SPACES OF NOVELTY: CAN UNIVERSITIES PLAY A CATALYTIC ROLE IN LESS DEVELOPED REGIONS?

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What are Universities for?

- Despite global integration of science, Universities remain national institutions

- In the context of the UK we can identify three challenges:
  1. *Commercialisation of higher education – financial burden shifted to students*
  2. *Research topics increasingly steered by government priorities*
  3. ***Traditional missions of the university are complicated by the growth of third mission activity***

- In other contexts there is variation in terms of (among others):
  1. *Public vs private funding*
  2. *Stability and scale of financing*
  3. *Independence from political interference*

How do Universities engage?

- Three models of University engagement:

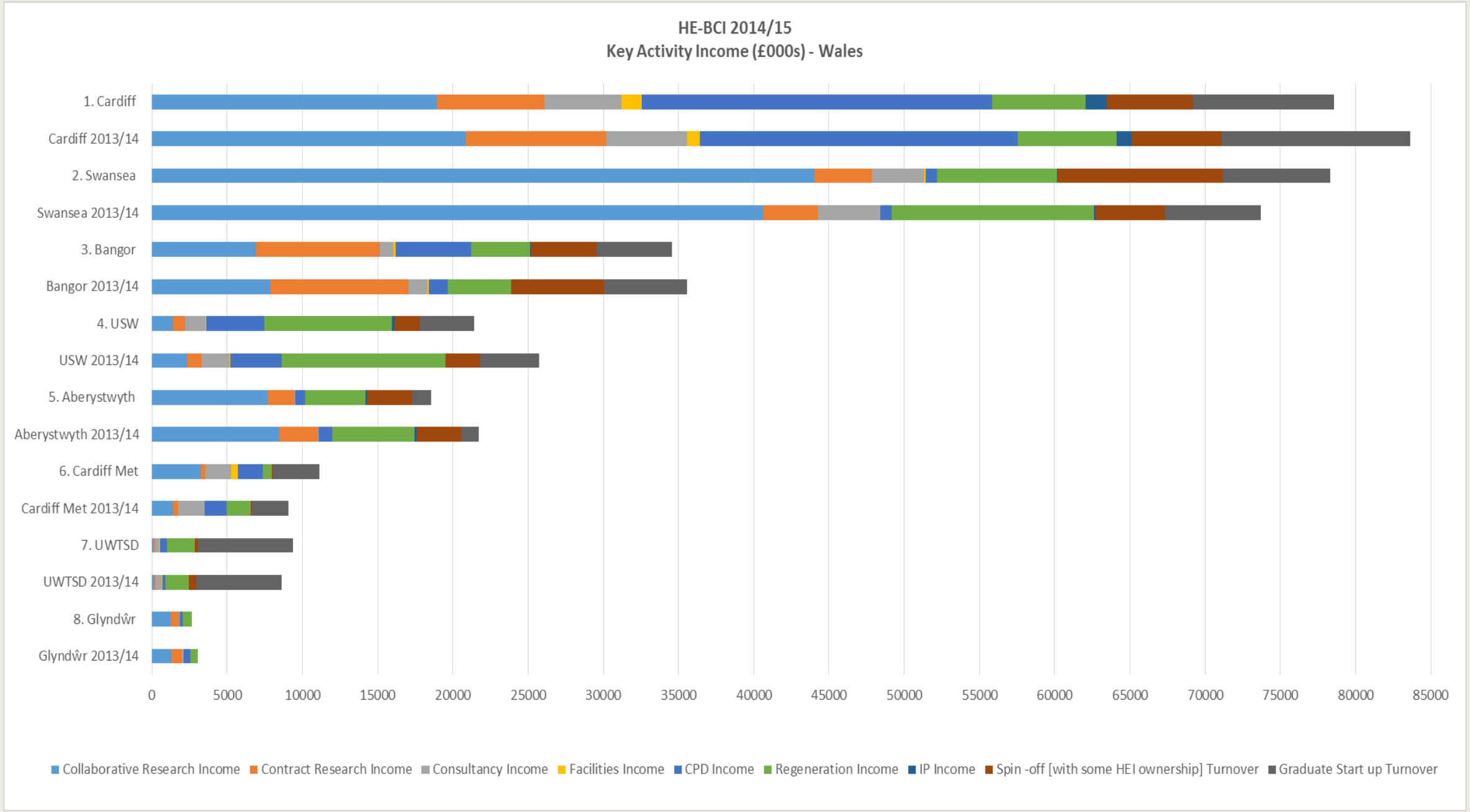
1. The ivory tower stereotype: self-absorbed academics educating an elite

