Policy needs in
S&T and innovation indicators
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Content of the presentation

- The European indicator debates :
  - search for the head-line indicator;
  - Monitoring the Innovation Union (IUS)
  - Monitoring the ERA
- The OECD debates : manuals and policy debates
  - The blue sky workshop
  - The Innovation Strategy and the measurement agenda
  - Today
- Concluding remarks

Dramatic changes over the last 20 years

- Systems view widely adopted :

    (All actors – all activities – linkages – outcome and impacts)

- Changing landscape for innovation :

    (new players – globalisation – new business strategies – knowledge intensity increased – wider importance of intangibles)

- Improved analytical possibilities :

    (micro-data linkages – new databases and surveys – better exploitation of existing databases (patents and bibliometrics) – administrative databases

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Dramatic changes - 2

- Search for new knowledge on :

    activities (public sector innovation, skills…), new actors (regions, networks), new technologies, etc;

- Policies :

    need for better measurement of wider innovation policies

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The European debates

(and its influence on the need for STI indicators)

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From Barcelona to the EU-2020 strategy

Ready for 2020?

- EU-2020 strategy : 3% target and a new target/headline indicator

- The innovation Union and the monitoring system

- ERA and indicators to monitor its progress

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EU-2020 strategy

- Research : 3%-target has been confirmed

- Context has broadened : innovation and new challenges added

- Search for head-line indicator on innovation to complement the 3%-target

  → High-growth innovative companies

  →Innovation expenditures or similar target (to the 3% input target) was not considered trustworthy

  →Is it feasible ?

Monitor the "Innovation Union"

FIGURE 1: EU MEMBER STATES' INNOVATION PERFORMANCE
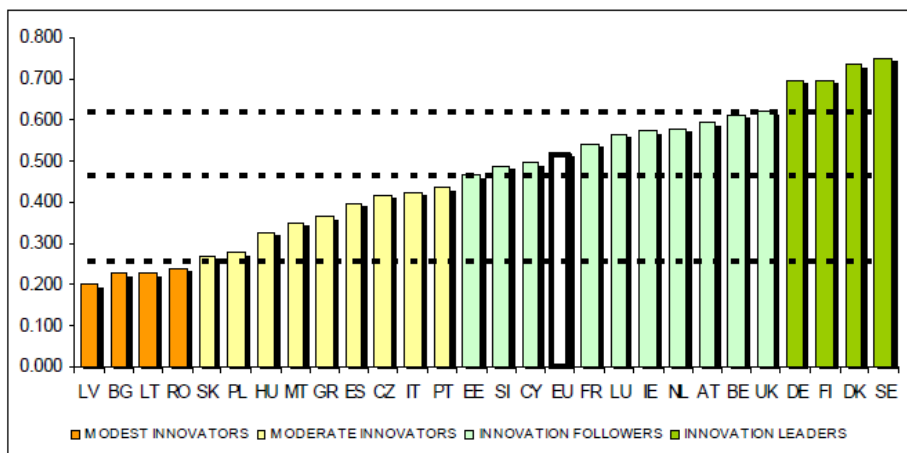
Note: Average performance is measured using a composite indicator building on data for 24 indicators going from a lowest possible performance of 0 to a maximum possible performance of 1. Average performance in 2010 reflects performance in 2008/2009 due to a lag in data availability.

The performance of Innovation leaders is 20% or more above that of the EU27; of Innovation followers it is less than 20% above but more than 10% below that of the EU27; of Moderate innovators it is less than 10% below but more than 50% below that of the EU27; and for Modest innovators it is below 50% that of the EU27.

The indicators used

TABLE 1: INNOVATION UNION SCOREBOARD INDICATORS

Main type / innovation dimension / indicator	Data source	Reference year(s)
ENABLERS		
Human resources		
1.1.1 New doctorate graduates (ISCED 6) per 1000 population aged 25-34	Eurostat	2004 – 2008
1.1.2 Percentage population aged 30-34 having completed tertiary education	Eurostat	2005 – 2009
1.1.3 Percentage youth aged 20-24 having attained at least upper secondary level education	Eurostat	2005 – 2009
Open, excellent and attractive research systems		
1.2.1 International scientific co-publications per million population	Science Metrix / Scopus	2004 – 2008
1.2.2 Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	Science Metrix / Scopus	2003 – 2007
1.2.3 Non-EU doctorate students[3] as a % of all doctorate students	Eurostat	2003 – 2007

