ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The Bioeconomy:

Why it matters and lessons for BRCs in delivering it

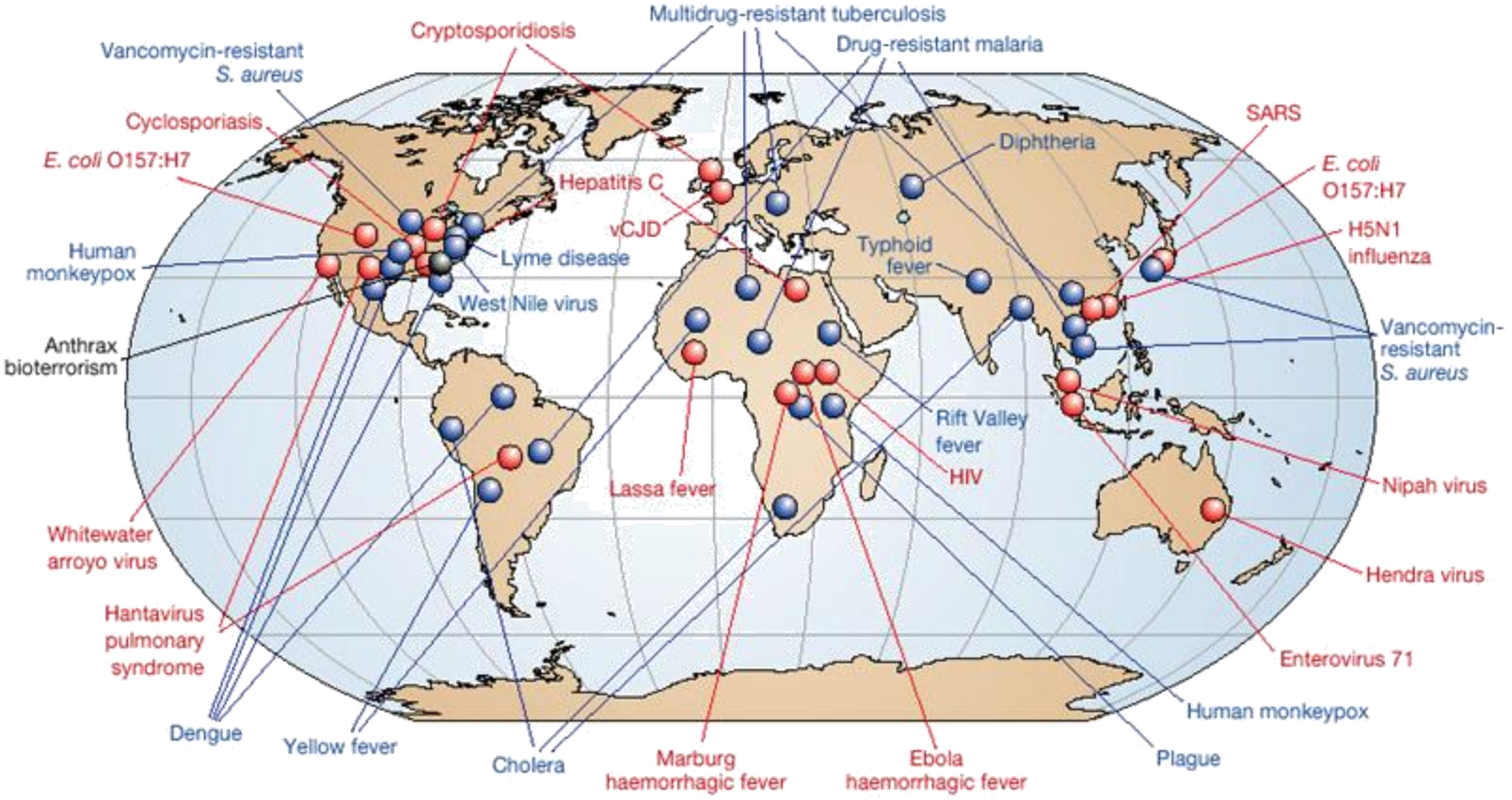
Iain Gillespie

Head of Science & Technology Policy

27 September 2010

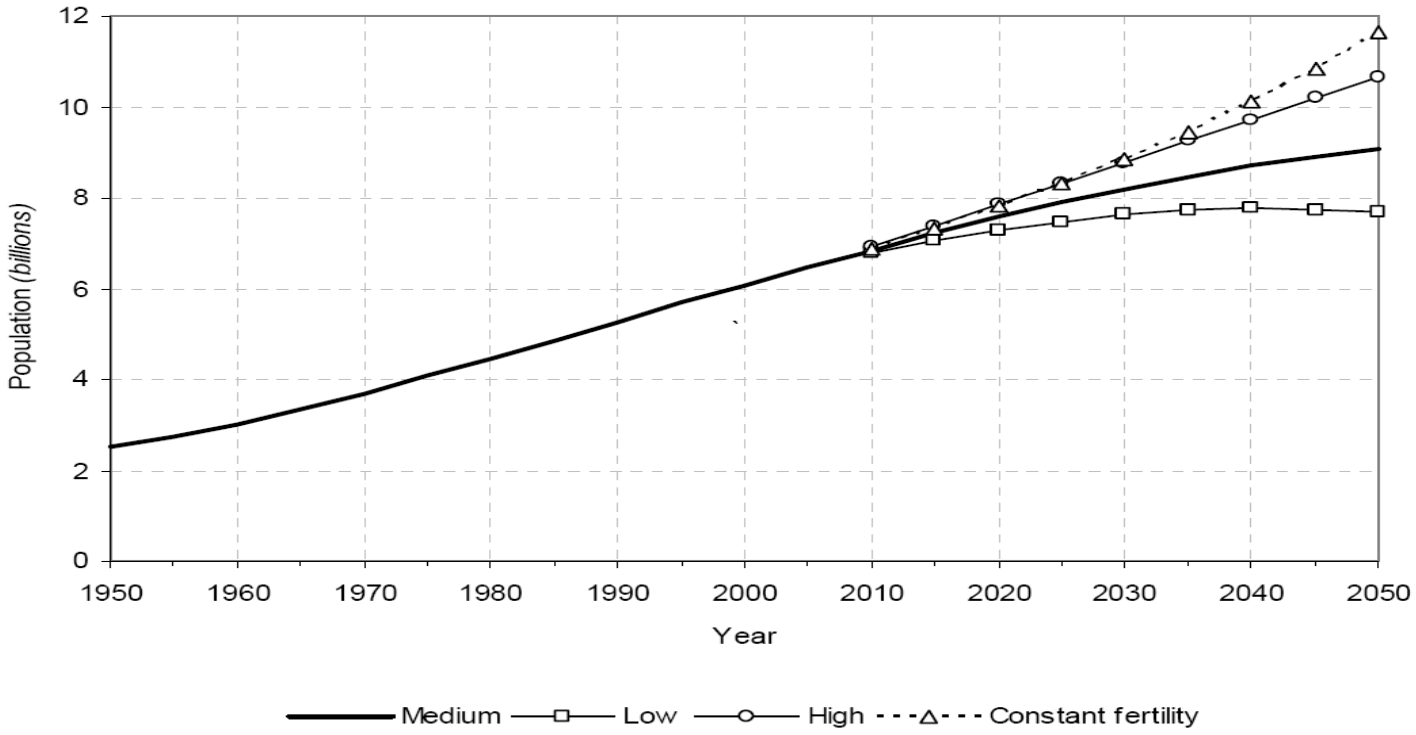
WE LIVE IN CHALLENGING TIMES…..

Infectious diseases globally

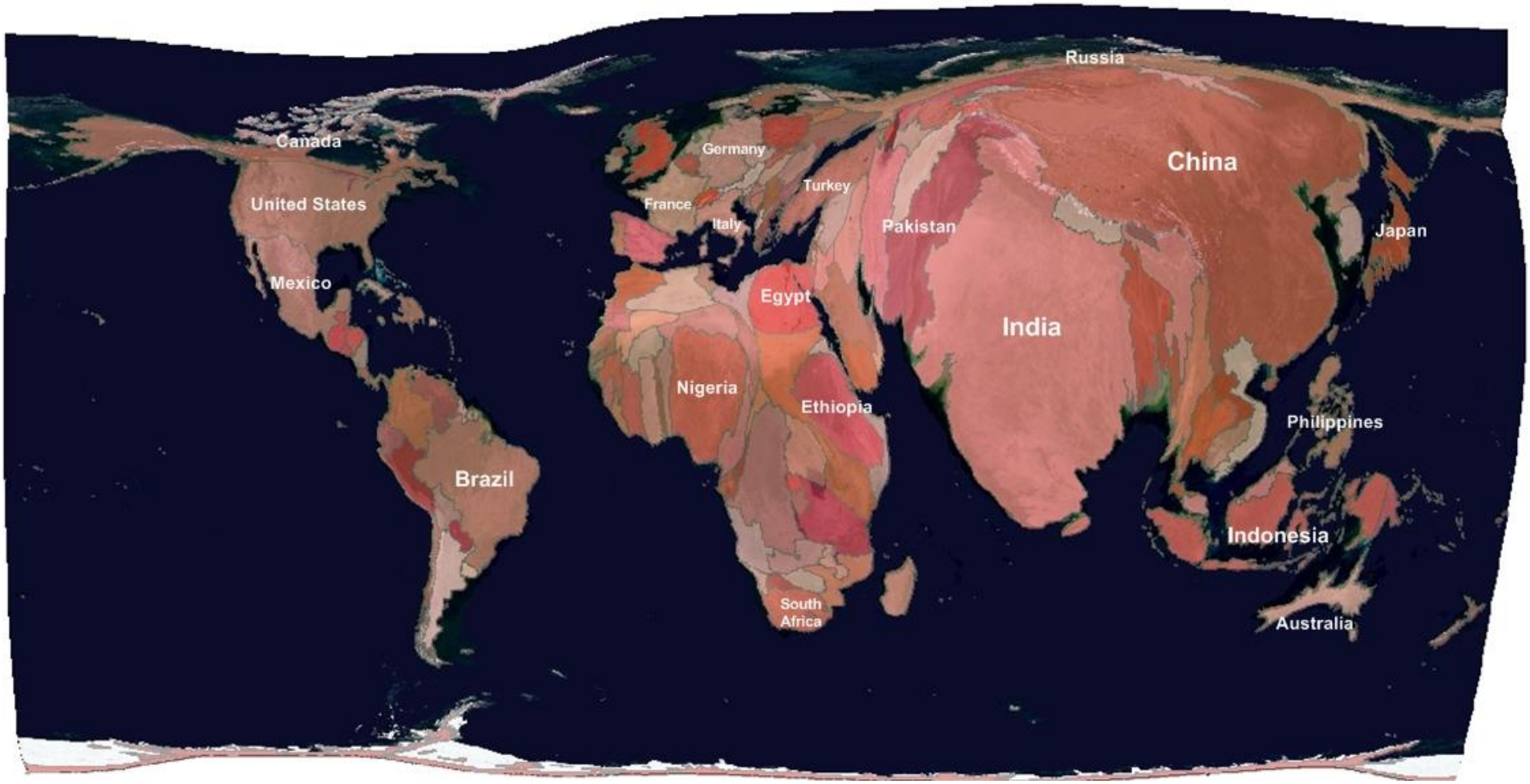


Projected World Population Growth

Figure 1. Population of the world, 1950-2050, by projection variants



Drivers for Agriculture– World population in 2030



Source: Salim Sawaya, based on medium variant of the UN Population Division's "World Population Prospects: The 2006 Revision Population Database"

