European Commission

Innovation Disparities

Panel 2. Firm, university and sector disparities in R&D

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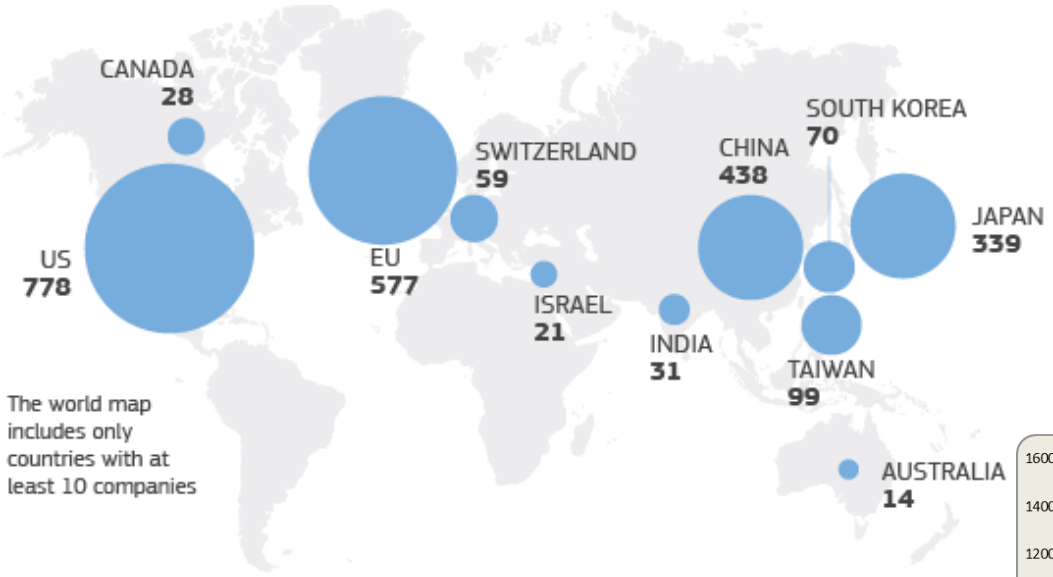
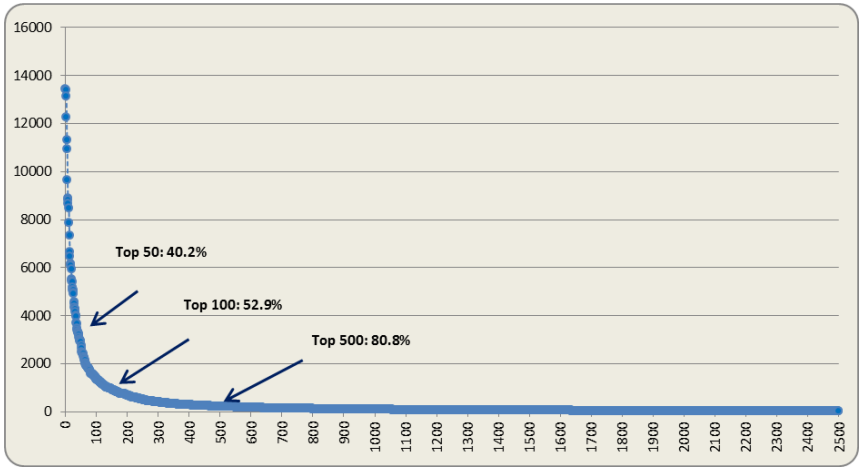
EVIDENCES FROM THE EU INDUSTRIAL R&D SCOREBOARD

top 2500 R&D investors , €736bn, ca. 90% of business R&D worldwide





R&D highly concentrated by company

Source: the 2018 EU R&D Scoreboard

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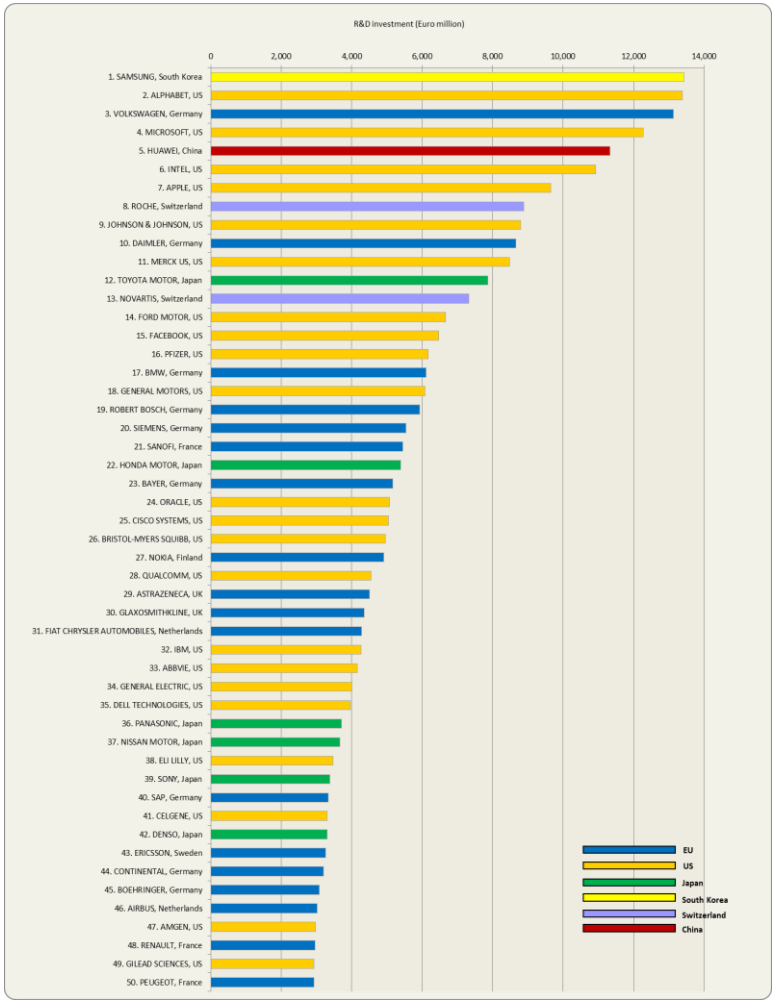
Top 50 R&D investors in 2018 (40% of total)