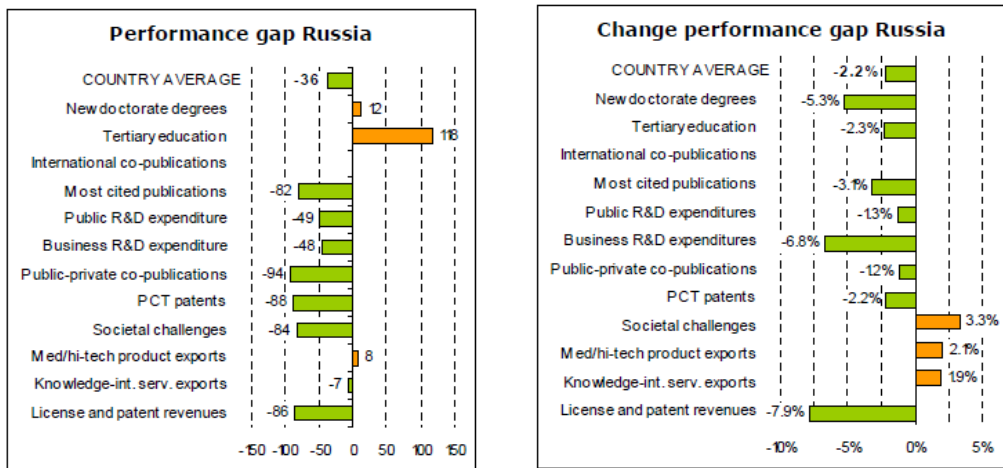|	Data source	Reference year(s)
Finance and support		
1.3.1 Public R&D expenditures as % of GDP	Eurostat	2005 - 2009
1.3.2 Venture capital (early stage, expansion and replacement) as % of GDP	Eurostat	2005 - 2009
FIRM ACTIVITIES		
Firm investments		
2.1.1 Business R&D expenditures as % of GDP	Eurostat	2005 - 2009
2.1.2 Non-R&D innovation expenditures as % of turnover	Eurostat	2004, 2006, 2008
Linkages & entrepreneurship		
2.2.1 SMEs innovating in-house as % of SMEs	Eurostat	2004, 2006, 2008
2.2.2 Innovative SMEs collaborating with others as % of SMEs	Eurostat	2004, 2006, 2008
2.2.3 Public-private co-publications per million population	CWTS / Thomson Reuters	2004 – 2008
Intellectual assets		
2.3.1 PCT patents applications per billion GDP (in PPS€)	Eurostat	2003 – 2007
2.3.2 PCT patent applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	OECD / Eurostat	2003 – 2007
2.3.3 Community trademarks per billion GDP (in PPS€)	OHIM / Eurostat	2005 – 2009
2.3.4 Community designs per billion GDP (in PPS€)	OHIM / Eurostat	2005 – 2009
OUTPUTS		
Innovators		
3.1.1 SMEs introducing product or process innovations as % of SMEs	Eurostat	2004, 2006, 2008
3.1.2 SMEs introducing marketing or organisational innovations as % of SMEs	Eurostat	2004, 2006, 2008
3.1.3 High-growth innovative firms	N/A	N/A
Economic effects		
3.2.1 Employment in knowledge-intensive activities (manufacturing and services) as % of total employment	Eurostat	2008, 2009
3.2.2 Medium and high-tech product exports as % total product exports	UN / Eurostat	2005 – 2009
3.2.3 Knowledge-intensive services exports as % total service exports	UN / Eurostat	2004 – 2008
3.2.4 Sales of new to market and new to firm innovations as % of turnover	Eurostat	2004 – 2008
3.2.5 License and patent revenues from abroad as % of GDP	Eurostat	2005 - 2009

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Benchmarking

FIGURE 15: EU27-RUSSIA COMPARISON

Performance gap Russia

Indicator	Value
COUNTRY AVERAGE	-36
New doctorate degrees	12
Tertiary education	118
International co-publications	
Most cited publications	-82
Public R&D expenditure	-49
Business R&D expenditure	-48
Public-private co-publications	-94
PCT patents	-88
Societal challenges	-84
Med/hi-tech product exports	8
Knowledge-int. serv. exports	-7
License and patent revenues	-86