2. The entrepreneurial University: selling IPR to raise revenue

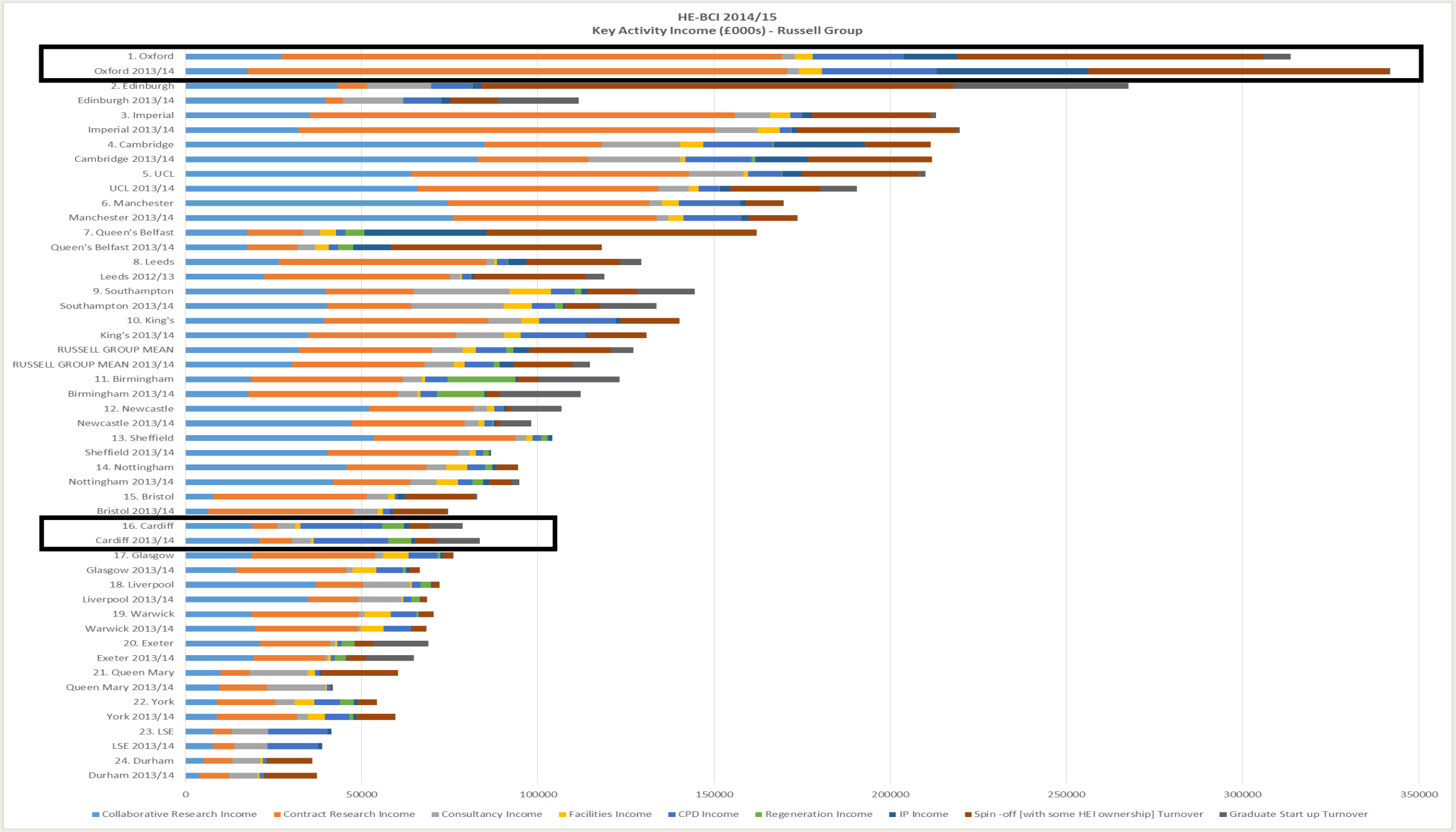
3. The connected University: part of an innovation ecology, which includes business engagement but also in other areas