Rank 2018	Company	Country	R&D in 2017/18 (€bn)	R&D intensity (%)	Rank change 2004-2018
1	SAMSUNG	South Korea	13.4	7.2	up 32
2	ALPHABET	US	13.4	14.5	up > 200
3	VOLKSWAGEN	Germany	13.1	5.7	up 5
4	MICROSOFT	US	12.3	13.3	up 9
5	HUAWEI	China	11.3	14.7	up > 200
6	INTEL	US	10.9	20.9	up 8
7	APPLE	US	9.7	5.1	up 97
8	ROCHE	Switzerland	8.9	19.5	up 10
9	JOHNSON & JOHNSON	US	8.8	13.8	up 3
10	DAIMLER	Germany	8.7	5.3	down 7
11	MERCK US	US	8.5	25.3	up 18
12	TOYOTA MOTOR	Japan	7.9	3.6	down 7
13	NOVARTIS	Switzerland	7.3	17.5	up 7
14	FORD MOTOR	US	6.7	5.1	down 13
15	FACEBOOK	US	6.5	19.1	up > 200
16	PFIZER	US	6.2	14.1	down 14
17	BMW	Germany	6.1	6.2	up 11
18	GENERAL MOTORS	US	6.1	5	down 12
19	ROBERT BOSCH	Germany	5.9	7.6	up 9
20	SIEMENS	Germany	5.5	6.7	down 15

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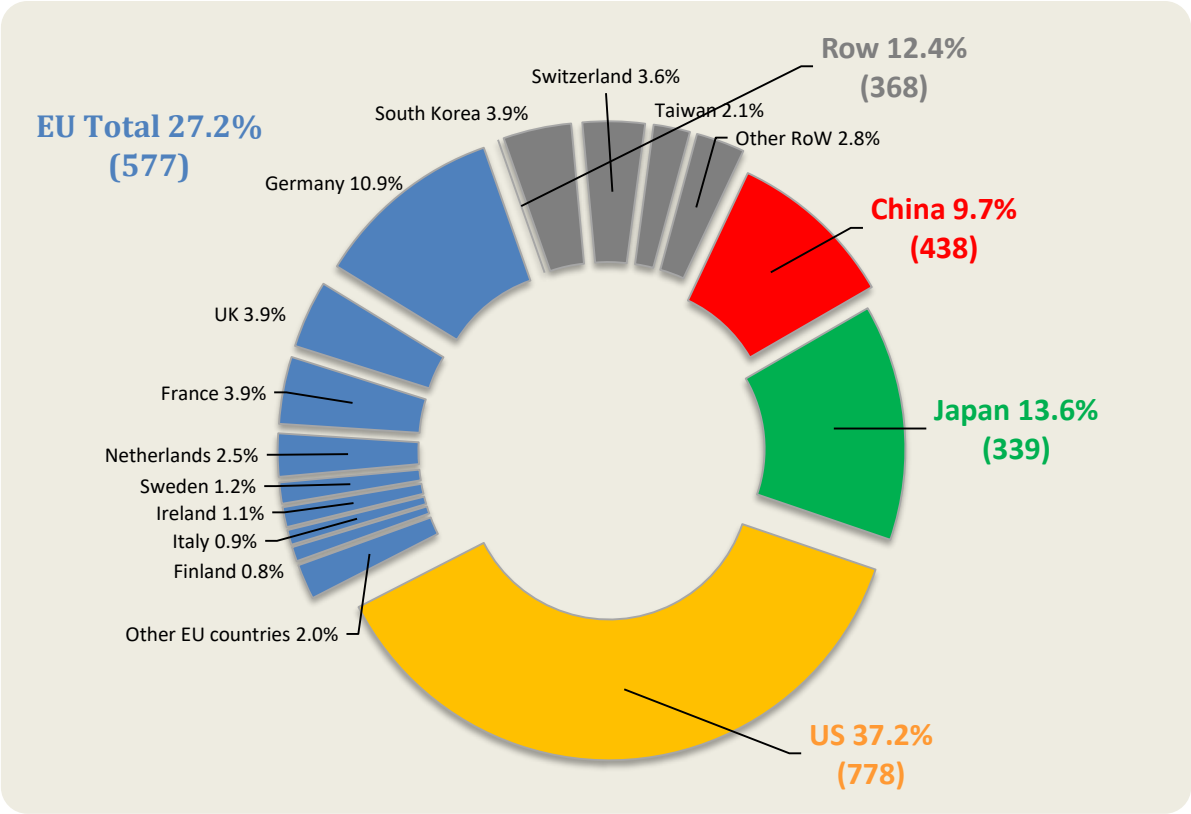
R&D highly concentrated by country …



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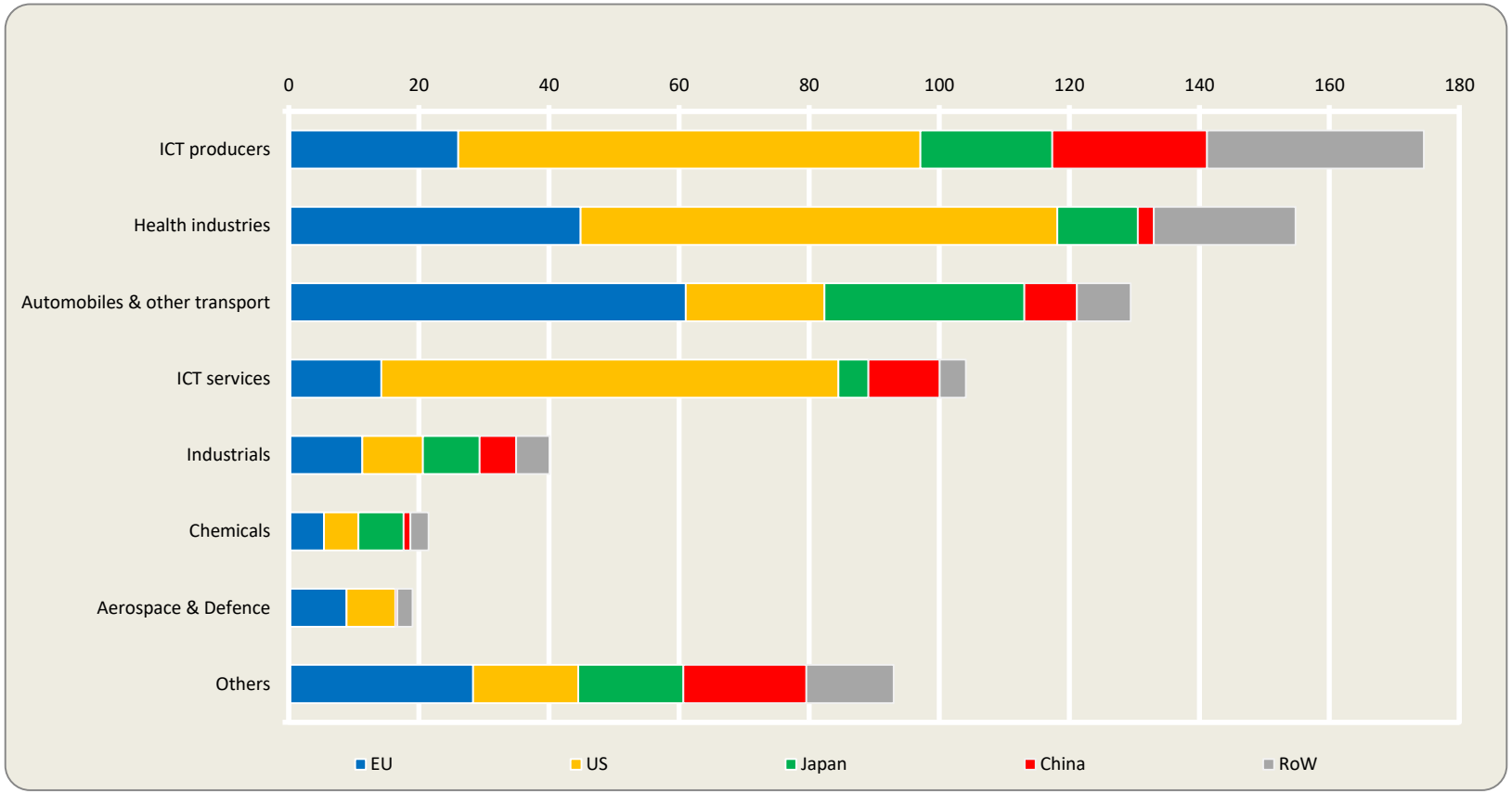
… and highly concentrated by industry



