

# International Collaboration

**Chris Llewellyn Smith**

Director of Energy Research Oxford University  
President SESAME Council

**Chair Advisory Group for the Royal Society Report**

**Knowledge Nations and Networks: Global scientific collaboration in the 21<sup>st</sup> century, on which  
much of this talk is based**

<http://royalsociety.org/knowledge-networks-nations>

For a summary of highlights see C Llewellyn Smith, *The Academic Executive Brief*, Vol. 1, p 2, 2011

# Near SLAC, Summer 1972



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# The Changing Scientific Landscape

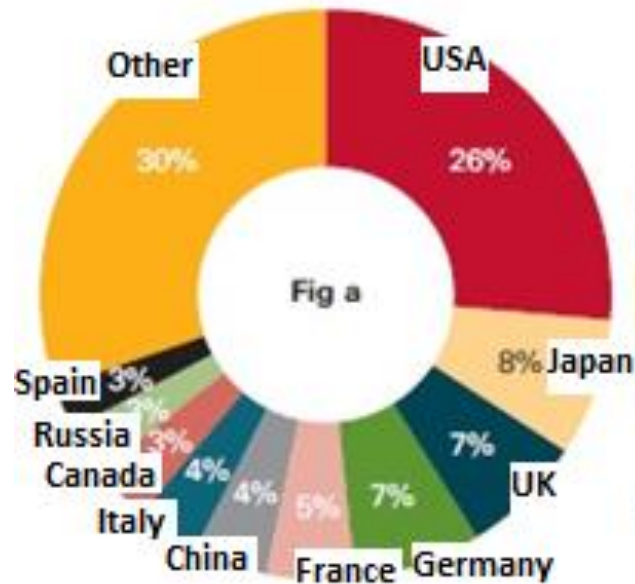
- 2002-07: Funding + 45% (+ 100% in developing countries)  
Researchers and publications + 25%
- Rise of new powers: China, Brazil, India, Korea,... + science taking off in many other countries
- WWW + reduced travel costs → increased international collaboration (1996: 25% of papers had international collaborators → 35% in 2008)  
driven by search for *quality* and *efficiency*, and by *necessity*
- Closure of central corporate labs + increasing need for multi-disciplinary approaches →
  - outsourcing of research by industry to universities (wherever the best researchers can be found)
  - multi-nationals setting up research labs close to markets (Microsoft has 4 in USA + one each in: UK, Germany, China, Egypt)



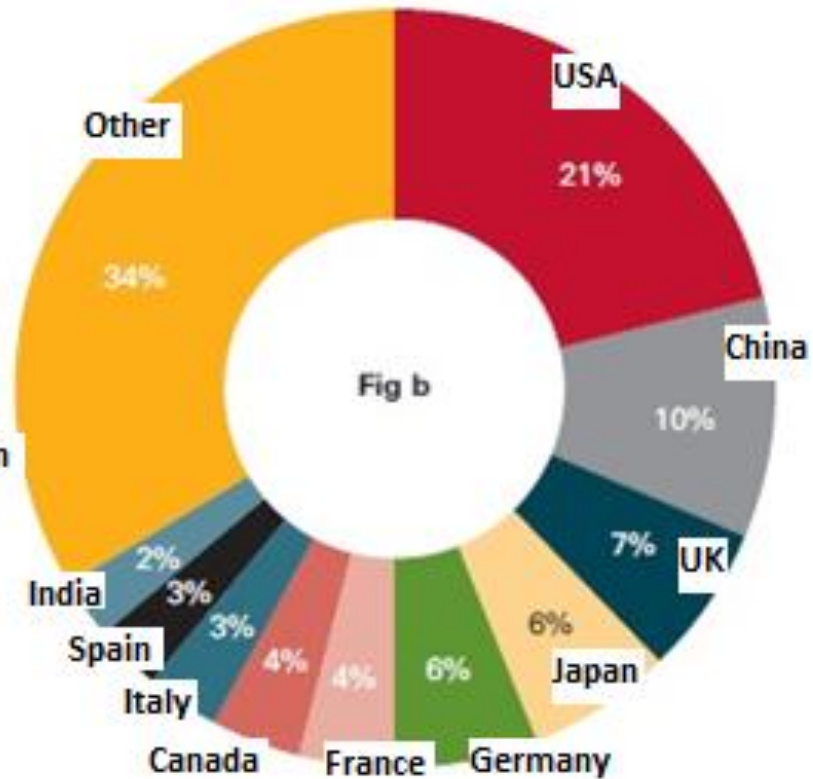
**Will elaborate some of these points before discussing harnessing science to address global problems**