Starting point

- Universities asked to perform a catalytic and transformational role in regional innovation strategies
- However Universities need support for translational activities i.e. activities that can turn knowledge into innovation
- This is particularly relevant in regions with **less developed regional innovation systems**
- A complex political, economic, social and cultural context, shapes the capacity of these organisations to act as ‘spaces of novelty’

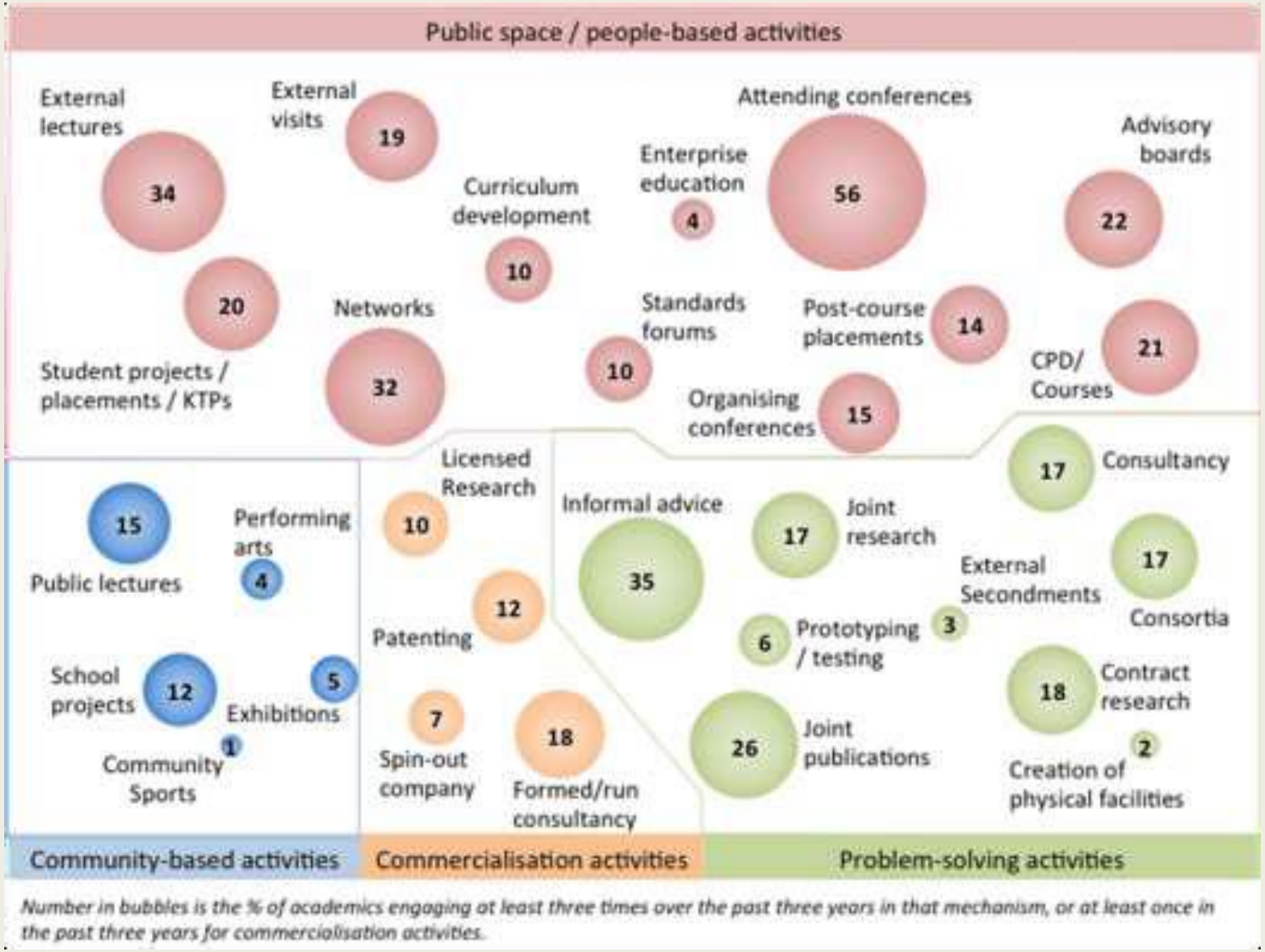


Source: (HE-BCI 2014/15)