about 2/3 of total R&D invested in auto, health- and ICT-related sectors

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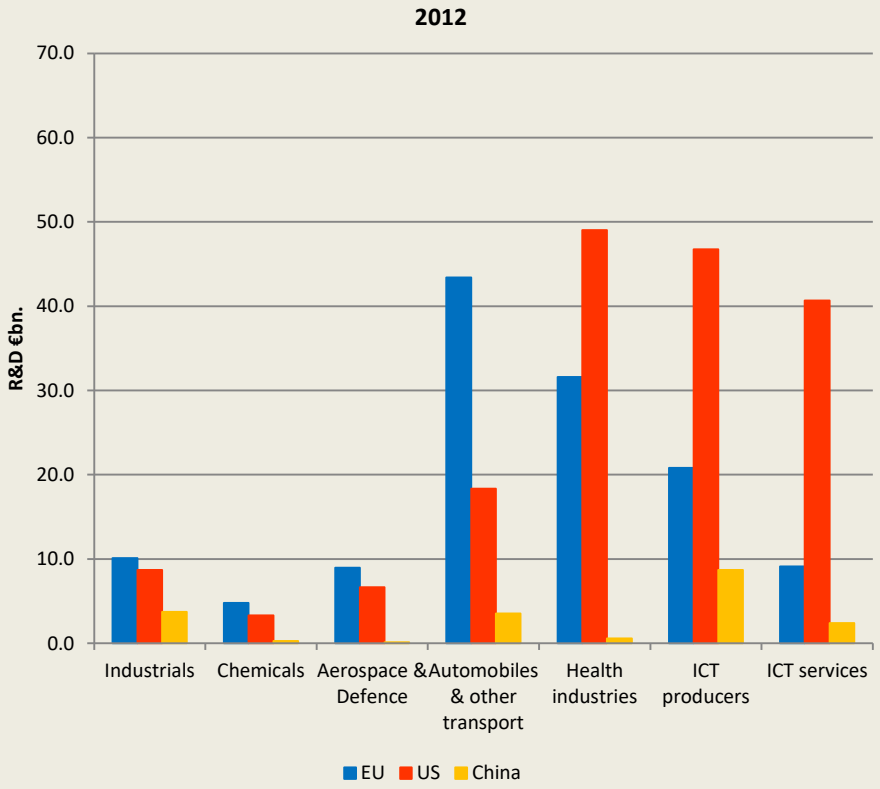
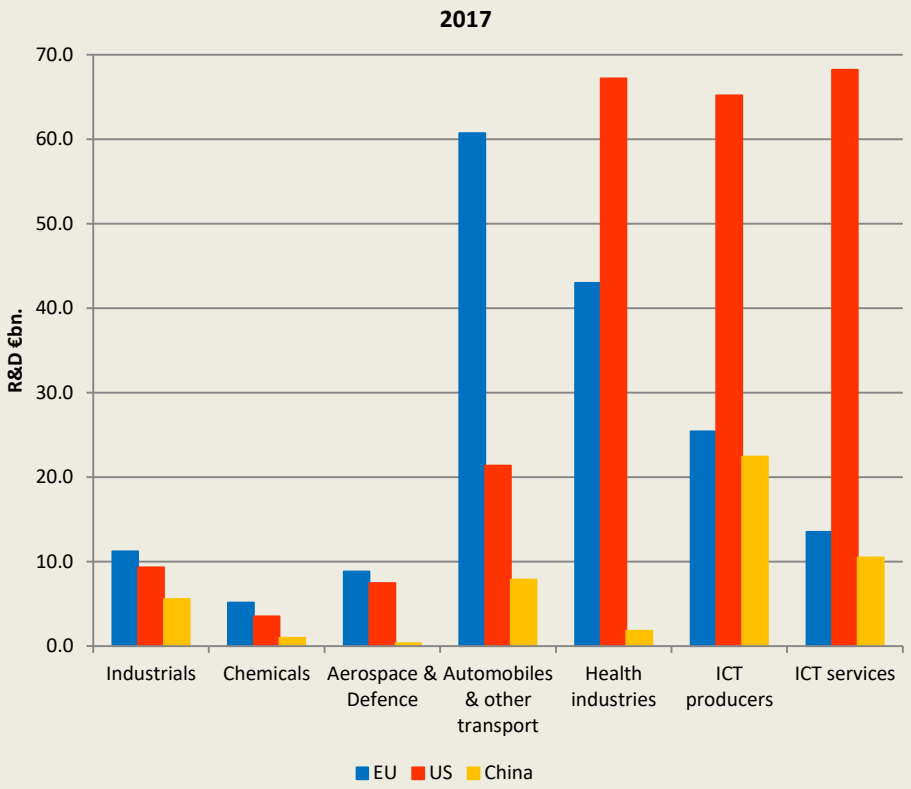
Global technology race – ICT, Health, Mobility





