



**The Abdus Salam  
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**2335-11**

**Workshop on Entrepreneurship for Physicists and Engineers from Developing  
Countries**

*23 - 27 April 2012*

**Invention to start--ups Translating best practices from Oxford to developing  
countries**

Rakesh Roshan  
*ISIS Innovation, Oxford  
UK*

# **Invention to start-ups**

## **Translating best practices from Oxford to developing countries**

Dr Rakesh Roshan

Isis Innovation

The technology transfer arm of the University of Oxford.



Joint ICTP-TWAS Workshop on Entrepreneurship  
for Physicists and Engineers from Developing Countries  
Trieste, Italy

April 25, 2012

# Oxford and Isis

# Oxford University & Isis Innovation Ltd

- **Oxford University** is the oldest university in the English-speaking world
- Highest University Research Spend in the UK
  - £500.6 million (2010/2011)
- **Isis Innovation Ltd** is a profitable company 100% owned by the University of Oxford, established 1987
- A world-class Technology Innovation business
  - Isis 9th highest British filer of PCT patent applicant (WIPO Data, 2010)
  - Highest European University PCT applicant (WIPO Data, 2010)



Institute of Biomedical Engineering

# Isis Innovation Ltd



Transferring  
Technology and  
Expertise from Oxford

Technology Commercialisation and  
Innovation Management for the rest of  
the world (Absolute Innovation  
Management)

University investment in Isis for protecting Oxford IP  
Isis returns several financial and non-financial benefits to the University

# Measuring Performance

## IP Management

- Isis manages 1629 (631 granted) patents & patent applications; and 460 active licensing deals (annual turnover £10.1m in 2011-12)

## Company Creation

- 63 new spin-out companies created since 2000
- University currently has equity stake in 51 (4 AIM listed, 1 LSE listed)
- Share value estimated £32m, 1000 employees, £30m+ turnover

## Successful stories and exits

- *Oxford PV Limited* (Physics) formed in 2010 – excellent recent results – watch this space
- *Oxford Nanopore Technologies* (Chemistry) have been valued at **\$2billion** in February 2012 since it unveiled its new nanopore sequencing platform at the Advances in Genome Biology and Technology meeting in Marco Island, Fla.
- *Oxford Asymmetry* (Chemistry) - Floated on London Stock Exchange in 1998 and acquired by Evotec for **£316m** in 2001
- *Powderject* (Engineering) - Sold to Chiron Corp (now part of Novartis) for **£550m** in 2003

# Isis Innovation works in more than 54 countries – Key Locations

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# Commercialising Technologies via Spinouts formation

# Start-ups (typical concerns)

It can fail

Negative  
Earnings

Takes time to  
achieve  
significant  
increase in  
value

Business  
goals based  
on certain  
assumptions

Untested  
model,  
products  
and market

Goes  
through  
several  
rounds of  
funding

# Start-ups (upside)

Preferred  
stage/  
start early

Risks are  
high and so  
are the  
profits

Often best ways  
of bringing  
Breakthrough  
'*game changing*'  
technologies to  
the market

Competitive  
edge/ larger  
share of the  
market

All the medium/  
large companies  
started at some  
point

# Oxford Spin-outs (post 2000)

2000	7	Third Phase, Mindweavers, Oxford BioSignals, Oxford BioSensors, TolerRx, OXIVA, Pharma DM
2001	7	OxLoc, Oxford Bee Co, Oxford Ancestors, Novarc, Oxford ArchDigital, Natural Motion, Inhibox
2002	9	Pharminox, Minervation, Oxford Biomaterials(Spinox), Zyentia, Oxitec, Oxford Immunotec, Oxford Risk, GlycoForm, BioAnalab
2003	4	Summit(Vastox)*, ReOx, Riotech, OCSI
2004	4	Avacta(OMD)*, G-Nostics, Surface Therapeutics, EKB Technology
2005	5	Oxford Nanopore Technologies, Oxford RF Sensors, Oxbridge Pulsars, Celleron, Oxford Catalysts*
2006	7	TDeltaS, Oxford Medistress, Particle Therapeutic, Aurox, Oxford Advanced Surfaces*, Cyttox, OxTox
2007	4	Eykona Technologies, Clinox, Oxford Biodynamics, Crysalin
2008	4	Semmle, Oxford-Emergent TB Consortium, Navetas(ISE), Organox
2009	3	Oxford Financial Computing, Zyoxel, Oxford Yasa Motors
2010	4	OxEms, Kepler Energy, IXO, Oxford PhotoVoltaic
2011	5	Oxyntix, Oxtex, Oxford Multi Spectral, Oxford Imaging Detectors, OCB

Total external investment to date in spin-outs since 2000: **£327m**

£42m 1st round Seed/Business Angels – average amount invested £850k; 1/3<sup>rd</sup> > £1m invested.

£285m follow-on Venture/Institution Capital

\* stock exchange listing

# Summary of some of our spin-outs

Company	Founded	Employees start/now
Oxford Gene Technology	1995	2/100
Oxonica	1999	1*
Oxford Catalysts	2005	2/90
Oxford RF Sensors	2005	2/30
Oxford Advanced Surfaces	2006	2/20

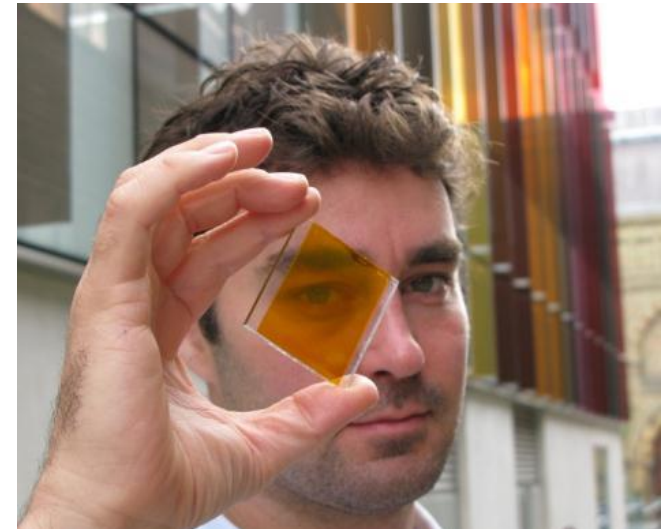
\* Reorganised business model at end of 2009

