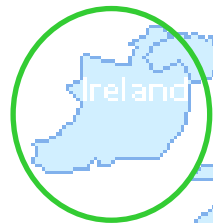


European Commission High Level Group on Key Enabling Technologies

Open Day Nanotechnologies
Oct 27th 2010



Deployment in Member States

The Ireland Story

Martin Cronin

Chair of the Ireland Nanotechnology Coordination Group

❖ *The Ireland Story*

❖ *The beginning*

- ❖ *Ireland – a history of Technology*
- ❖ *Ireland's Inflection Point in 2000*

❖ *Where we are today*

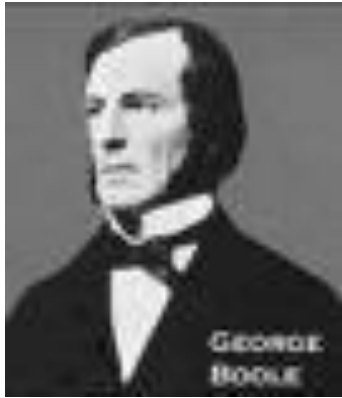
- ❖ *A strong Infrastructure and Research Competence*
- ❖ *Academic, Industry and State Engagement*

❖ *Next Steps for Ireland*

- ❖ *Nanotechnology Commercialisation Framework 2010-2014*
- ❖ *Specific Recommendations*

❖ *Ireland – a history of Technology*

Robert Boyle 1627 – 1691
The Father of Chemistry



George Boole 1815 – 1864 –
Professor of Mathematics at
UCC
Inventor of Boolean Logic - the
basis of modern digital
computer logic



Ernest Walton 1903 – 1995 Ireland Physicist and
Nobel Laureate
Split the nuclei of lithium atoms

❖ *Ireland's Inflection point in 2000*

1998 : a major **Technology Foresight** exercise.

The **conclusion** was that biotechnology and information and communications technology represented ***"the engines of future growth in the global economy....A world class research capability in selected niches of these two enabling technologies is an essential foundation for future growth."***

A new **funding agency**, **Science Foundation Ireland** was established in 2000 with a budget of €646 million.



❖ *A strong infrastructure and research competence*



BioDiagnosticsIreland(BDI) at Dublin City University

- Academic-Industrial-Clinical partnership
- Development of next-generation biomedical diagnostic devices

Materials and Surface Science Institute (MSSI) at Limerick University

- Synthesis, Characterisation and modelling of nanomaterials
- Quantum mechanical and phenomenological simulation



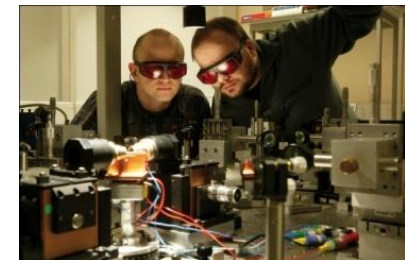
Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN) at Trinity College Dublin

- New nanomaterials with improved mechanical, magnetic, electrical or optical properties
- Application in electronic or medical devices, sensors, or new drug delivery systems.



Tyndall National Institute (TNI) at University College Cork

- Theoretical modelling and design
- Novel materials
- Nanotechnology
- Device processing and fabrication
- Packaging and integration
- Novel systems incorporating these new devices.



Equipment – High Level Overview

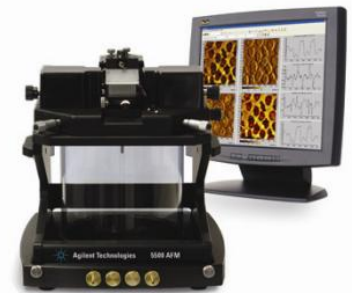
- **BDI:** XRD, PLD, fs laser, luminescence spectrometer
- **MSSI:** FEG SEM, TEM, AFM, UPS/XPS
- **CRANN:** FEI Titan TEM with EELS, FIB, tunable fs laser
- **TNI:** HR-SEM, ALD system, SECM, AFM, low angle XRD

Also :

- **NUIG, Galway:** ps and fs lasers, AFM, confocal Raman
- **CIT, Cork:** ps laser, streak camera, fast scope
- **DIT, Dublin:** Dynamic light scattering, AFM, Raman, SEM