about 2/3 of total R&D invested in auto, health- and ICT-related sectors

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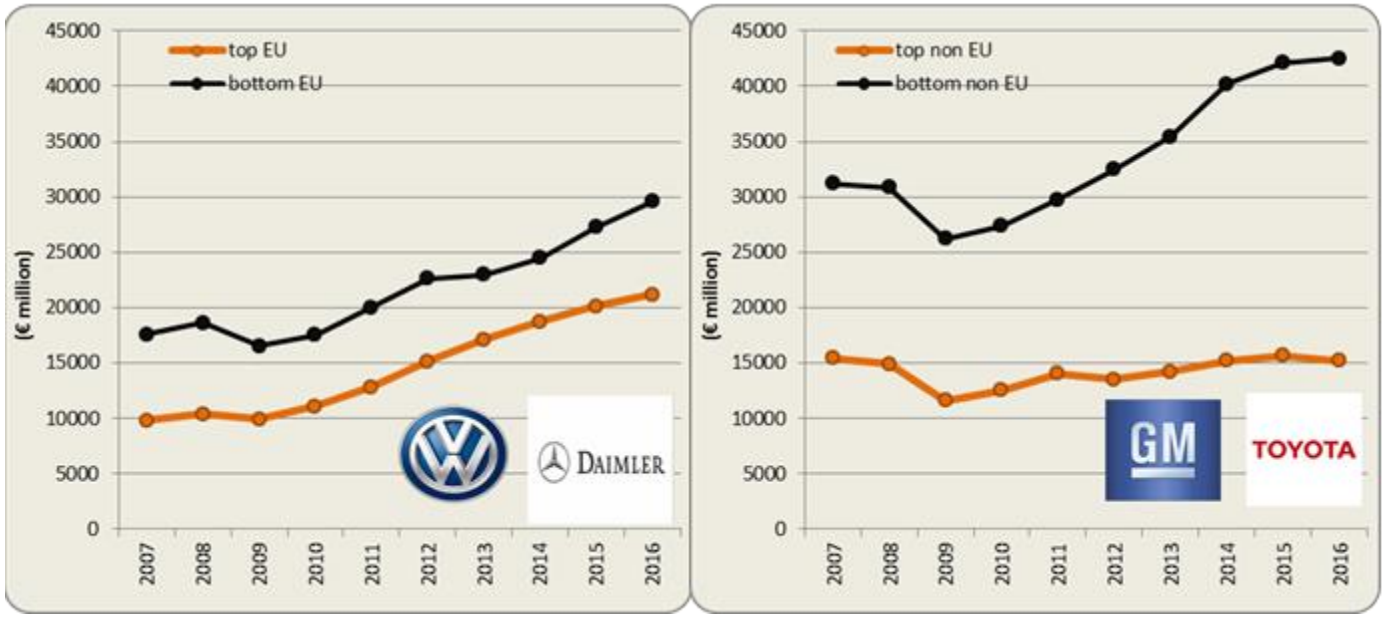
R&D disparities within industries: Automobiles



Top = companies accounting for more than 25% of sector's R&D
Bottom = rest of sector's companies

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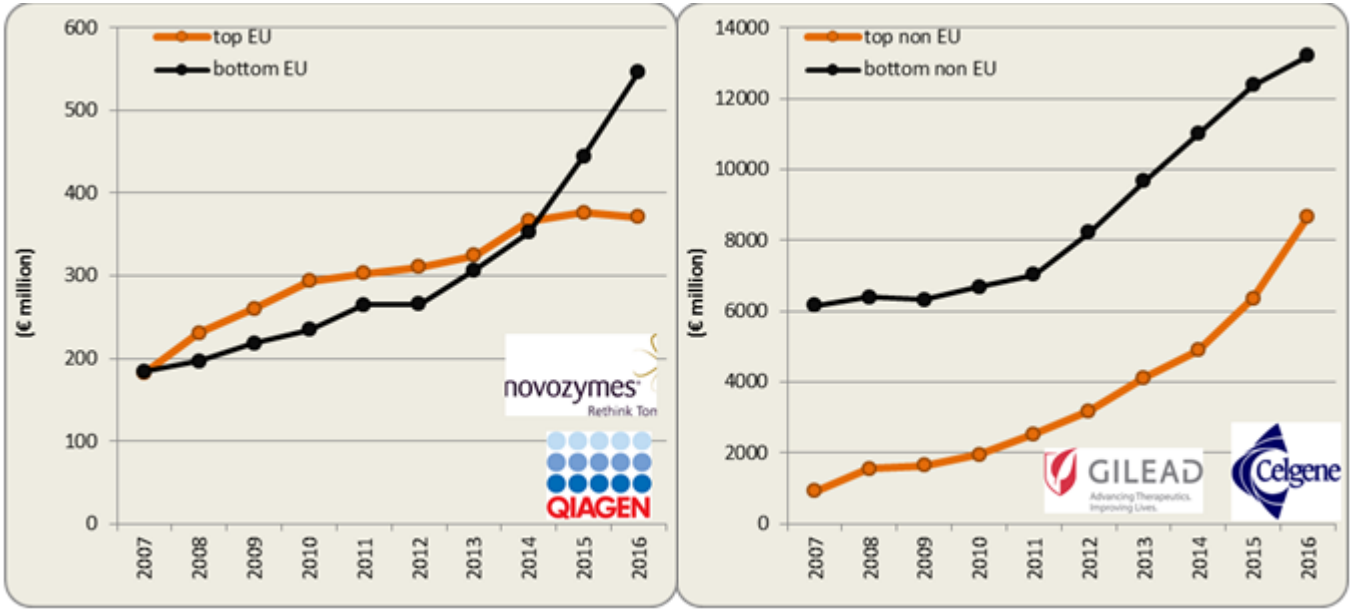
R&D disparities within industries: Biotechnology



Scales of the two panels are different

Top = companies accounting for more than 25% of sector's R&D
Bottom = rest of sector's companies

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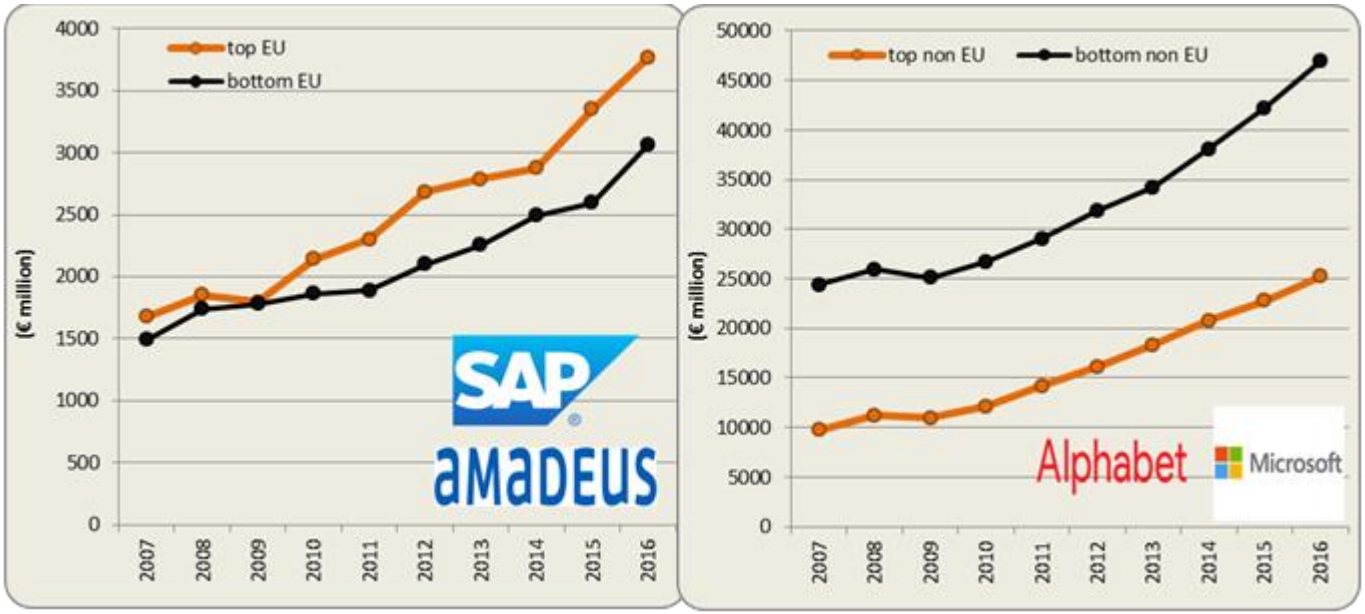
R&D disparities within industries: ICT services