Scale: -150 -100 -50 0 50 100 150

Change performance gap Russia

Indicator	Value
COUNTRY AVERAGE	-2.2%
New doctorate degrees	-5.3%
Tertiary education	-2.3%
International co-publications	
Most cited publications	-3.1%
Public R&D expenditures	-13%
Business R&D expenditures	-6.8%
Public-private co-publications	-12%
PCT patents	-2.2%
Societal challenges	3.3%
Med/hi-tech product exports	2.1%
Knowledge-int. serv. exports	19%
License and patent revenues	-7.9%

Scale: -10% -5% 0% 5%

No data for International co-publications for Russia. **Left:** The indicators highlighted in orange reflect a performance gap for the EU27; those highlighted in green reflect a performance lead for the EU27. **Right:** Relative growth compared to that of the EU27. Orange coloured bars sow that the country is growing faster than the EU27; green coloured bars show that the country is growing slower than the EU27.

Other issues in Innovation Union (role for self-assessment tool)

- Governance and strategies;

- Investments in societal challenges;

- General framework (single market, fragmentation, "smart" specialisation)

- Broad concept of innovation (non-technological, services, design, etc.);

- Policies (public procurement, innovation)

- Revisit the university rankings; Etc.

3rd challenge : measure progress in building ERA ?

- ERA : European Research area = about what countries are doing together (5th freedom)
  - Money flows (institutions, joint programming,..)
  - Ideas (knowledge transfers)
  - Researchers
- But most statistics are national → ERA is about multinational activities → additional challenge
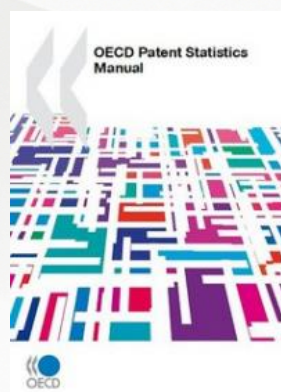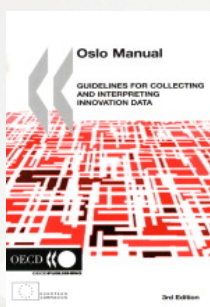
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Concrete : the ERA framework

- joint programming of research (GBAORD)
- mobility of researchers (CDH)
- international knowledge transfer ,
- international research infrastructure,
- international collaboration (with non-EU countries),
- universities

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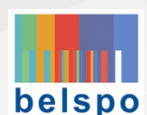
Some debates inside the OECD

Long tradition in policy debates

- Series of manuals on (Research, Patents, Innovation, Human resources, Measurement of specific technologies,…)

- Continuous reflection in committees, workshops…

Blue sky workshop

- Ottawa 2006 : policy makers, statisticians, and analysts debate the need for new STI-indicators

- Main messages :

  - Research in innovation is fragmented : the entire story needs to be understood

  - From input to output and impact

  - Importance of micro-data linking

  - Ensure the policy relevance of STI-indicators and analyses

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MEASURING INNOVATION: A NEW PERSPECTIVE