FEI, Titan TEM at CRANN



*Agilent 5500 AFM/SPM
N9410S at LightHOUSE*

Ireland in FP7: January 2007 to April 2010

- Ireland's drawdown to date (i.e. 3¼ years): €213.4M (with €55.4M going to industry partners) , has bypassed the total funding obtained under FP6 (€198.7m) over 5 years
- 4 Key thematic areas:
 1. Information & Communication Technologies (€66M)
 2. Marie Curie (€38M)
 3. Nanoscience, Nanotechnology, Materials & New Production Technologies (€21M)
 4. Health (€16M)
- Nanoscience and Nanotechnology feature in many projects. e.g. Ireland, through the CBNI (centre for Bio-Nano Interaction, UCD) is coordinating QNano, a Research Infrastructures project in Nano-safety – 40 partners across the EU, focused on access to facilities (€7M project)

❖ All Ireland Academic Network

- INSPIRE

Since 2007, a consortium of 10 Irish third level institutions with strong research capability in nanoscience and nanotechnology

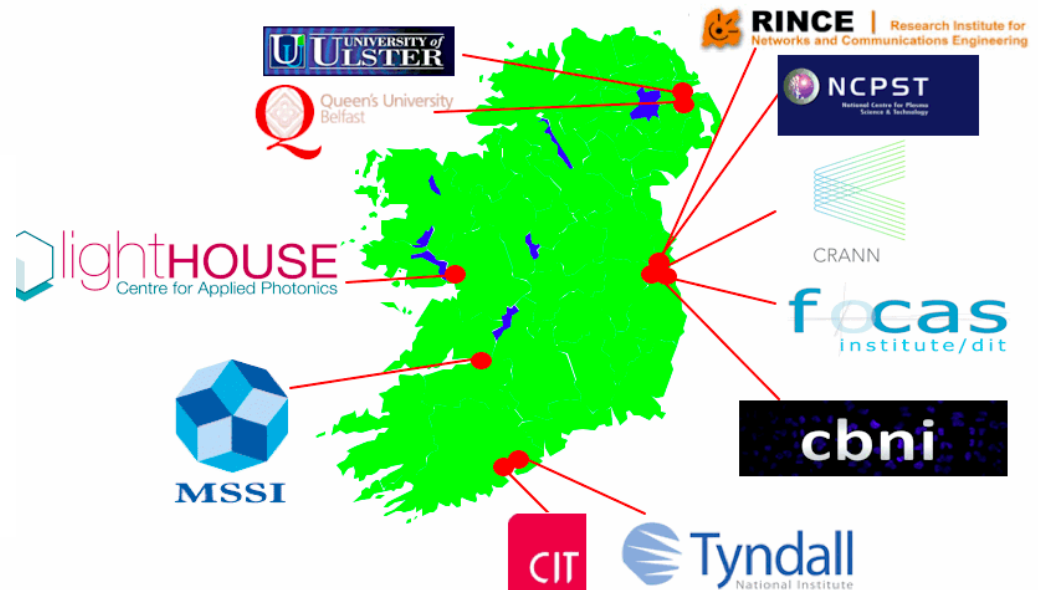
- €32 M State funding

- INSPIRE brings together all leading nanoscience researchers on an all-island basis to enable :

- (1) the establishment of shared nanoscience infrastructure
- (2) the development of enhanced research collaboration and
- (3) the implementation of a national graduate programme.

inspire

Integrated NanoScience
Platform for Ireland



Today

Strong industry engagement with early adoptors



Applied Nanotechnology

AN ENTERPRISE IRELAND
& IDA IRELAND INITIATIVE



CREGANNA



The Competence Centre in Applied Nano Technology (CCAN) is an industry-led collaborative research consortium

The CCAN provides leadership in the development of industrial relevant nanotechnology R&D.