# Who, what, where?

## Publication trends:



1999-2003



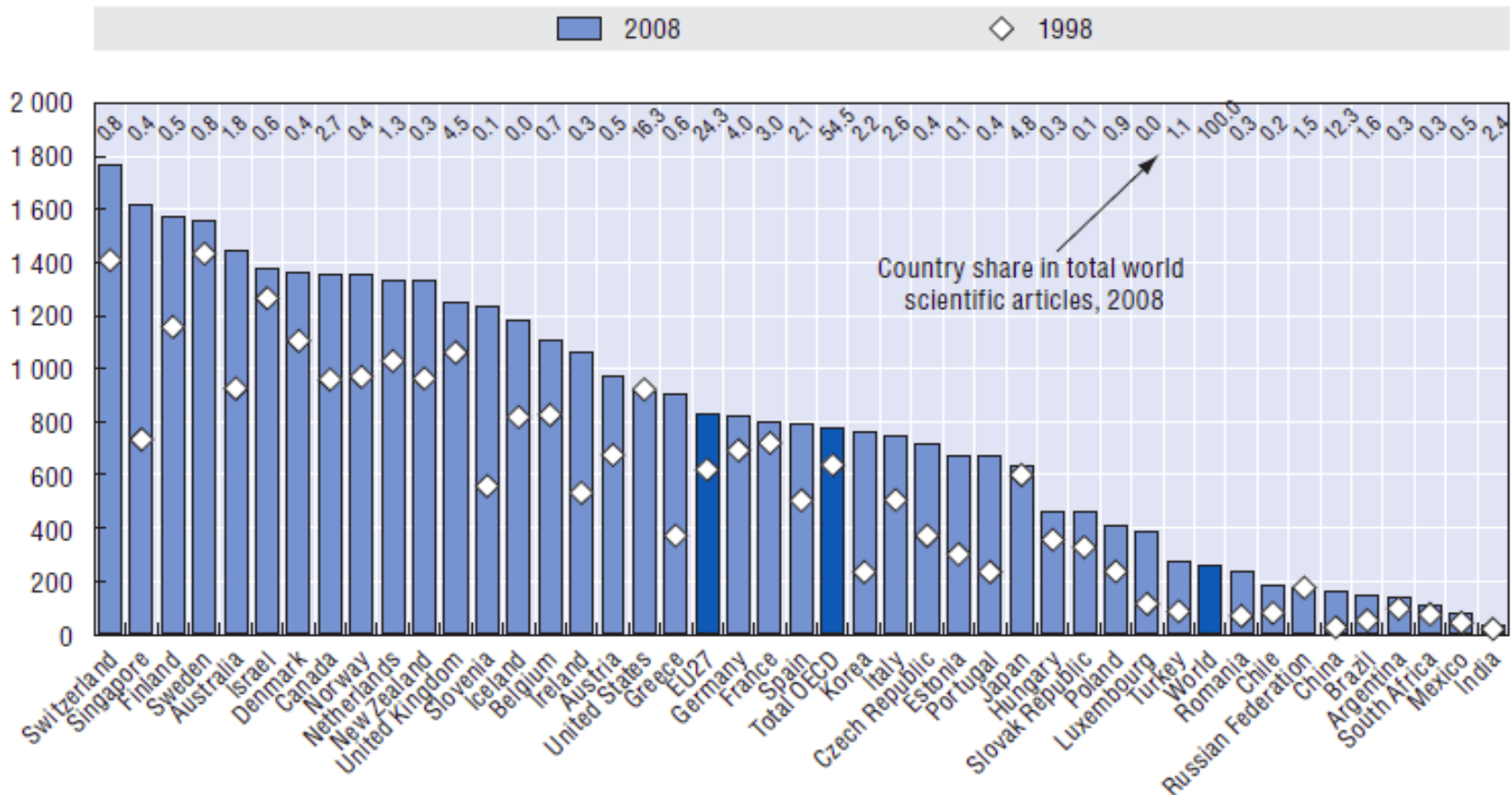
2004-2008

## Science taking off in many other countries:

Funding: Turkey x 6 1995-07 (to 0.72% of gpd), Tunisia: 0.013% of gpd in 1996 → 1.25% 2009, Singapore 1.37% (1996) → 2.61% (2009), big investments in the Gulf

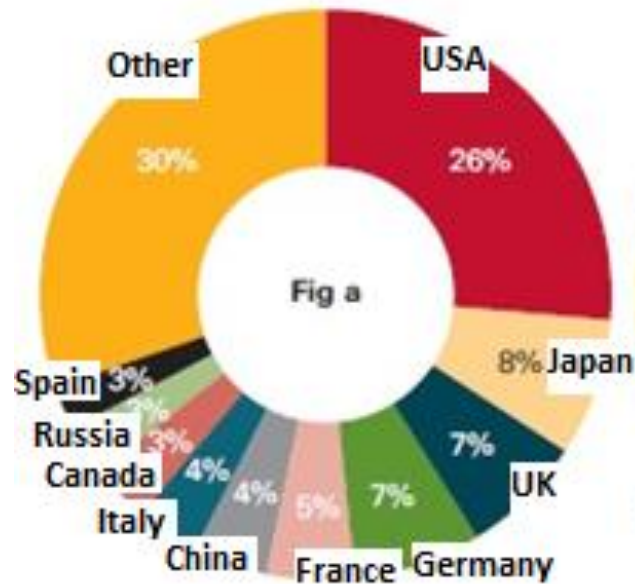
Iran: 736 papers 1996 → 13,238 2008. Leaders acknowledging importance of science in Africa.