Typical pre-money valuation of spin-out companies: £750K - £1.3M

# Spin-out: Oxford Photovoltaics

(<http://www.oxfordpv.com/>)

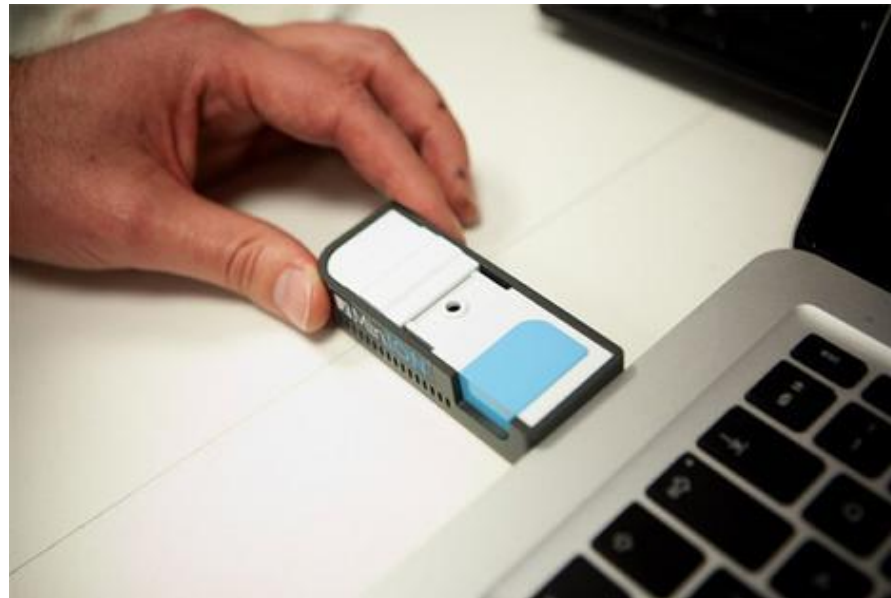
- Oxford Photovoltaics Ltd will bring to market low cost, stable and fully scalable (thin film) solar cell technology that combines the benefits of inexpensive abundant organic materials with simple screen printing manufacturing technology
- “Green technology” similar to photosynthesis with wide range of colours and transparency options (solid state version of DSSC)
- Target application: Low cost solar power glazing for buildings and other application areas
- TSB funding of £100k in October 2010
- VC investment of £650k in July 2011



# Oxford Nanopore Technologies

[http://www.ox.ac.uk/media/science\\_blog/120315.html](http://www.ox.ac.uk/media/science_blog/120315.html)

Technology can analyse the building blocks of life via "strand sequencing", in which an entire string of DNA passes through a tiny hole in a cell membrane, called a nanopore, and an electric current is used to decode the DNA.



Earlier this month, Oxford Nanopore presented its technology at a genetic conference in America and also revealed a device the size of a memory stick that is said to sequence DNA more simply and cheaply.



# Good attention!

www.telegraph.co.uk/finance/newsbysector/pharmaceuticalsandchemicals/9105797/Oxford-Nanopore-considers-flotation-within-18-months.html

Thursday 22 March 2012


## The Telegraph




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### Oxford Nanopore considers flotation within 18 months

Oxford Nanopore, the business that has developed a DNA sequencing device the size of a computer memory stick, could consider a possible \$1bn (£630m) flotation within 18 months.



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Oxford Nanopore has developed technology that can analyse the building blocks of life via "strand sequencing", in which an entire string of DNA passes through a tiny hole in a cell membrane, called a nanopore, and an electric current is used to decode the DNA.

MARKET DATA >

	UK	WORLD	FOREX
FTSE 100	5,833 -1.0%		
FTSE 250	11,536 -1.0%		
All Share	3,031 -1.0%		
S&P 500	3,131 -0.3%		

3 AM 10 AM 12 PM 2 PM 4 PM GMT

22/03/12

www.nytimes.com/2012/02/18/health/oxford-nanopore-unveils-tiny-dna-sequencing-device.html?\_r=1

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### Company Unveils DNA Sequencing Device Meant to Be Portable, Disposable and Cheap

By ANDREW POLLACK  
Published: February 17, 2012

DNA sequencing is becoming both faster and cheaper. Now, it is also becoming tinier.

A British company said on Friday that by the end of the year it would begin selling a disposable gene sequencing device that is the size of a USB memory stick and plugs into a laptop computer to deliver its results.

The device, expected to cost less than \$900, could allow small sequencing jobs to be done by researchers who cannot afford the \$50,000 to \$750,000 needed to buy a sequencing machine.

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SOUND OF MY VOICE IN THEATERS MARCH 2012

RNA Sequencing

Well  
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Do Women Like Child Care More Than Men?  
March 21, 2012  
Making the Case for Running Shoes  
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An Early Start to Allergy Season  
March 20, 2012  
The Annual Appointment Loses Some Relevance  
March 19, 2012

9:30 22/03/12

www.guardian.co.uk/science/2012/feb/17/dna-machine-human-sequencing?INTCMP=SRCH

the guardian

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News > Science > Genetics

### DNA machine can sequence human genomes in hours

Oxford Nanopore has come up with a DNA sequencing machine the size of a USB memory stick that can decode the building blocks of life within hours rather than days

Julia Kollerwe  
guardian.co.uk, Friday 17 February 2012 18:48 GMT  
Article history



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## Science

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February 17, 2012 5:09 pm

### Oxford Nanopore unveils mini-DNA reader

By Clive Cookson, Science Editor

A young British company has made a powerful entry into one of the fastest-moving and most competitive fields of technology – gene sequencing for science and medicine.