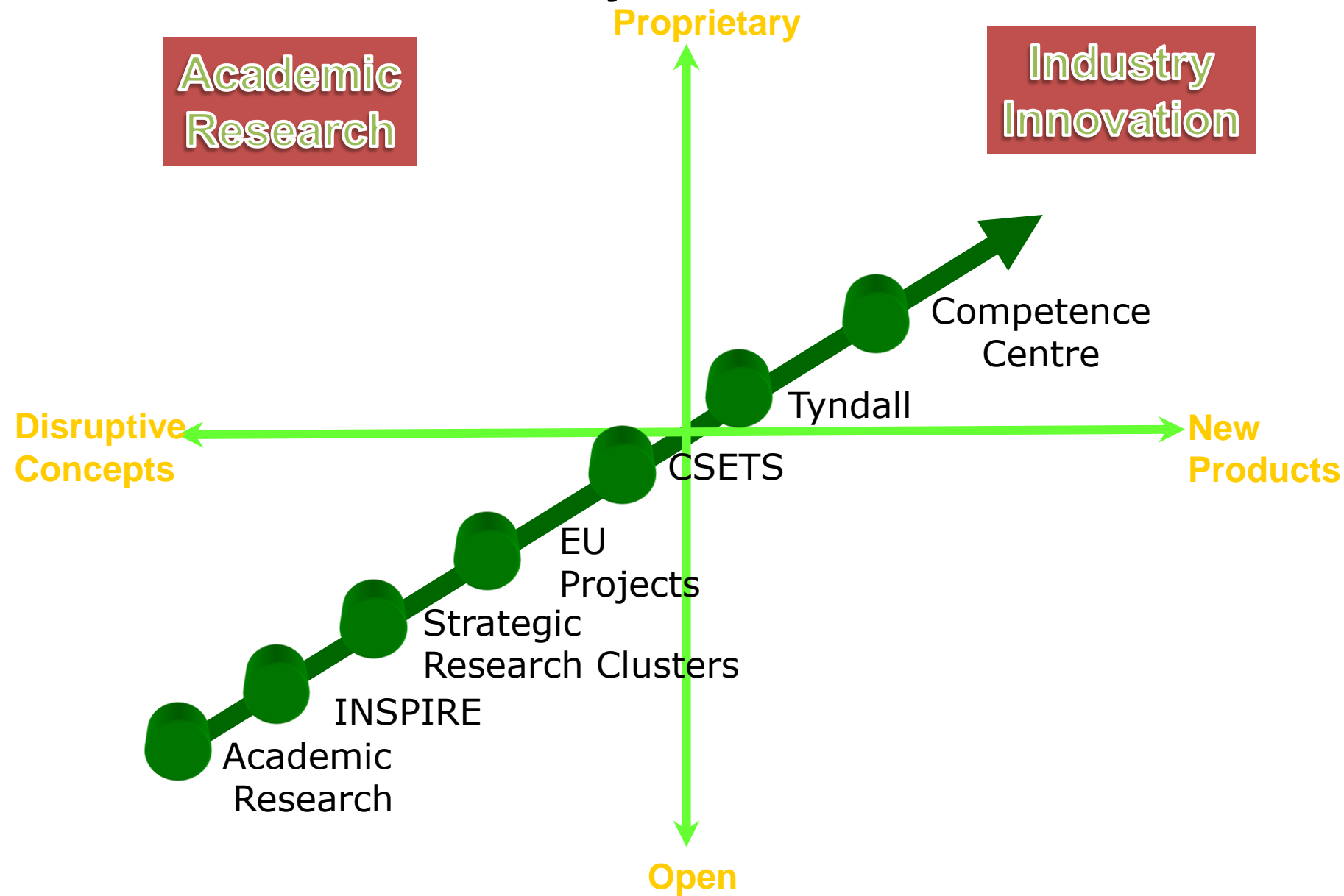
- ICT/nano-electronics and nanophotonics
- nano-biotechnology/nano-medicine
- the convergence of these two latter disciplines

Examples of current projects:

- Integrated light source for heat assisted magnetic recording
- Development of 2 and 3 dimensional nanostructured constructs from commercially available biomaterials for control of cellular function
- Nanoparticle based *in vivo* diagnostics and/or drug delivery
- Barrier layers for advanced interconnects in nanoelectronics