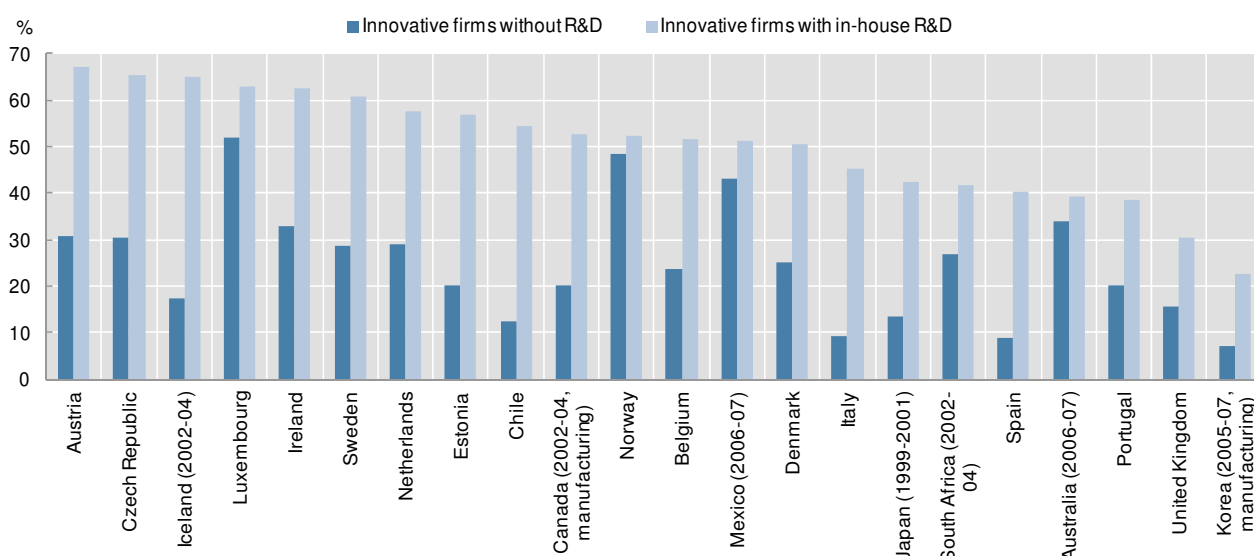Part of the OECD innovation strategy debates (2010)

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MEASUREMENT AGENDA FOR THE FUTURE

❑ 1 - Improve the measurement of broader innovation and its link to macroeconomic performance (intangibles, …)

❑ 2 - Invest in a comprehensive, high-quality data infrastructure for measuring impacts

❑ 3 - Recognise the role, and improve the measurement of, innovation in the public sector

❑ 4 - Invest in new statistical methods and interdisciplinary approaches to data collection (new tech, skills, networks…)

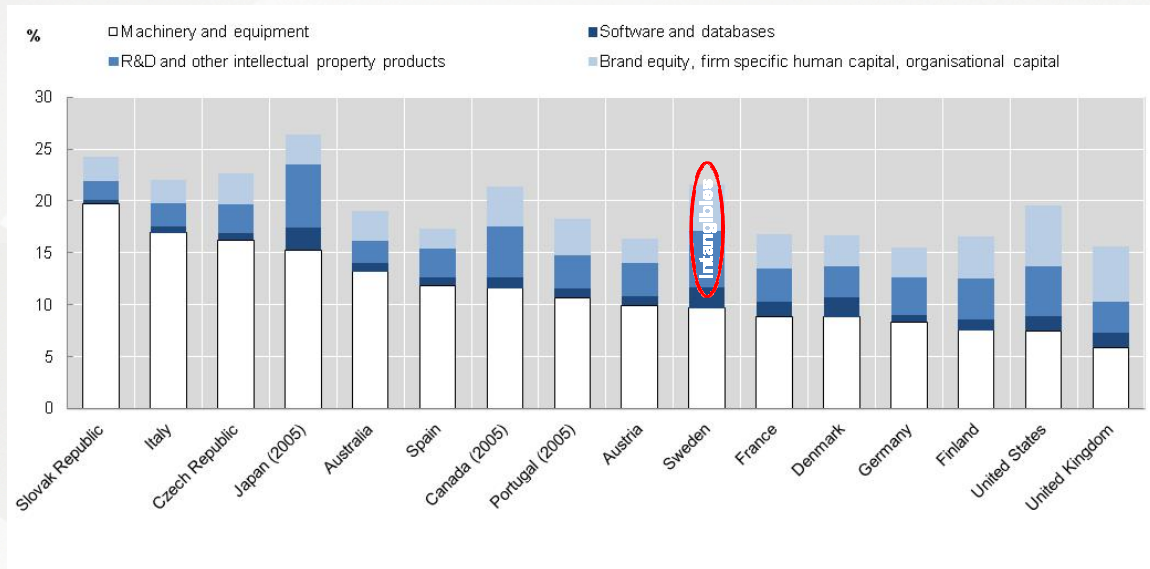❑ 5 - Promote measurement of innovation for social goals and of social impacts of innovation

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Better understanding non R&D-innovation

New-to-market product innovators, 2004-06

As a percentage of innovative firms by R&D status

■ Innovative firms without R&D   ■ Innovative firms with in-house R&D

Source: OECD (2010), *Measuring Innovation: A New Perspective*, OECD, Paris based on OECD, Innovation microdata project.