Source: (HE-BCI 2014/15)

Types and levels of KE engagement of university academic staff



Source: (HEFCE 2016)

The University as a socio-spatial institution (1)

- Capacity to engage with external partners depends on institutional characteristics:
  1. *The type of university in question and whether or not it is a research-led institution*
  2. *The national context of the university*
  3. *The sub-national urban and regional context*
  4. *The strategy of the university*

- Below organisational level, each academic responds to multiple, potentially conflicting, loaylties:
  - *(i) to the institution, (ii) to the department, (iii) to the discipline, (iv) to extramural organisations (particularly funders), (v) to the professional rules that regulate career advancement, and (vi) to subjective personal or social values*

The University as a socio-spatial institution (2)

- Translational activities depend on the existence of an innovation ecology:

1. Firms with absorptive capacity

2. Upstream and downstream activities, including, among others, financial resources, KIBS, suppliers and potential clients

3. A variety of public and private organisations that can provide funding, political support and an appropriate regulatory environment

This dense and well connected environment is necessary to sustain the translational activity that can turn Universities into a place-based institution that can contribute to regional development

Case study 1: SPECIFIC

- SPECIFIC (Sustainable Product Engineering Centre for Innovative Functional Industrial Coatings)

- Launched in 2011 to develop and commercialise a portfolio of functional, coated glass and steel products that deliver clean renewable energy from the built environment

- SPECIFIC claim potential to reduce carbon emissions by 6 million tonnes per annum within the next 10 years and to create a new industry valued at £1bn and providing up to 10,000 new jobs

SPECIFIC: innovation ecology

Funding from Engineering and Physical Sciences Research Council (UK), Innovate UK and the Welsh Government

£££

Strategic partners

BASF We create chemistry

TATA STEEL

Swansea University Prifysgol Abertawe

NSG GROUP

Cardiff University Prifysgol Caerdydd

Academic partners

Imperial College London

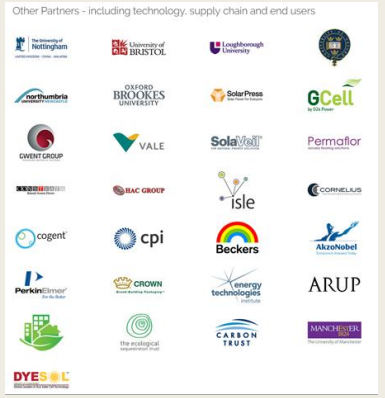
The University Of Sheffield.

Prifysgol Bangor University

University of Bath

Prifysgol Glyndŵr University

Other partners



SPECIFIC

- Professor George Wilshire (Swansea University) established links with the Steel Company of Wales (SCW) in Port Talbot in the 1980s (which became British Steel, then Corus and now Tata Steel)
- Physical site where team of researchers is located and nearby production facility to test products – linked to Materials Research Centre (Swansea University)
- Efforts to integrate value chain (20 partners in HE and 20 in industry, mix of small and large organisations)
- Managers strongly believe that physical proximity helped to overcome the translational barriers in a context (Wales) where this type of activity is not celebrated

SPECIFIC - challenges

- Main partner (Tata Steel) announced plans to close local steel plant – though it has recently backtracked
- Even before, Tata Steel showed interest in taking the technology to Tata HQ in Mumbai, which operates a solar division, and where R&D costs are one-fifth of the costs in the UK
- Difficulty in attracting human capital; cultural resistance to translational research, IPR issues
- At this stage project only exists as an R&D facility – upscaling is not guaranteed, and not within Wales

Case study 2: Compound Semiconductor Centre (CSC)

- Compound Semiconductor Centre (CSC) was launched in 2015 with two aims in mind:

1. To become a centre of excellence for the development and commercialisation of Compound Semiconductor (CS) technologies

2. To become the focal point for the development of a new CS cluster centred in South Wales.

CSC: innovation ecology

Funding from Cardiff University, IQE, UK Research Partnership Infrastructure Fund (HEFCE), Welsh Government

£££

Core partners

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

IQE

LINKS WITH:

ViDAP, the consortium was formed to establish a pan-European supply chain capability for the high volume production of vertical cavity surface emitting lasers (VCSELs) for infrared illumination, data communications, gesture recognition and industrial heating applications.

