reeducate the population

The job context of the ‘hour-glass economy’

For every 10 middle-skilled jobs that disappeared between 1996 – 2008 in:

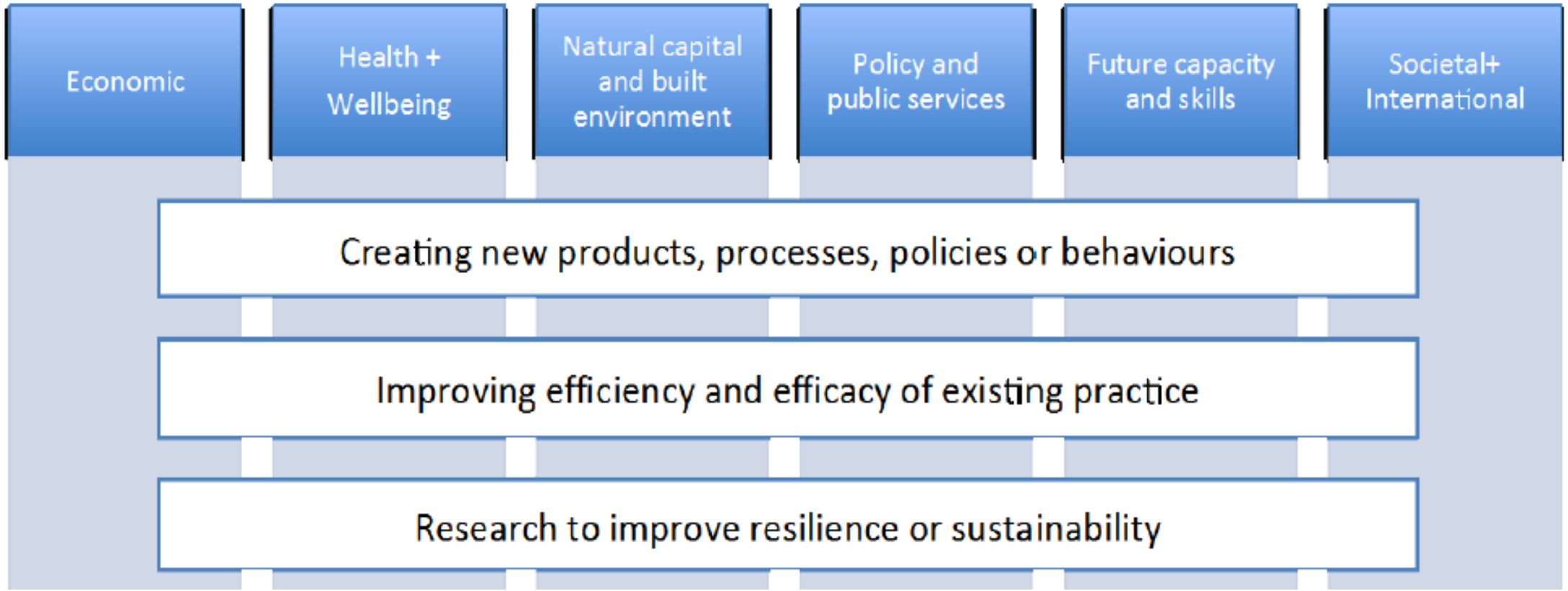
UK:	4.5 replacement jobs were high-skilled and 5.5 low-skilled
Ireland:	8 replacement jobs were high-skilled and 2 low-skilled
France:	7 replacement jobs were high-skilled and 3 low-skilled
Germany:	7 replacement jobs were high-skilled and 3 low-skilled
Portugal:	0 replacement jobs were high-skilled and 10 low-skilled

Reference: Holmes C & Mayhew K 2012 The Changing Shape of the UK Job Market and its Implications for the Bottom Half of Earners. Resolution Foundation Commission on Living Standards and S. O’Connor: UK economy shows shift to low skilled jobs, research finds, Financial Times 19 January 2015.

What is Impact?