Projected Global Temperature Change

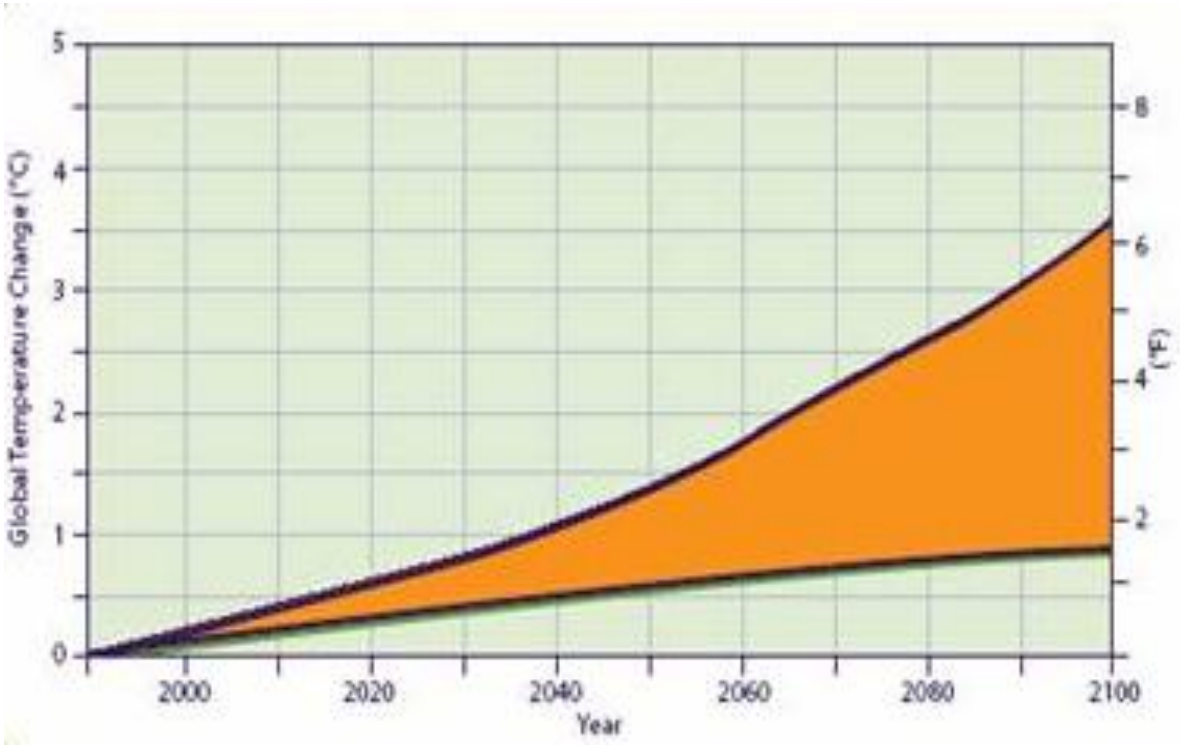
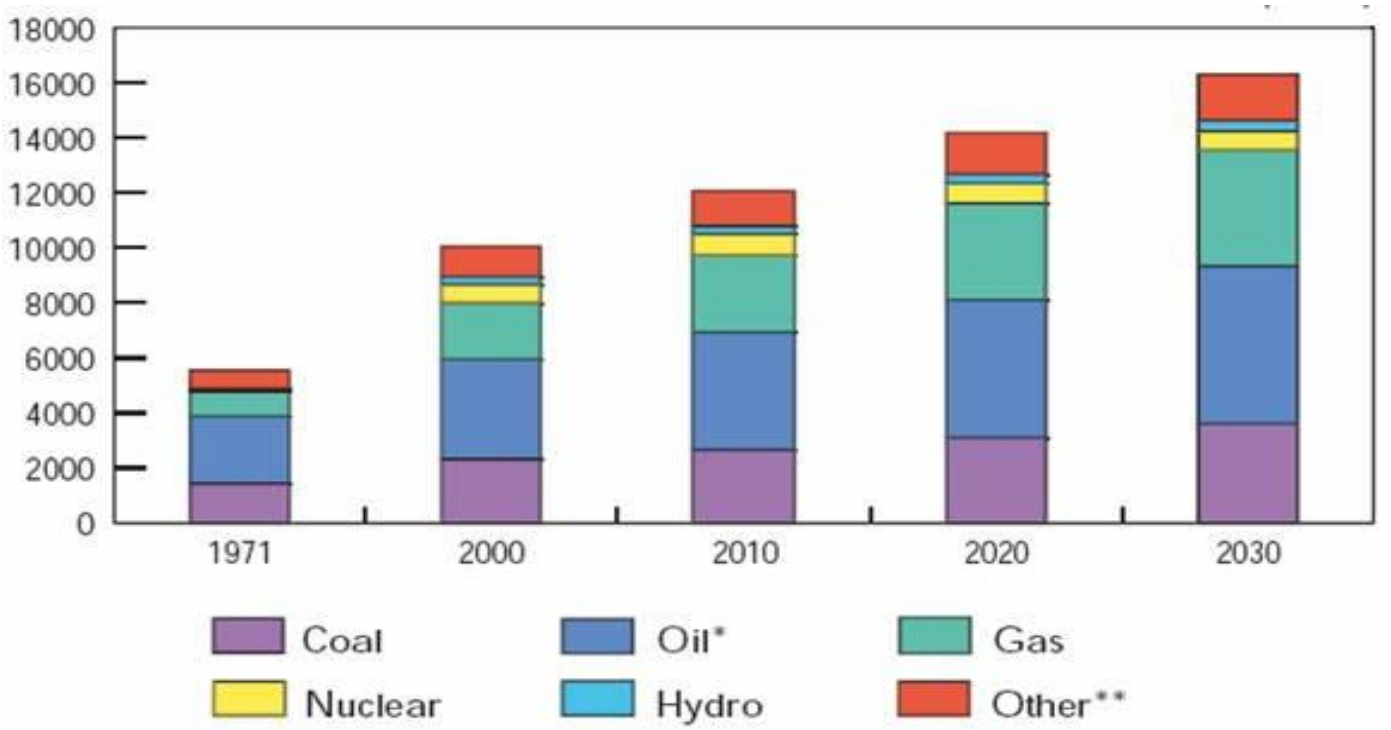


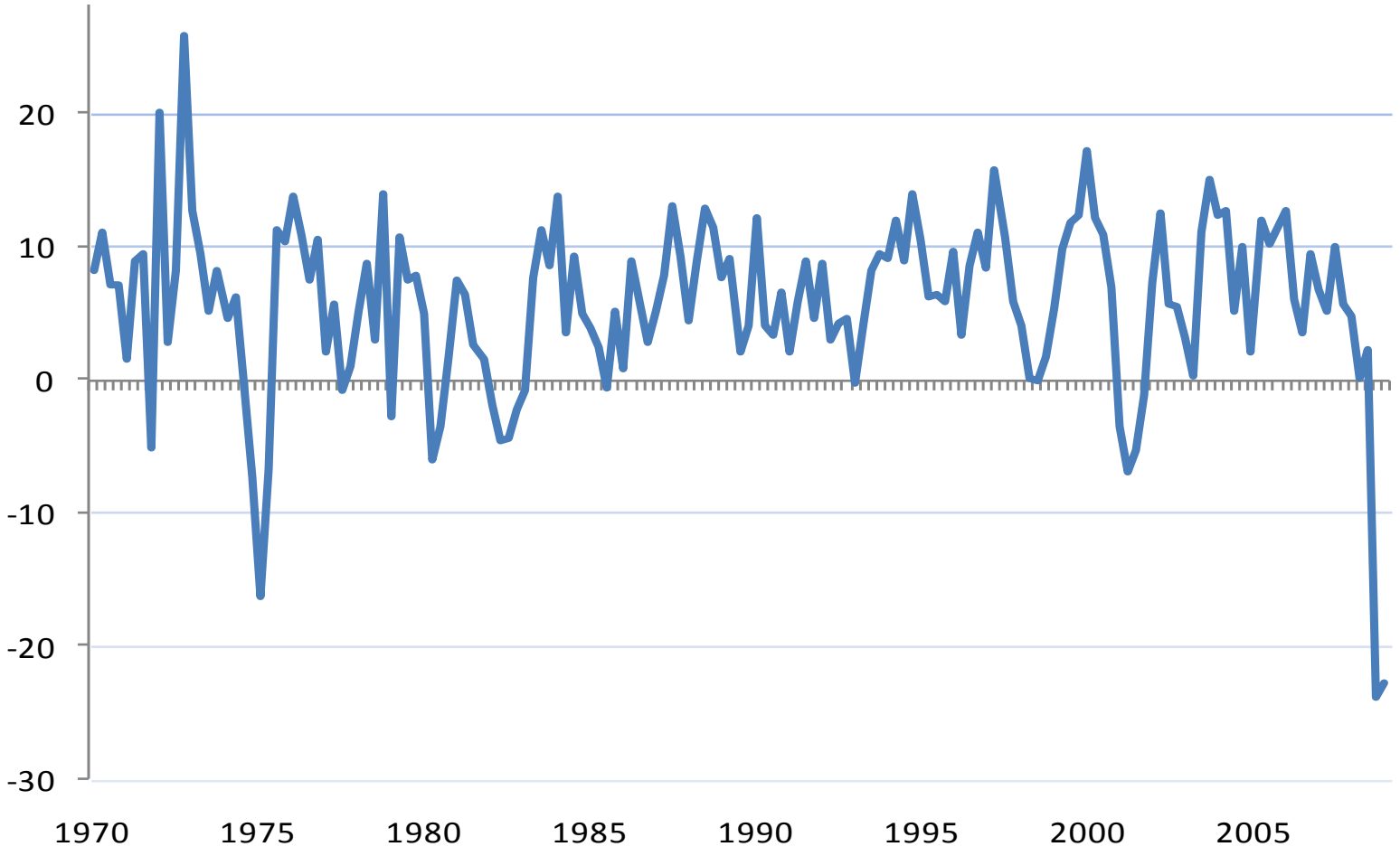
Chart B -
Projected Global Temperature Change
(Source: IPCC website, May 2002)

Outlook for World Total Primary Energy Supply



Strong economic downturn…..

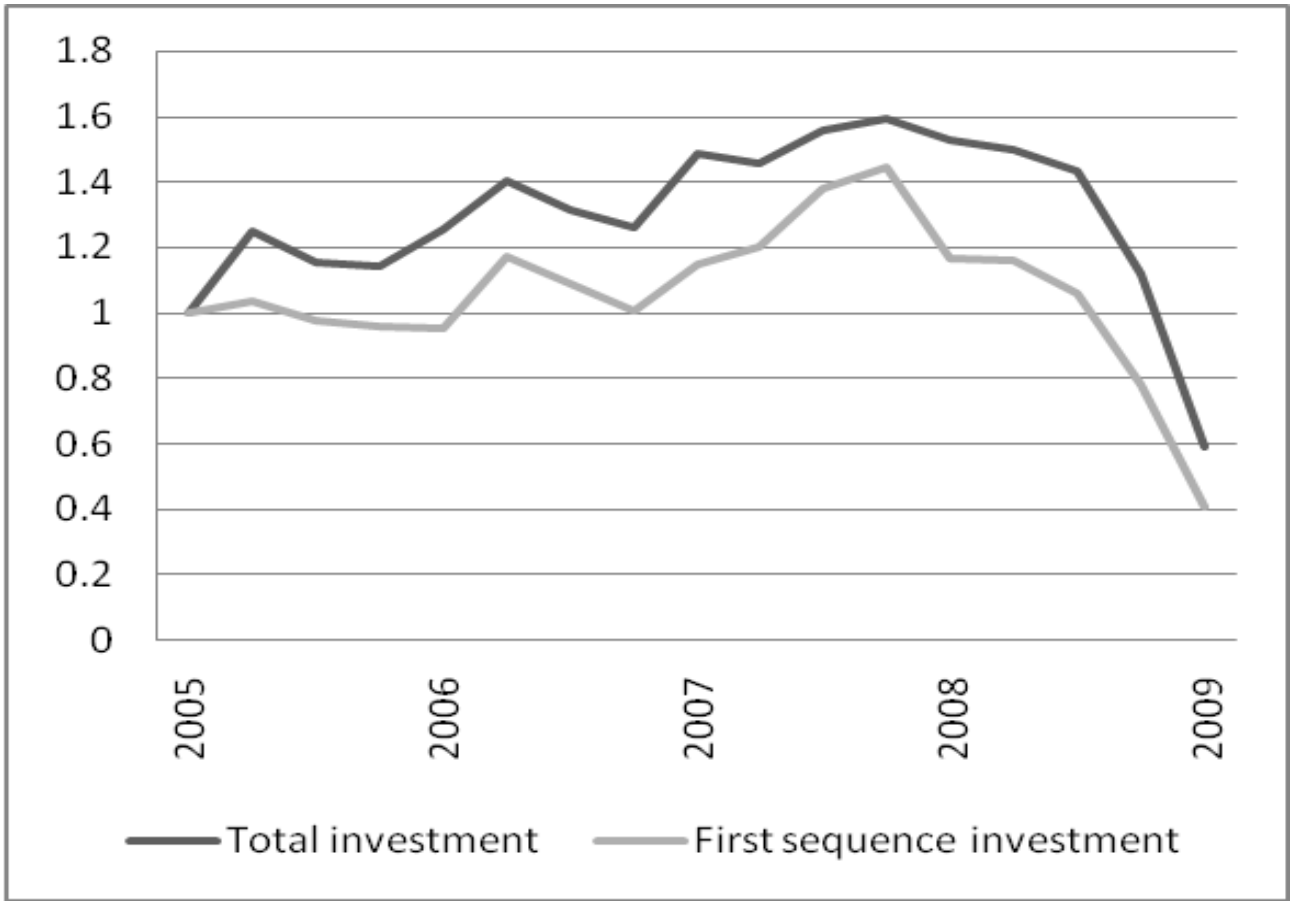
Annualised quarter on quarter growth in world trade (%)



Source: OECD.

.. accompanied by a strong decline in capital availability

(Venture capital investment in the United States, index: 2005 Q1 = 1)



Source: OECD, based on PricewaterhouseCoopers and NVCA.

The Potential for growth - Key determinants of differences in GDP

Decomposition of cross-country differences in GDP per capita into their determinants, 2005

(United States = 100)

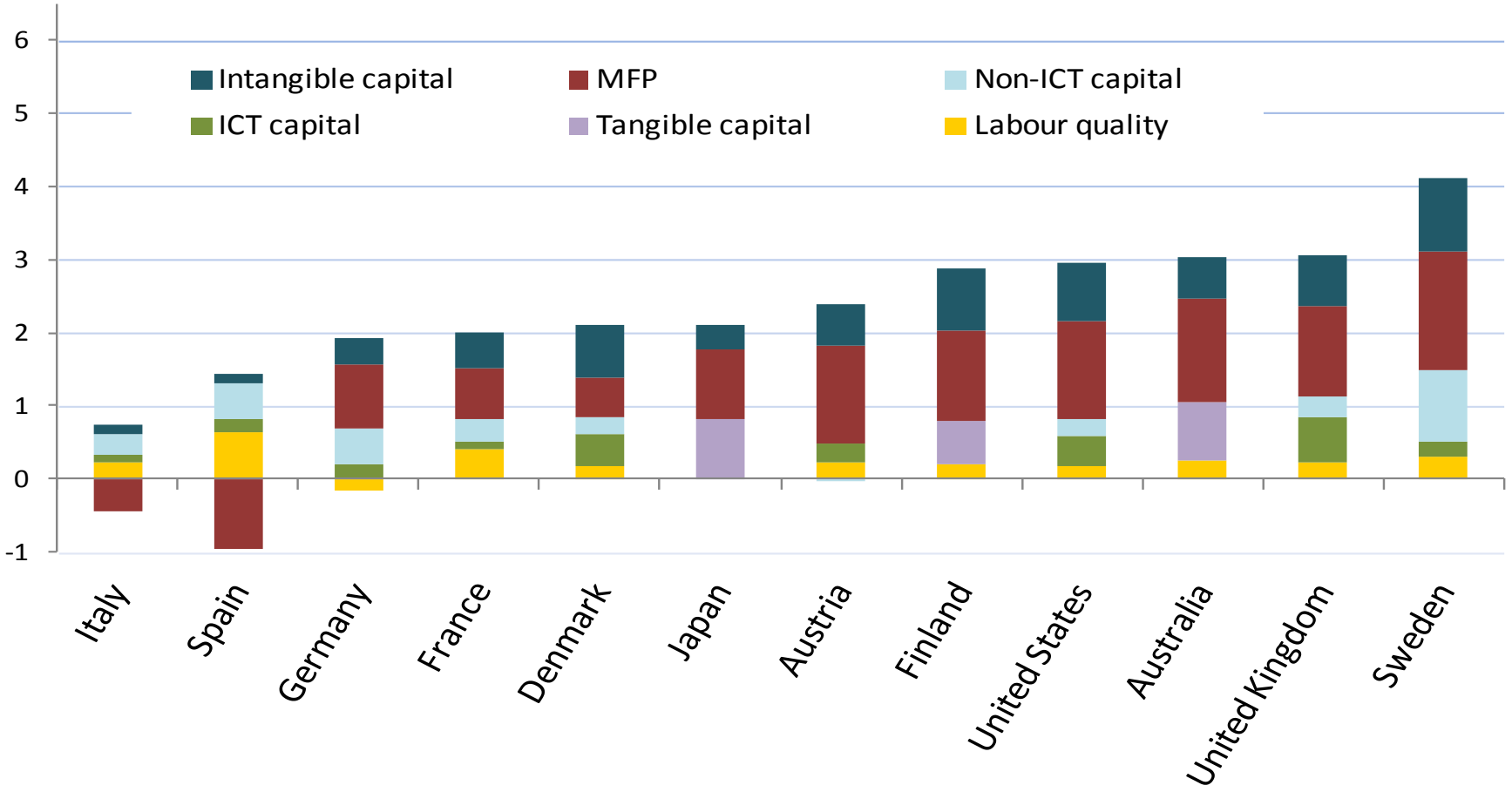
	GDP PPP per capita	TFP	Human capital	Physical capital	Employment
United States	100.0	100.0	100.0	100.0	100.0
Canada	83.5	72.0	103.3	105.8	106.0
Japan	72.6	52.6	100.4	130.7	105.1
China	9.8	13.6	57.3	105.2	119.5
India	5.2	12.7	47.7	98.3	87.1
Brazil	20.5	29.3	70.1	103.1	96.8
Russian Federation	28.6	31.5	84.9	97.4	99.3
EU27 + EFTA	64.7	67.8	91.2	114.1	91.3
Total World	22.8	27.9	64.2	104.2	95.8

Source: OECD.