Scales of the two panels are different

Top = companies accounting for more than 25% of sector's R&D
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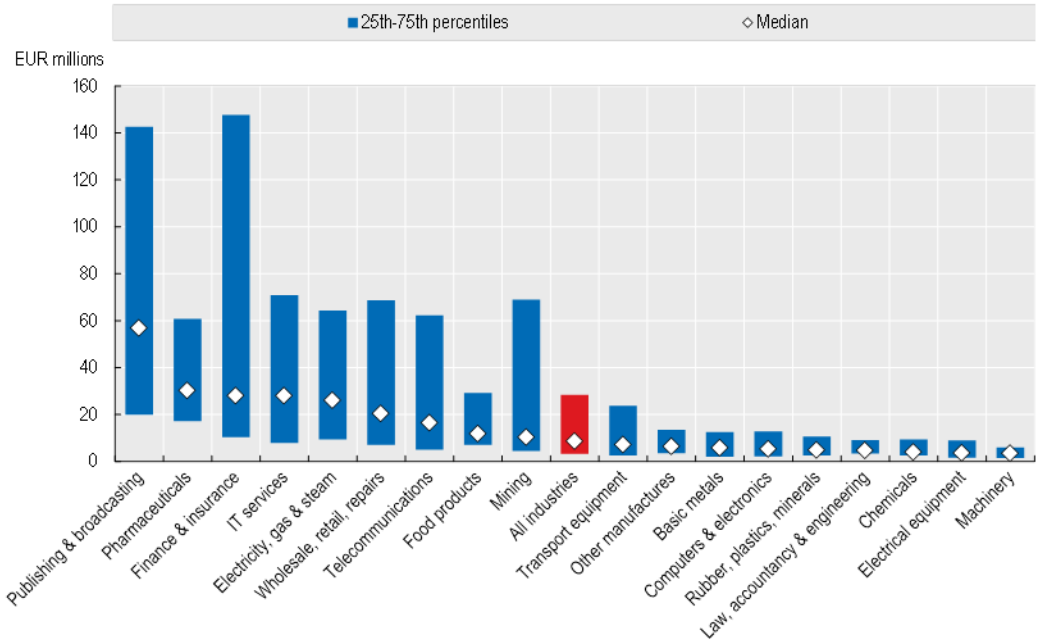
R&D investment per patent of top R&D performers by industry

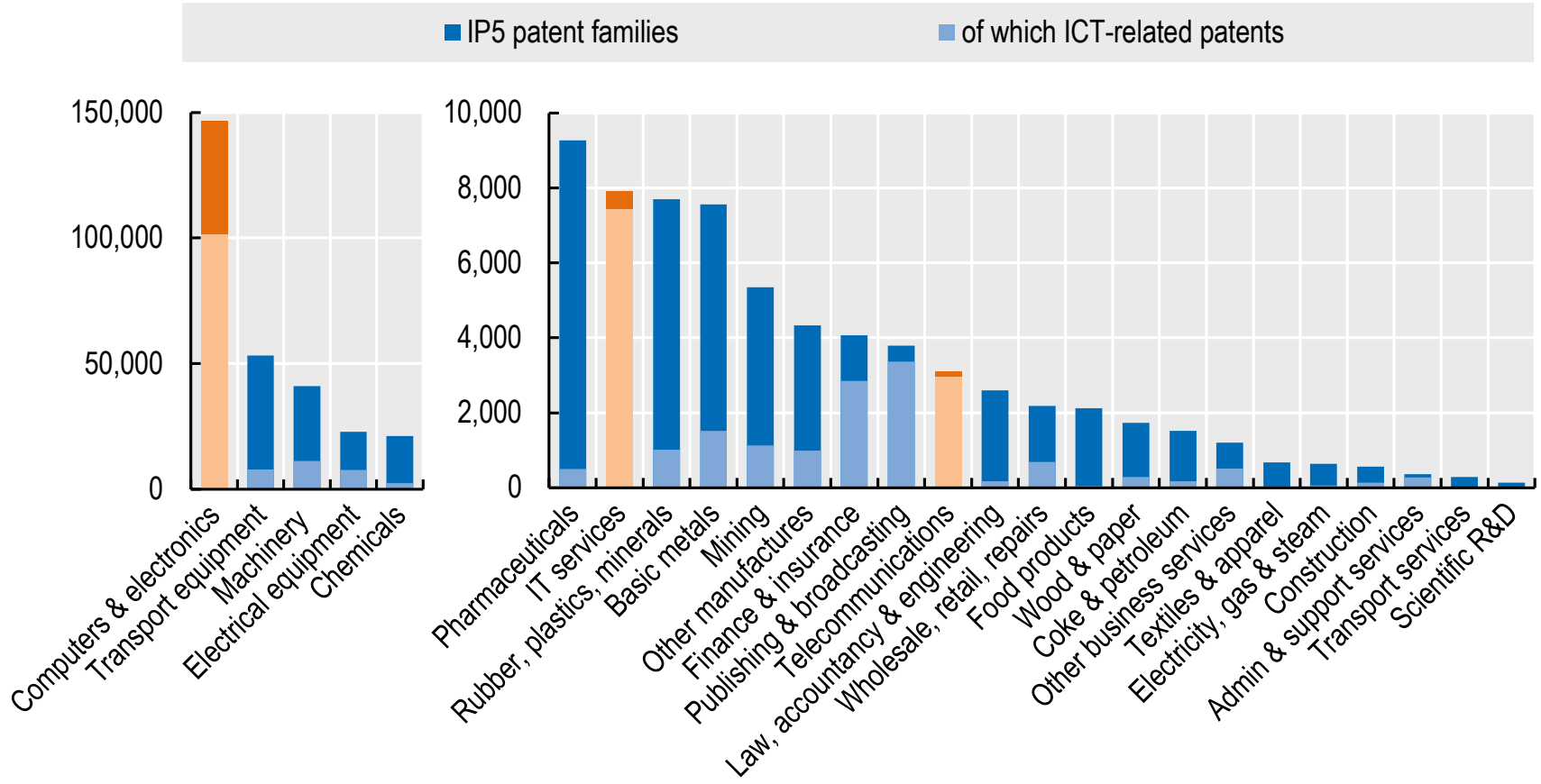
- Substantial heterogeneity within and across industries.
- Reflect complexity of the products and differences in cost of developing new technological solutions (e.g. pharmaceuticals)