LONGESST, the consortium was formed with the primary objective of developing multi-junction space solar cells on high quality, low cost, large area (150mm diameter) Germanium substrates, which will have conversion efficiencies >33% (AM0), utilising novel 4- Junction architectures.

Institute for Compound Semiconductors (Cardiff University)

Compound Semiconductor Applications Catapult, following consultation by Innovate UK and the Knowledge Transfer Network involving industry and academia, a new Compound Semiconductor Applications Catapult – to be based in Wales – has been announced.

Expertise Wales, The online resource for driving collaboration and innovation in Wales.

CSC

- Results from a partnership between IQE and Cardiff University that started in 1988
- IQE asked for such an investment as a condition to stay in Wales; the University benefited from a new strategy for translational activity (£300M Innovation Campus)
- The CSC has the potential to create a unique R&D environment in compound semiconductor (CS) technology in Europe because they combine basic research, technology translation and commercialisation.
- Welsh government supported it because an independent evaluation concluded that, notwithstanding the risks, it was a worthwhile project, as the potential benefits outweighed the costs

CSC - challenges

- The Welsh Government has the most to lose because it is paying the lion's share of the upfront costs of the project
- The Government's involvement and IQE's position that without CSC it would leave Cardiff raises questions about the transfer of risk to the public sector
- Similar to SPECIFIC it remains an R&D facility, though the lower number of partners means less coordination problems and a clearer focus

Conclusions

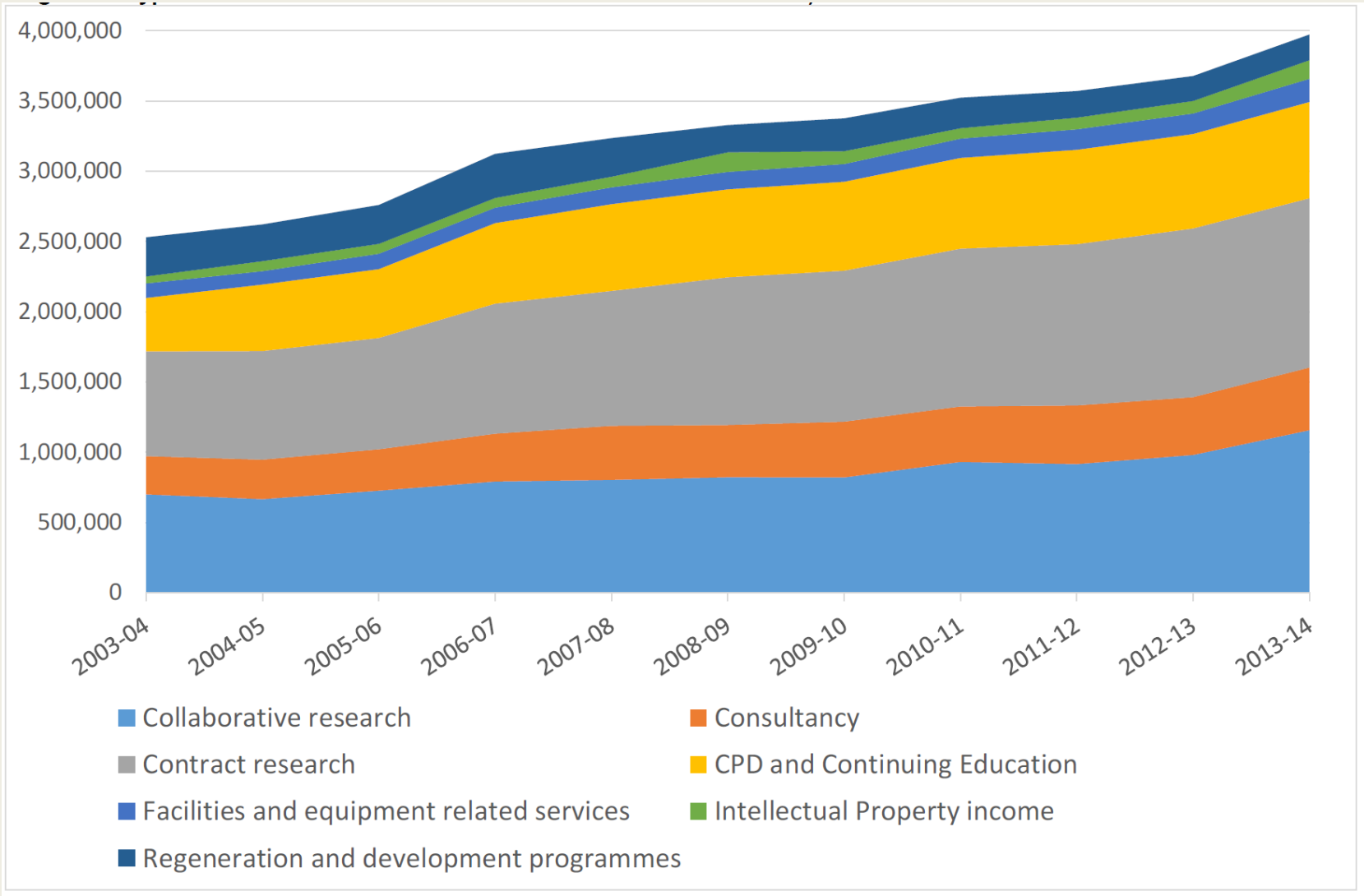
- Both case studies exhibited similarities:
  1. *High quality research departments*
  2. *Physical proximity to industrial partners and personal ties (social proximity)*
  3. *Existence of key individuals animating projects*
  4. *Both partnerships started in the 1980s*