THE CHANGING NATURE OF INNOVATION

Innovation is key to growth...

Contributions to labour productivity growth, 1995-2006, in %

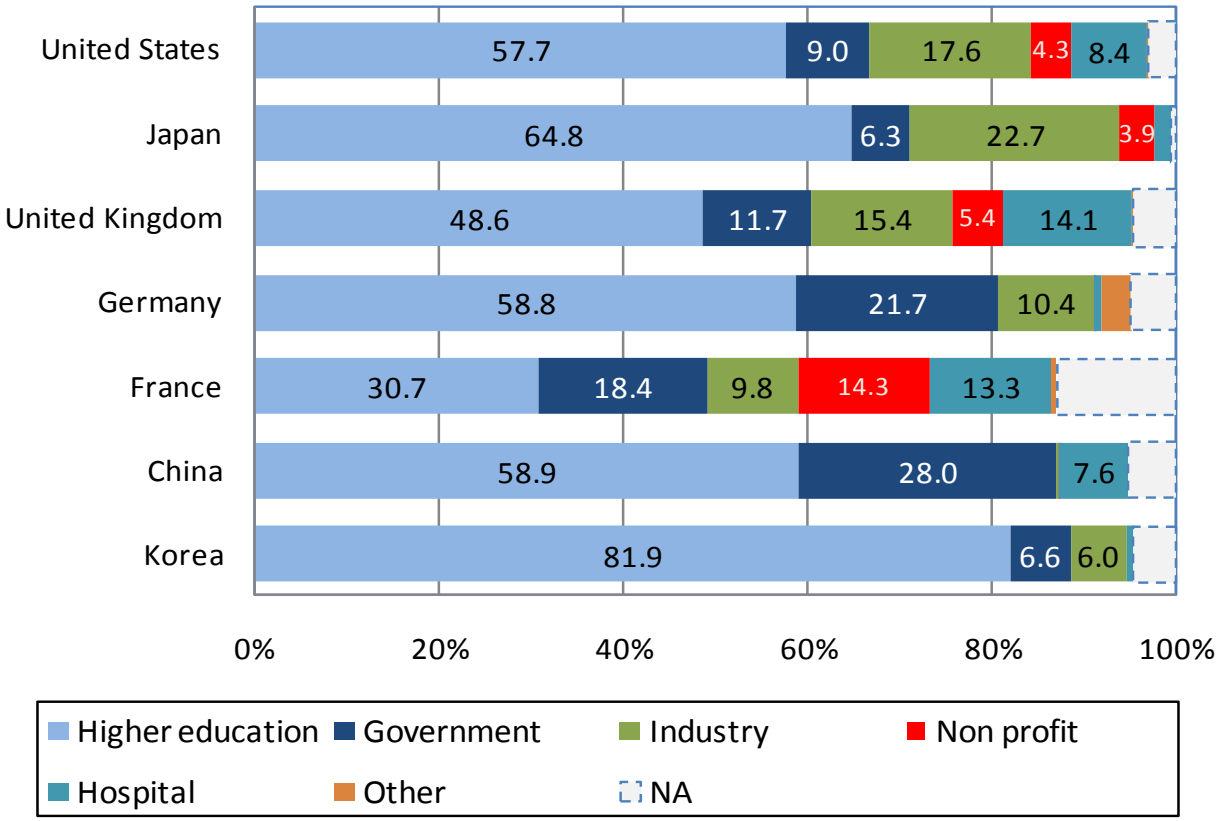


** Investment in intangibles and multi-factor productivity growth account for between two-thirds and three-quarters of labour productivity growth*

Biotech reliance on Science…

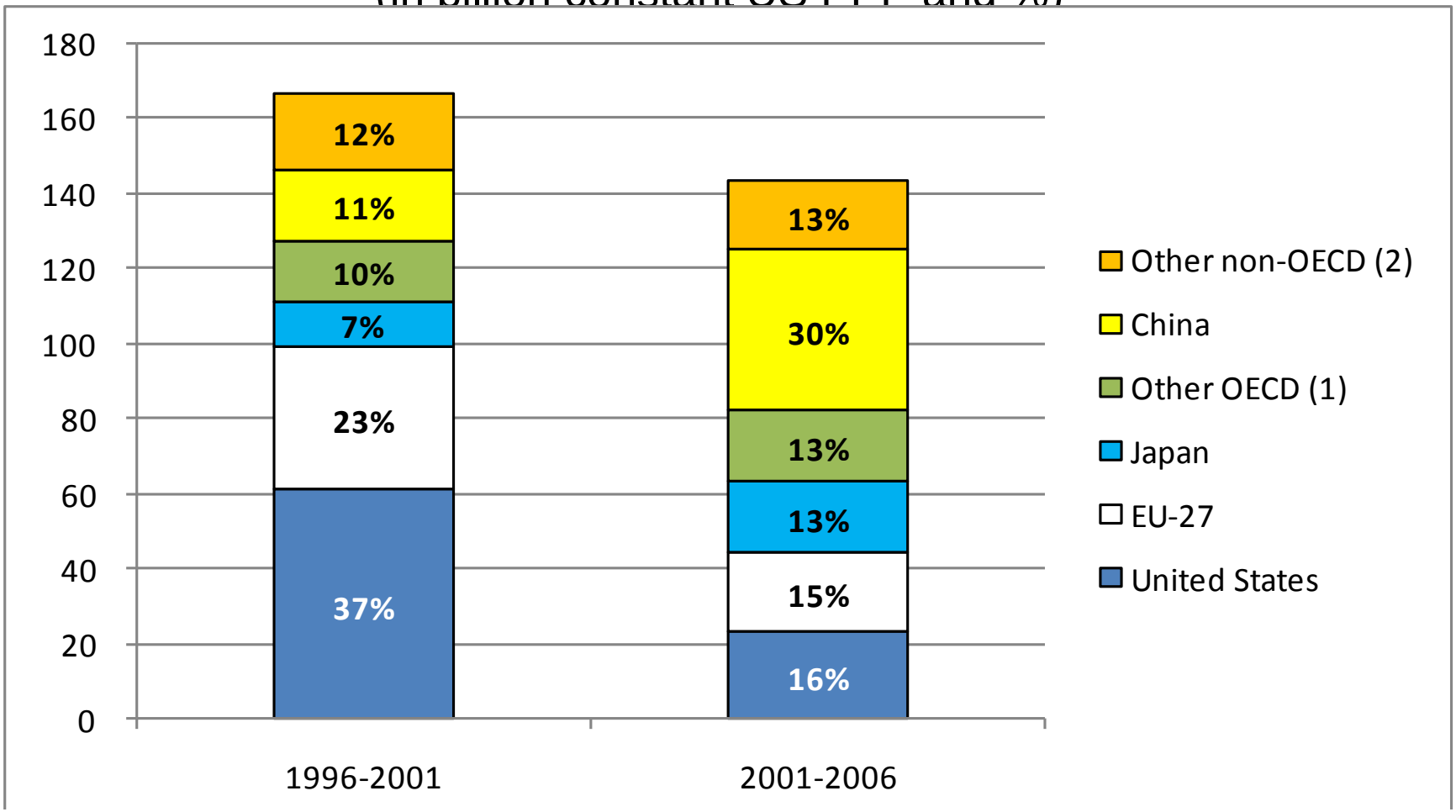
Reliance of patents on science citations

(biochemistry papers cited by pharmaceutical patents)



New global players have emerged . . .

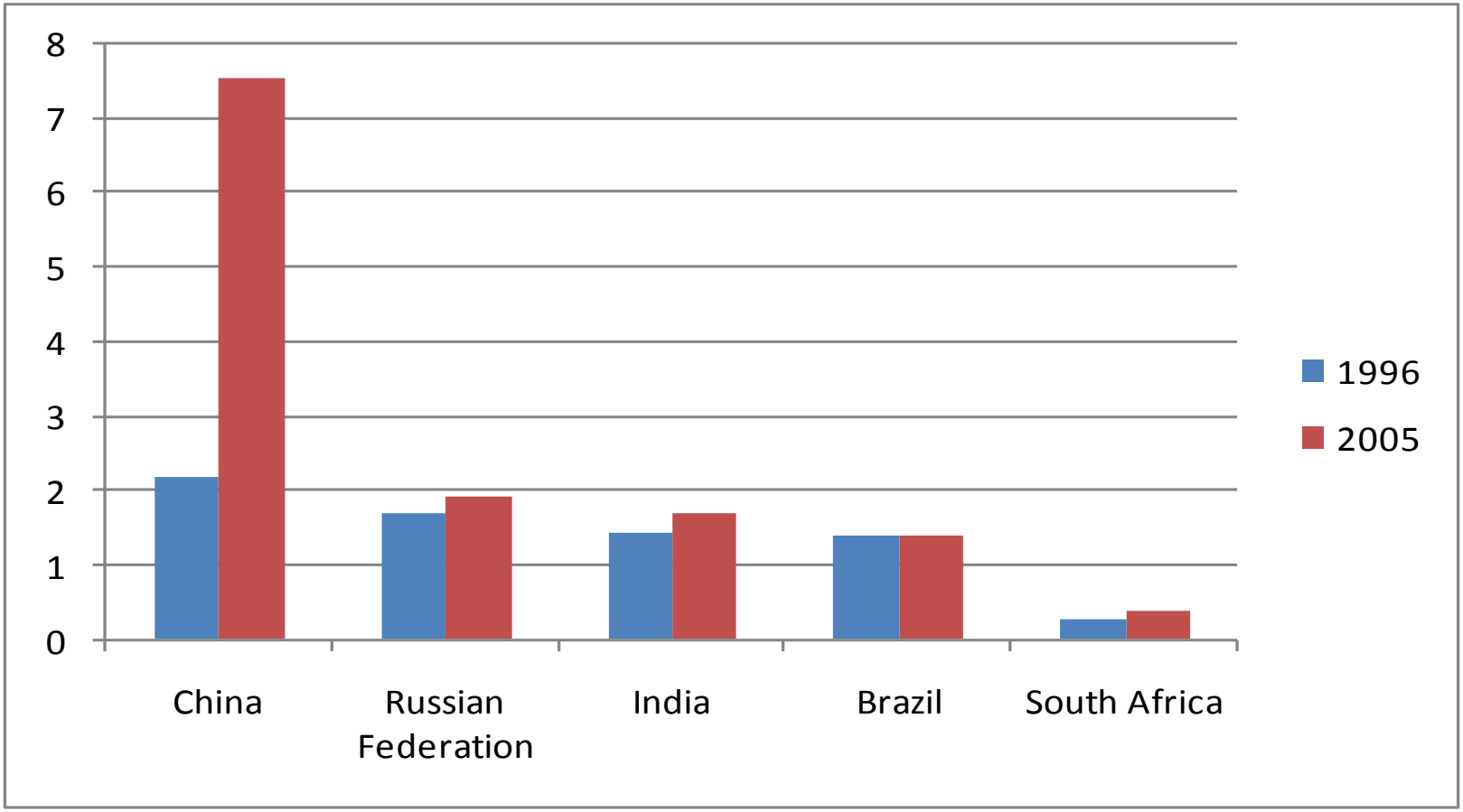
Contributions to growth in global R&D, 1996-2001 and 2001-2006
(in billion constant US PPP and %)