The demonstrable effect that excellent research makes to society and the economy

6 Pillars of Impact and 3 Cross Cutting Themes



From Inputs to Impact…

Inputs

Funding/Support

Infrastructure

People

Activities

Awards granted

Teams established

Research undertaken

Education

Outputs

Publications

Networks

Conferences

Pre-Commercial Outputs

Funding diversification

Events

Outcomes

Research capacity/leaders

Research quality/productivity

Sustainability

Recruitment of researchers

Industry more competitive

Impact

Increase RTDI capacity

Established international STI profile

Transformational change in industry e.g. new or improved product/process

Improved international competitiveness

Increased employment and economic growth

New or improved public policy

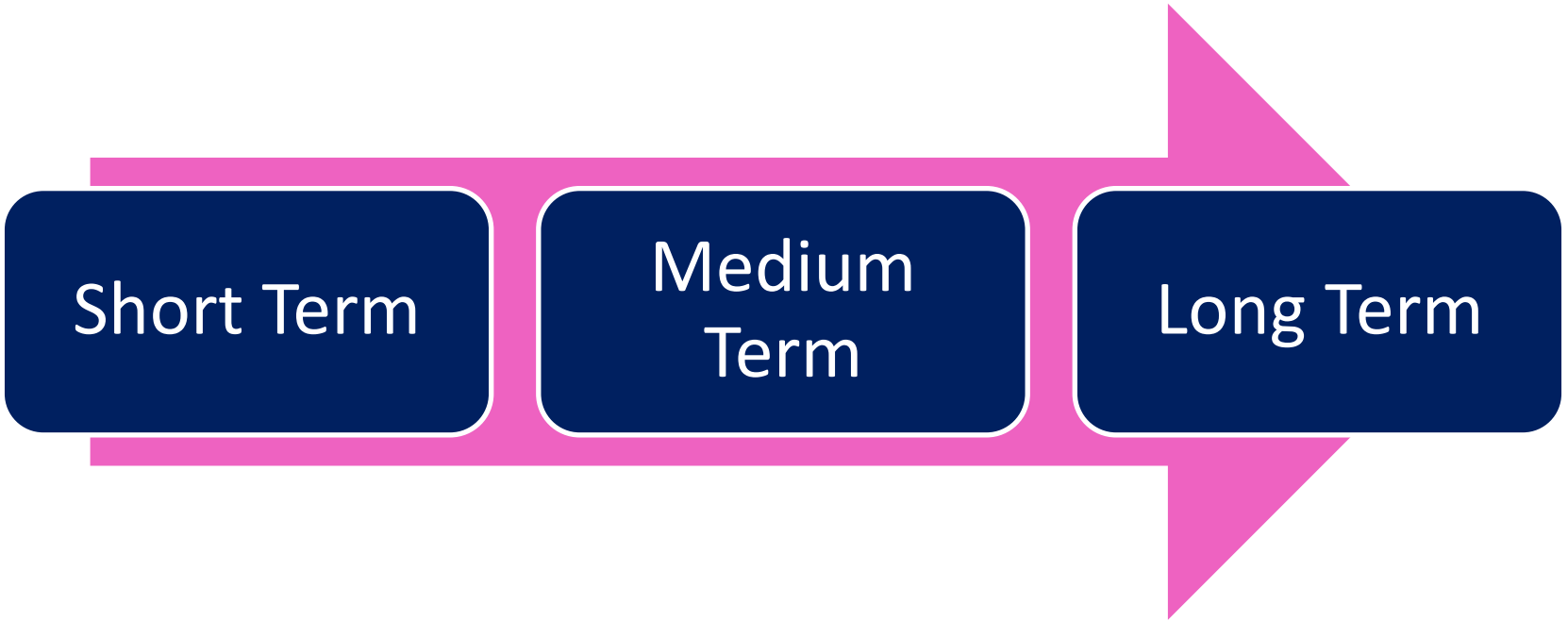
Improved health outcome

Reduced environmental pollution

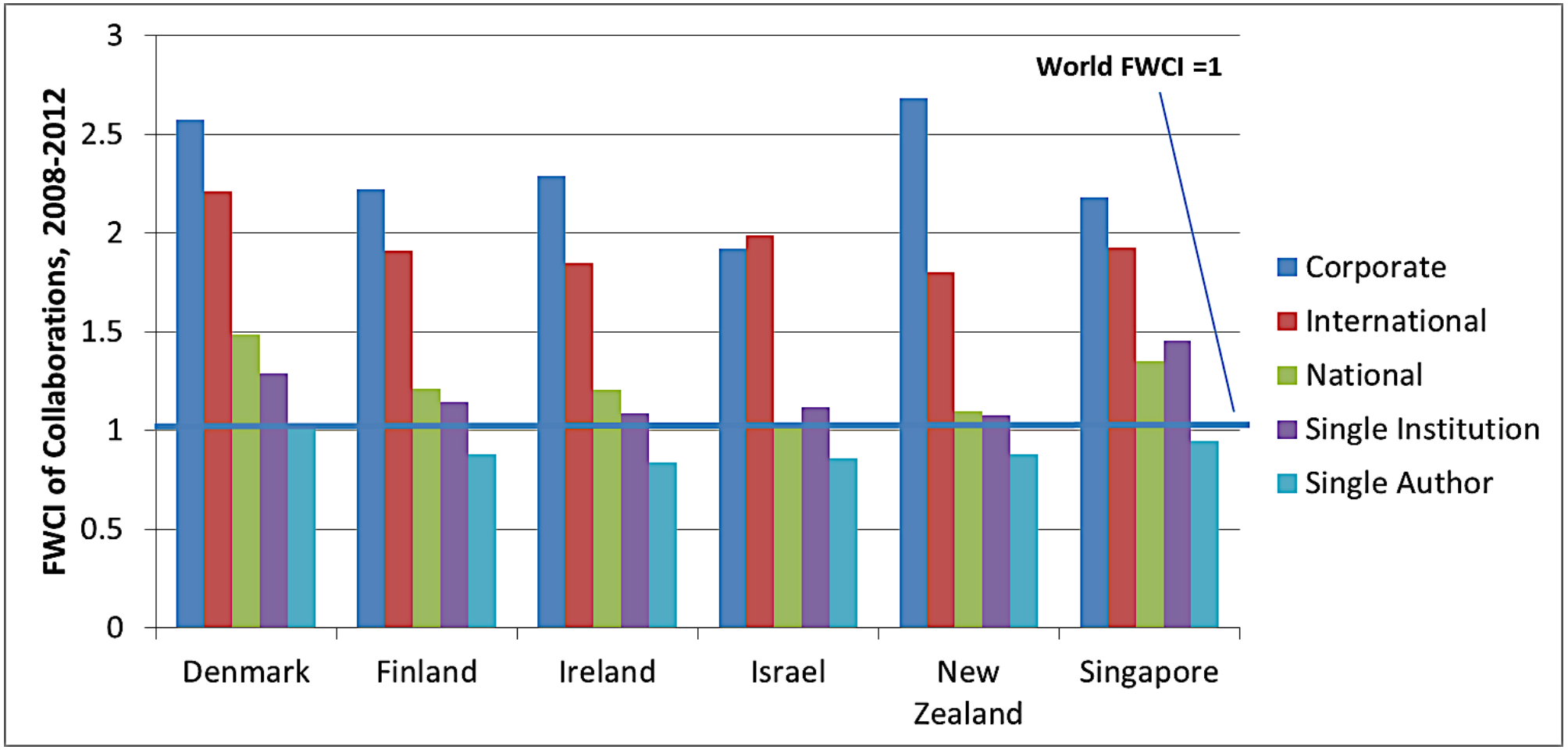
Introduction of new or improved service

Though not necessarily linear!

Time to Impact



Collaboration with industry and internationally enhances the quality of published scientific research



Scientists like evidence based policy in all areas except science policy

Exploding some myths:

Conclusions from Peer Review studies

- Peer Review widely accepted as ‘gold standard’ but few studies of effectiveness and few serious alternatives
- Little analysis – role for EU Horizon 2020 / FP9
- Few experiments – role for EU Horizon 2020 / FP9
- The NIH studies show that peer review is good at determining what to fund or not fund but very poor at rank ordering the fundable proposals.