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Better understanding innovation related expenditures (intangibles)

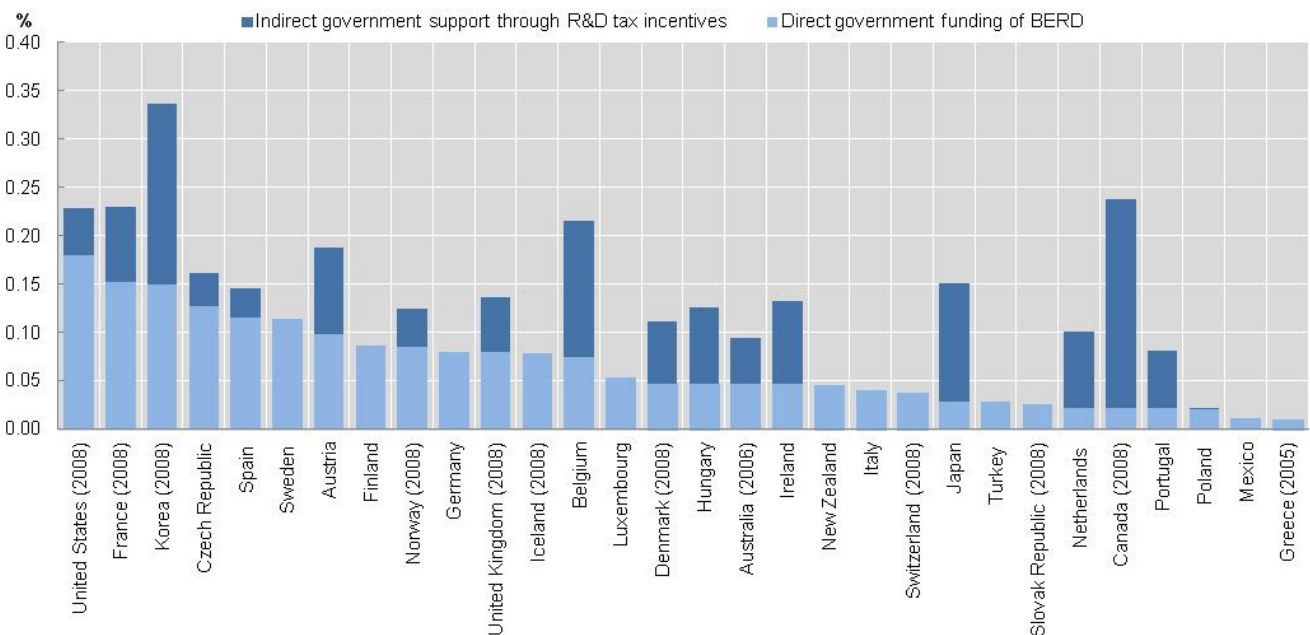## Investment in fixed and intangible assets as a share of GDP, 2006

Legend:
- Machinery and equipment
- Software and databases
- R&D and other intellectual property products
- Brand equity, firm specific human capital, organisational capital

Countries (left to right): Slovak Republic, Italy, Czech Republic, Japan (2005), Australia, Spain, Canada (2005), Portugal (2005), Austria, Sweden, France, Denmark, Germany, Finland, United States, United Kingdom

Investing in innovation goes beyond R&D. Investment in intangible assets is rising and taking over investment in physical capital (machinery and equipment).

