

Research, Research Engagement & Commercialisation

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Outline

- Going global
- Research education
- Commercialisation

Going Global

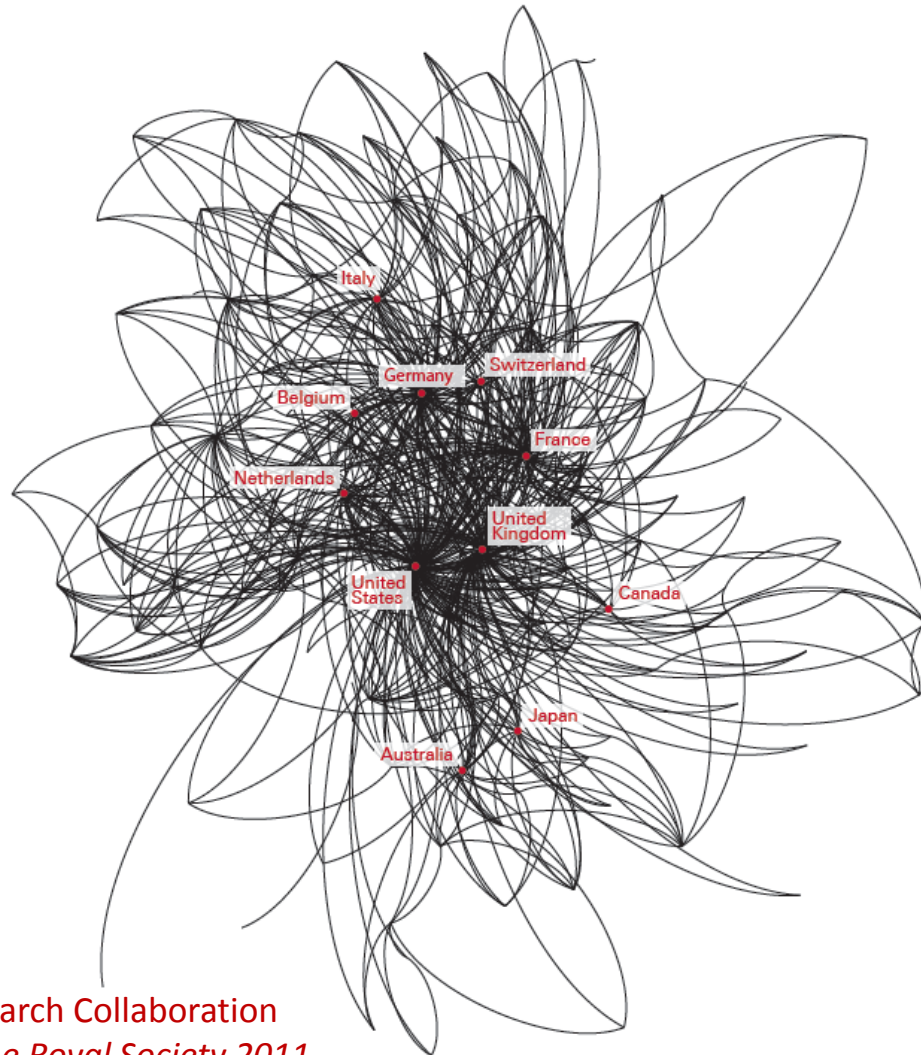
*Knowledge belongs to humanity, and
thus science knows no country and is
the torch that illuminates the world.*

Louis Pasteur

Research: A Global Enterprise

- 7 million researchers
- Global R&D spend of US\$1000 billion annually
- 25,000+ journals
- 1.5 million research papers
- 35% of journal articles are internationally collaborative
- Massive spread – Tuvalu's 1 paper, to 320,000 from the US (2008)

Global Networks



Global Research Collaboration
2004-08. *The Royal Society* 2011

Why Collaborate Internationally?

- Increasing globalisation of knowledge
- Increased participation by less well-resourced communities
- Sharing of infrastructure
- Expanded vision of young researchers
- Pursuit of research intensification
- Emergence of interdisciplinarity

Strugnell & Beckett, 2009

Why Collaborate Internationally?