- Particularly problematical at low percentage success rates
- Use other criteria for ranking after having determined excellence by peer review, e.g. potential impact, gender, geography etc.
- Conservative – entrepreneurs and disruptive research have few peers

SFI Research Centres

- Largest ever state/industry co-funded research investment in Ireland
- €350m of new Exchequer funds from SFI for **12 World Class Research Centres** over 6 years
- **€190m** co-investment by over **250** industry partners
- Supports key growth areas targeted in the NRPE and Action Plan for Jobs
- Targets research into major social challenges, including Health and Energy
- Directly supporting **1300** top-class researcher positions
- Leading in **Horizon 2020** programmes
- KPI driven
- Leading SFI's **Education and Public Engagement** Agenda
- State of the art **Infrastructure**
- Virtual, **multi-institutional**, multi-disciplinary Centres

SFI Research Centres

7 funded in 2013, 5 funded in 2015, *4 new Research Centres in 2017*

ADAPT	– Centre for Global Digital Content and Engagement
AMBER	– Advanced Materials and BioEngineering Research Centre
APC	– APC Microbiome Institute
CONNECT	– Future Broadband, Cellular and Internet of Things networks
CÚRAM	– Centre for Research in Medical Devices
iCRAG	– Irish Centre for Research in Applied Geosciences
INFANT	– Irish Centre for Fetal and Neonatal Translational Research
INSIGHT	– Centre for Data Analytics
IPIC	– Irish Photonic Integration Research Centre
LERO	– Irish Software Research Centre
MaREI	– Marine and Renewable Energy Ireland
SSPC	– Synthesis & Solid State Pharmaceutical Centre