- However this is not sufficient to explain outcomes:
  1. *Contribution of the UK's research and innovation ecology (academic partners, multiple funding streams*
  2. *Different organisational and geographical boundaries are crossed to deliver these projects*

- Serendipity and non linearity are important, but maybe also redundancy and waste…

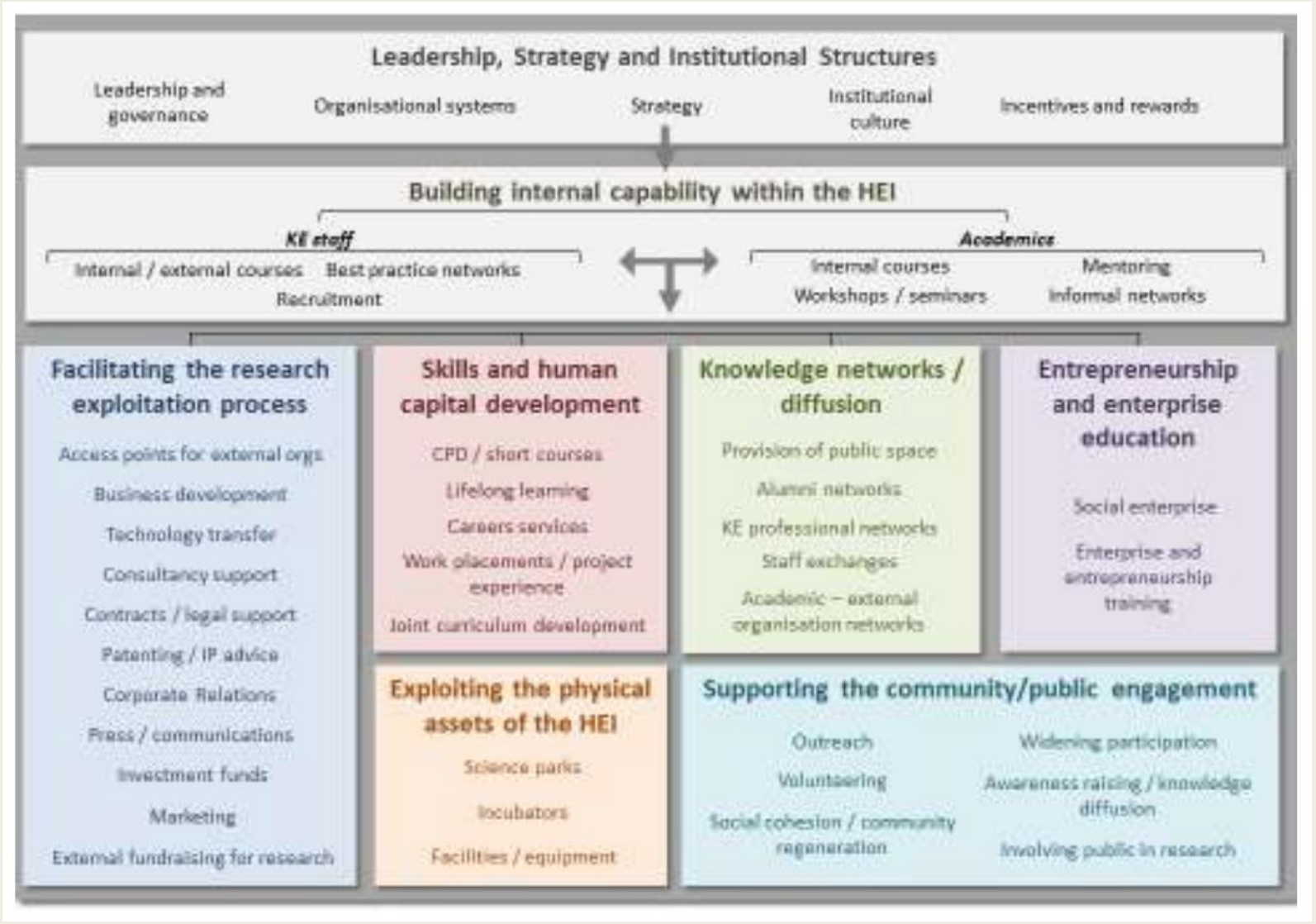
Questions

Types and levels of KE income streams UK £000s Real Terms)



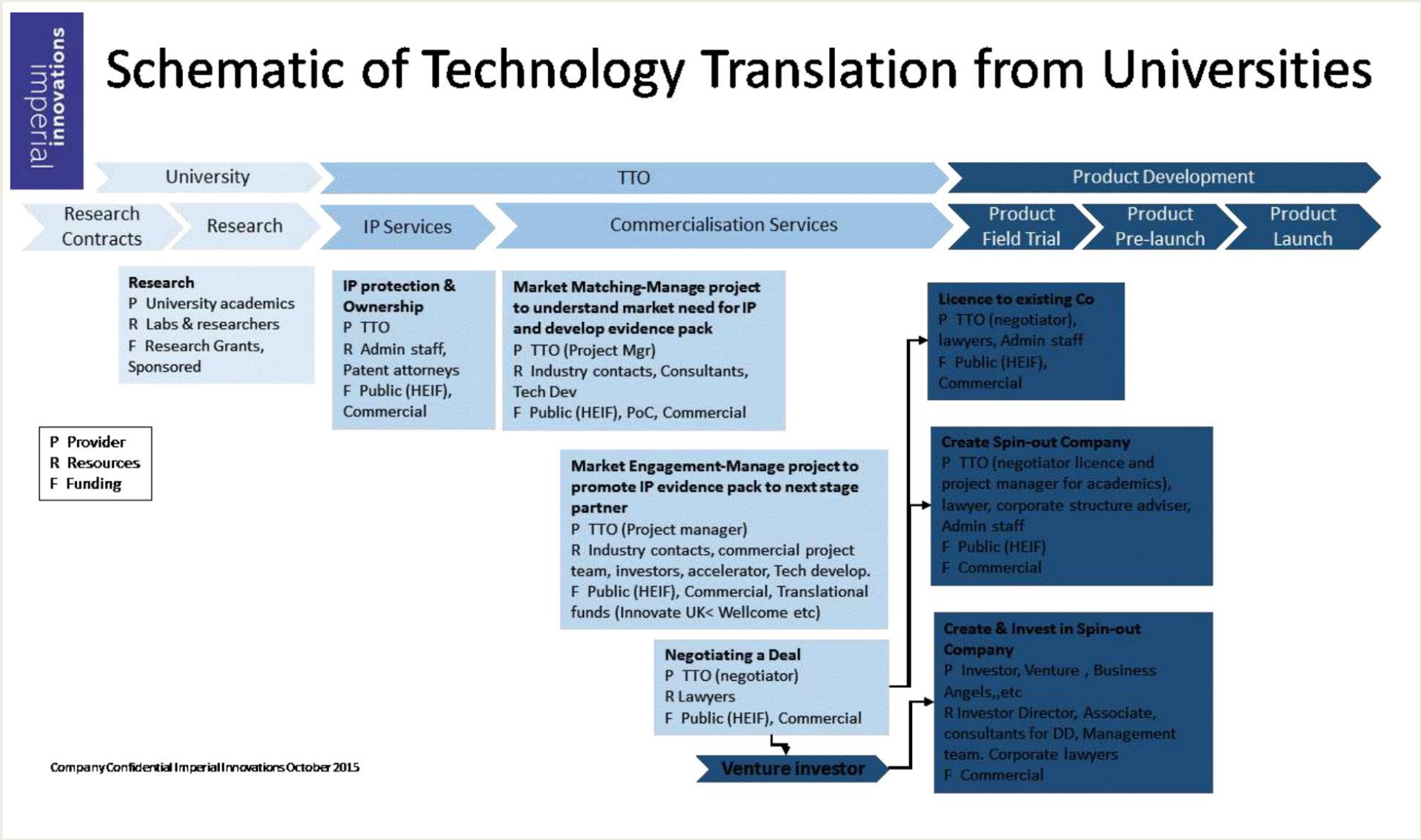
Source: (HEFCE 2016)