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Better understanding public support

Direct and indirect government funding of business R&D and tax incentives for R&D, 2007
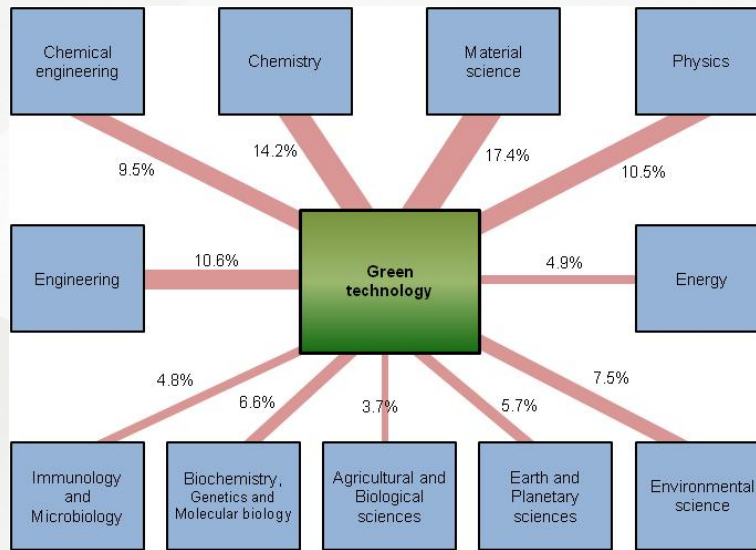### As percentage of GDP

Legend:
- Indirect government support through R&D tax incentives
- Direct government funding of BERD

Countries (left to right): United States (2008), France (2008), Korea (2008), Czech Republic, Spain, Sweden, Austria, Finland, Norway (2008), Germany, United Kingdom (2008), Iceland (2008), Belgium, Luxembourg, Denmark (2008), Hungary, Australia (2006), Ireland, New Zealand, Italy, Switzerland (2008), Japan, Turkey, Slovak Republic (2008), Netherlands, Canada (2008), Portugal, Poland, Mexico, Greece (2005)

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Better measurement of societal challenges and horizontal technologies
Science for "green" innovation

Chemical engineering	Chemistry	Material science	Physics
	14.2%	17.4%	
9.5%			10.5%

Engineering — 10.6% — **Green technology** — 4.9% — Energy

4.8% 6.6% 3.7% 5.7% 7.5%

Immunology and Microbiology | Biochemistry, Genetics and Molecular biology | Agricultural and Biological sciences | Earth and Planetary sciences | Environmental science

NEW INDICATOR: matching environmental patents and scientific publications using co-citation analysis

Patents

Patent-science link via citations

(100% = all citations)
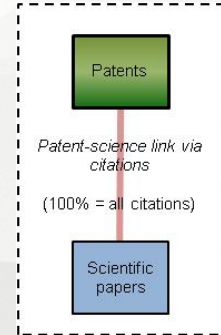
Scientific papers

Green technologies (patents) draw on a broad base of scientific knowledge

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BETTER MEASURE THE INTERNATIONALISATION OF RESEARCH
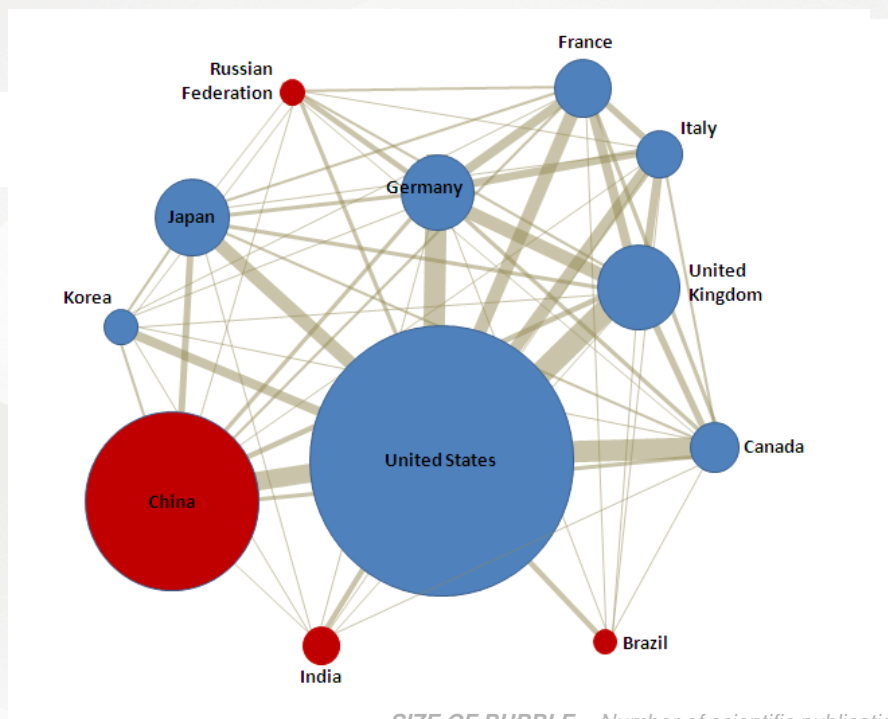
SIZE OF BUBBLE = Number of scientific publications