# Publications per million inhabitants 1998 and 2008

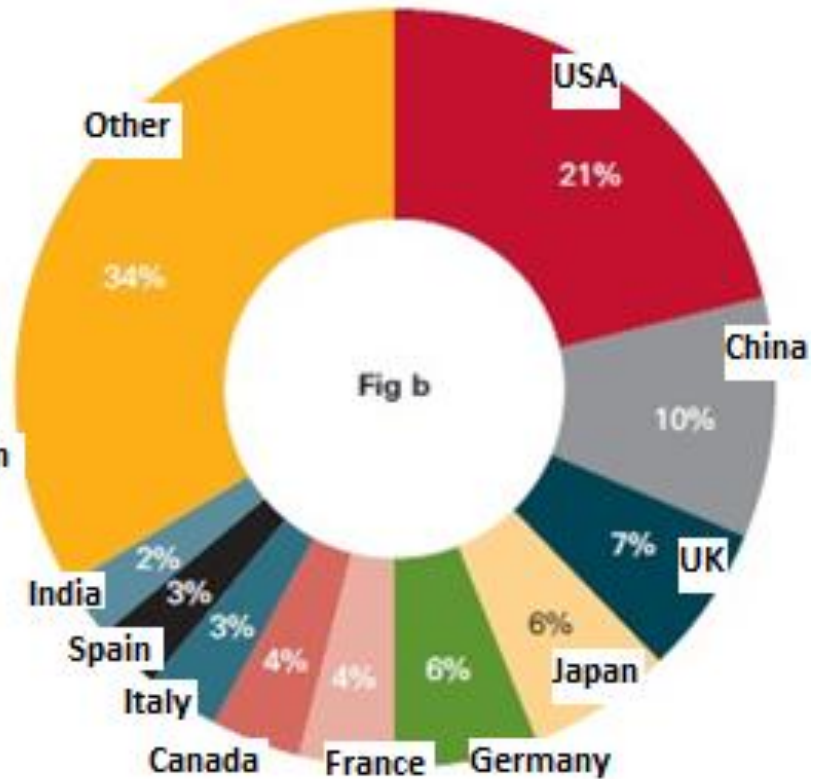


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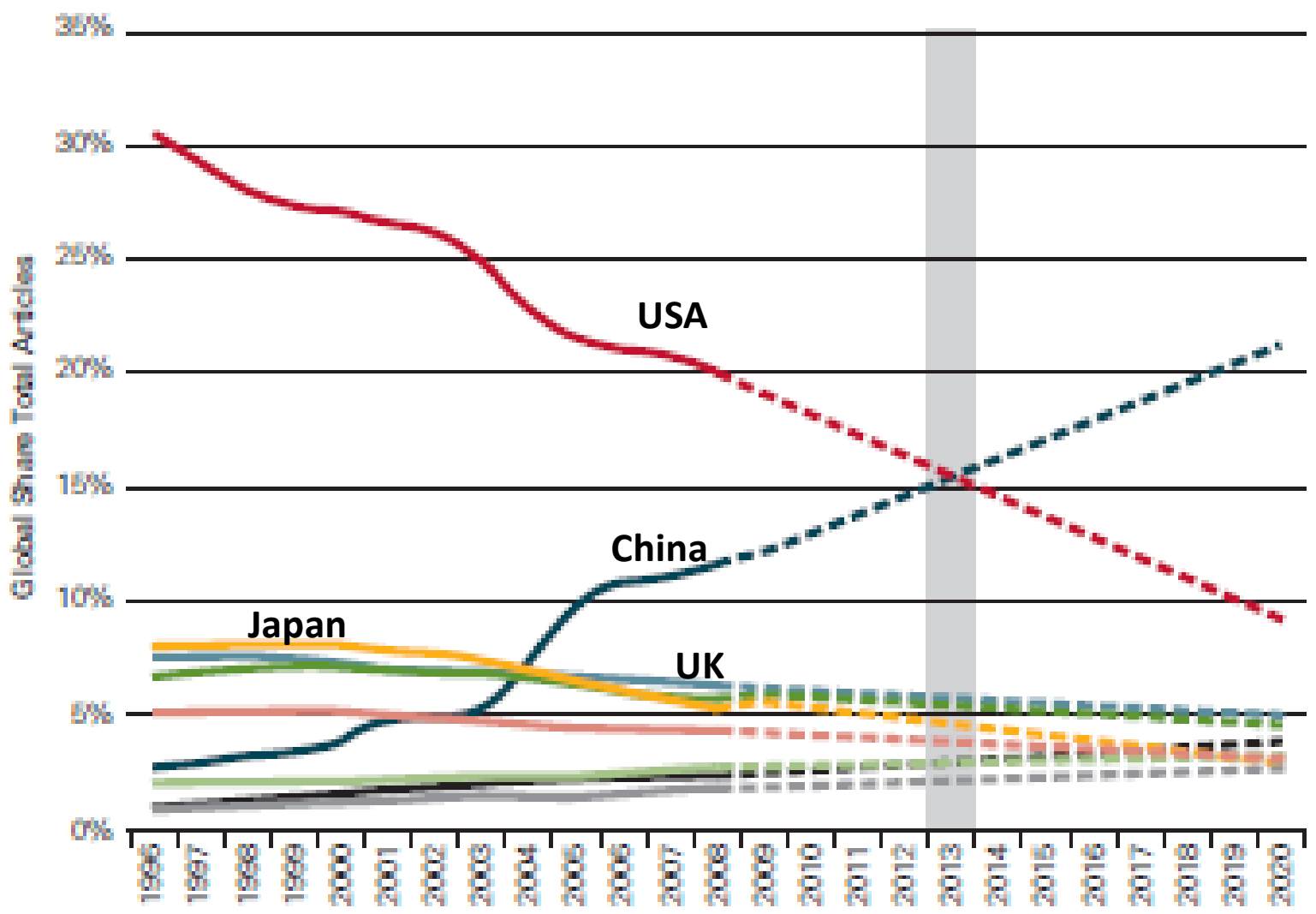
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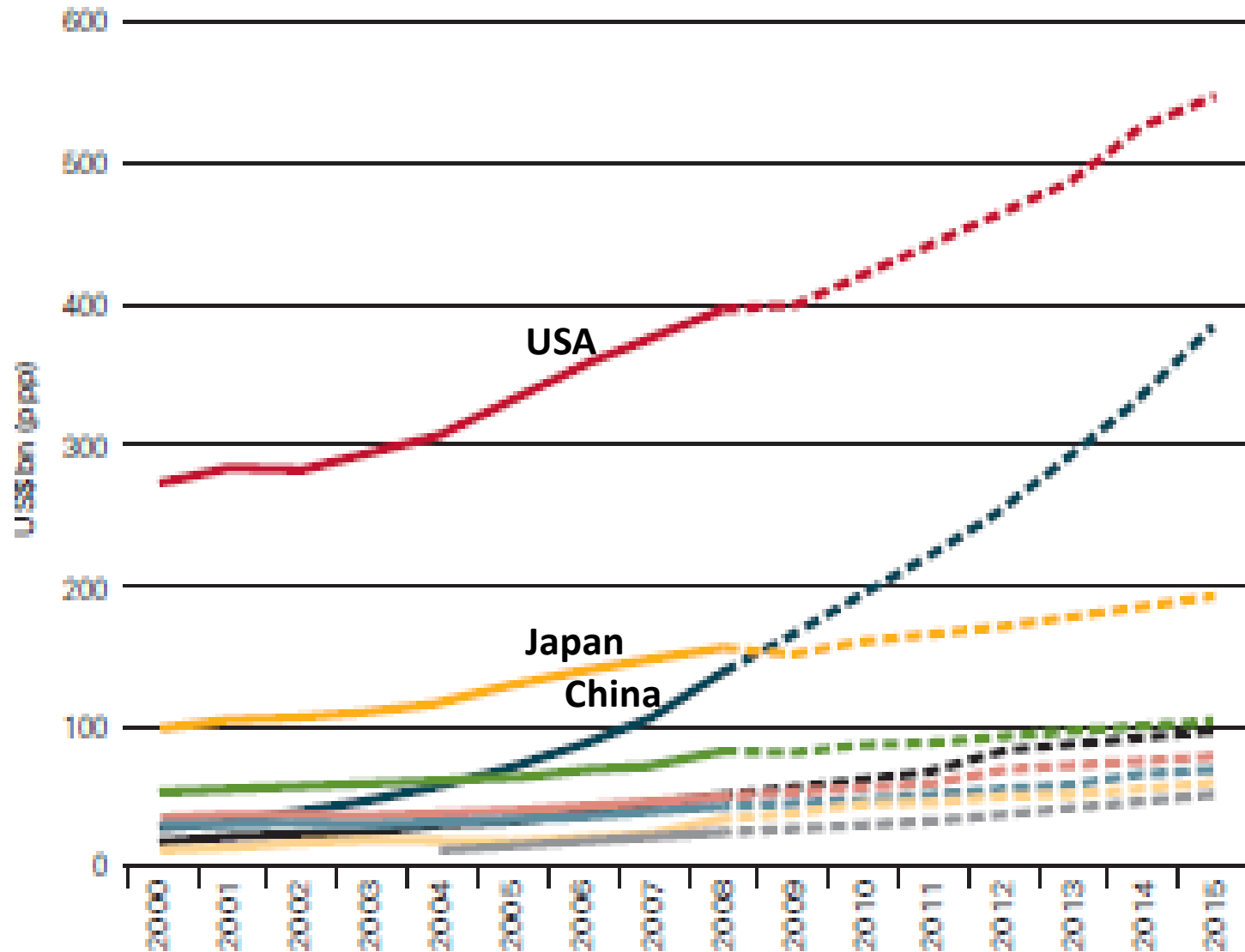