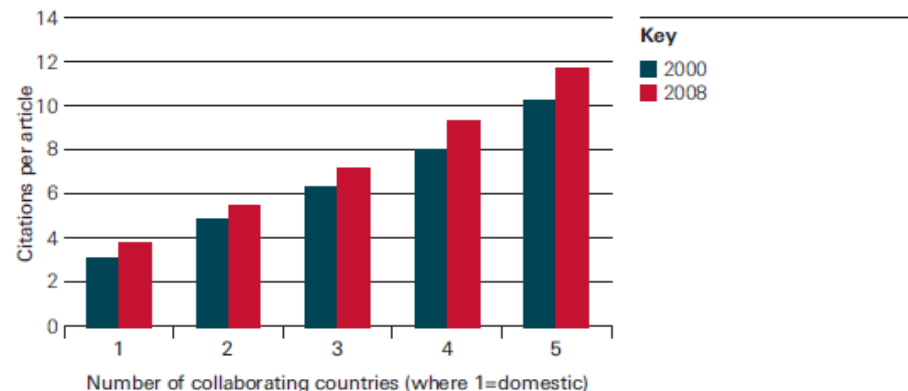
Because good research is by nature international, the international agenda is a key part of any research environment.

Furthermore, the global problems we face (e.g. climate change, energy, healthcare and security) need global solutions and these in turn will require global brain power and new multidisciplinary approaches.

Why Collaborate Internationally?

- Scientists seek to work with the most outstanding scientists in their field
- Collaboration brings with it the obvious benefit of scale
- Sharing the burden of research activity, breaking down complex tasks into manageable pieces
- Push of external factors (e.g., complex problems, such as pandemics)

Figure 2.7. Citations per article versus number of collaborating countries.¹⁹⁵



Global Problems, Global Approaches

Humanity's most pressing concerns:

- Climate change
- Global health
- Food security
- Biodiversity
- Water security
- Population
- Energy security

Knowledge; Networks and Nations; Global Scientific Collaboration in the 21st Century. The Royal Society, 2011.

IRU Perspectives

- The Go8 is strongly developing international alliances – should the IRU do the same?
- If so, what are the prospective foci – thematically and geographically?
- Should there be a balance between capacity development and enhancing excellence?
- What form should collaboration take – research education, publication, funding, infrastructure?

Research Education



IRU Submission

...does not recognise **the need for a more coordinated review of the full range of research training programs** – the PhD, masters by research and honours programs of universities. Such a review needs to be undertaken urgently by universities, in consultation with industry and government and in the context of an analysis of best practice internationally.

International Context

Beyond doubt, a quiet revolution is under way in doctoral education in Europe, and European universities have been at the forefront of these reforms. EUA's evidence on the rapid growth of structured doctoral programs is that schools now offer greater critical mass, better supervision and enhanced employment opportunities for PhDs in both public and private sectors.

Reform Imperatives

2.52

The pace of change in research activities and the research and innovation systems in which they are embedded has been rapid. Globalisation has contributed to increased mobility of talent and an increasingly competitive market for the highly skilled. *In turn, such developments have contributed to a move towards greater standardisation of processes, as evidenced by the Bologna reforms, and a heightened emphasis on the quality of research and research training programs.* These developments all have implications for Australia if it is to maintain the competitiveness of its research training system and research workforce.

Reform Imperatives

4.314

Finally, global moves to streamline and strengthen research training provision present challenges to Australia in the future. In particular, a shift across Europe towards the Bologna model of at least eight years' training for attainment of a doctorate (three- or four-year bachelor degree, two-year masters degree and three-year doctorate) places the doctoral pipeline in Australia at a cross-roads.

With seven years' nominal training for doctorates (three-year bachelor degree, one-year honours and three-year doctorate) and no dedicated time allocation for academic and professional competency building, Australia faces the prospect of a weakened capacity to compete with its European counterparts for candidates in future years. The marketability of its domestic doctoral graduates in the global research workforce may also be at risk.

Reform Imperatives

- the changing nature of demand for research skills;
- the changing circumstances of students and researchers and modes in which they engage with research activity; and
- global moves to streamline degree structures and enhance the rigour and relevance of research training.