Source: JRC-OECD, COR&DIP© database v.1., 2017

Innovation disparities

Total number of IP5 patent families and ICT patents
by industry, ISIC rev.4, 2014



Source: IPTS-OECD, COR&DIP© database v.1., 2017.

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Technological specialization

RTAs by geographical location of the headquarter, 2012-14

Revealed technology advantages and changes compared to 2010-12 level

Field of Technology	Europe	United States	Japan	Korea	China	Rest of the World
Electrical machinery	1.0	0.6	1.1 ↗	1.3	0.4 ↘	1.1
Audio-visual tech.	0.4 ↗	0.6 ↗	1.1 ↘	1.7 ↗	1.4 ↗	2.0
Telecommunications	0.7	0.8 ↗	1.1	1.2 ↘	1.9 ↘	1.5 ↗
Digital communication	0.9 ↘	1.3 ↗	0.6	1.2	3.9 ↘	0.9 ↘
Basic communication	0.7	1.2 ↗	0.9 ↘	1.1 ↗	0.5 ↘	1.8
Computer technology	0.5	1.1 ↘	0.8	1.6 ↗	1.9 ↗	1.8
IT methods	0.8 ↘	1.7	0.7	0.9 ↘	2.0 ↗	0.8 ↘
Semiconductors	0.5 ↗	0.6 ↘	1.0	1.9	1.2 ↗	1.8 ↗
Optics	0.3 ↗	0.4 ↘	1.7	1.0 ↘	1.4 ↗	1.2 ↗
Measurement	1.5	1.2	0.9	0.6 ↗	0.4 ↗	0.7 ↘
Bio materials	1.6	1.4 ↘	0.8	0.6 ↗	0.1 ↗	0.2 ↗
Control	1.2 ↘	1.1 ↘	1.0 ↗	0.5 ↗	0.5 ↘	1.2 ↘
Medical technology	1.6	1.3 ↘	0.9	0.5 ↗	0.1 ↗	0.2 ↗
Organic chemistry	1.9	1.3 ↘	0.6	0.4 ↗	0.3 ↘	0.4 ↗
Biotechnology	1.8	1.5 ↘	0.6	0.7 ↗	0.1 ↘	0.2 ↘
Pharmaceuticals	2.0	1.5 ↘	0.5	0.3 ↗	0.2 ↗	0.8 ↗

The arrow denotes more than 5% changes in the RTA. China is not specialised in the 19 technologies not reported in the figure.

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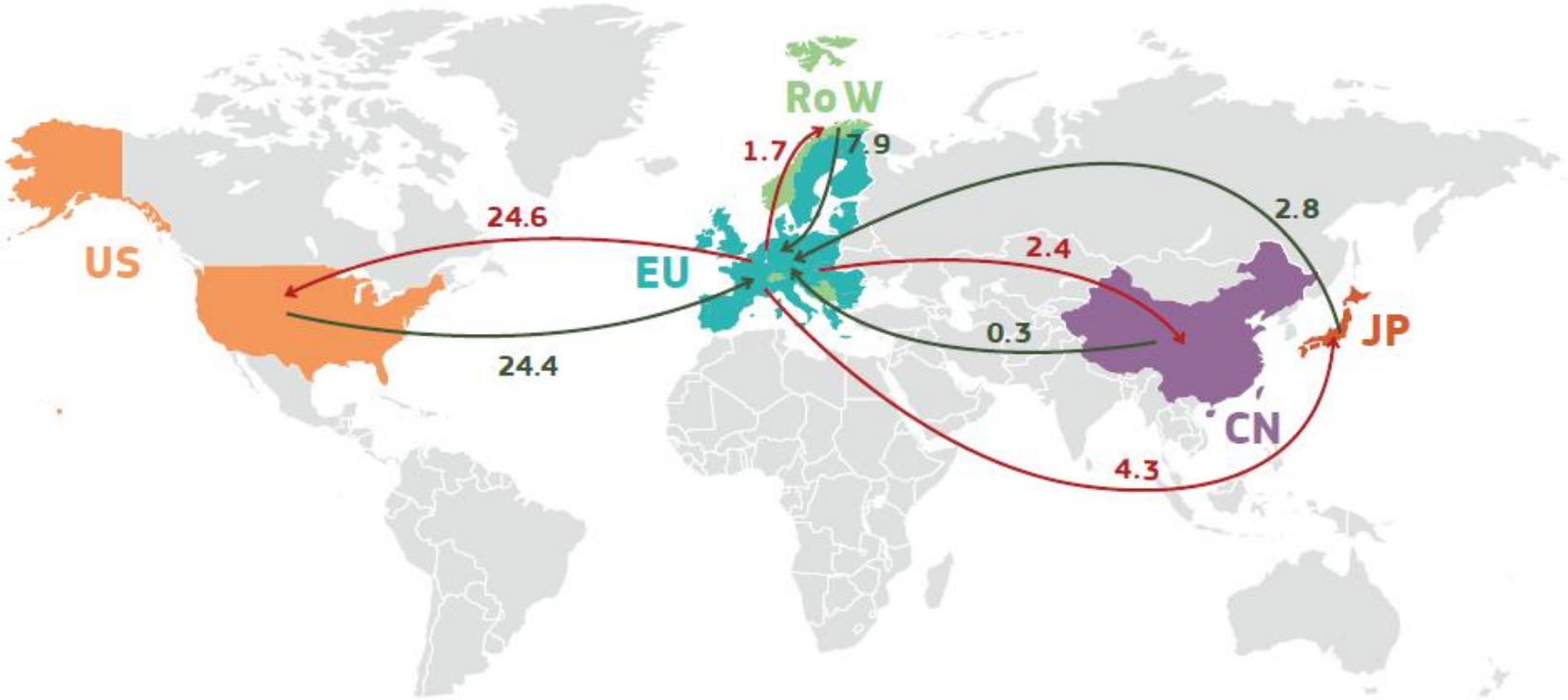
Global Industrial R&D Flows