# Publications 2000 -2015?



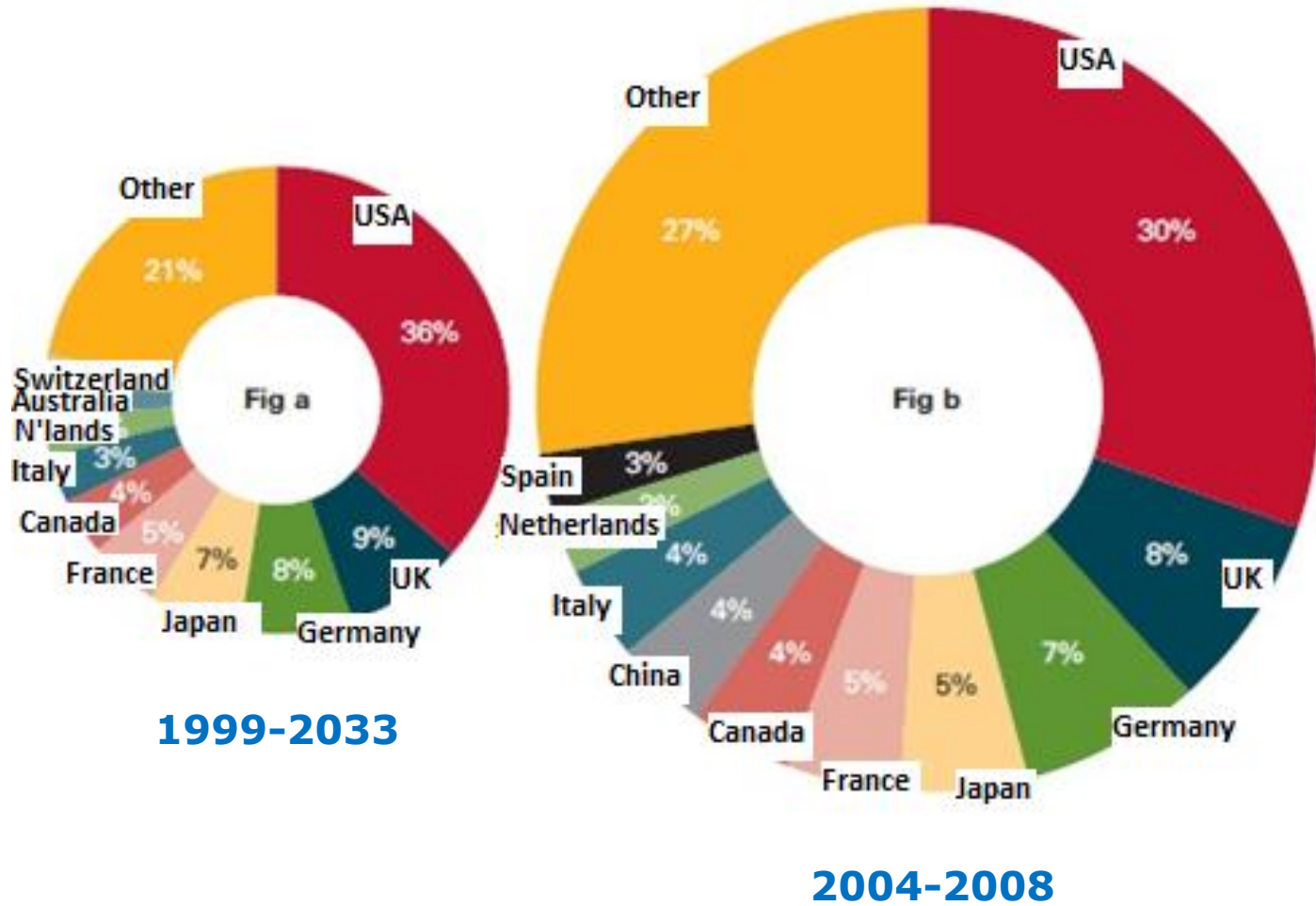


# R&D Spend 2000 -2015



# Who, what, where?

## Citation trends



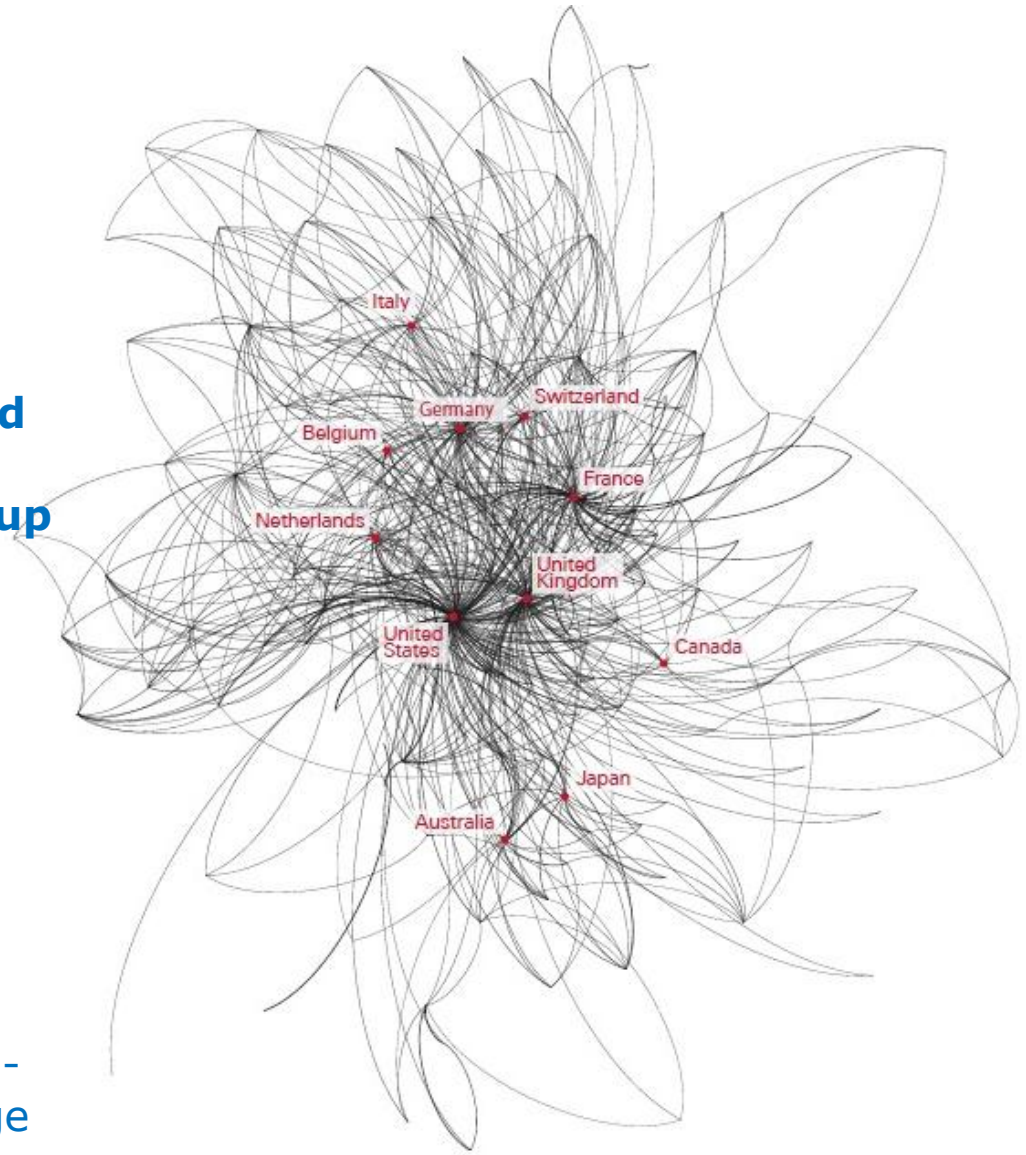
# Patents registered in USA

1989		1999		2009	
Japan	20,169	Japan	31,104	Japan	35,501
Germany	8,352	Germany	9,337	Germany	9,000
France	3,140	France	3,820	South Korea	8,762
UK	3,100	Chinese Taipei	3,693	Chinese Taipei	6,642
Canada	1,960	UK	3,576	Spain	6,472
Switzerland	1,362	South Korea	3,562	Canada	3,655
Italy	1,297	Canada	3,226	UK	3,175
Netherlands	1,061	Italy	1,492	France	3,140
Sweden	837	Sweden	1,401	China	1,655
Chinese Taipei	591	Switzerland	1,279	Israel	1,404
Australia	501	Netherlands	1,247	Italy	1,346
<i>USA</i>	<i>50,184</i>	<i>USA</i>	<i>83,905</i>	<i>USA</i>	<i>82,382</i>
<i>Global total</i>	<i>95,537</i>	<i>Global total</i>	<i>153,485</i>	<i>Global total</i>	<i>167,349</i>