Today

❖ Ireland's Nano 'ecosystem'...under construction



❖ **'NanoNet Ireland'**

Academia and Industry

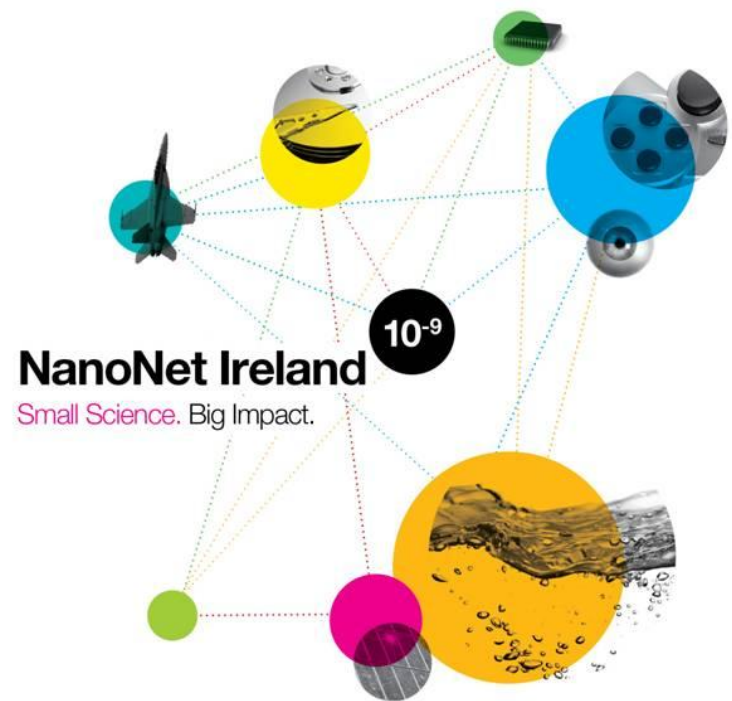
- **'Connecting the dots'** from

- nanoscience to nanotechnology,
- academia to industry,
- agency to agency,
- consortium to consortium,

and representing a coherent nano-ecosystem in Ireland.

- A **"one stop shop"** that

- brings companies, academics and government agencies together..
- Creates a space for policy discussion and influencing.
- Acts as an 'interface' for Ireland to showcase its capabilities to the rest of the world.



WWW.NanoNetIreland.ie

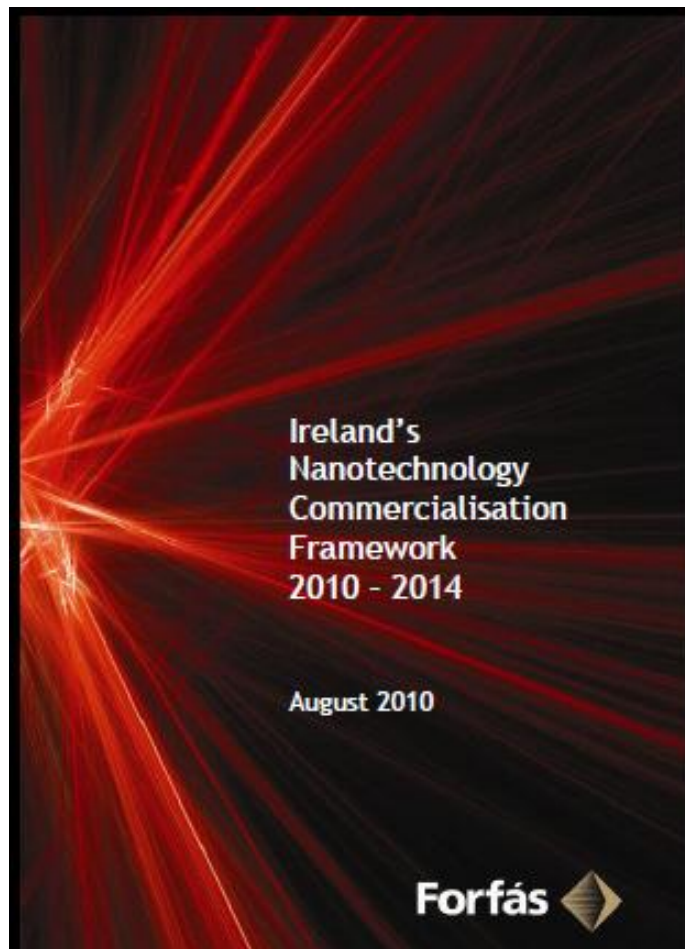
- **Nanoweek** Nov 2009, Next event February 2011

Today

❖ *Nanotechnology Coordinating Group*

Government

Government advisers Forfás sponsored a report, **Ireland's Nanotechnology commercialisation Framework 2010-2014**, with international consultants Lux Research.