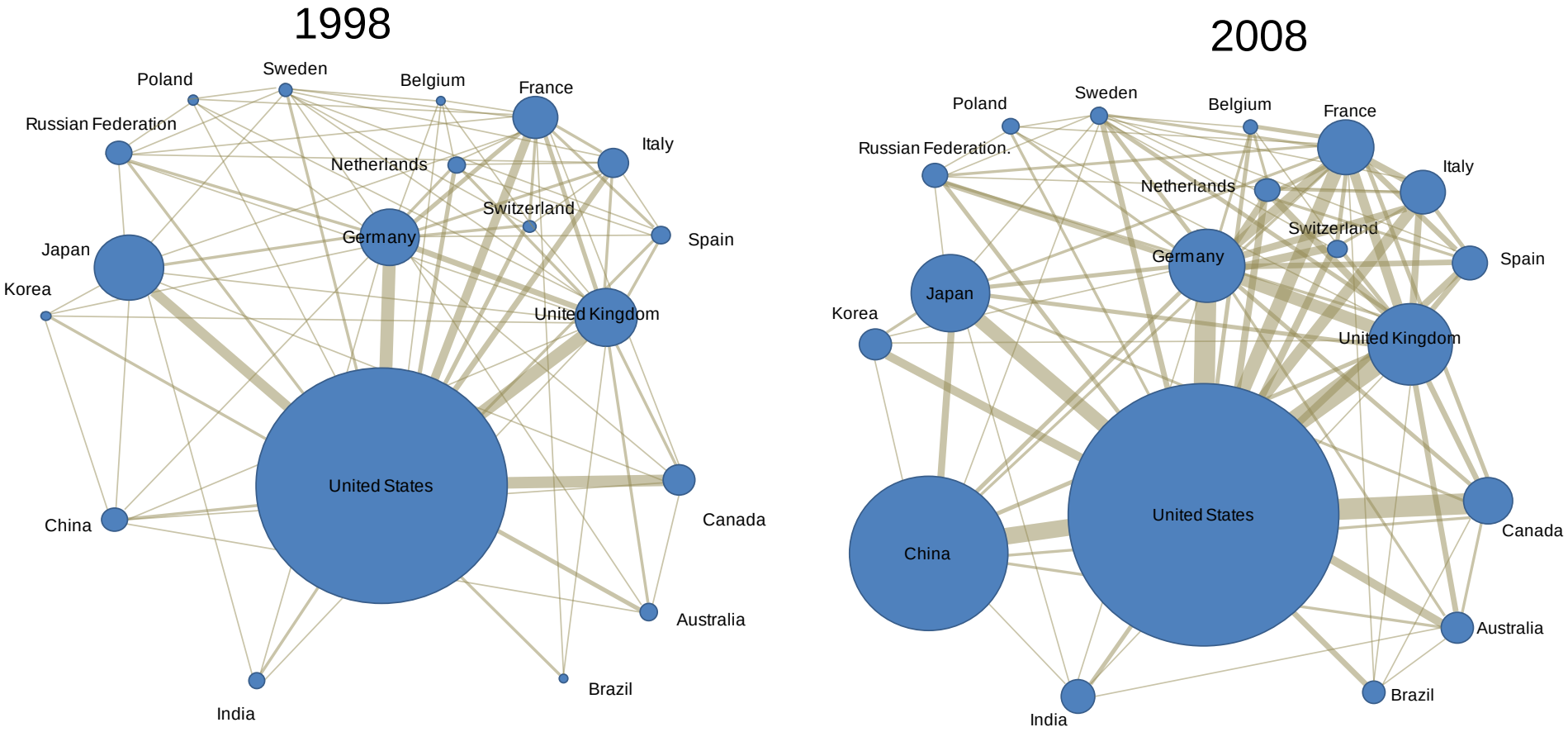
Note: (1) Australia, Canada, Iceland, Korea, Mexico, New Zealand, Norway and Turkey
(2) Argentina, Brazil, India, Israel, Russian Federation, Singapore, South Africa, Chinese Taipei
Source: OECD.

How the BRICS stack up…

Global R&D, percentage share



Science is increasingly international...

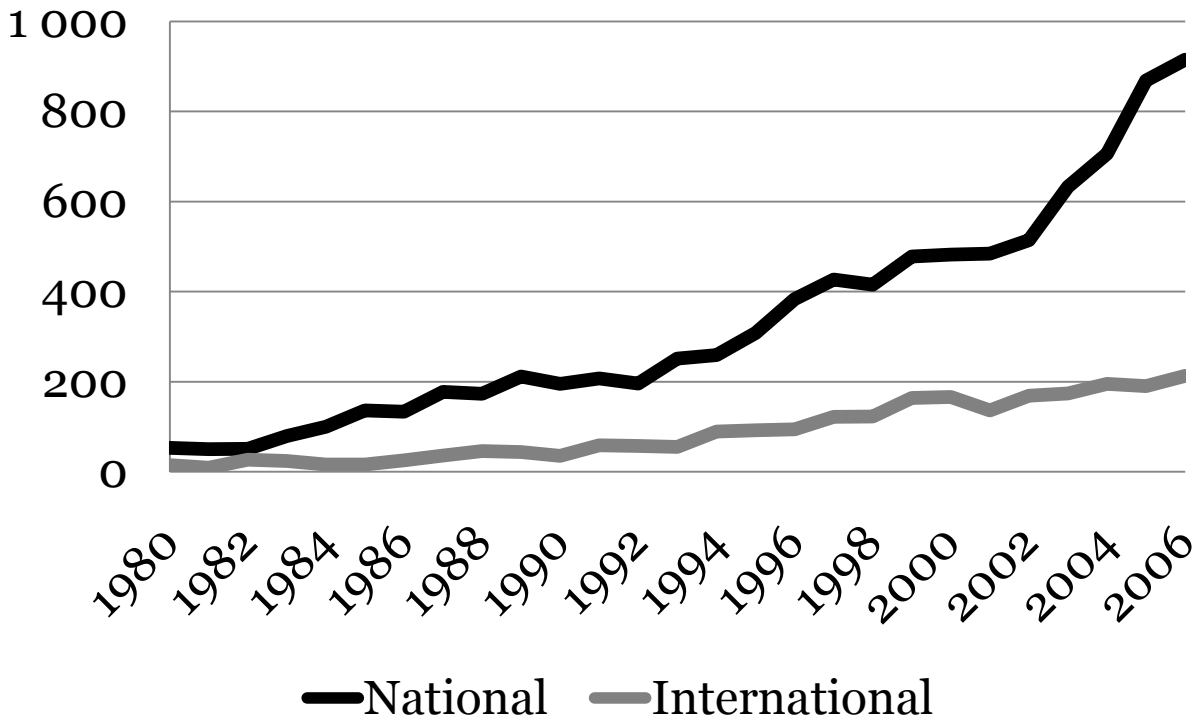


Source: OECD (2010) *Measuring Innovation: A New Perspective*

Co-ownership of Innovation is growing

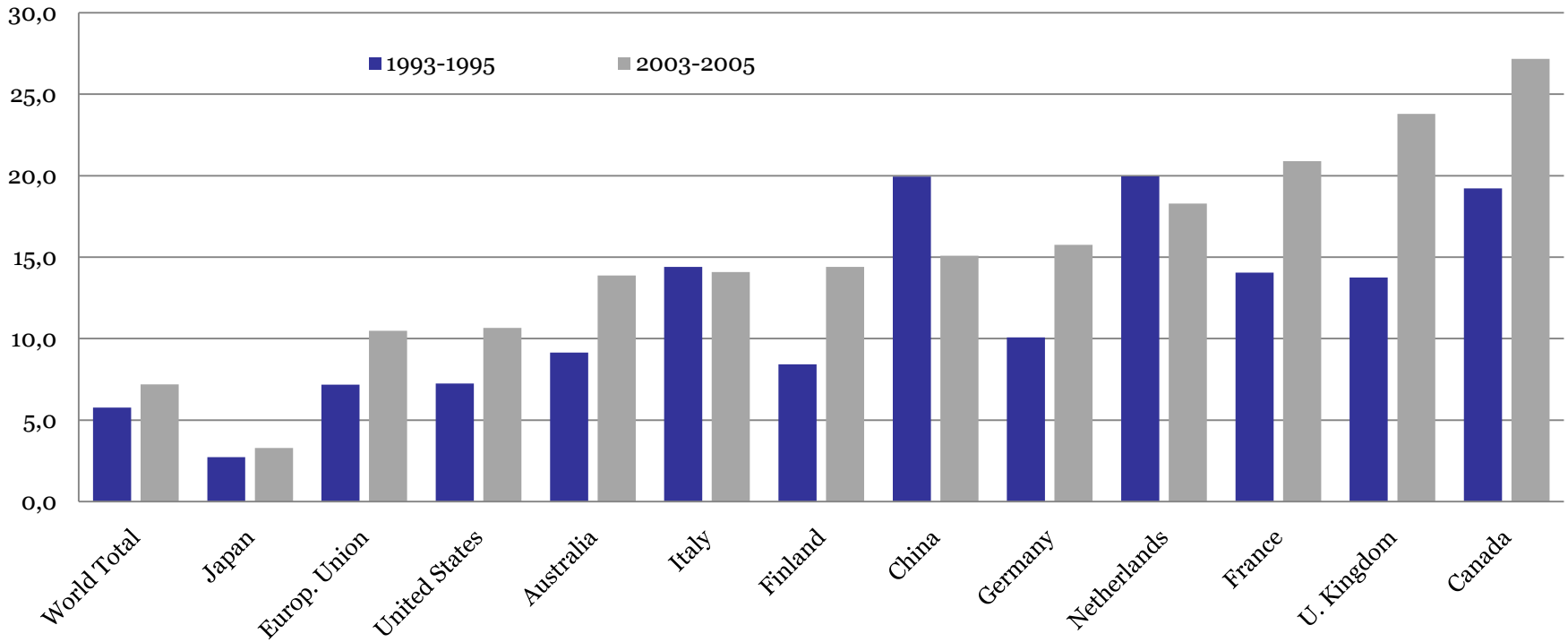
Between Businesses and PROs…

numbers of co-owned patents



Innovation increasingly happens across borders

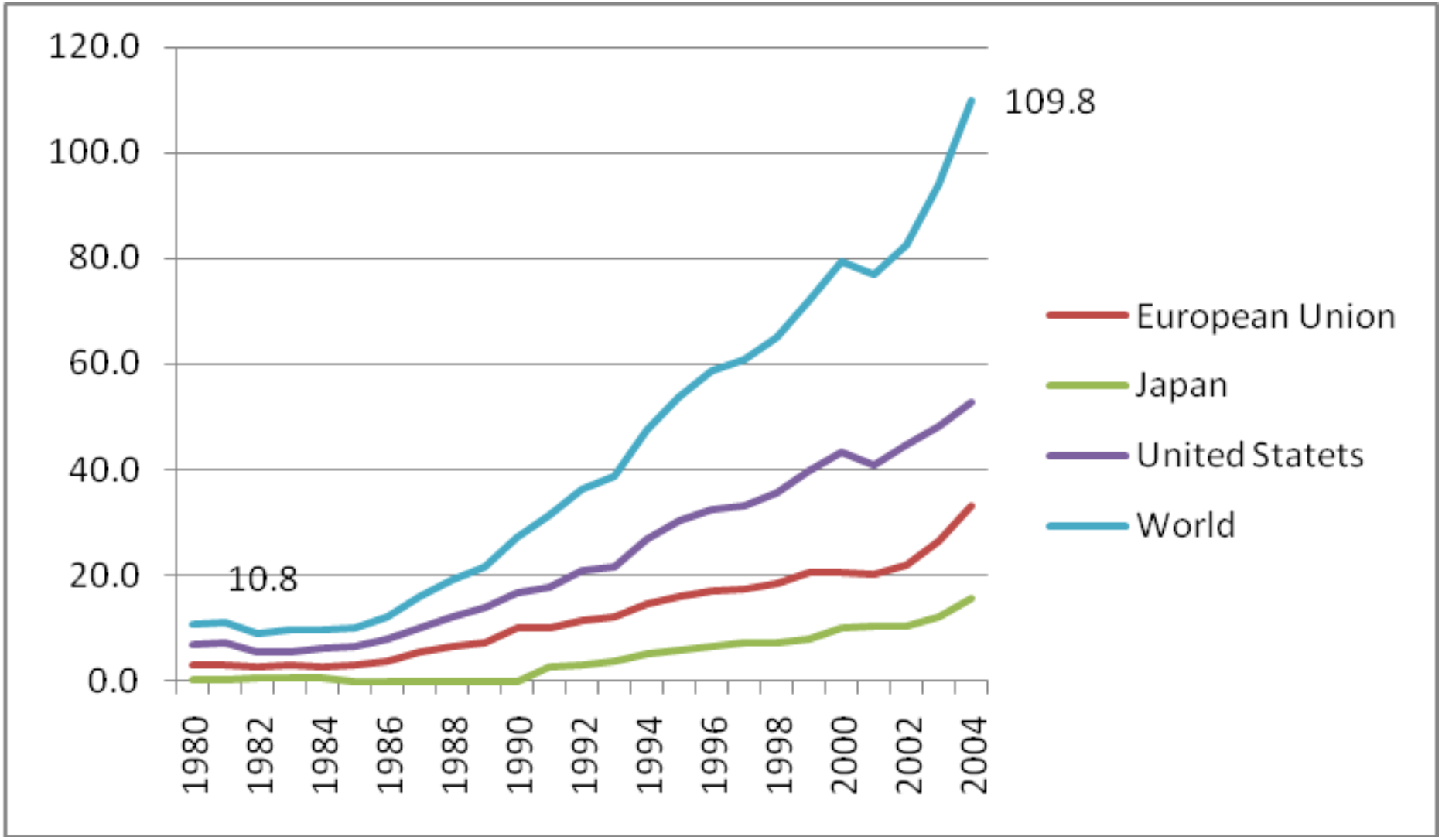
Share of patents with foreign co-inventors (%)



Source: OECD Patent Database.

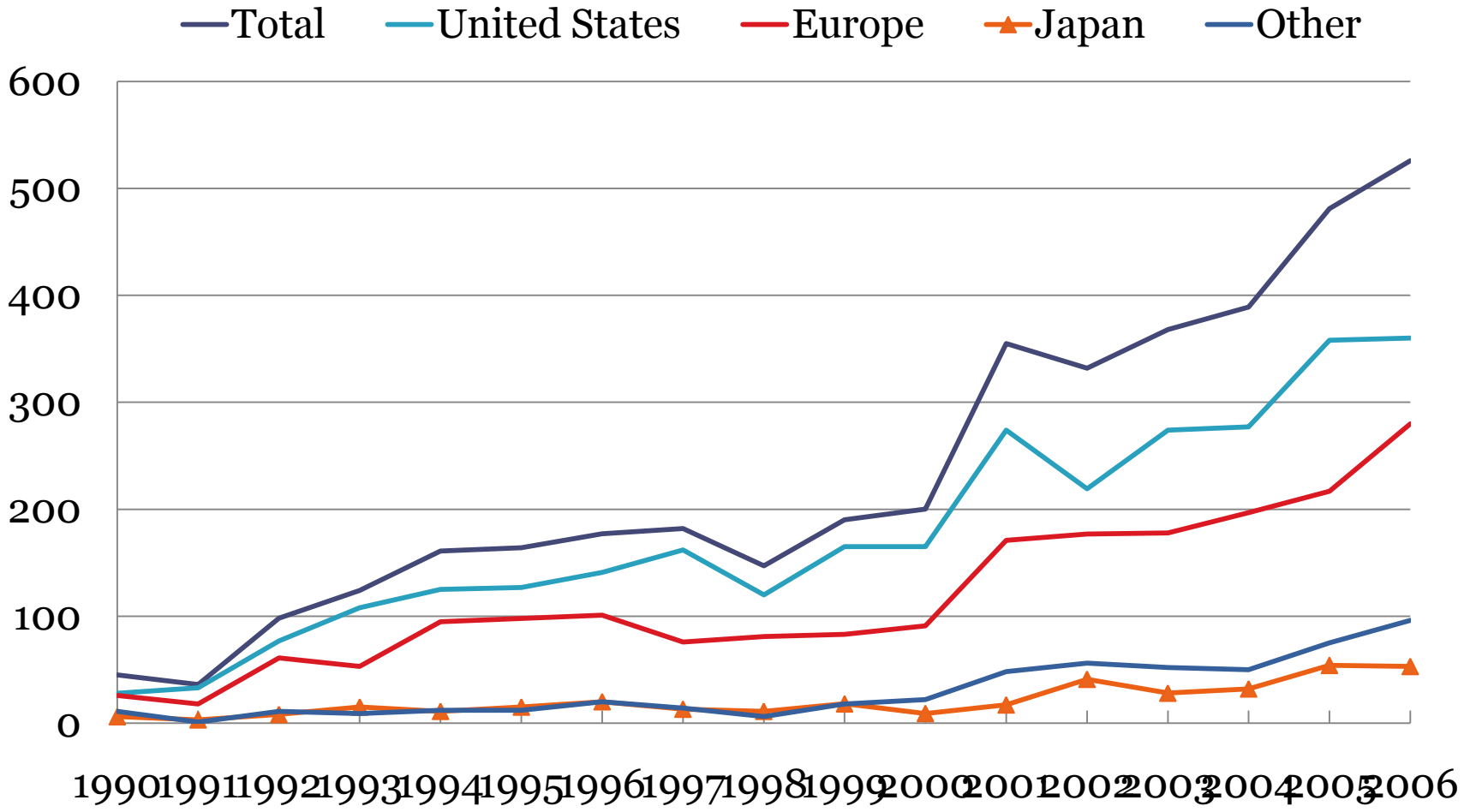
Receipts from international licensing

(billions of USD)



Source: OECD

Number of biotechnology alliances , 1990 to 2006



Note: Other: non-triad (alliance partners outside of the United States, Europe or Japan).