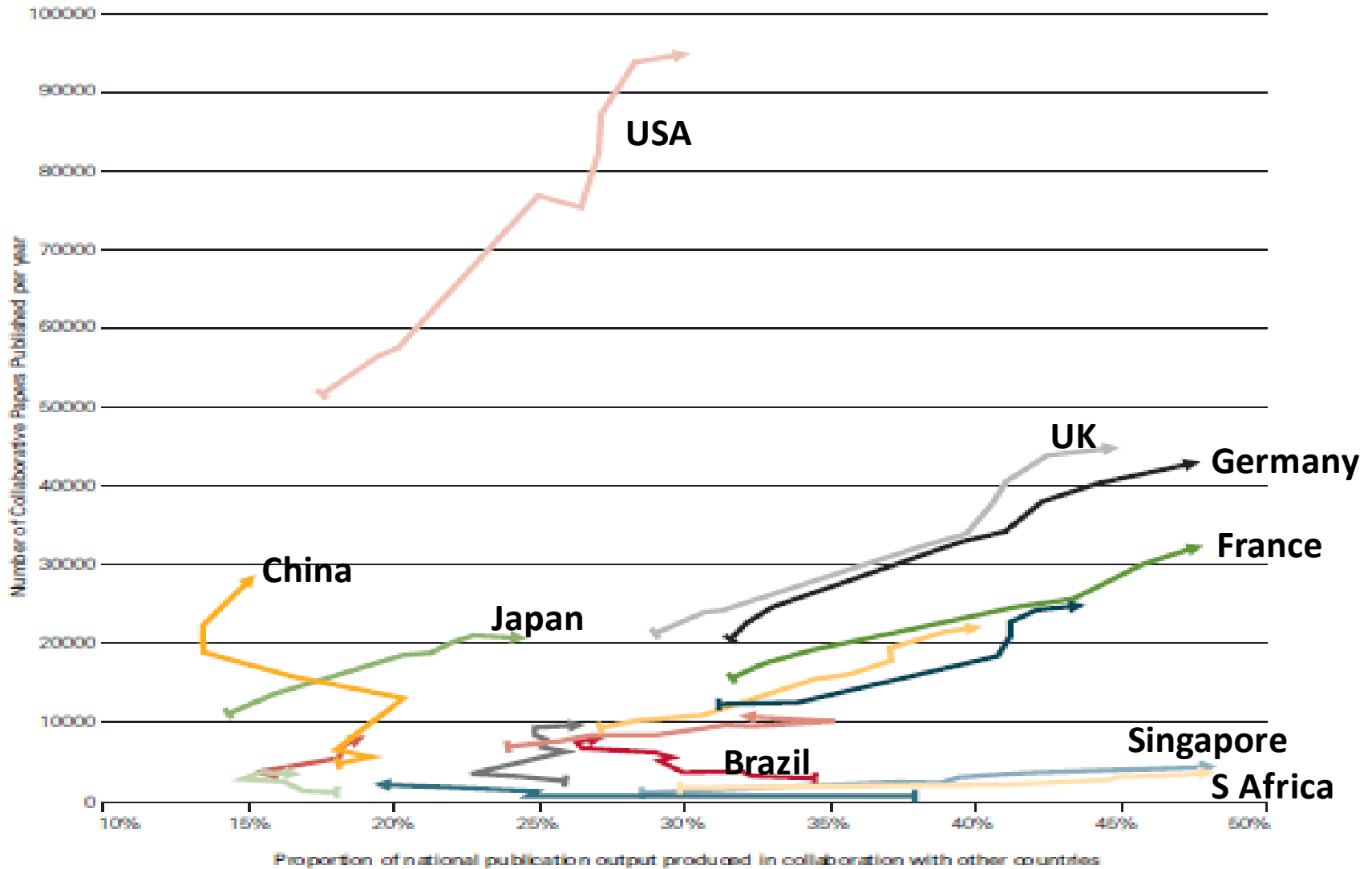
Source: US Trademark and Patent Office

# International collaboration

- **Over 35% of articles published in international journals are internationally collaborative, up from 25% 15 years ago**
- **Search for**
  - quality** → best collaborators & facilities, complementary skills
  - efficiency** → LHC, human genome,...
  - and by necessity** → data on biodiversity, effects of climate change