Challenges

- (a) ensuring that there are sufficient HDR qualified individuals to meet workforce demands;
- (b) maintaining the quality and international standing of Australian research degrees in the face of the expanding skill requirements and global competition; and
- (c) providing supportive career structures and pathways for researchers throughout their careers



Generic skills



Industry engagement



International collaboration



Interdisciplinarity



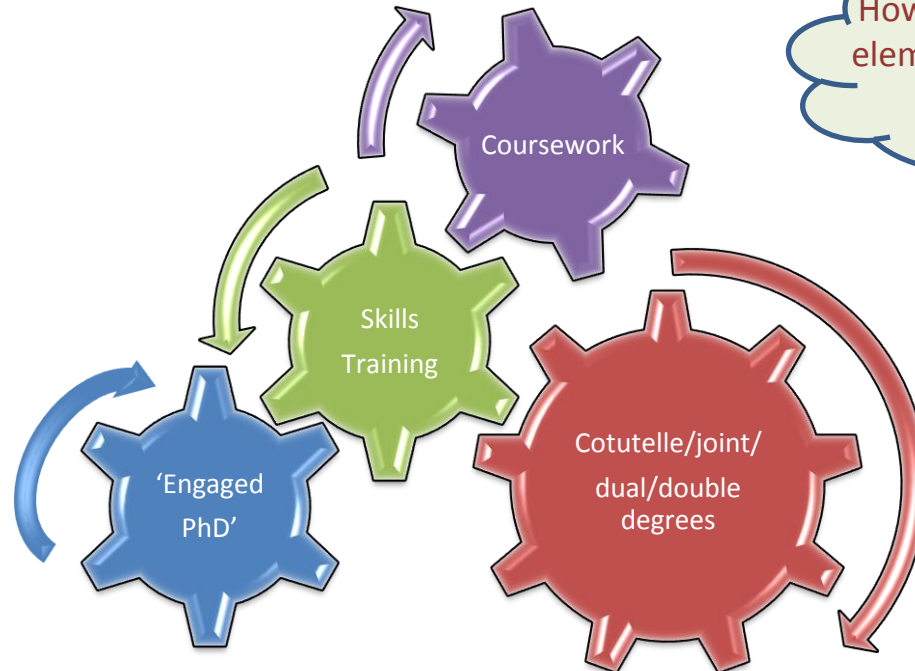
Institutional collaboration



Hons



PhD

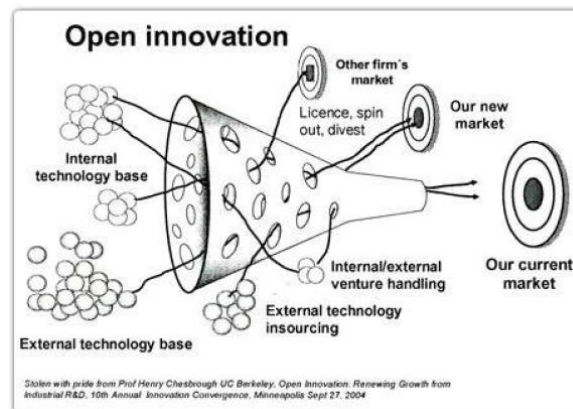


How do we shape the individual elements into a coherent, fit-for-purpose framework?