THICKNESS OF LINK = Number of co-authorship

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And the linkages that are developing internationally…
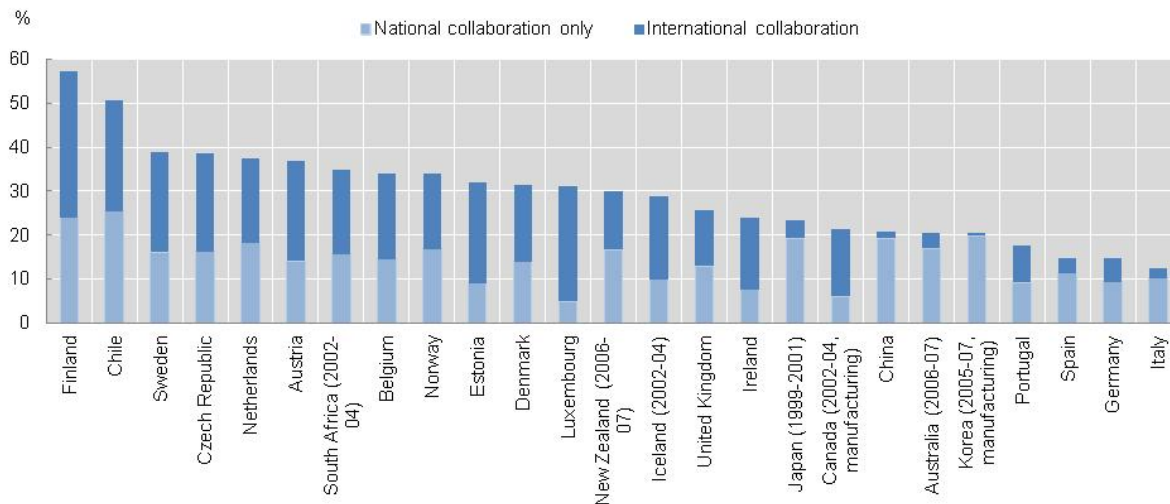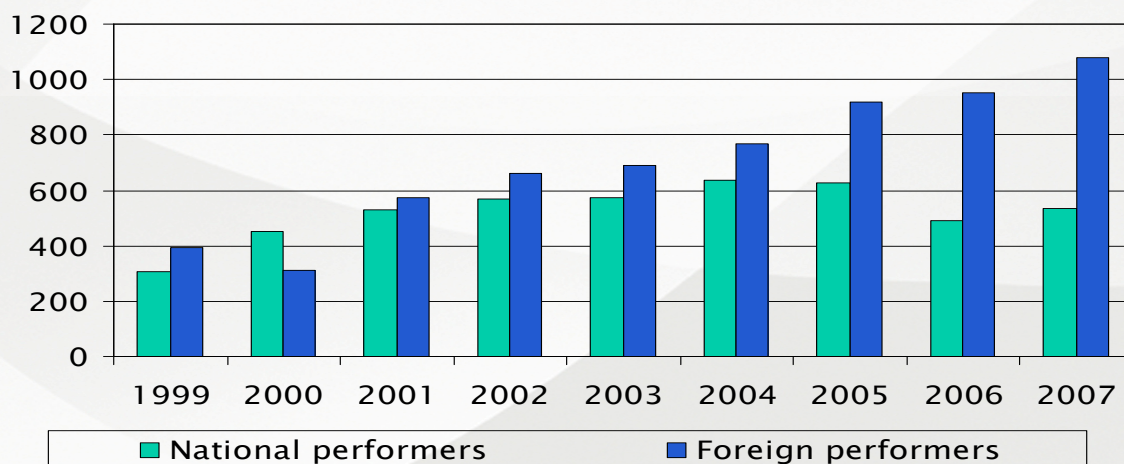

Source: OECD (2010), *Measuring Innovation: A New Perspective*, OECD, Paris based on OECD Innovation microdata project.