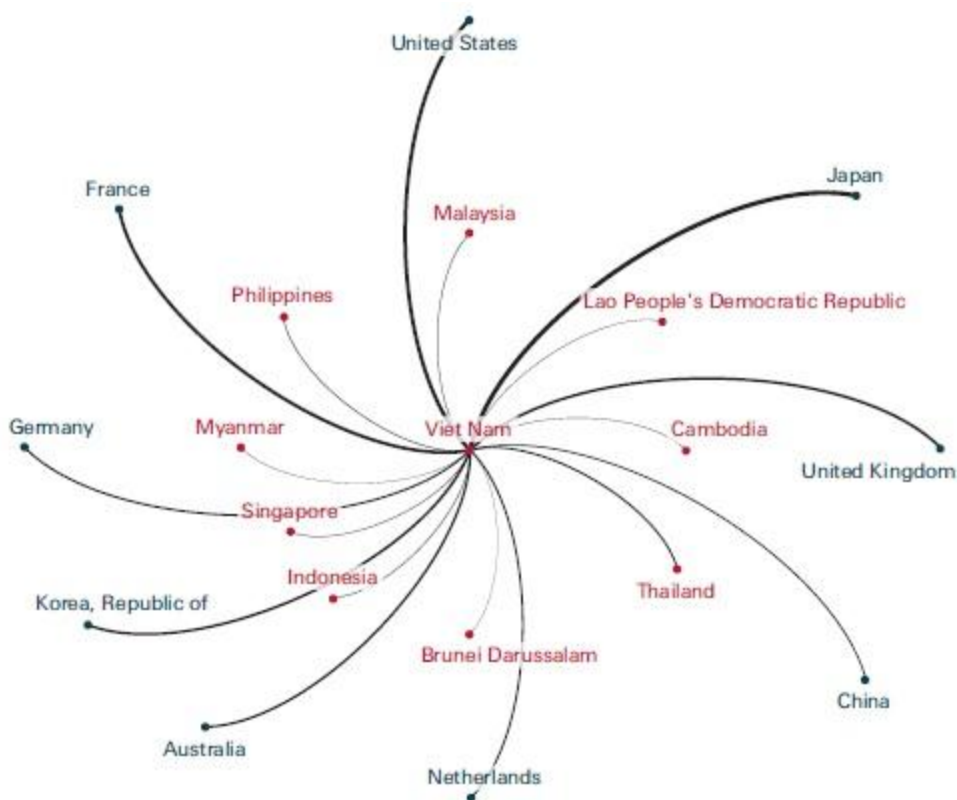


# Importance of Collaboration 1996-2007



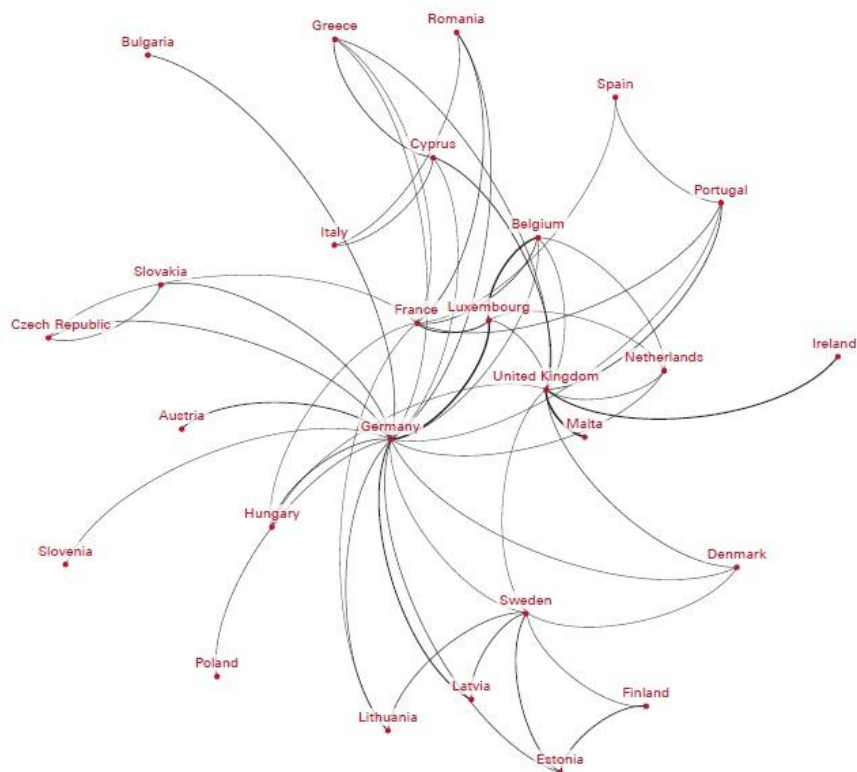
# Regional collaboration

is growing, but for developing countries global collaboration dominates

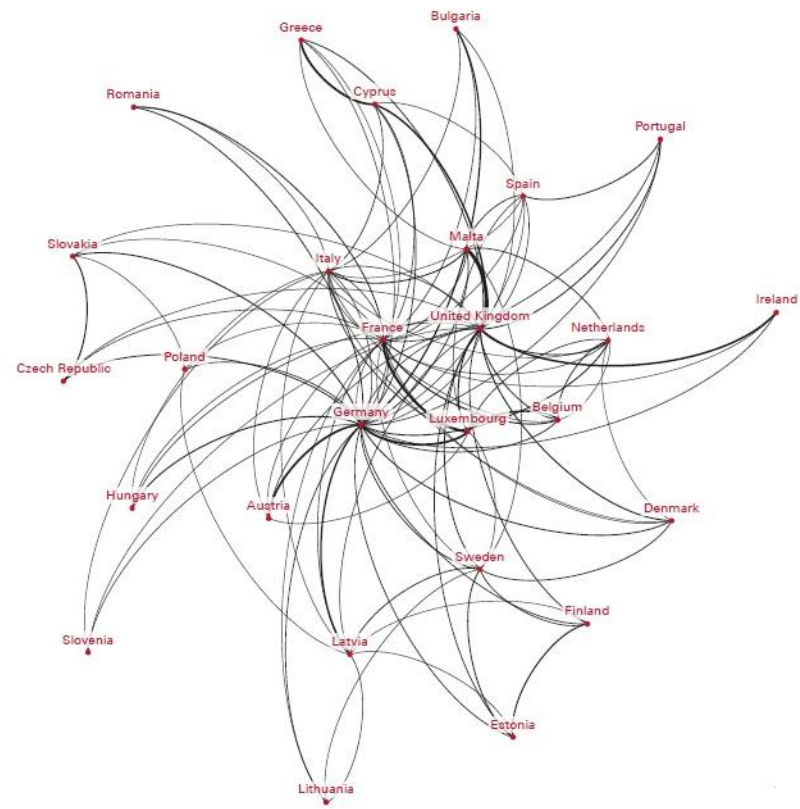


# Regional collaboration

Intra-European collaboration has (exceptionally) grown faster than international collaboration in general – as a result of deliberate EU policy



1996-2000

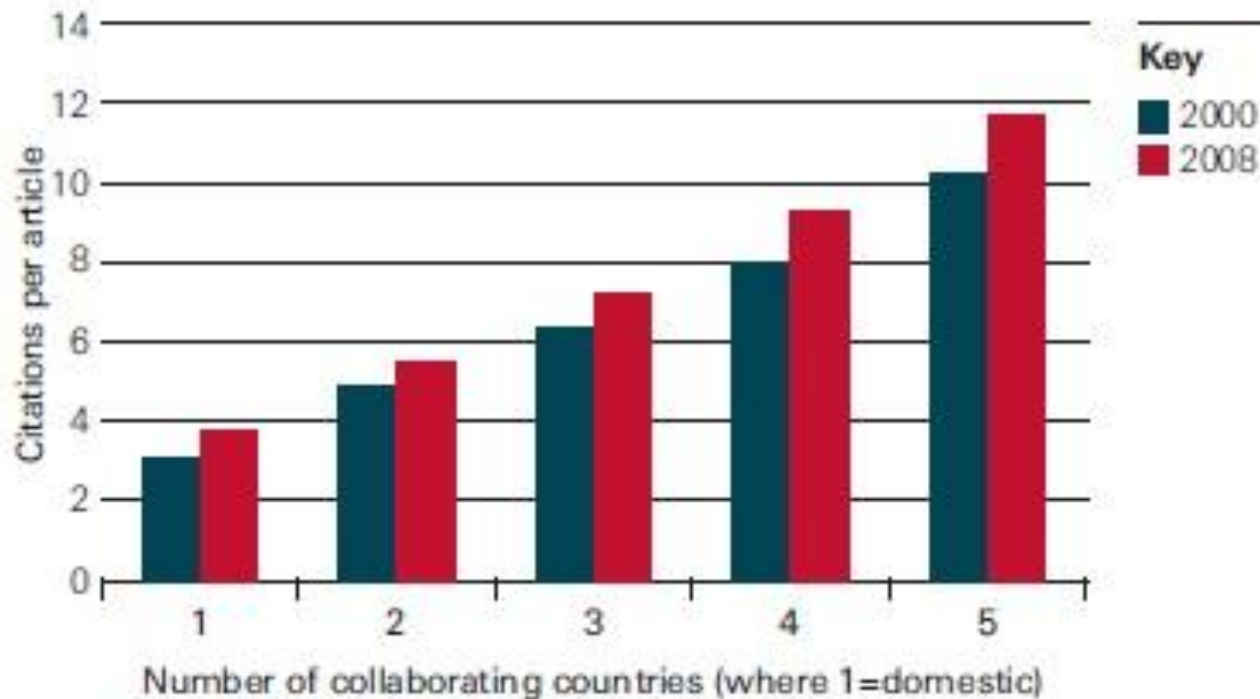


2004-2008