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Location of patent inventors vs owners & company concentration (EU)

Inventor Country	Patents by applicant versus inventor *(% differences)*	1st applicant country *(ownership)*	2nd applicant country *(ownership)*	Share of top 3 companies
Romania	-85%	Germany	Romania	60%
Croatia	-69%	Croatia	UK	41%
Hungary	-63%	Hungary	Germany	37%
Slovakia	-49%	Slovakia	Germany	16%
Czechia	-40%	Czechia	Germany	15%
Poland	-36%	Poland	Switzerland	14%
Greece	-36%	Greece	US	29%
Estonia	-35%	Estonia	Germany	25%
Lithuania	-33%	Lithuania	Germany	51%
UK	-31%	UK	US	9%
Slovenia	-30%	Slovenia	Germany	20%
Bulgaria	-30%	Bulgaria	US	15%
Spain	-29%	Spain	Germany	14%
Italy	-16%	Italy	Sweden	5%
Portugal	-15%	Portugal	Germany	19%
Belgium	-13%	Belgium	US	14%
Latvia	-12%	Latvia	Finland	24%
Austria	-7%	Austria	Germany	10%
Denmark	-1%	Denmark	Germany	17%
France	1%	France	Switzerland	10%
Germany	1%	Germany	US	12%
Ireland	13%	Ireland	US	27%
Finland	14%	Finland	Switzerland	31%
Sweden	19%	Sweden	Switzerland	33%
Netherlands	23%	Netherlands	US	44%
Cyprus	371%	Cyprus	UK	39%
Luxembourg	484%	Luxembourg	US	42%
Malta	968%	Malta	Luxembourg	31%

Source : Own computation based on Patstat 20118A

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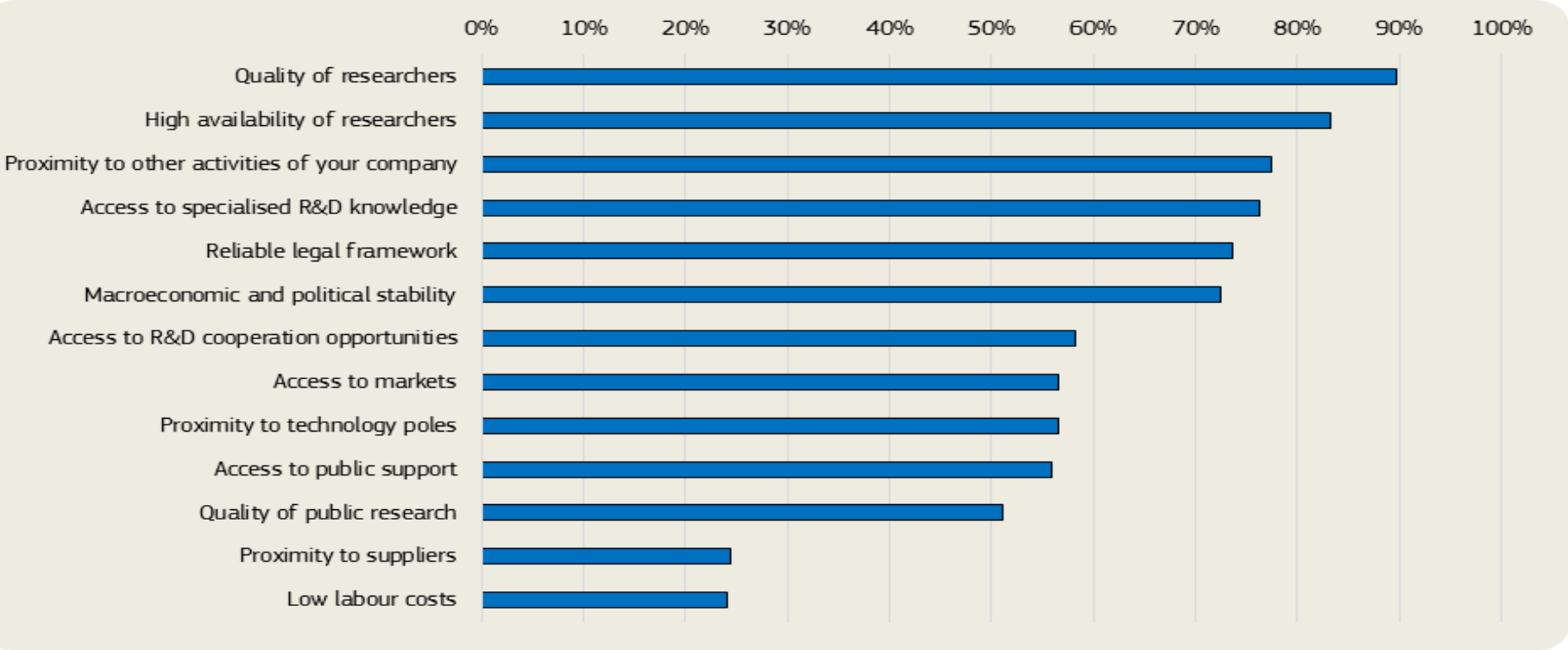
Evidence from the EU Industrial R&D Survey

Attractiveness of a location for performing R&D is mainly about the quality and availability of researchers



Share of respondents rating a factor as (highly) attractive

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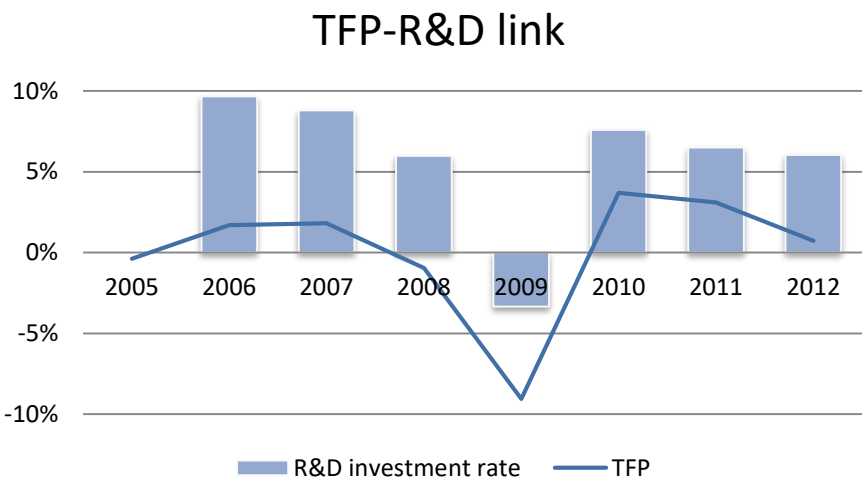
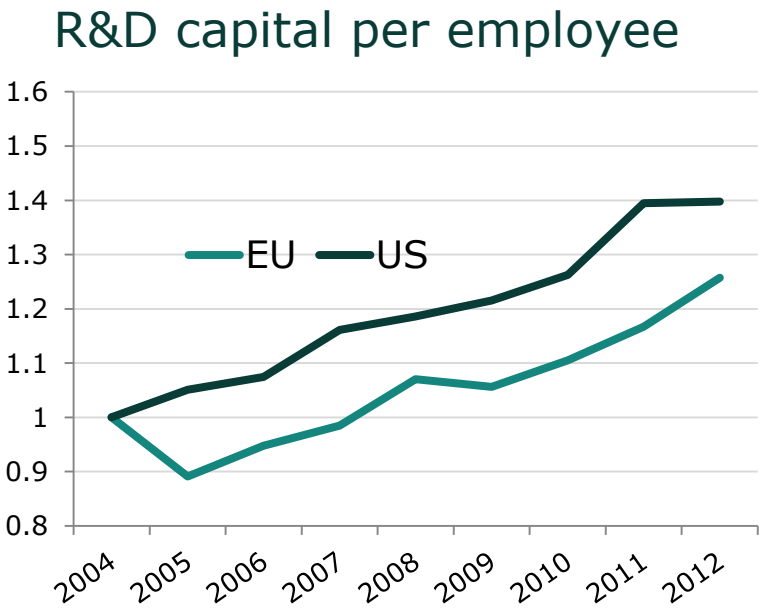
Industrial R&D and productivity