Oxford Nanopore, set up in 2005, unveiled on Friday the world's first miniature DNA sequencer, small enough to fit in the hand.

More

ON THIS STORY  
Small-cap takeover delay hits Synchronica  
DNA technology to move into mainstream  
NHS urged to adopt DNA testing  
Machine to read individual's DNA for \$1,000

The company says its technology reads the four biochemical letters of DNA more quickly and less expensively than the established companies in the field.

The corporate leaders in DNA sequencing are two US companies: Illumina, for which Roche of Switzerland launched a \$5.7bn hostile bid last month, and Life Technologies, which made a splash with its recent announcement of a partnership with the UK's Wellcome Trust.

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9:31 22/03/12

# Inventor's experience (Hagan)

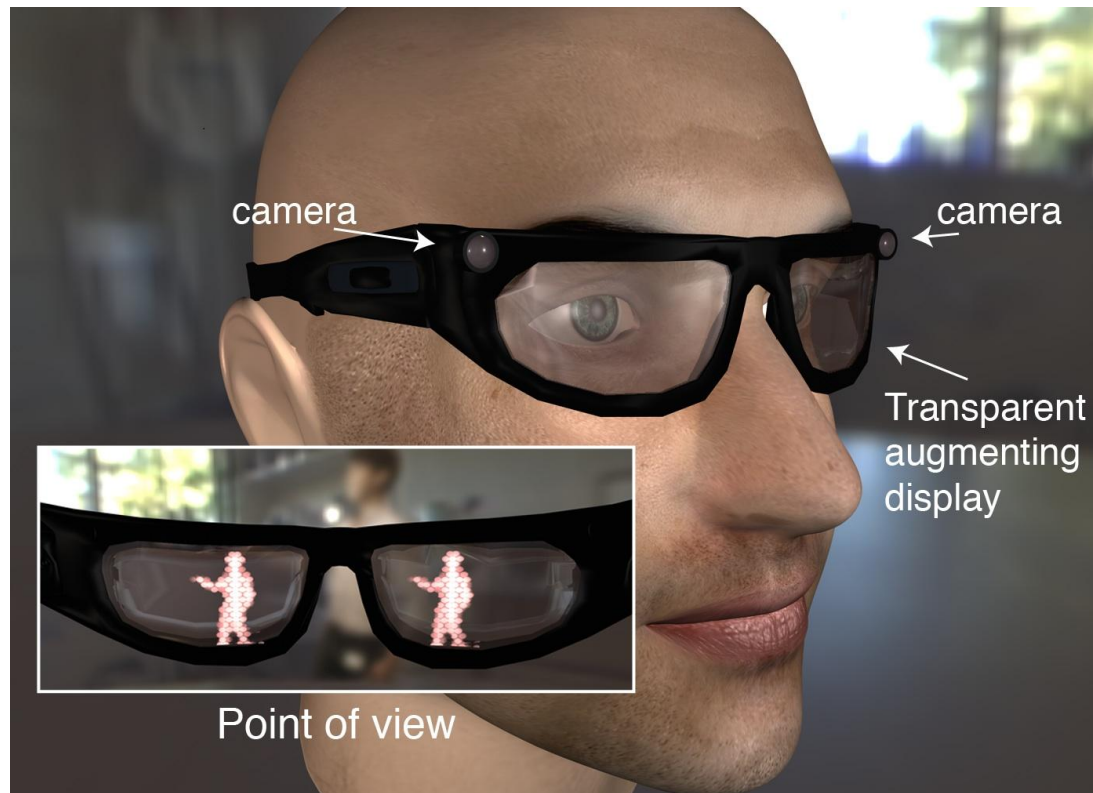
Motivation - He believes that most new commercial exploitation opportunities come from basic research, and instead of research councils and universities trying to plan 'pathways' to new products and services: 'the best way to do initial research is to find good motivated scientists, give them funding and time, and leave them alone.'

Support- Hagan tells me: 'we need to make it simple for academics to form a company, don't make them have to take a year out from their academic work or quit their university job to get things going.' The support he received from Isis Innovation and others around the University indeed made spinning out a firm 'relatively easy'.

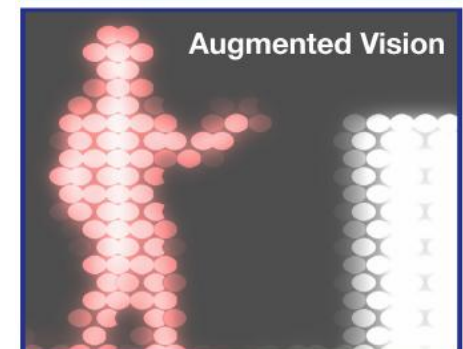
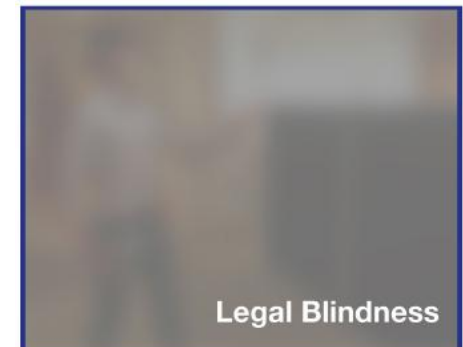
Choice- Despite his role as the firm's founder, a board member, and long-time scientific adviser, Hagan didn't become its CEO; 'my interest was always in the basic research' he says. Instead, he continued to work with his team on the scientific challenges of understanding nanopores and what they can do, publishing papers that were useful to both the spinout and others interested in the potential of this emerging technology.