# International collaboration

## Benefits of joint authorship

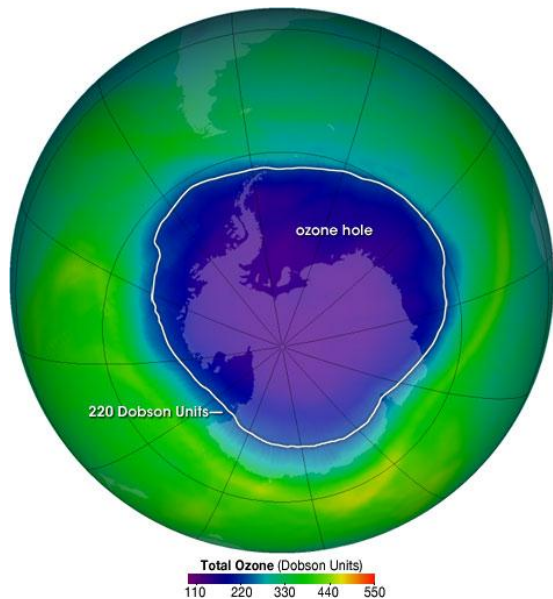


# Global Approaches to Global Problems

- **Problems with global impacts** (climate change, global health, food security, bio-diversity, water security, energy security...) **need global approaches**
- **Science crucial:** measure and predict impacts, identify solutions, evaluate pathways for adaptation and mitigation
- **How can governments, scientists, NGOs, industry, ... best address these issues**, combining scientific, social, political and economic perspectives?