New SFI Research Centres

4 new SFI Research Centres in 2017

- €72m from SFI over 6 years

- €38m from 80 industry partners

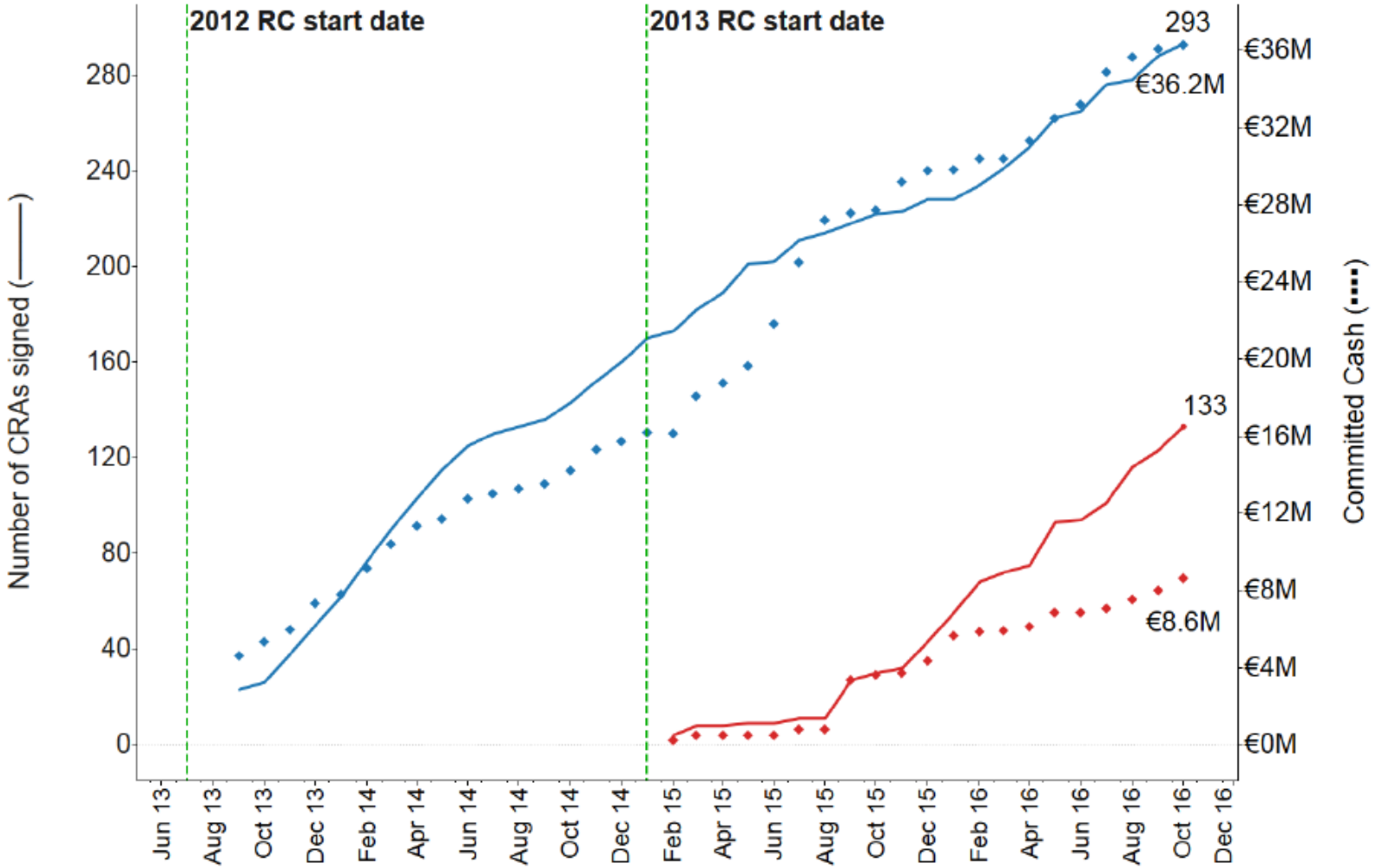
- ✓*Smart Manufacturing IT and industrial automation systems*
- ✓*Biological Resources as alternative materials to finite fossil resources*
- ✓*Innovative techniques and processes in Additive Manufacturing*
- ✓*Diagnosis, monitoring and treatment of chronic and rare neurological diseases*

4 further SFI Research Centres approved in principle - SFI seeking budget of €21.5m per year from 2018 to fund

- *Smart Agriculture*
- *Systems Biology*
- *Immunology*
- *Biopharmaceutical Manufacturing*