Higher education KE capacity and competencies



Source: (HEFCE 2016)

Technology transfer processes



Source: (HEFCE 2016)

Technology sector differentiation in technology transfer

Aspect	Life Science	Physical Science
Driving Force	"*Science*"	"*Engineering*"
Innovation Mode	Linear, sequential, based on *discovery*	Interactive, based on *recombination*
Nature of Need	*Exists*, solutions missing	Often *emergent*, plenty of alternative solutions
Nature of Market and the Innovation Process	Structured, established, sequential	Often emergent, changing, interactive
Type of Research Contract	*Long-term*, basic research	*Short-term*, application development
Key Bottleneck	Scientific *discovery*	*Customer adoption*, positive feedback
Role of IPR	Basis of *licenses*	Determines business model, *mode of market entry*

Source: (HEFCE 2016)

Commercialisation activity in 2013-14 for the US, UK and Japan

	US AUTM	UK HEBCI survey	Japan UNITT
Total research resource (£M)	35,722	7,043	14,715
IP income including sales of shares in spin-offs (£M)	1,290	131	18
IP income as % of total research resource	3.6%	1.9%	0.12%
Spin-off companies formed	747	147	18
Research resource per spin -off (£M)	48	48	817
Patents granted	5,163	976	4,776
Research resource per patent (£M)	7	7	3.1
Industrial contribution (£M)	2,330	508	64
% industrial research	6.5%	7.2%	0.4%
US cashed-in equity and UK Sale of spin-off shares (£M)	20	49	3.6
(Cashed-in equity and sale of spin-off shares) as a % total research resource	0.06%	0.7%	0.2%

Source: (HEFCE 2016)

Performance by research expenditures (euro M) to produce one output

	European universities/research organisations	United States	Ratio (EU/US)
Invention disclosures	3.3	2.1	1.6
Patent applications	6.6	2.3	2.9
Patent grants	10.4	9.7	1.1
US Patent and Trademark Office patent grants	47.1		
Start-ups established	30.4	68	0.4
Successful start-ups	16.4		
License agreements	7.5	7.5	1
License income (euro M)	81.1	24.4	3.3
Research agreements	0.6		
Total reported research expenditure (euro M)	41,072	45,631	

Source: (HEFCE 2016)

References

HE-BCI (2015) *Higher education-business and community interaction survey (HE-BCI) 2014/15*, HEFCE, Bristol

HEFCE (2016) *University Knowledge Exchange (KE) Framework: good practice in technology transfer*, Report to the UK higher education sector and HEFCE by the McMillan group