# Global challenges

Global challenges have been successfully tackled before



Hole in ozone layer



Smallpox

Science clear, threats easy to grasp, solutions simple, no losers

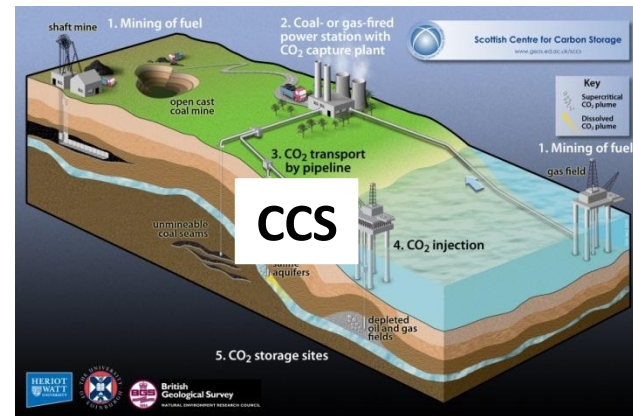
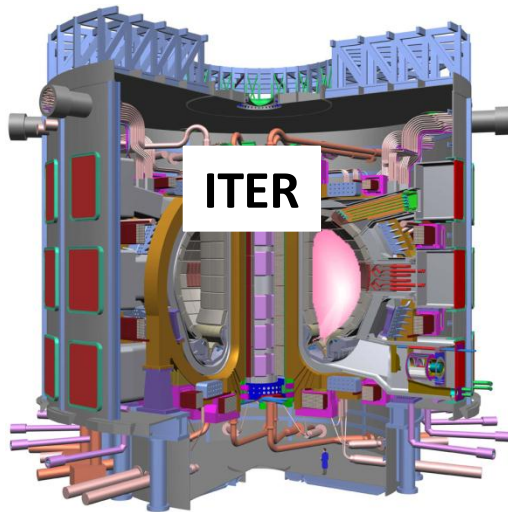
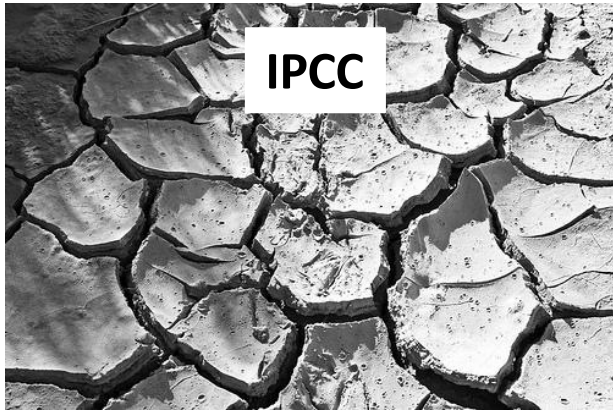
# Approaching today's global problems

## Many very complex + solutions not clear cut & expensive

- Many players: scientists, government, industry, NGOs, philanthropy
- Many different forms of partnership
- Various bodies with relevant mandates: UNESCO, UN-CBTD, ICSU, COST
- Various global and regional initiatives – not necessarily optimised to address the global problems of the 21<sup>st</sup> century

# Global challenges

## Five detailed case studies



# Three Steps

## Identification of the challenge/solution

- Blue skies research crucial (cf Arrhenius prediction of climate change, ozone hole)
- How to attract attention of policymakers/funders? Governments, industry, philanthropy?

## Identification of suitable forum to prepare implementation

- Use what exists – if appropriate

## Implementation

- Governance: simple, transparent – conflict with buy-in?
- Reconcile different interests
- Capacity building, engagement

# Desiderata and Issues

- As many countries as possible should participate in devising and assessing solutions
  - necessary for buy-in to implementation, but tension between inclusivity and quality of science
  - capacity building crucial
- Possible tension between coordination and encouraging local initiative & maintaining buy-in
- Major philanthropic input very welcome (fast, flexible) – but accountability?
- Time needed to set up global organisations has to be balanced against the advantages
- Possible tension between technical, political and industrial interests
- Intellectual property issues may be a barrier



# 'Science for Peace'

Two organisations created under the umbrella of UNESCO:

## CERN

Conceived late 1940s - two aims:

- Enable construction of a facility beyond means of individual members
- Foster cooperation between peoples recently in conflict

## SESAME

Conceived late 1990s with the same aims

- Members: Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestinian Authority, Turkey

'A parallel universe'

- Hope commissioning 2015  
It will work politically *provided* science is first class



<http://mag.digitalpc.co.uk/fvx/iop/esrf/sesamebrochure/>

<http://mag.digitalpc.co.uk/fvx/iop/esrf/sesamepeople/>

[http://www.sesame.org.jo/pdf/Press\\_Release\\_Final.pdf](http://www.sesame.org.jo/pdf/Press_Release_Final.pdf)

# SOME CONCLUSIONS & NEXT STEPS

- The scientific landscape is changing dramatically, with new powers rising
- Global scientific collaboration is generally win-win and should be fostered
- Combing forces to find solutions to global problems is desirable per-se and necessary to endure that actions are accepted by all, but it is not straightforward
- We need better metrics – this is being pursued by UNESCO (with collaboration of the Royal Society)
- The OECD\* is taking forward analysis of global collaborations, especially issues (with input from the Royal Society)

\* Oslo Workshop on International Co-operation in Science Technology and Innovation to Address Global Challenges – 18-20 May 2011