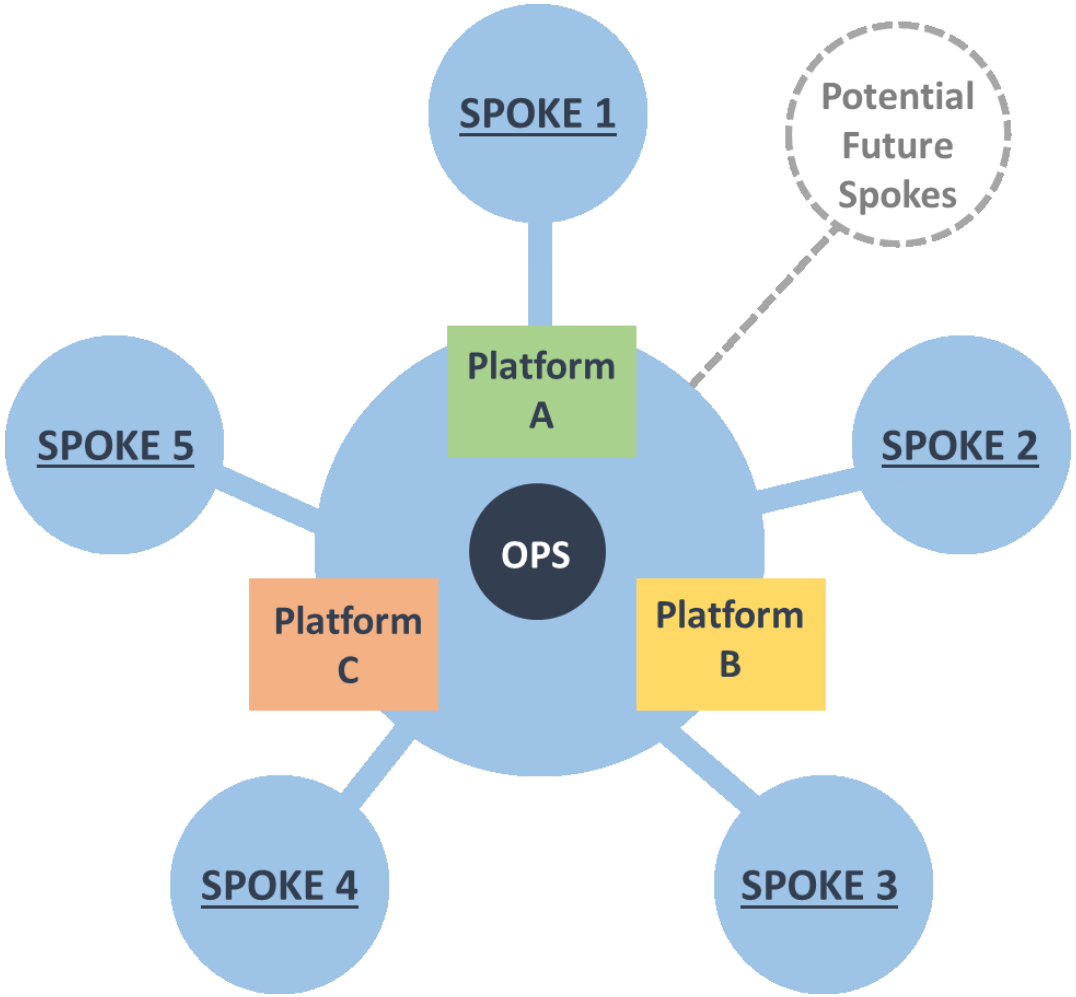
€60m from 100 industry partners

Collaborative Research Agreements (CRAs) signed with industry

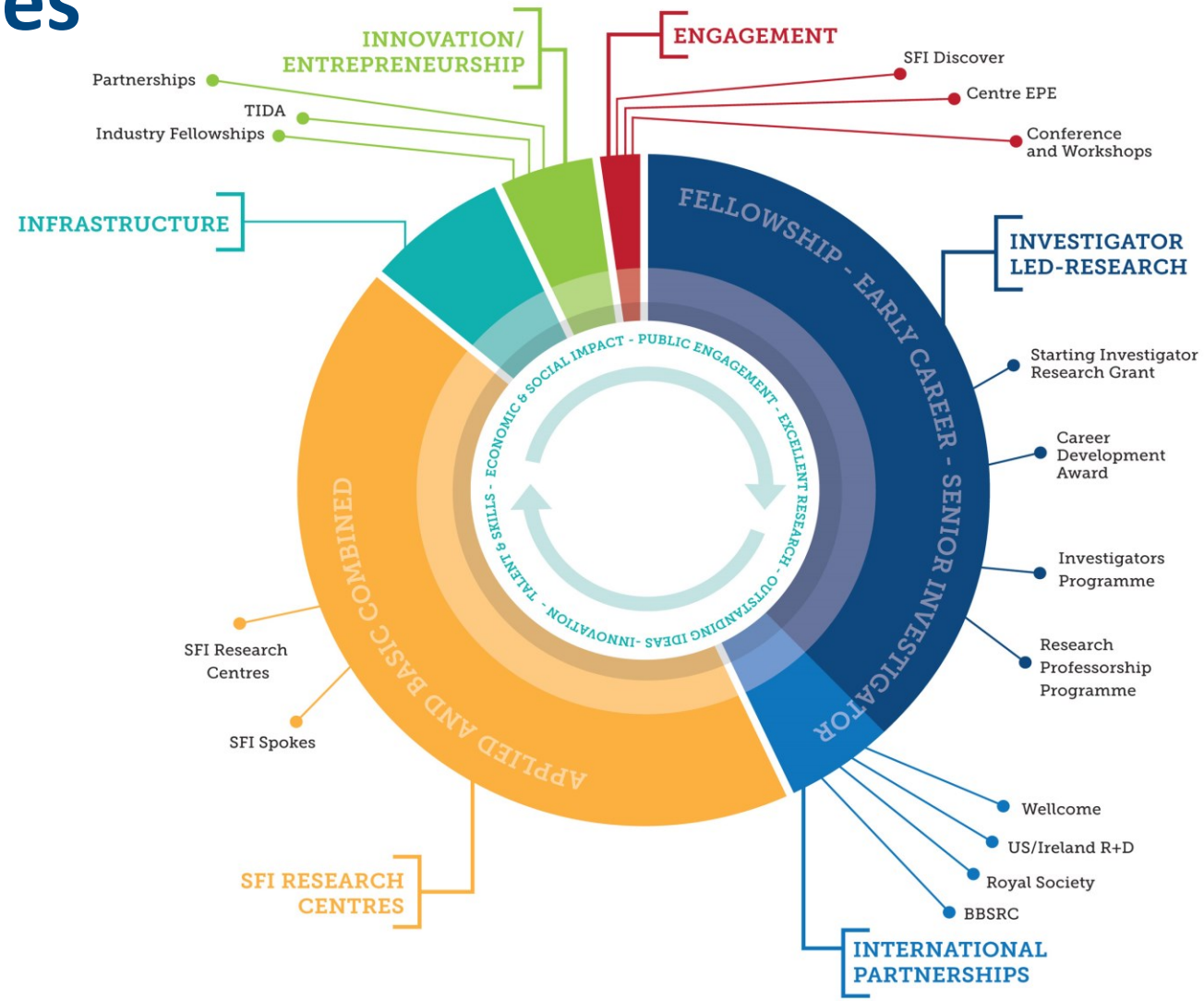


SFI Research Centre Structure

- Hub & Spoke Model
- Opportunity to develop new Centres through the Research Centres Programme
- Opportunity to join existing Centres through Spokes Programme