# Oxford Bionics

A visual aid that helps the “blind” brain process visual information



285 millions are vision impaired



# Well received by the market

- International media

**The Telegraph**

*The* **INDEPENDENT**

**Daily Mail**

**METRO**

**BBC**  
**NEWS SCIENCE**

**ABC Radio**

**THE HUFFINGTON POST**

*The Sydney Morning Herald*

**CNN**

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- Exhibitions

**THE ROYAL SOCIETY**

**NATURAL HISTORY MUSEUM**

- Parliamentary report for Assistive Technology 2012

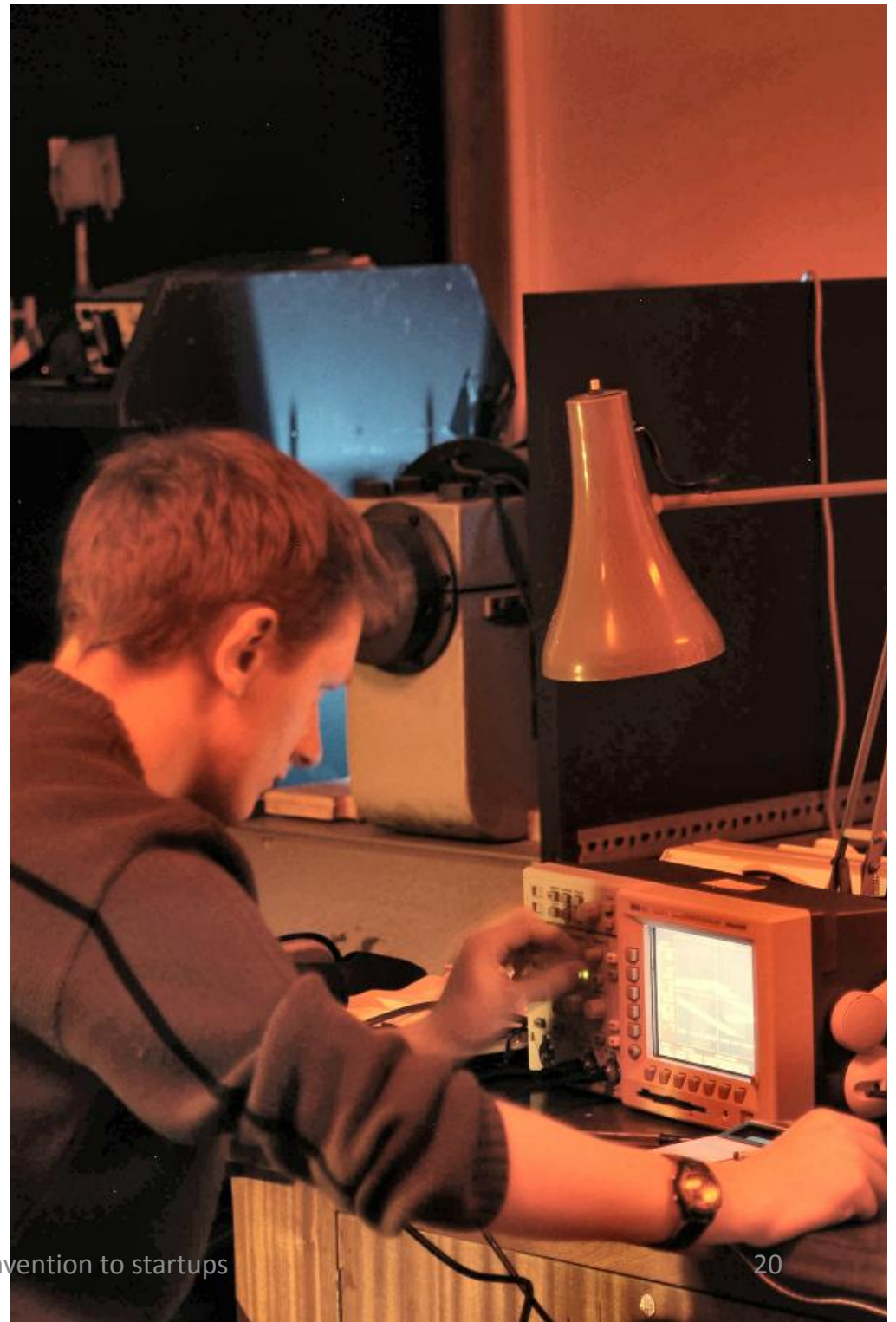
# Structuring Spinouts



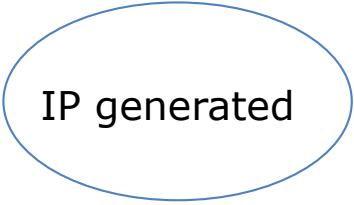
# **(A marriage of technology and investment)**