Knowledge flows

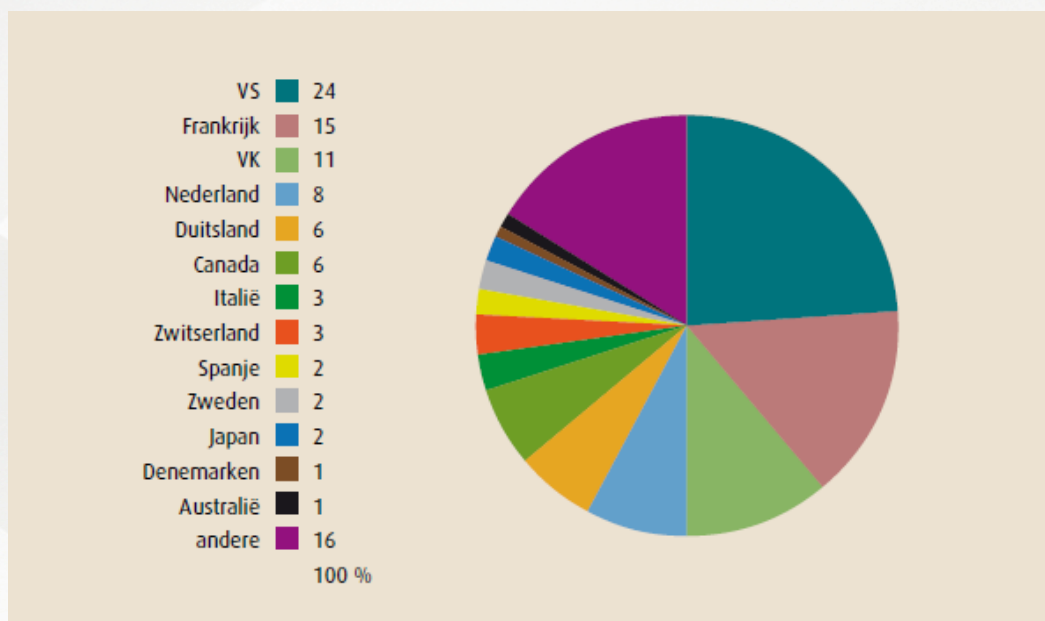## Subcontracting : nationally and internationally

Business Enterprise in Belgium: extramural R&D expenditure per performer in million constant euro

Data : CFS-STAT

International mobility and careers

Land	Kleur	%
VS	▣	24
Frankrijk	▣	15
VK	▣	11
Nederland	▣	8
Duitsland	▣	6
Canada	▣	6
Italië	▣	3
Zwitserland	▣	3
Spanje	▣	2
Zweden	▣	2
Japan	▣	2
Denemarken	▣	1
Australië	▣	1
andere	▣	16
		100 %

Source : CDH, Pierre Moortgat, Belspo, 2011

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But policy makers also insist on a reliable measurement framework

Data must be reliable and comparable

- Complexity of issue : measuring research or innovation; innovation expenditures; services;

- Methodological complexity (role of definitions, coverage of the population, role of the need for administrative simplification and reduction of response burden, etc.

- Methods differ (mandatory, administrative data vs surveys, samples or register, etc.)

Revision of Frameworks is being undertaken

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Other relevant issues in the debate

- How to measure research and innovation in national or international networks ?
- Quid multinationals ?
- Knowledge flows between sectors (national and internationally)
- Capitalisation of R&D in national accounts is starting
- What link between input and output (which is covered in other manuals) and outcome/impact of research
- Measuring knowledge intensity

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Wrapping up : key issues for a policy analyst

- Innovation :
  - Understanding innovation beyond research;
  - Innovation expenditures;
  - Measuring government efforts;
- Knowledge
  - Intangibles
  - Capitalisation of research in the national accounts
  - Services sector : research vs innovation
  - New technologies (horizontal or emerging)

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Wrapping up (2)

- People : intersectoral mobility, careers,…

- Internationalisation : mobility of people, knowledge, money, international infrastructure building;

- Policies : measurement of policies beyond research or education

- Public sector innovation (procurement, …)

- Linkages between research actors

Thanks for listening