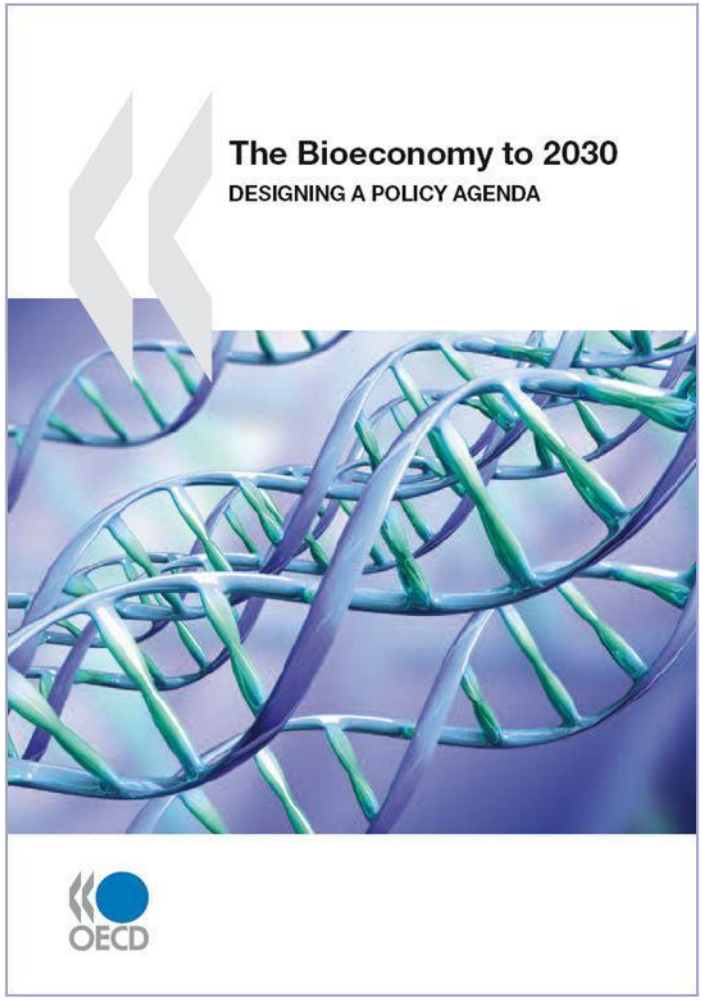
Source: OECD (2009), *OECD Biotechnology Statistics 2009*, OECD, Paris, available at: http://www.oecd.org/dataoecd/4/23/42833898.pdf

To Recap so far…..

1. **Science …Innovation…Growth**
2. **Science is globalising**
3. **Innovation is increasingly networked**
4. **Intellectual property provides the network glue**
5. **Businesses also are increasingly linked**
6. **Knowledge is increasingly tradable**

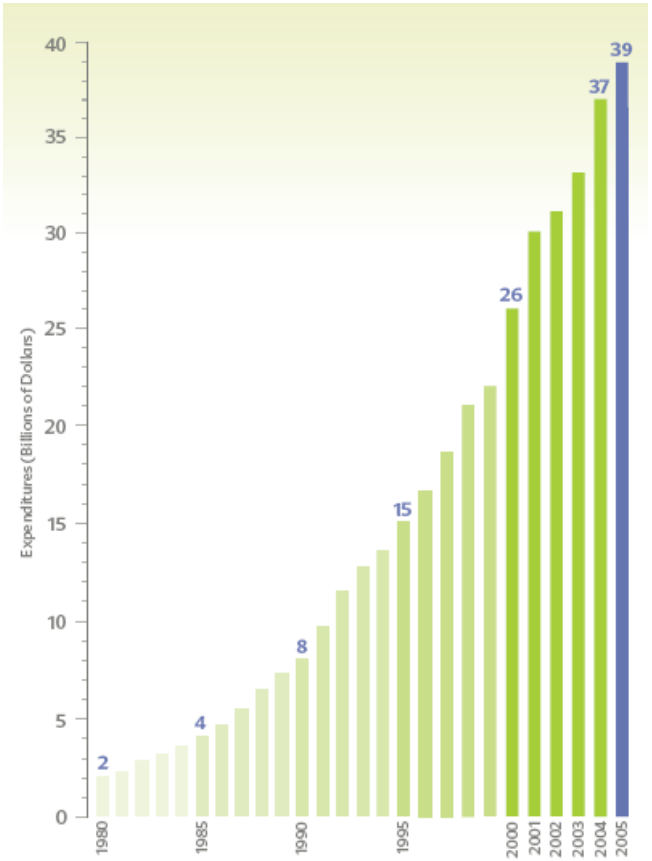
THE BIOECONOMY?

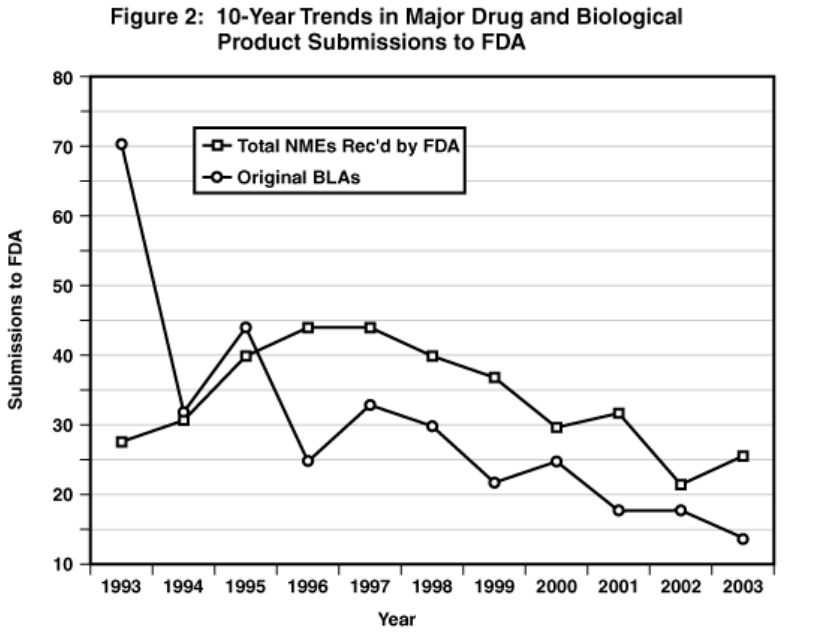
The Bioeconomy – harnessing the latent value in biological systems



- OECD review of Bioeconomy to 2030 (2009)

Global Context: Challenges & the Life Sciences





The figure shows the number of submissions of new molecular entities (NMEs) — drugs with a novel chemical structure — and the number of biologics license application (BLA) submissions to FDA over a 10-year period. Similar trends have been observed at regulatory agencies worldwide.

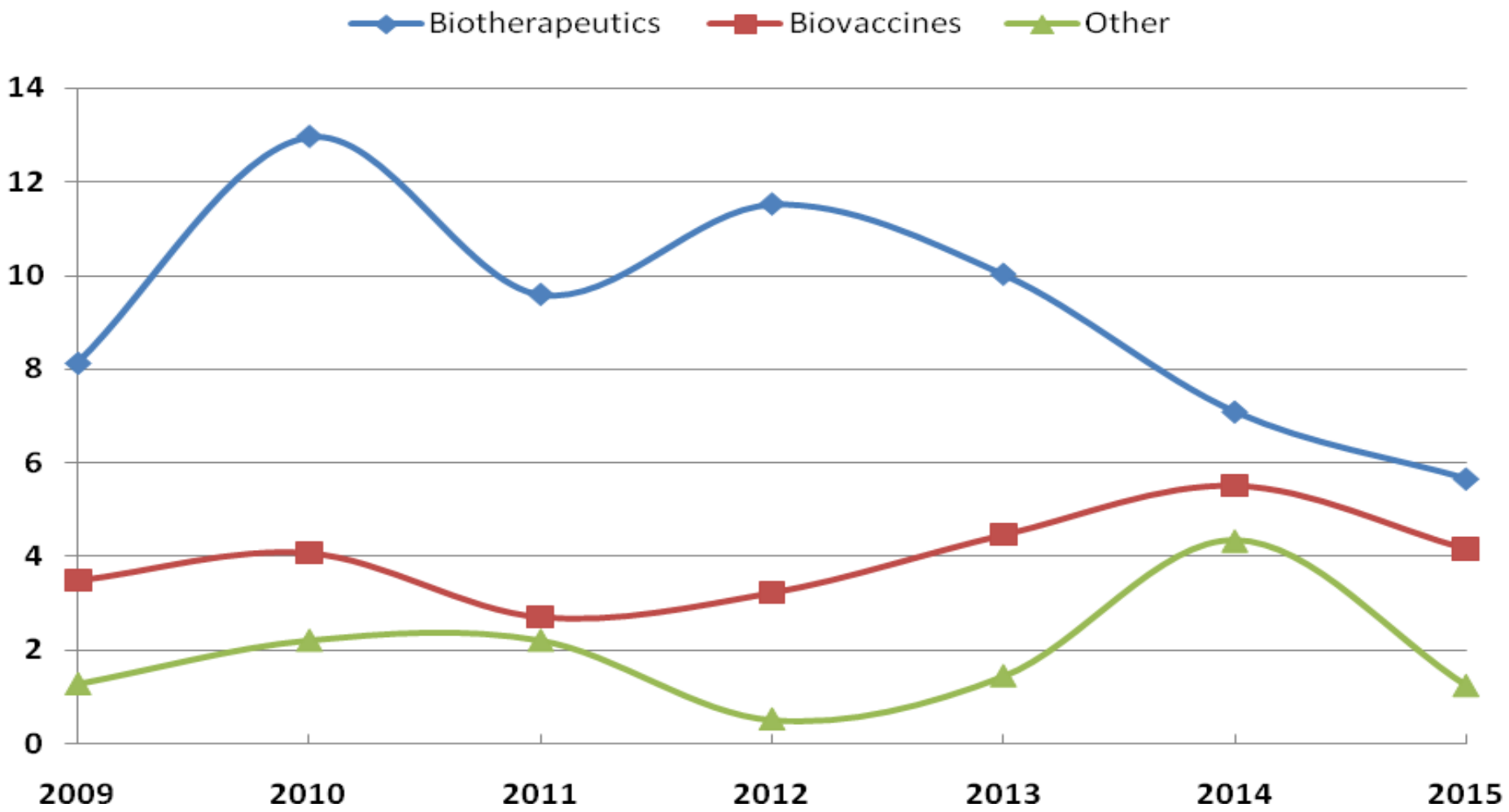
The Biotechnology Advantage

Haut Authorité de Santé evaluations of the therapeutic value of biopharmaceuticals and all other drugs (Jan 2001– December 2007)

	Biopharmaceuticals				All other drugs	
	Highest rating		All indications		All indications	
Evaluation Class	**N**	**%**	**N**	**%**	**N**	**%**
Major therapeutic progress	5	9.4%	9	8.7%	35	2.4%
Important improvement	13	24.5%	22	21.4%	52	3.5%
Moderate improvement	12	22.6%	18	17.5%	96	6.5%
Minor improvement	8	15.1%	9	8.7%	105	7.1%
No improvement (“me too”)	11	20.8%	40	38.8%	1139	77.2%
Judgement reserved	4	7.5%	5	4.9%	49	3.3%
Total	53	100%	103	100%	1,476	100%