Entrepreneurship Workshop  
April 23-27, 2012  
Trieste, Italy

Rakesh Roshan: Invention to startups



# Structuring Oxford Spin-outs



IP generated

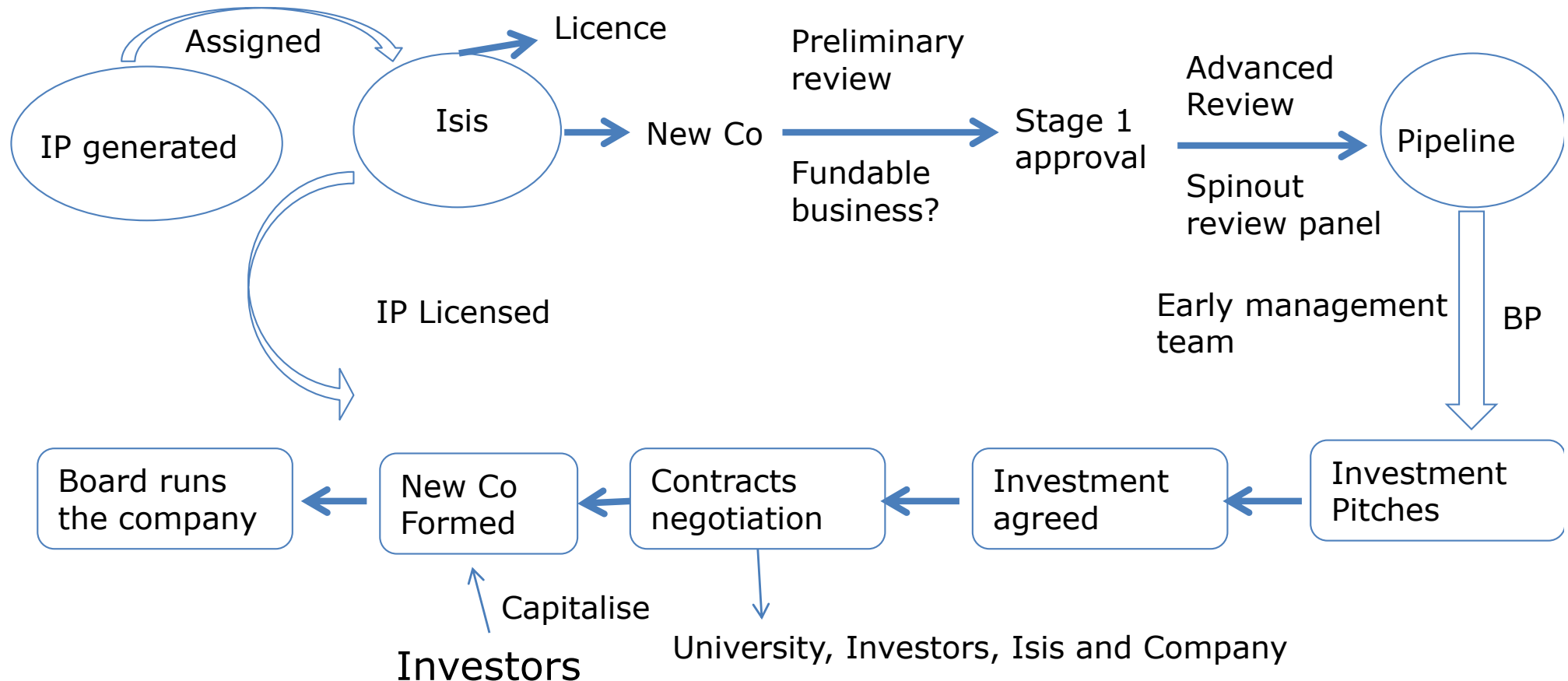


# Commercialising technologies (early days)



Why spinout?  
Can it be licensed?  
What are the academics motivation?  
Can he afford the time?  
Is the idea fundable?  
Is it a platform technology - having several applications (metamaterials)?  
How big is the market?  
Is the market ready (Spintronics)?  
What is the readiness level of the technology?  
Cost Vs Performance?  
Competition?  
Reliance on external factors/ Supply chain?

# Structuring Oxford Spin-outs



Everyone in the ecosystem shares the risk (CEO, Isis, Service Providers)  
 All the shareholders are treated equally (academics, University and investors)  
 Not keen on forming shell companies  
 Communication holds the key and Project Managers has no vested interest  
 Convince private investors the merits  
 Hard work, always takes longer than one thinks, a measure of luck needed.