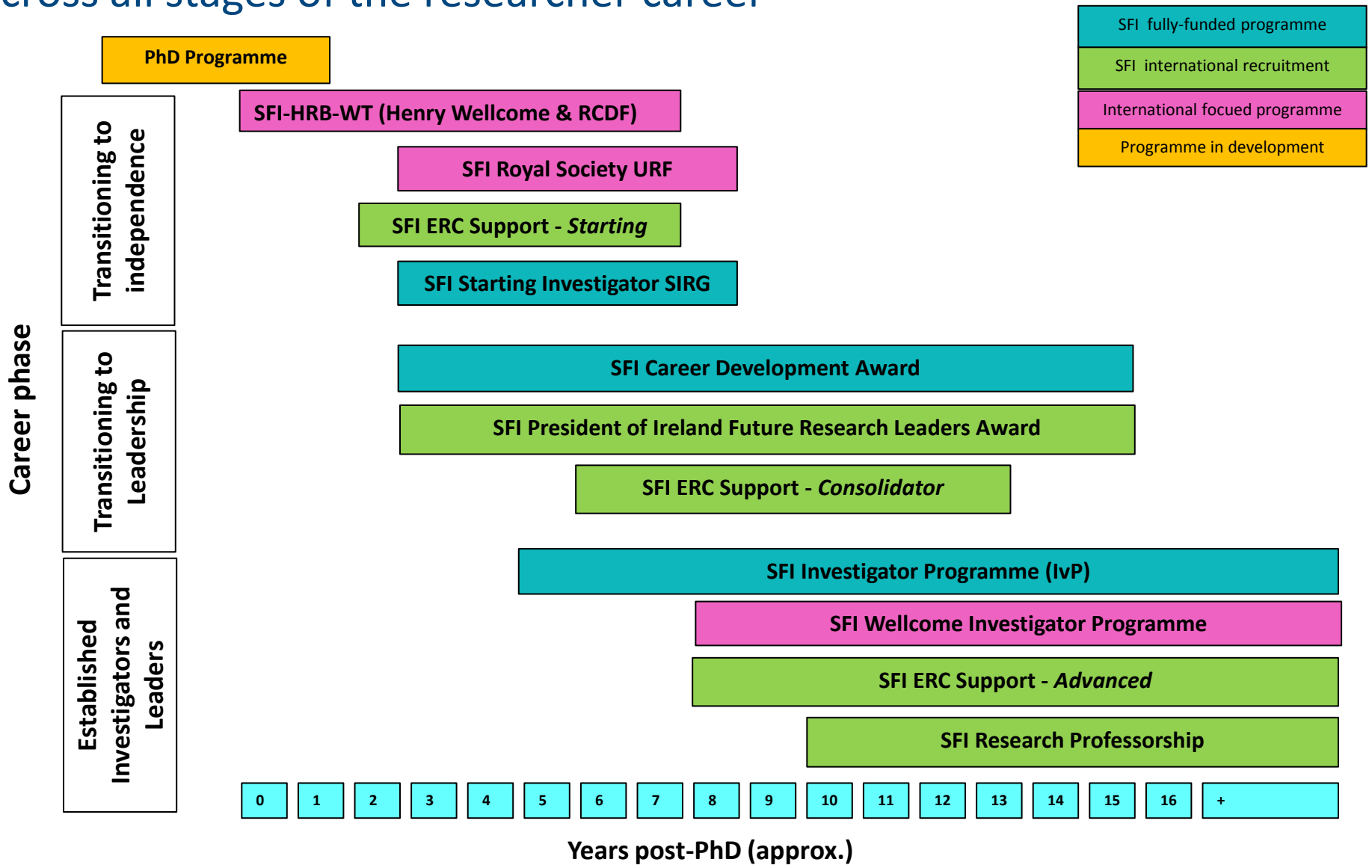


SFI Balanced Portfolio of Competitive Programmes



Human Capital – pipeline of talent

Building across all stages of the researcher career



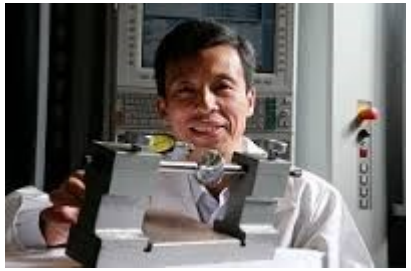
SFI Research Professors

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

Prof. Stefan Andersson-Engels
UCC / Tyndall
Biophotonics / Med devices

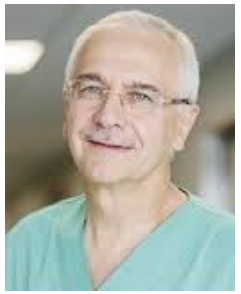
Prof. Mike Zaworotko
UL
Chemistry (pharma/energy)