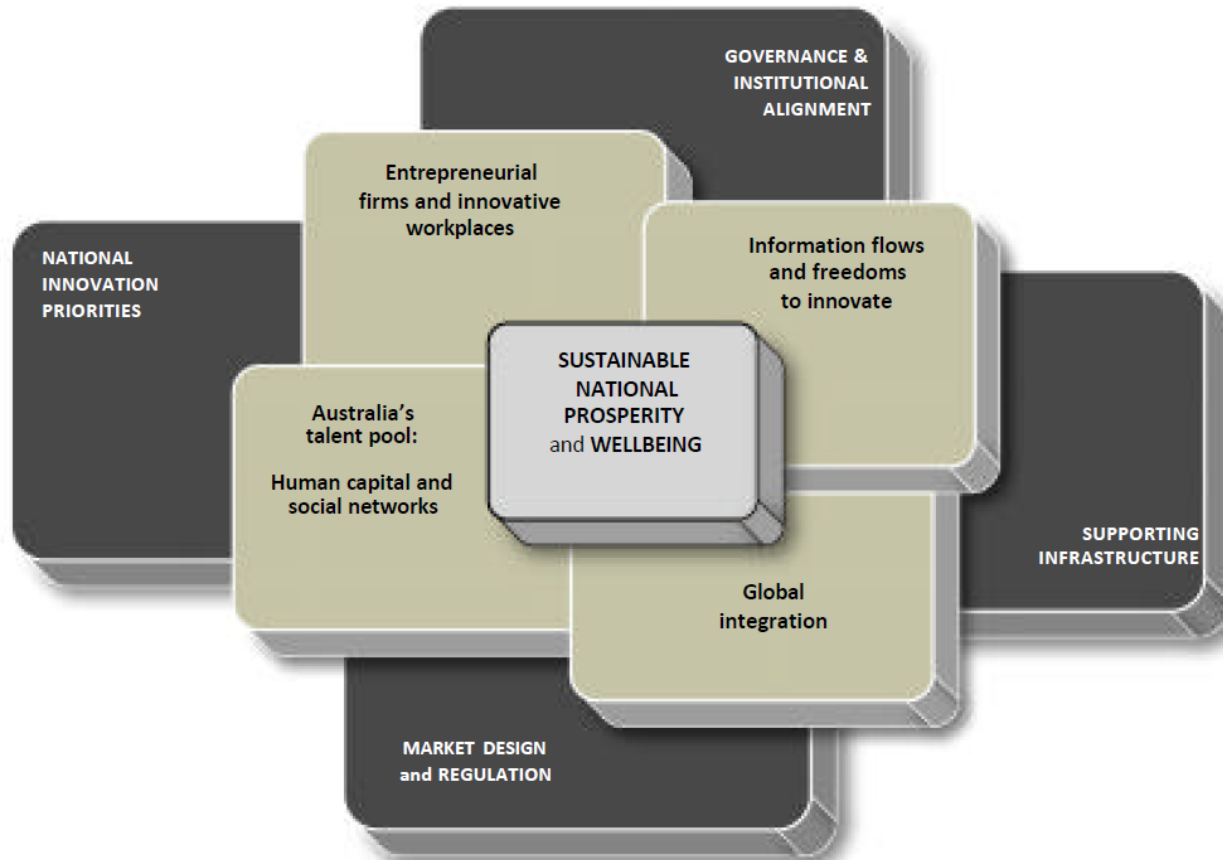
IRU Perspectives

- The ATN has developed a collaborative PhD – should the IRU do the same?
- Is there a case for collaboration in other ways – e.g., skills training, joint supervision?
- Does the IRU have a role in marketing post-graduate training internationally?

Commercialisation



The Innovation System



KEY DRIVERS OF DESIRED OUTCOMES

CORE ROLES FOR GOVERNMENT

Universities, Innovation, Commercialisation

It is impossible to overstate how important universities are to our innovation system.

They are engines of invention and discovery.

They create new knowledge and they produce people with the skills to apply that knowledge in the real world.

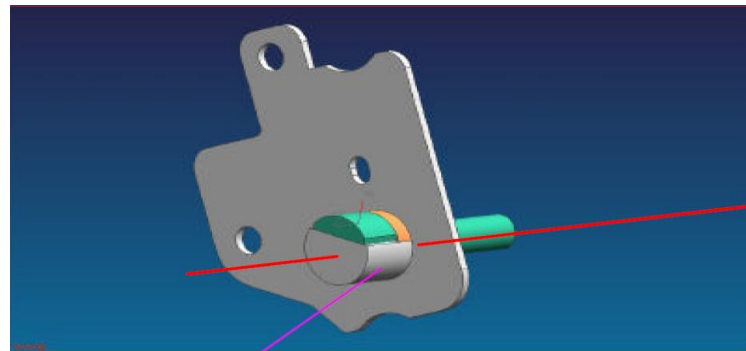
They are places where new industries, products and services are born.

They are increasingly vital hubs in the industry networks and clusters of the knowledge economy.

If we neglect our universities, the whole innovation system suffers. No nation can compete internationally without an internationally competitive university system.