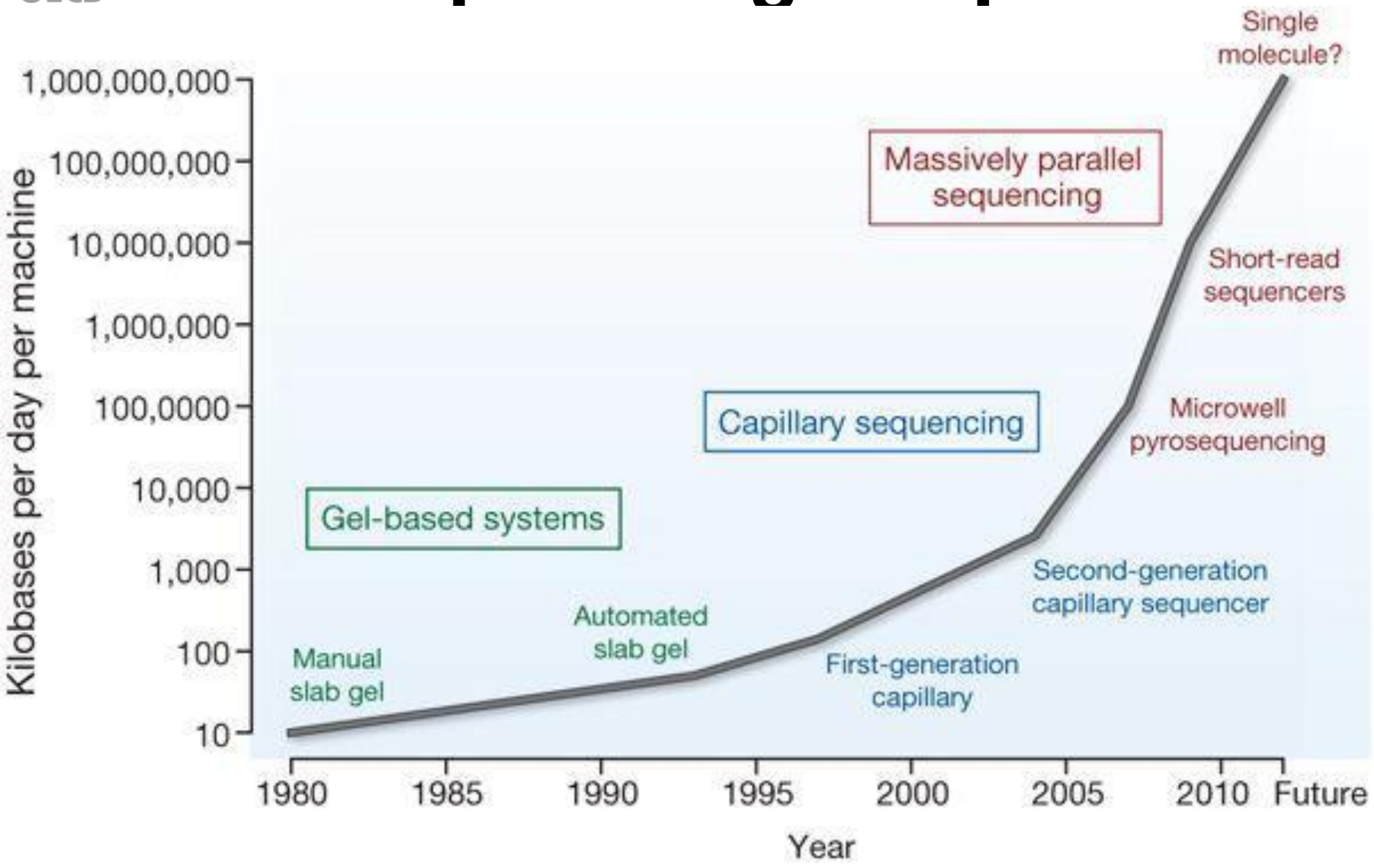
Source: OECD, based on HAS data.
Note(s): (1) Includes therapeutics but excludes diagnostics and vaccines.
(2) Analysis excludes generic drugs.

Bio-NME products expected to reach registration, by year



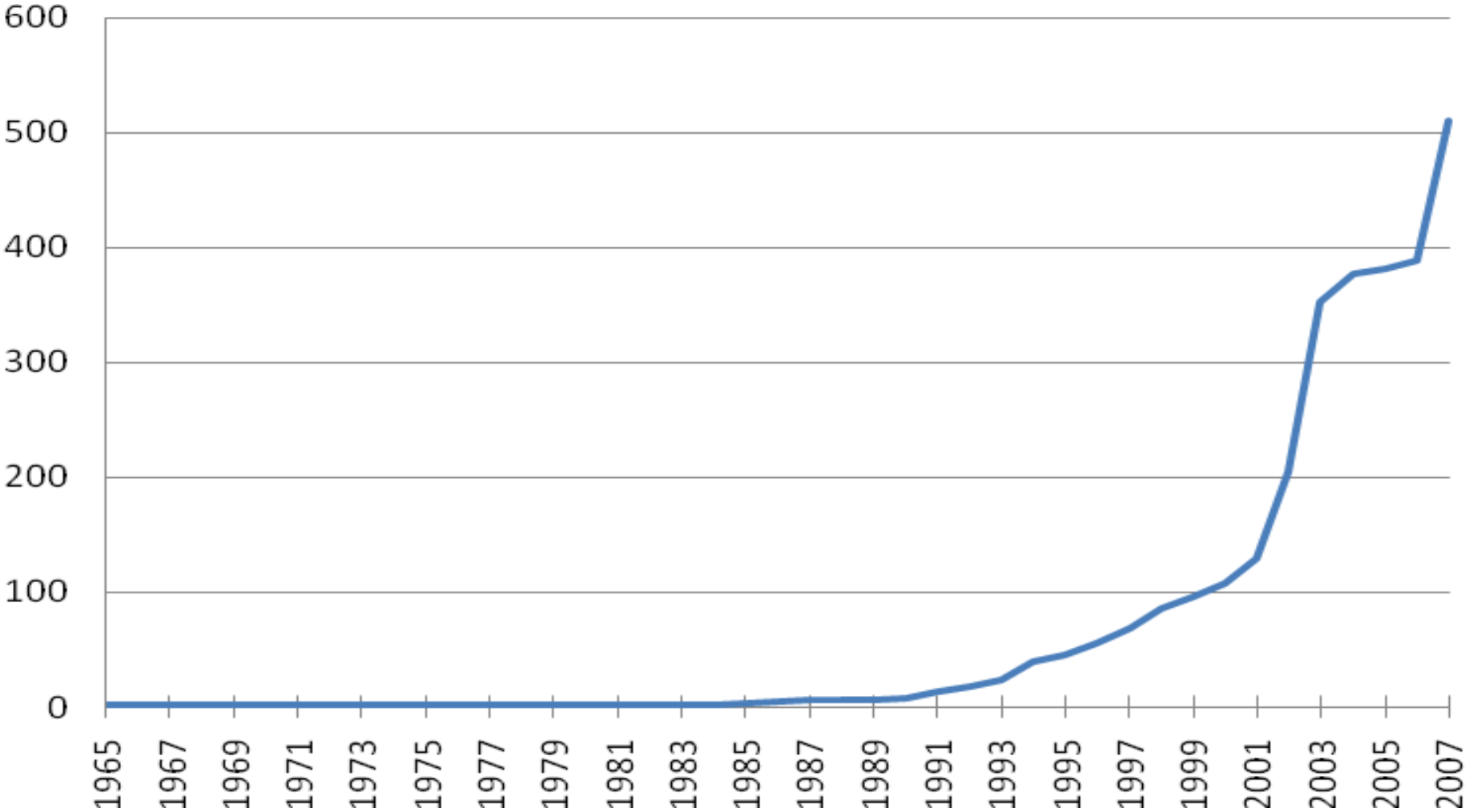
Source: OECD, based on data from PHARMAPREDICT.
Notes: (1) All results exclude formulations.

Sequencing Output



Source: MR Stratton *et al. Nature* **458**, 719-724 (2009)

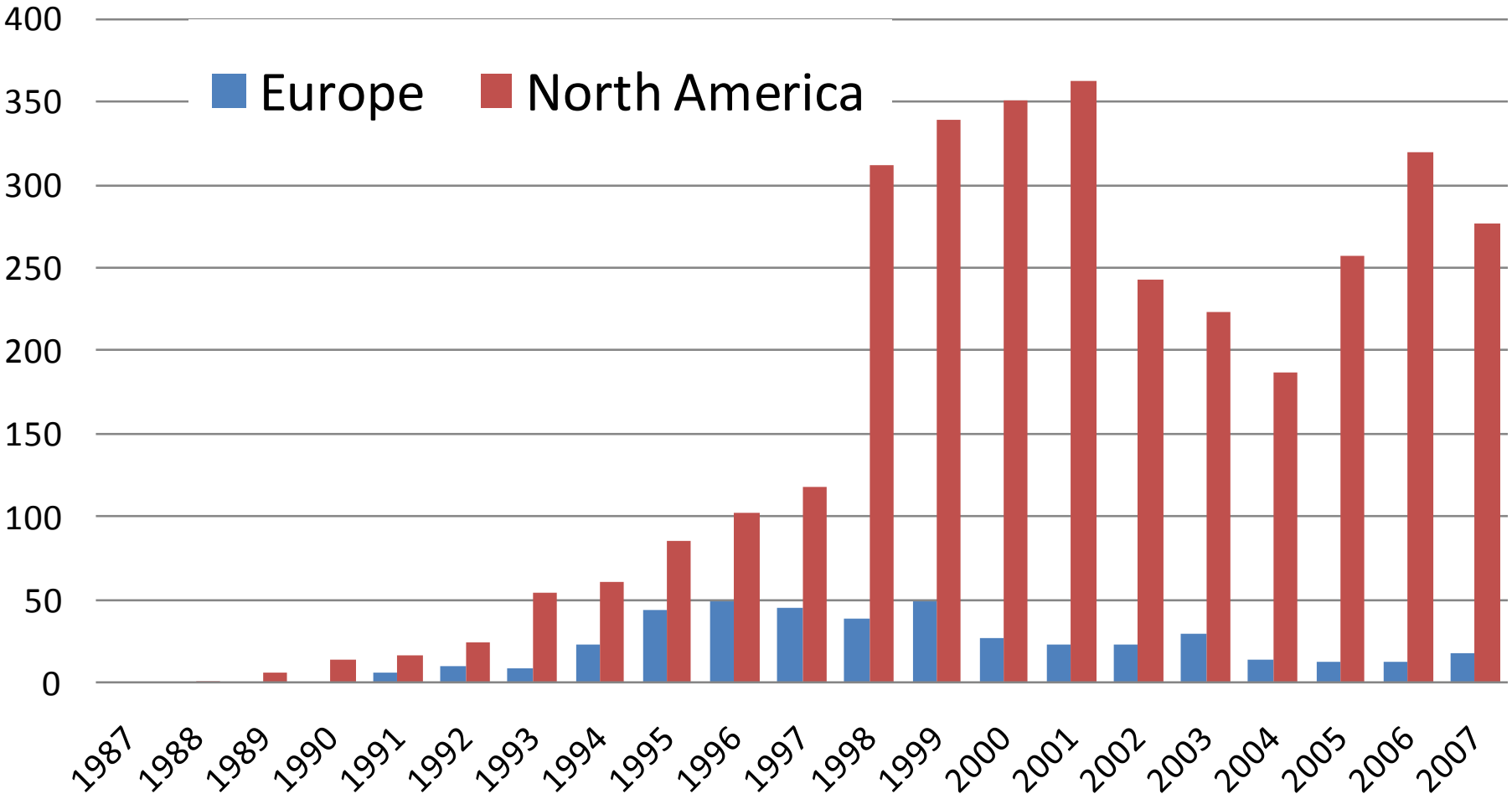
Number of publications identifying a drug-gene relationship (3yr running avg)



Source: OECD, based on PharmGKB database as of December 10, 2007.

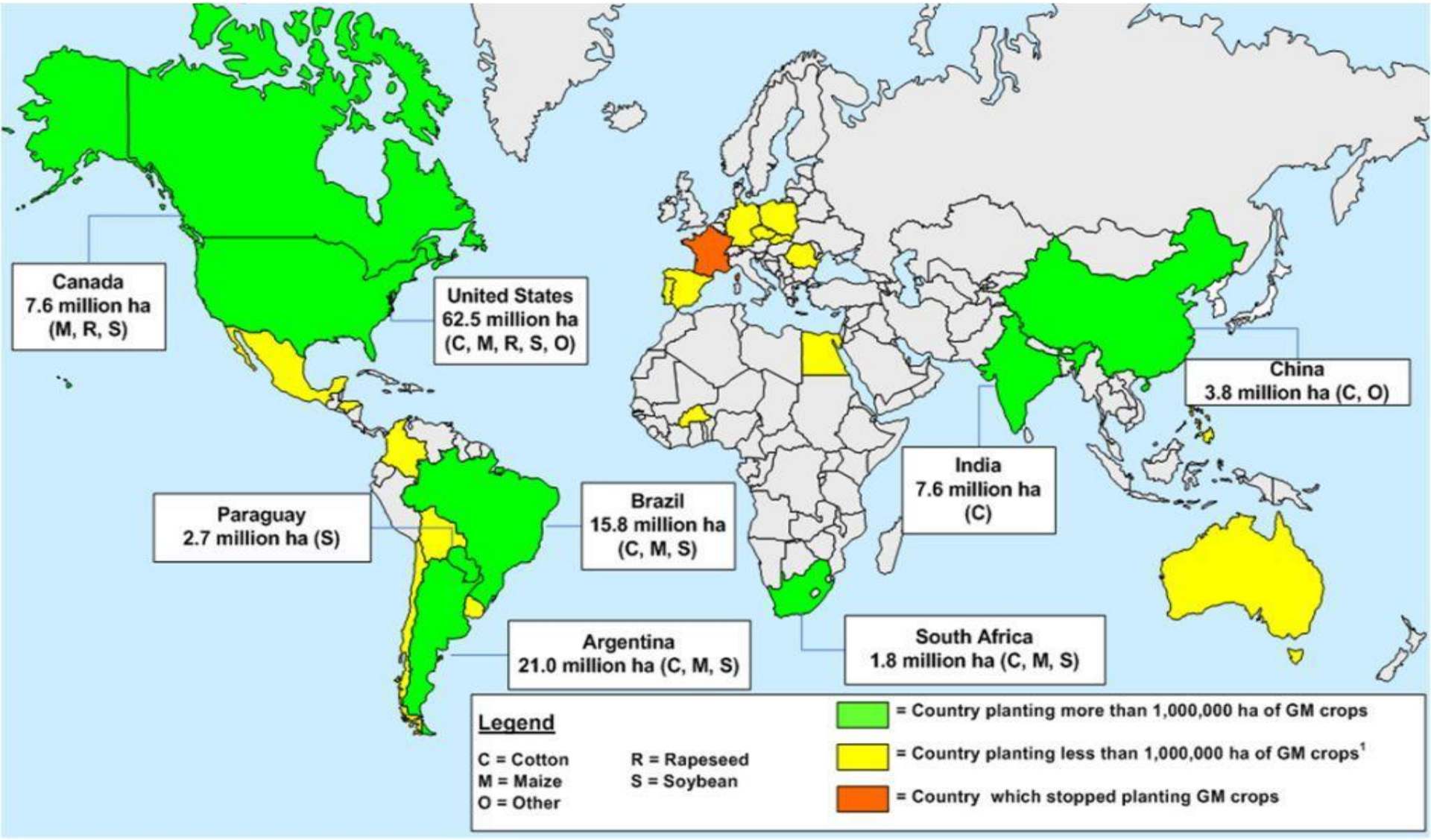
Regulation has had a major impact on public research

GM field trials by public research organisations in Europe and North America



Source: OECD, based on the UNU-MERIT field trial database.