Prof. Fengzhou Fang
UCD
Manufacturing

Prof. Paul Michael Weaver
UL
Manufacturing

Prof. Bogdan Staszewski
UCD
Electrical Eng / IOT



Prof. William Wijns
NUIG
Medical devices / Clin trials

Prof. Dr. Aljoša Smolić
TCD
Digital Platforms and Content

Prof. Piet Lens
NUIG
Energy Technologies

SFI Programmes for Industry

Industry Fellowship

- Funds salary, travel and subsistence of an academic researcher to spend up to one year full time or two years part time in industry, anywhere in the world
- Funds travel and subsistence of Industry personnel to spend up to one year full time or two years part time in academia in Ireland
- No limit on the number of Fellows in any company
- No requirement for academic Fellow to return to the Research Body
- Up to max of €100k per Fellowship

SFI Partnerships

- Flexible Mechanism to support ambitious research projects of scale between industry and academia
- SFI matches the investment by industry
- (i) Competitive Joint Funding Partnership Programme: SFI-Industry co-funded, competitive call to research community for proposals
- (ii) Strategic Partnerships: proposal submitted to SFI jointly by academic researcher and company following an EoI stage

Are we delivering? YES

- **Ireland 10th place in global rankings for the overall quality** of scientific research - moving up 26 places in only 13 years.
- Field specific global excellence:
  - 2nd for **Animal and Dairy**
  - 2nd for **Immunology**
  - 2nd for **Nanotechnology**
  - 3rd for **Materials Sciences**
  - 4th for **Agricultural Sciences**
  - 5th for **Chemistry**
  - 6th for **Basic Medical Research**
  - 6th for **Computer Science**

- **Ireland ranked 10th in the world by the Global Innovation Index 2017**
- **Most R&D efficient country in EU**, achieving maximum innovation output per Euro of public funding (Eurostats).
- **Ireland highlighted as one of five up and coming countries** in the world to watch for scientific research excellence (Nature Journal, 2013)

Ireland's Standing in Global Research

Ireland is 10th in global scientific ranking

Animal and Dairy	2nd
Immunology	2nd
Nanotechnology	2nd
Materials Sciences	3rd
Agricultural Sciences	4th
Chemistry	5th
Basic Medical Research	6th
Computer Science	6th

Economic Impact

Research investment supporting jobs and Ireland's economic future

Ireland is

1st in the world for knowledge diffusion

3rd in the world for knowledge and technology outputs

3rd in the world for knowledge impact

7th most innovative country in the world

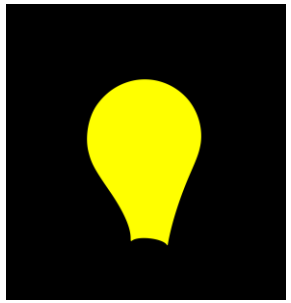
(Global Innovation Index 2016)

Ireland's Standing in Global Research & Innovation

1. Pitchbook Universities Report 2015/2016 **(top global programmes producing VC–backed entrepreneurs)**

   Europe Ranking:

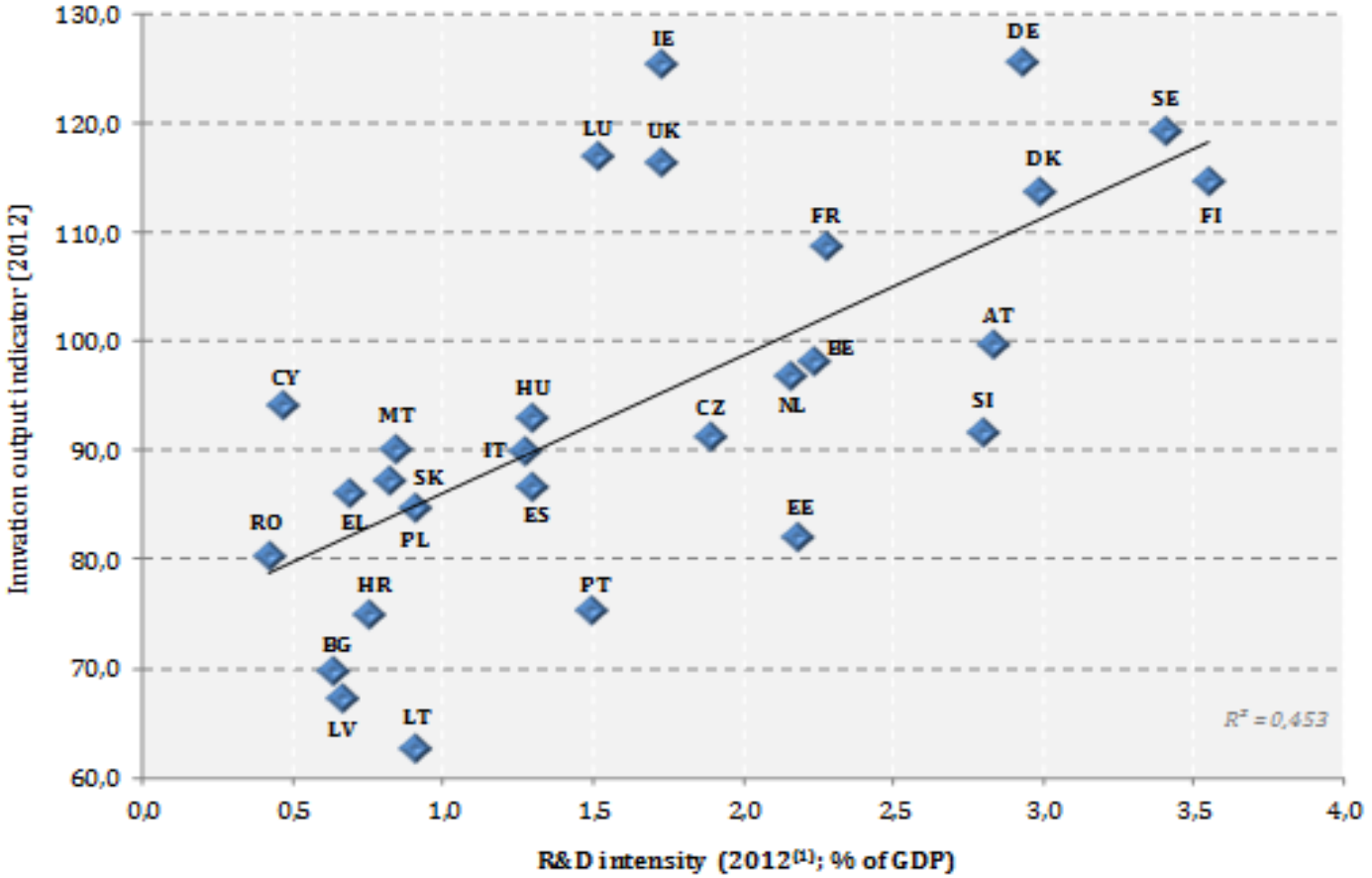
   1. **Trinity College Dublin**
   2. University of Oxford UK
   3. University of Manchester UK
   4. **University College Dublin**
   5. University of Cambridge UK
   6. London School of Economics
   7. Copenhagen Business School
   8. Imperial College London