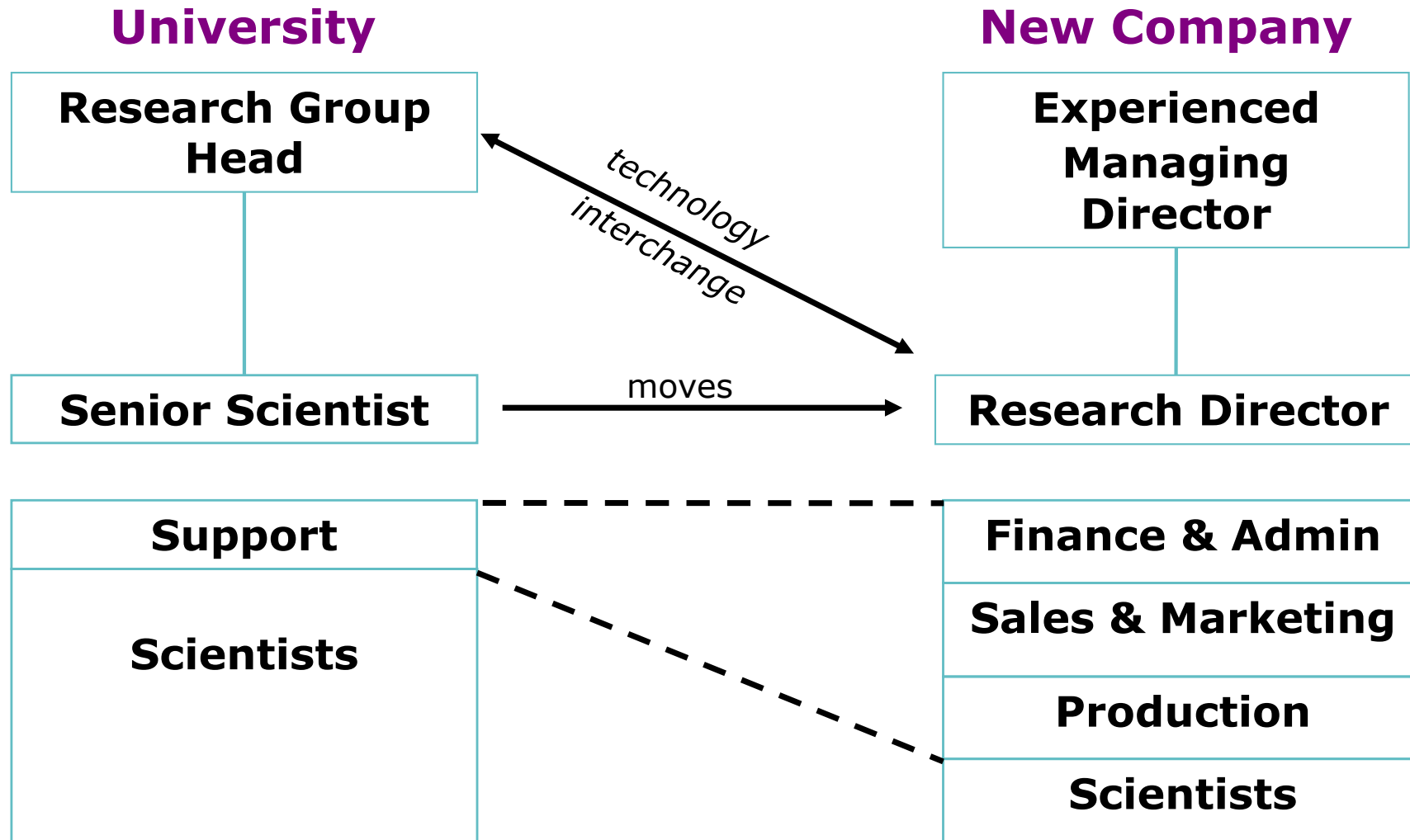
# Completion of the marriage



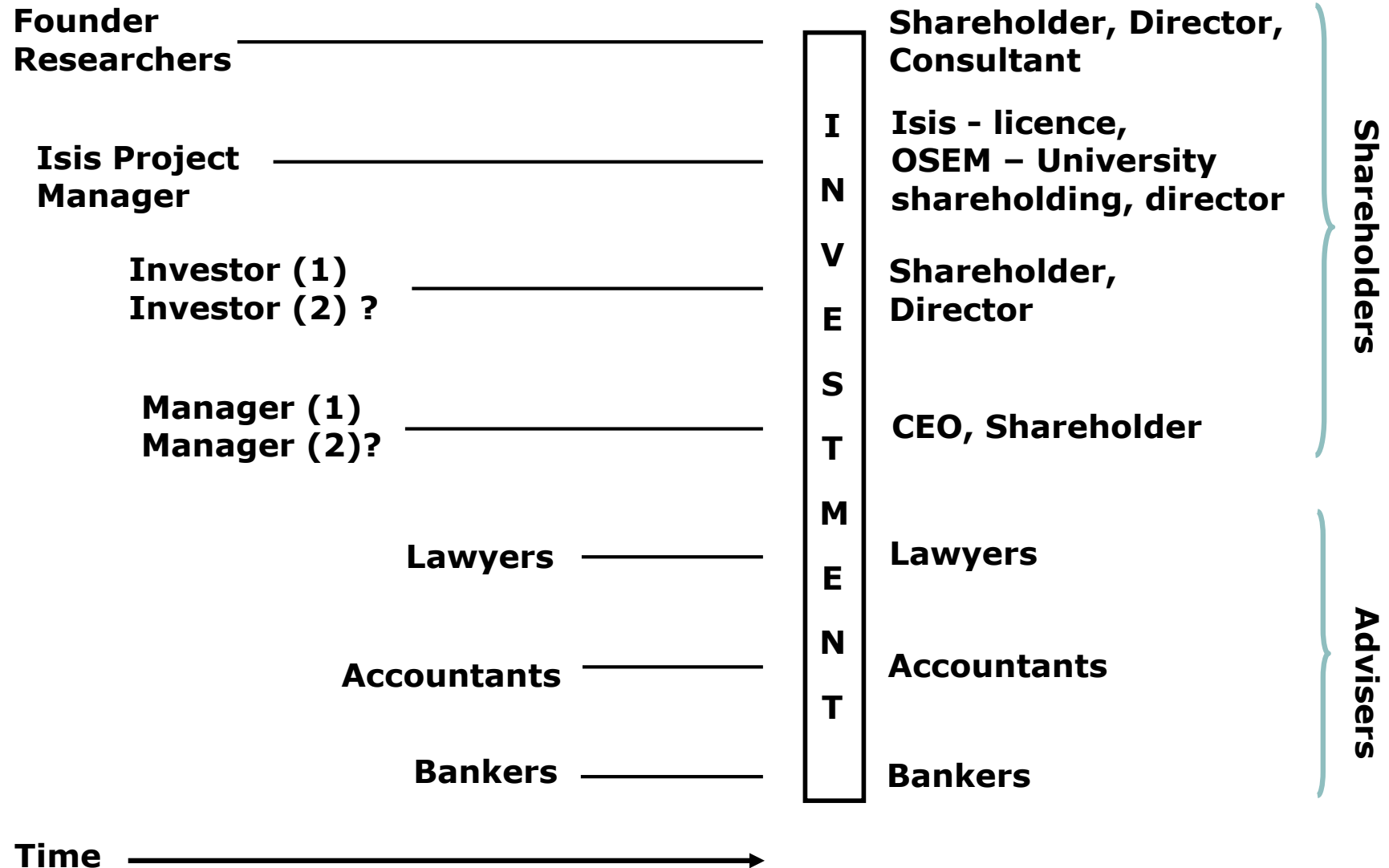
- Celebration
- Best wishes + Farewell



# Spin-out Strategy



# Spin-outs – The Players



# Being creative

# As its getting quite complex

**NESTA is the National Endowment for Science, Technology and the Arts - an independent body with a mission to make the UK more innovative.** Recent NESTA report suggests that investment activity is now lower than after the dotcom crash => Seed and first round funds are hard hit