GM crop plantings 2008



Source: Salim Sawaya, based on data from James (2008).

Notes: (1) Countries planting less than 1,000,000 hectares in 2007 include: Australia (200,000 ha), Bolivia (600,000 ha), Burkina Faso (<50,000), Chile (<50,000), Colombia (<50,000), Czech Republic (<50,000), Egypt (<50,000), Germany (<50,000), Honduras (<50,000), Mexico (100,000 ha), Philippines (400,000 ha), Poland (<50,000), Portugal (<50,000), Slovakia (<50,000), Spain (100,000 ha), Romania (<50,000), and Uruguay (700,000 ha).

Concentration and small market crops

Share of GM field trials by Firm type: 2005 - 2008

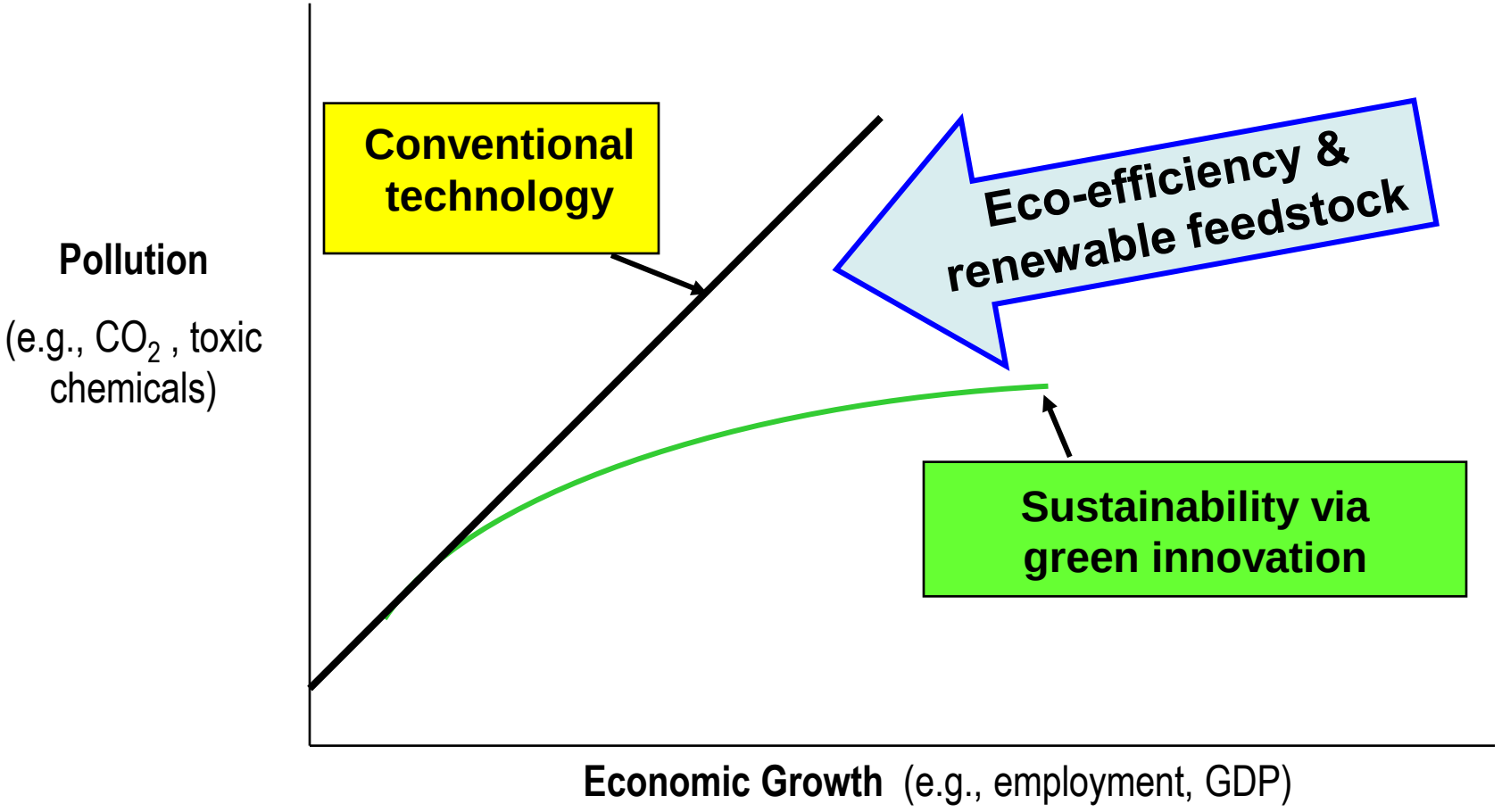
	Large market crops	Small market crops
Large firms	**82.1%**	**23.6%**
SMEs	**17.9%**	**76.4%**
	100.0%	**100.0%**
Number of GM trials	***3 870***	***229***

By 2030, emerging econmies will become the world's bread basket

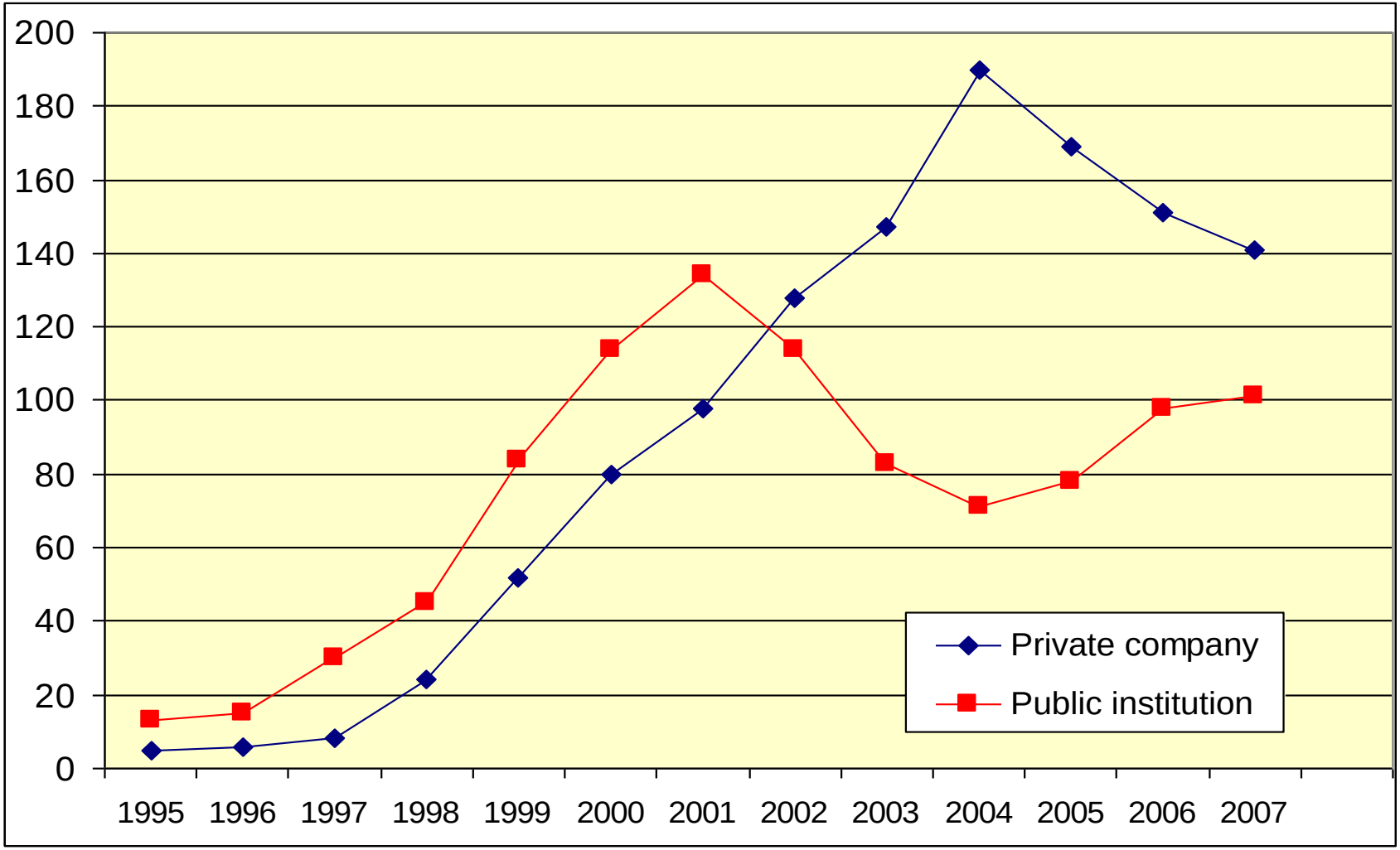
- Strong evidence that European agbio R&D has slowed down significantly
- Developing country activity has increased
  - Of the 8 countries planting more than a million ha of GM crops, 6 are non-OECD countries
  - Over 550 biotech field trials have occurred in 47 non-OECD countries
  - Major agricultural biotechnology programmes

Country	Agricultural biotechnology R&D spending (in USD PPP)
Brazil	**350 million per year over next 10 years**
China	**120 million per year (24 million going to GM rice)**
India	**100 million per year**

Green Innovation



Biofuels: Number of GM field trials in OECD of potential 2nd generation biofuel crops: trees and grasses



Note: Three year running average. Public includes private non-profit

Bioethanol from wood, grasses etc.

- Using 25% of NZ landbase would be needed to produce 100% of NZ's liquid fuel needs (softwood plantations).
- 1% of NZ liquid fuel needs could be met from current wood wastes
  - Trevor Stuthridge, SCION NZ

Algal biofuels

Algal biodiesel could provide 100% of **global** demand using 0.9% of the Earth's surface at 33% of predicted maximum efficiency.

Best conditions are desert locations near the ocean – W Australia, Mexico, Chile, NW Africa, etc.

Problem: scaling up, contamination, strain selection

Where is the money?

	Potential **OECD market (billion USD GVA) in 2005**	**Share of total *business* biotech R&D in 2003**
Health (pharma manufacturing & medical devices)	350	87%
Primary production (ag, forestry, etc)	680	4%
Industry	~ 1,100	2%

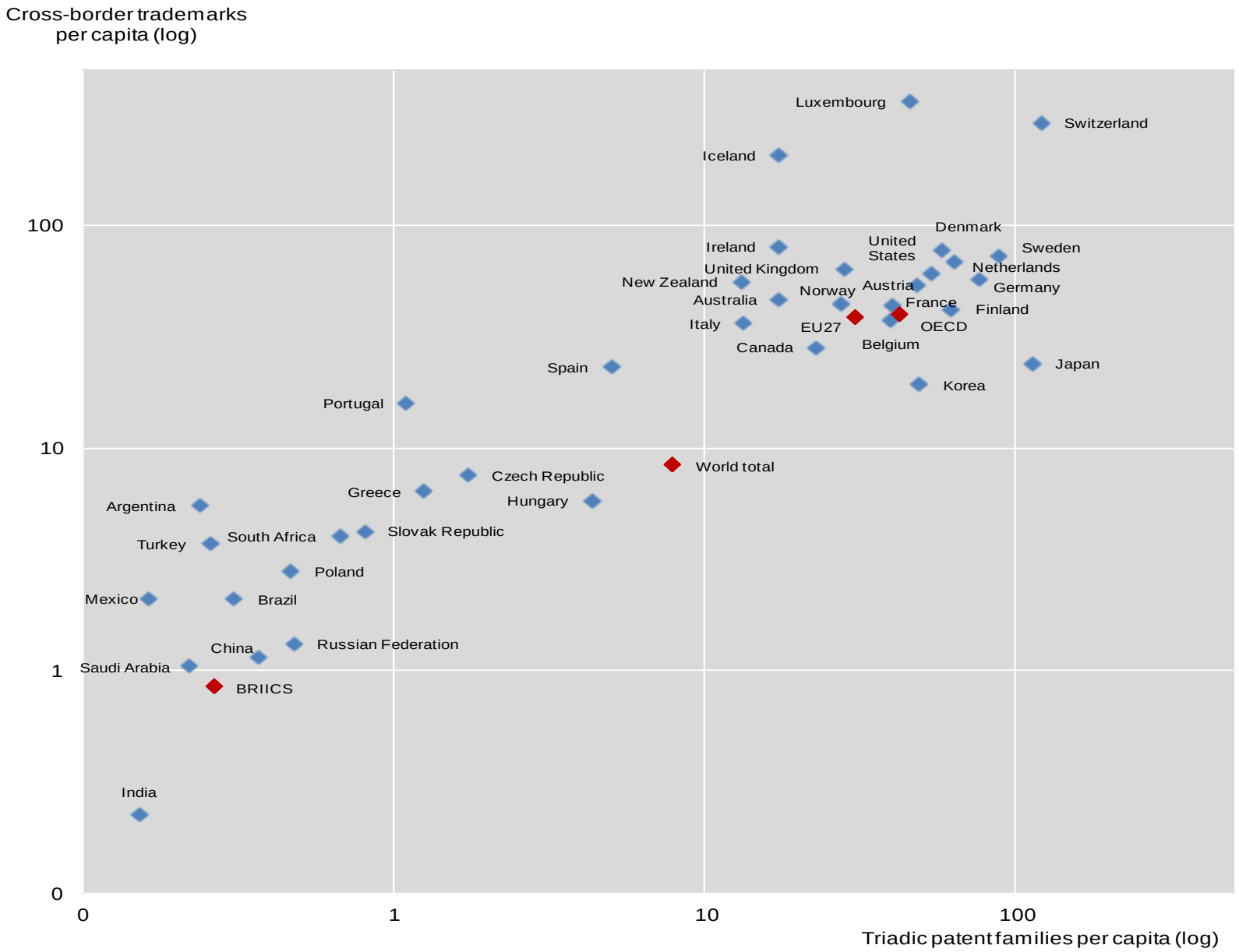
Source: OECD & EUKLEMS. GVA = Gross Value Added