2. **Trinity College Dublin** has the highest % of cited patents of any European University (Reuters 2016)
3. More top 100 Innovative Universities per capita than any other European Country (Reuters 2017)
4. H2020 Champions Four universities in Ireland (NUIG, UCC, UCD, TCD) in the top 50 (out of 8,000) at securing competitive EU Horizon 2020 funding (World University News 30th October 2015)
5. Most R&D efficient country in EU, achieving maximum innovation output per Euro of public funding (Eurostats)
6. Small enough to collaborate and test, large enough to scale and succeed (Ireland as a Test Bed)

Ireland - most R&D efficient country in EU

Extracting the top percentile innovation output from a below average public expenditure on R&D



Source: DG Research and Innovation - Analysis and monitoring of national research policies unit

Data: Eurostat, OECD, IUS 2014, UN (Comtrade)

Notes (1) LU: 2010.

Economic Impact

SFI directly and indirectly supports **31,000 jobs** in Ireland.

40 Conferences and Workshops Programme awards – **8,876** international delegates.

Projected local economic value to Ireland **€10.5m**

31% of SFI Investigator Programme awards published articles that were cited by patents, indicating strong innovation and knowledge transfer to industry.

€184m spend across SFI programmes generates:

- **€133m** leveraged non-exchequer funding
  - €71m EU funding
  - €45m secured from private enterprise

18%

Supporting Industry

Industry Collaborations

Science Foundation Ireland awards directly supported

1,603 industry collaborations

929 collaborations with **399 MNCs**

674 collaborations with **491 SMEs**

Talent & Skills

...supporting the next generation of our talent pipeline

4,239 People

working on Science Foundation Ireland supported research projects

1,441 Postgraduate students supported by Science Foundation Ireland

27% of PhD departures to industry as a first destination

32% of Postdocs to industry as first destination

- 53% of SFI team members are in the private sector 6-8 years post SFI award.

% of publications in the top 1% as measured by citations

Country	Funder	# Documents in Web of Science	Documents in the Top 1%
USA	All	7,628,277	1.74%
UK	All	2,079,720	1.75%
New Zealand	All	134,292	1.70%
Singapore	All	171,345	2.03%
Israel	All	227,063	1.50%
Finland	All	187,873	1.63%
Denmark	All	232,099	2.38%
Ireland	All	133,713	1.54%
China	All	2,729,495	0.9%
Ireland	SFI	11,852	2.41%
All	European Research Council (ERC)	37,475	4.82%
All	NSF	365,378	2.7%
All	NIH	596,566	2.9%

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

Source: Incites, Thomson Reuters 2003-2016

What Science Foundation Ireland delivers for its annual €162.5m budget

A research engine of **4040** people led by **450** leading scientists

12 world leading research centres spanning several HEIs and industry

750 Active Research Projects

Generating Annually

4,406 scientific publications

1220 collaborations with industry (including 372 MNCs, 437 SMEs)

17 spin out companies formed

30 licensed technologies

80 patent filings, **25** patents awarded

2,081 international collaborations in 62 countries

€170m in leveraged non-SFI funding

550 primary schools received Discover Primary Science and Maths Awards

250,000 people reached in over **800** events during Science Week

Science Foundation Ireland sfi For what's next

Thank You