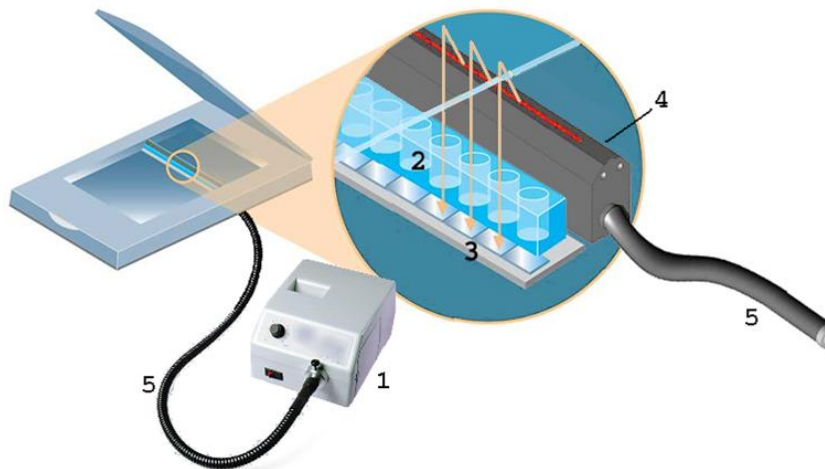
- Rising expectation bars (risk adverse) - OxEMA
- Incubated for long
- Tranched payments – threshold is lower for investors – milestone dependent
- Bootstrap model
- Interesting mix of investors: value and supply chain, often more than five angel investors
- JV's (Strategic partners)
- Closer to the money – New eco-system - subsidiaries on day one – OMS limited



# Oxford Multispectral Limited

<http://oxfordmultispectral.com/>

1. Spinning out a company from the Classics Department (Oxford and UK's first)
2. Securing investment from mainland China followed by a significant manufacturing deal
3. Excellent Press
4. Interested customers include several border control agencies



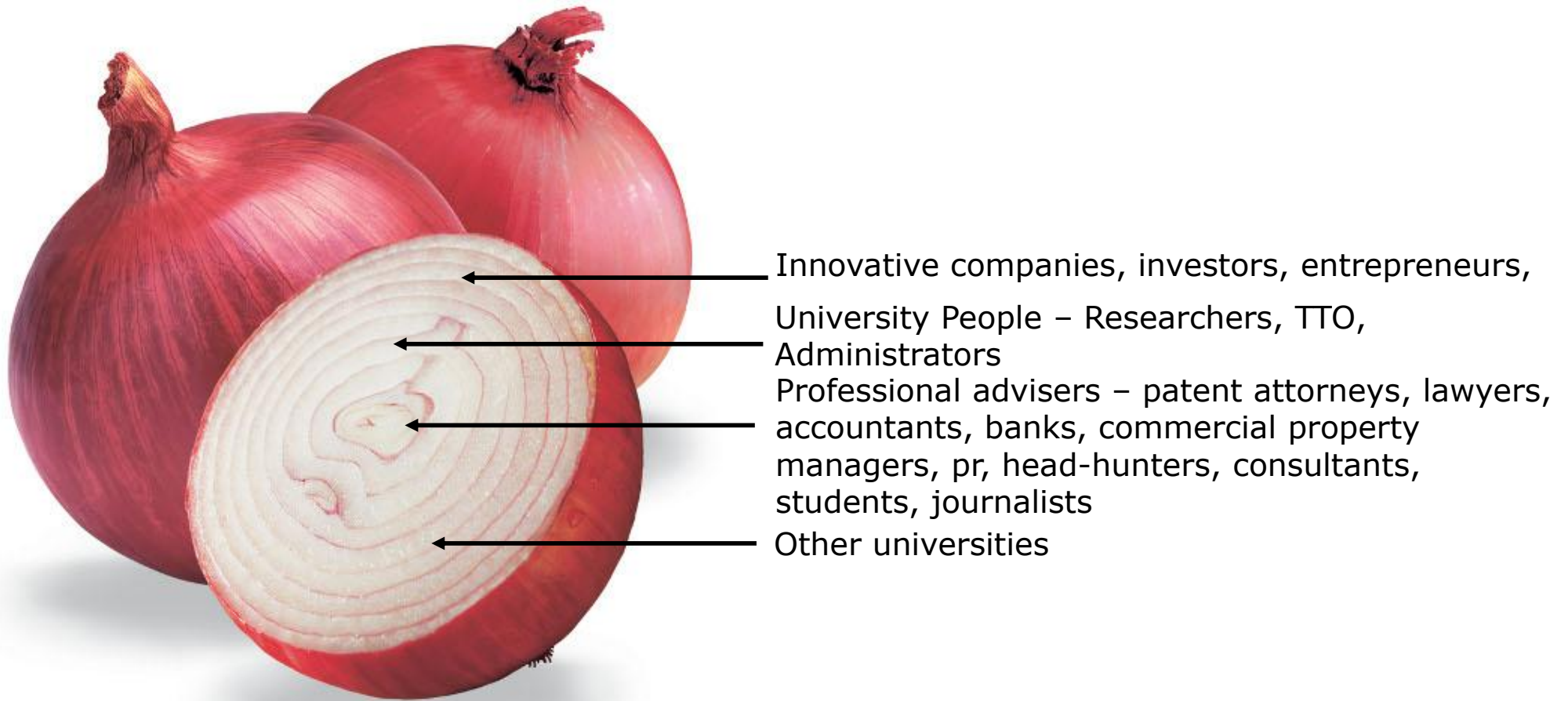
# Oxford Imaging Detectors

*Produce market leading Imaging Solutions for Scientific Applications*

- TEM is the prime market
- Patented technologies from Oxford University
- Breakeven after 18 months
- Investor is a large Japanese Corporate and is also the first customer holding 50% of TEM market