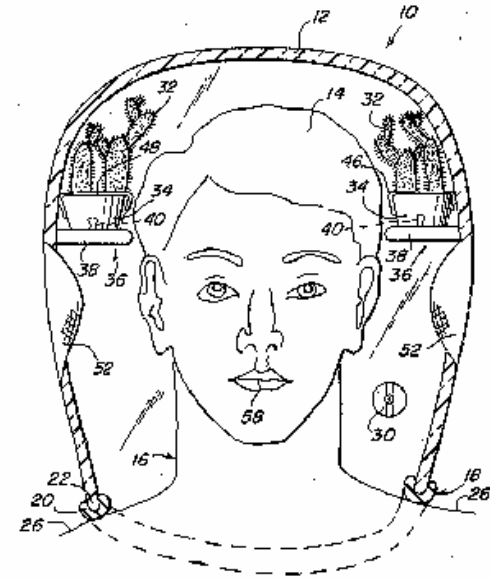
‘Although business funds a greater share of global R&D in comparison to government, public support for longer-term fundamental research in universities and public research organisations remains critical. It is key to developing new scientific and technological knowledge and the human capital that can lead to innovations to benefit the economy and society. By nature, this type of research has a long time horizon and uncertain returns. Indeed, while business continues to invest in some basic research, it continues to rely on public research for many of the seeds that can trigger innovation.’

OECD, 2010



Innovation

- More than 90% of innovations fail before they reach the market
- More than 90% of those innovations that do reach the market will also fail
- More than 90% of innovations are delivered late, over-budget or to a lower quality than was originally planned
- More than 90% of collaborative innovations fail



University R&D

TABLE 2: ADJUSTED TOTAL RESEARCH EXPENDITURE (ALL PER \$10.0M)

	U.S.A.			CANADA			U.K.		AUSTRALIA	
	2001	2002	2003	2001	2002	2003	2001	2002	2001	2002
Research expenditure (\$b ATRE)	\$27.6	\$31.7	\$34.8	\$2.1	\$2.5	\$2.5	\$2.6	\$3.1	\$1.9	\$2.1
Invention disclosures	41	40	39	44	48	50	54	72	28	25
Patents, filed	21	21	21	20	17	17	29	35	21	22
Patents, issued	12	10	10	8	7	7	11	11	6	6
Licenses, executed	12	12	11	16	15	18	15	21	9	11
Licenses, active	83	-	-	67	70	-	-	52	-	-
Licenses, yielding income	28	27	26	-	30	35	16	20	-	-
Start-up companies, total	1.8	1.1	1.0	3.2	2.0	2.3	6.7	5.1	2.4	2.1
Start-up companies, still operating	9.1	-	-	-	20.0	-	-	-	5.2	5.2
Staff, professional	1.9	1.9	1.9	4.2	4.6	5.5	17.7	24.3	5.8	4.8
Staff, support	2.0	2.0	1.9	4.5	5.0	5.4			2.8	2.5
Disclosures to:										
licenses	29%	30%	28%	36%	31%	35%	27%	29%	33%	43%
start-ups	4%	3%	3%	7%	4%	5%	12%	7%	9%	9%
licenses + start-ups	34%	32%	31%	43%	35%	39%	40%	36%	41%	51%
License income	3.0%	3.0%	2.8%	2.6%	1.3%	1.6%	1.0%	1.1%	1.8%	1.4%
Legal expenses as % total res exp ^a	0.3%	0.3%	0.5%	0.2%	0.2%	0.3%	0.5%	0.5%	0.2%	0.2%
Legal expenses as % of licence income ^b	10%	10%	18%	6%	13%	19%	51%	48%	9%	12%

Academic research: every \$100 invested will, on average, return \$3 (gross) in revenue.



Collaboration Performance

Indicators	2008-09 Data	OECD Ranking
Proportion of SMEs Collaborating in innovation with higher education institutions*	3.89%	13th
Proportion of large firms collaborating in innovation with higher education institutions	13.20%	20th

Petifer, K, 2011

Different Agendas

For government

Is it economic development, enterprise creation, to maximise employment, or to solve community problems?

For universities

Is it to improve research or teaching? Is it to brand the university as “real world”? Is it to make money?

For industry

Is it to develop products, build networks, recruit staff, or sell products?

Stakeholder Challenges

The firm often lacks:

- Propensity for innovation risk (i.e. cost)
- Absorptive capacity
- Understanding and “knowing” the research institution
- (e.g. how, who, IP, execution)

Many research organisations have a:

- Focus on publications and research *per se* e.g., ERA
- Difficulty with timelines and milestones
- Lack of interest in industry problems

IRU Perspectives

- Is there an IRU role/strategy, in addition to what members do individually?
- What shape might this take?
- Are there specific fields of research in which collaborative innovation/commercialisation activities could be pursued?