A co-ordinating group established to push forward the report's findings as quickly as possible. This is made up of industrialists, academics and enterprise development agencies



❖ Ireland's Nanotechnology commercialisation Framework 2010-2014,

Objective

- Identify the options and models to leverage the nanotechnology research base to spur the development of the enterprise base.
- Evaluate various commercialisation options

Outline

- **Phase I benchmarks the Irish nanotechnology research base.**
- **Phase II** evaluated the nanotechnology **commercialisation strategies** employed by a select group of five comparable and “best-in-class” nations.
- **Phase III** focused on establishing Ireland’s nanotechnology **vision and focus areas.**

❖ Phase I Summary

- 2001 and 2009 : Ireland spent approximately €282 million on nanotechnology.
- **The key underlying theme should be focus.**
- Ireland benchmarks well internationally.
- Quality, volume and industrial relevance of the research output will be crucial to achieve commercialisation.
- Ireland needs to strategically incentivise nanotechnology developments most relevant to its industrial base.
- Ireland should adopt a different way of planning, conducting and evaluating research.

❖ Phase II Summary

- Ireland's investment in world-class infrastructure is in line with international best practice.
- Ireland lacks market-driven demand pull for research or a "super-customer" to perform this role.
- A particular challenge in Ireland is a lack of critical mass.
- Leading nations have learned the importance of focus.
- Commercialisation strategy will have to devise programmes to make the research more commercially relevant.
- Governments play a prominent role in supporting the commercialisation of nanotechnology.

❖ Phase III Summary



- Ireland can derive significant economic value from continued nanotechnology investments.
- Any nanotechnology strategy should be consistent with national priorities for developing the industrial base.
- Spending realignment informed by sharp focus, and funding source diversification will enable Ireland to continue investing in nanotechnology with an affordable level of government funding.

Table i: Proposed Focus Areas for Irish Nanotechnology Research

• Ireland should formally and proactively include industry in setting priorities and identifying focus areas;

• Significant industry involvement in a short timeframe is unlikely without a proactive and focused implementation strategy.

• Nanosafety is an important aspect of nanotechnology

Application focus areas →	Next-gen electronics	Medical devices and diagnostics	Environmental applications	Industrial process improvements
Technology focus areas ↓				
Advanced Materials (Functional nanomaterials and nanostructures, Composites, Coatings, Catalysts)	Post-Silicon (Si) materials, Beyond CMOS, printed electronics	Coatings, delivery and diagnostics systems, imaging	Nanostructured membranes, Pollution abatement and treatment, LEDs, coatings	Insulation, coatings, catalysts
More than Moore	System-on-chip, radio, sensors, actuators, cooling element	Bio-logic, sensors, personal health monitors	Sensors Intelligent system control	Sensors, Intelligent system control
Nanobiotech - (Red, Green and White)⁴	-	Encapsulation	Waste treatment	Green chemistry

❖ Recommendations

- Focus Irish nanotechnology research efforts
- Establish a nanotechnology coordinating group.
- Align funding to focus areas and coordinate funding management
- Establish a self sustainment strategy - diversify funding sources / increase industrial funding
- Leverage and network existing infrastructure
- Encourage and foster intensive collaboration at a national and international level
- Develop an entrepreneurial workforce to enable the effective translation of relevant research into commercially interesting opportunities



In Summary.....

- Ireland has invested significantly in **Science & Technology** and has a key focus on **ICT, Life Sciences and Energy**, all underpinned by **Nanoscience and Nanotechnology**
- Ireland has a proven track record in collaborative international linkages
- There is a need for more 'joined-up' national and international activities
- We believe that collaborative R&D will enable a more competitive EU