# Translating skills elsewhere – developing countries

# Managing disparate interests with multi parties in the Innovation Ecosystem



# Observations and Challenges

- IP policy – who owns the IP, Framework to allow effective translation of research
- Fragmented Ecosystem - lack of depth understanding of this regime
- Very few support to advance the development of early stage technologies, Valley of Death translational funds
- Lack of dedicated IP budget for protection
- Framework for commercialisation – CSIR labs in India
- A few VC funds - reliance on banks
- Less appetite for early stage investment –too risky

# Observations and Challenges

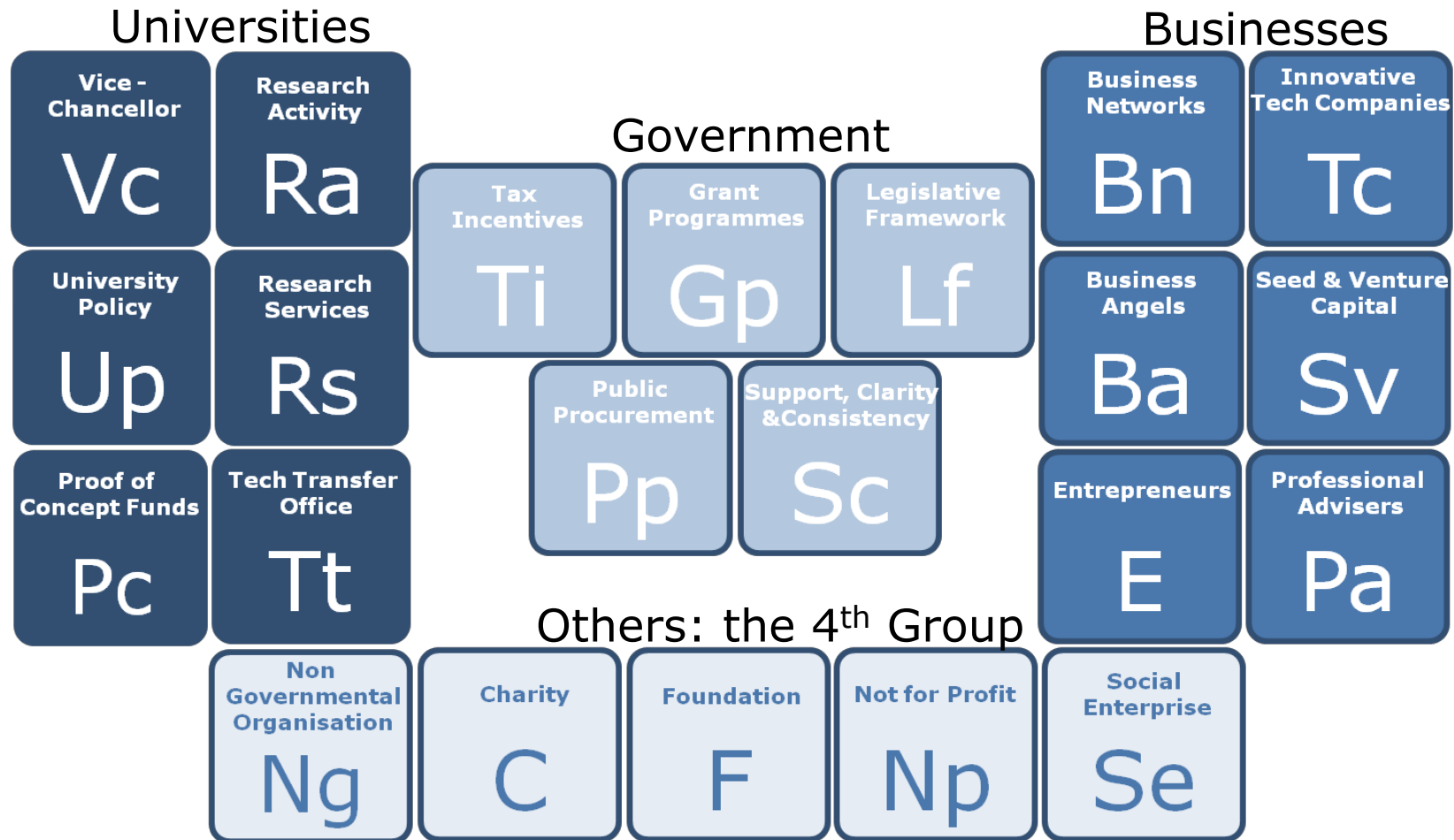
- Interest exists – needs confidence building
- Fundamental research gets some encouragement in Industry
- Government support not at the same par as developed countries such as tax incentives to early stage technology companies/ startups (university based)
- Encouragement to investors to invest in start ups
- Surge of Science Parks and Technology Parks – Improve academia/industry relationship and can act as incubation centers
- “Money is there but need good technologies” – China and India
- We need investment to scale up our technologies – Columbia/Brazil

# Isis' international engagements

- Building upon its solid track record of commercialisation success of innovations at Oxford, Isis works with governments, science parks, universities, research institutes, and companies (SME's and multinationals) in more than 50 countries.
- Innovation Ecosystem study and setting up Technology Transfer Offices
- Isis Venture Fund
- Development Centers for SME's and large corporate
- We link technology providers with technology seekers and work with other key players in the innovation ecosystem.



# Innovation Ecosystem – Successful TT Activities



It's a long term investment

Validating the model

**Believe in yourself and do not give up**

**Thank you for your attention**