Where does this get us…

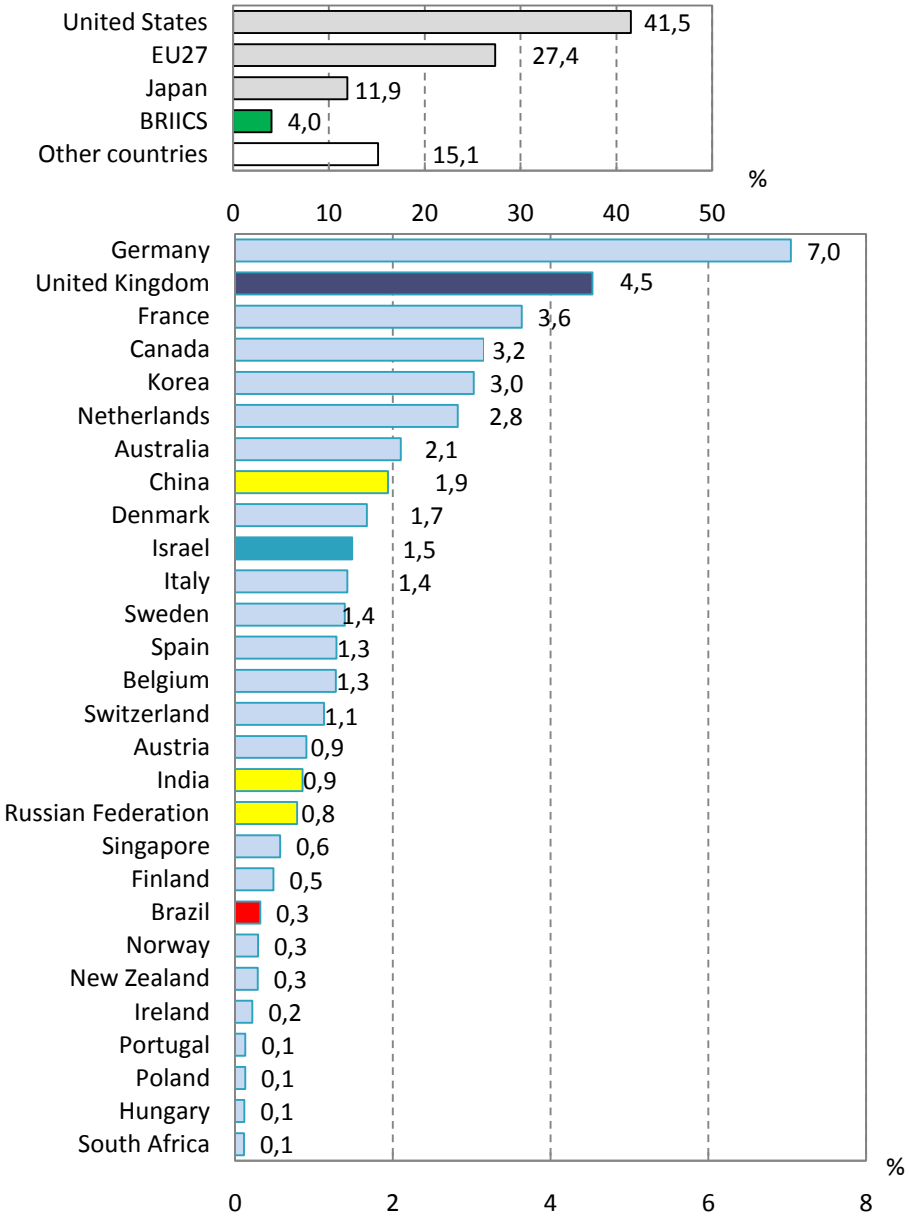
1. **Revealed biotech advantage in health – but networking and access to materials and information essential**
2. **Food security needs biotech – but Europe is on the margins for the foreseeable future. Understanding diversity will drive progress.**
3. **Biotech can drive decoupling and green growth but rapid ramp up of investment is critical.**

SO, WHO ARE THE PLAYERS?

Technological and non-technological innovation unevenly distributed



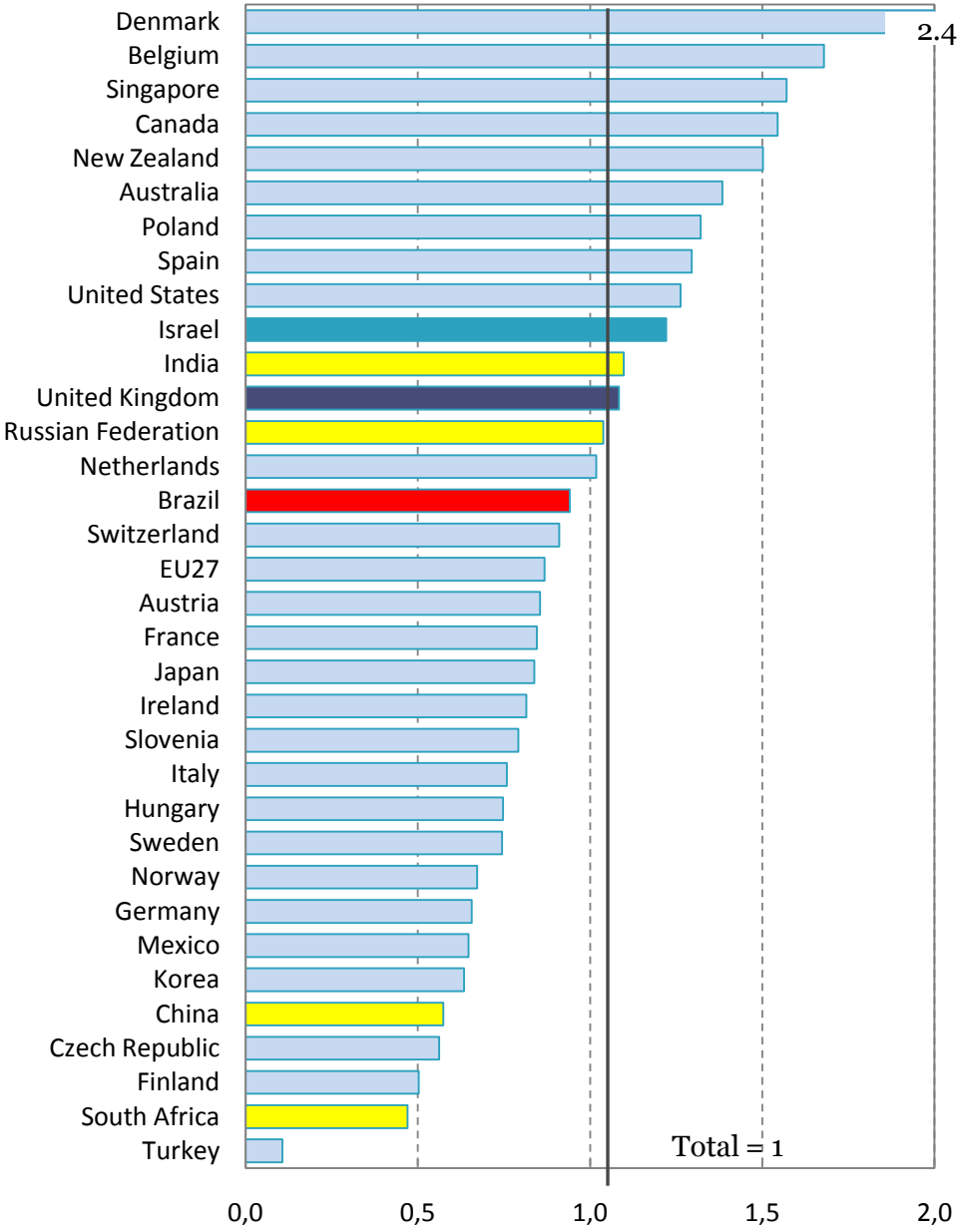
Share of countries in biotechnology PCT patent applications, 2006



Notes: Patent counts are based on the priority date, the inventor's country of residence and use fractional counts on PCT filings at international phase (EPO designations). BRIICS refers to Brazil, China, India, Indonesia, Russian Federation and South Africa. Regional allocation of PCT filings is based on the inventor's address, according to OECD's territorial grids (see Maraut et al., 2008).

Source: OECD (2009), *OECD Biotechnology Statistics 2009*, OECD, Paris, available at: http://www.oecd.org/dataoecd/4/23/42833898.pdf

Revealed technological advantage in biotechnology, 2004-06



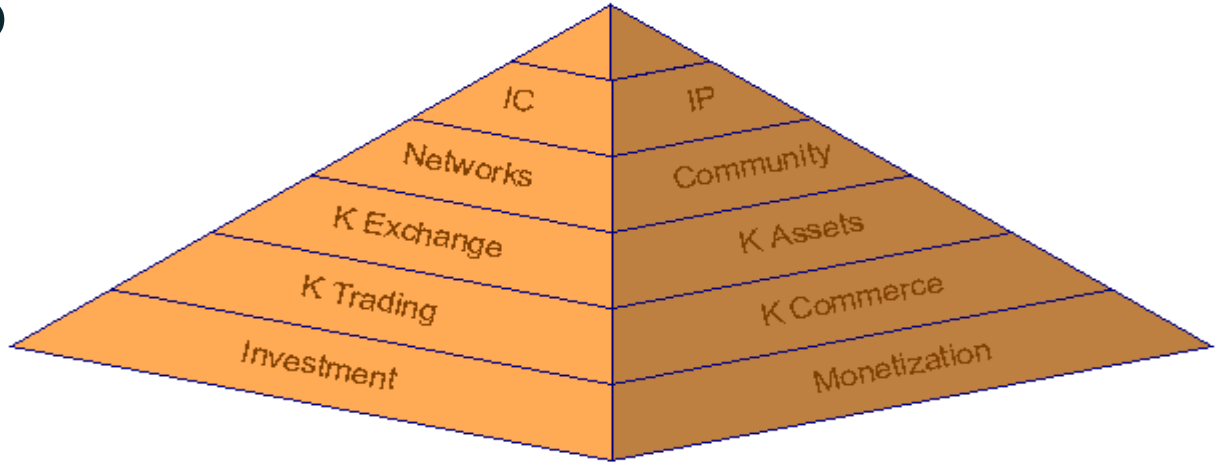
Note: Patent counts are based on the priority date, the inventor's country of residence and use fractional counts on PCT filings at international phase (EPO designations). BRIICS refers to Brazil, China, India, Indonesia, Russian Federation and South Africa.

1. Share of PCT biotechnology patent applications out of the total PCT patent applications for each country relative to the share of all PCT biotechnology patent applications out of the total number of all PCT applications. Only countries with more than 250 PCT patent applications between 2004 and 2006 are presented in the chart.

Source: OECD (2009), *OECD Biotechnology Statistics 2009*, OECD, Paris, available at: http://www.oecd.org/dataoecd/4/23/42833898.pdf

Developing collaborative knowledge networks & markets (KNMs)…

- KNMs encompass a number of different mechanisms, or marketplaces, where buyers and sellers exchange a variety of knowledge intensive goods and services.
- E.g.: IP exchanges, patent pools, netwo
- Brokering
- services



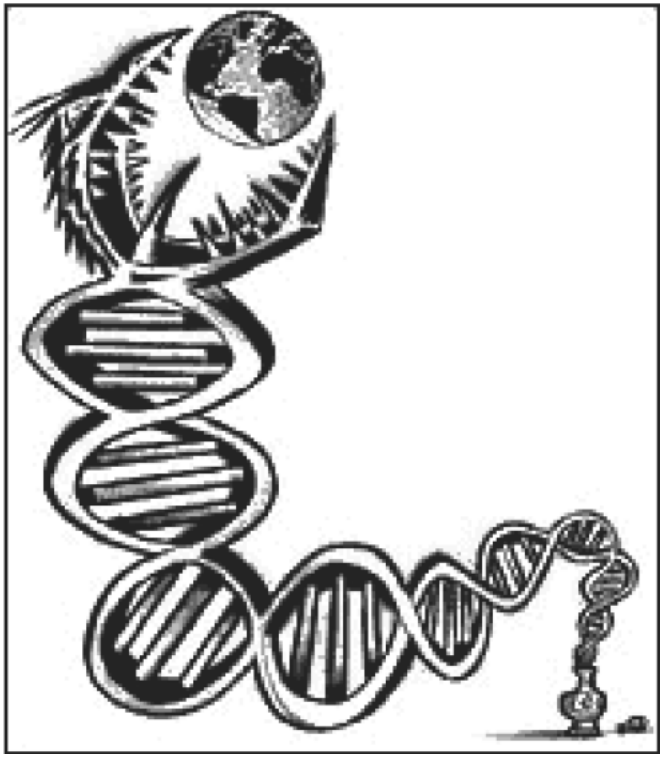
Governance Dimensions

I	Outreach, Agenda and Priority Setting	- models to ensure optimal outreach of STI networking - decisions on agendas and priority setting - involvement of stakeholders (governments, academia, private sector, civil society)
II	Institutional and Access Arrangements	- institutional arrangements - treatment, access and utilisation of knowledge generated through multilateral STI co-operation
III	Funding and Spending Arrangements	- contribution of stakeholders to the budget, amounts, trends -traditional vs. non-traditional funding schemes, public and private sources - dynamism and responsiveness of funding
IV	Capacity Building and Technology Transfer	- promising models to strengthen capacities in emerging economies and developing countries - role of FDI - transfer of equipment and infrastructure
V	Putting Research into Practice	- mechanisms to deliver outcome of multilateral STI co-operation into practical use - balance of supply and demand, products not only accessible but also affordable and actually used?

LESSONS FOR BRCS

(AND POLICY MAKERS!)

“The 1918 flu genome: Recipe for Destruction”



**“This is extremely foolish. The genome is essentially
the design of a weapon of mass destruction.”**

New York Times **Op-Ed**
October 17, 2005
Ray Kurzweil and Bill Joy

Key Lessons

1. The bioeconomy is a reality – **biological resources are its foundation**
2. **Science and knowledge is globalised** like never before
3. New **networks and markets for knowledge** are emerging – these complex systems are well **beyond one-to-one deals**
4. Knowledge **brokering services are essential** to facilitate this transition
5. And a new **model of governance** for cooperation, access and exchange is critical.

A GBRCN?

1. Quality matters – **but inclusiveness and networking** matter perhaps even more.
2. You cant get value of what you don't own**– secure the IP.**
3. But to get value you need to **trade – fast, often and pragmatically.**
4. **A GBRCN** need to bring **concentration** to disperse resources and help **broker value.**
5. **And it needs to happen now.**

Contacts: www.oecd.org/sti/innovation

www.oecd.org/biotechnology

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