Strong R&D (patents) – productivity link only in high/medium sectors

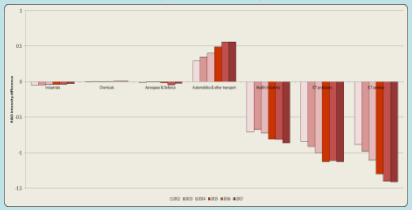
Higher returns to R&D for US firms

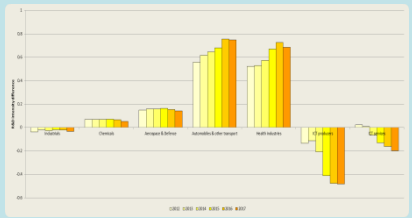


Strong relationship between R&D and productivity → **key to understand the productivity gap** between Europe and its competitors in the last two decades

POLICY CHALLENGES

TECHNOLOGY INNOVATION GAPs





Field of Technology	Europe	United States	Japan	Korea	China	Rest of the World
Digital communication	0.9 ↘	1.3 ↗	0.6	1.2	3.9 ↘	0.9 ↘
Surface and coating	0.9 ↗	1.1	1.2 ↗	0.7	0.4 ↗	0.7 ↘
IT methods	0.8 ↘	1.7	0.7	0.9 ↘	2.0 ↗	0.8 ↘
Basic communication	0.7	1.2 ↗	0.9 ↘	1.1 ↗	0.5 ↘	1.8
Télécommunications	0.7	0.8 ↗	1.1	1.2 ↘	1.9 ↘	1.5 ↗
Textile and paper machines	0.6	0.5 ↘	2.1 ↗	0.1 ↘	0.1 ↘	0.1 ↘
Semiconductors	0.5 ↗	0.6 ↘	1.0	1.9	1.2 ↗	1.8 ↗
Computer technology	0.5	1.1 ↘	0.8	1.6 ↗	1.9 ↗	1.8
Audio-visual tech.	0.4 ↗	0.6 ↗	1.1 ↘	1.7 ↗	1.4 ↗	2.0
Optics	0.3 ↗	0.4 ↘	1.7	1.0 ↘	1.4 ↗	1.2 ↗

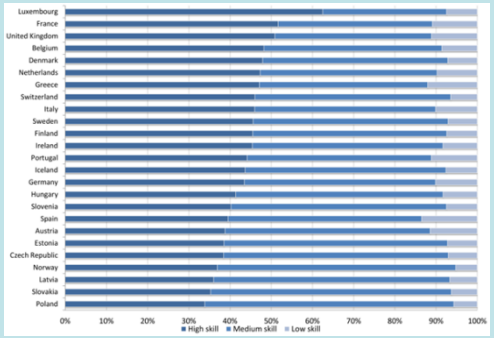
Investment

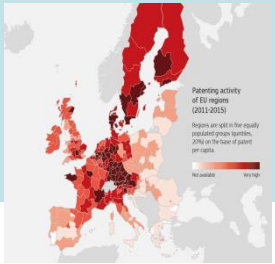
Skills

?

Diffusion

SKILL GAPs





TERRITORIAL GAPs

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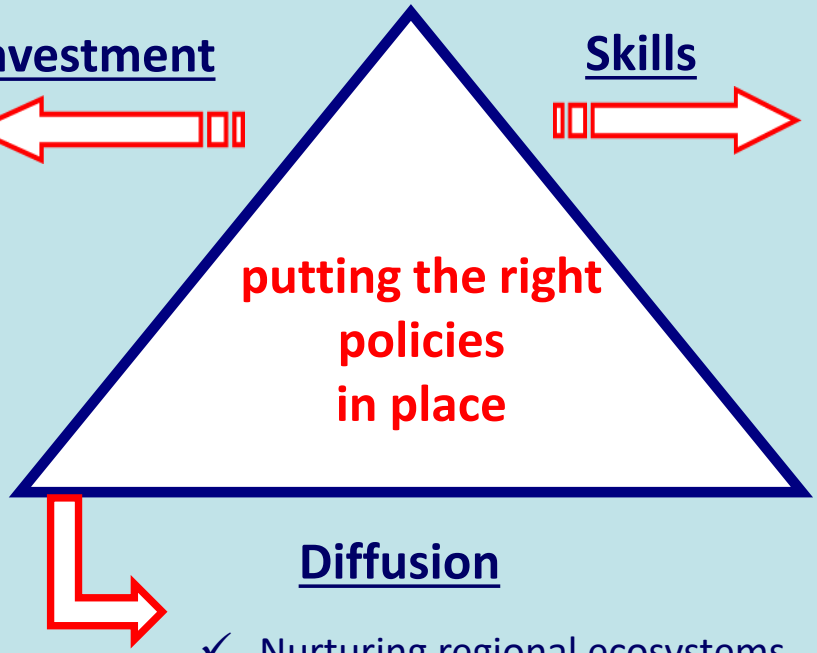
POLICY RESPONSES



- ✓ Regulation
- ✓ Institution
- ✓ Taxation

(favouring VCs and start-ups)

- ✓ Knowledge co-creation
- ✓ Clustering around universities
- ✓ Vocational trainings

- ✓ Nurturing regional ecosystems
- ✓ Open innovation
- ✓ Links to strategic industrial value chains

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Quid of the EU R&D intensity target?

- EU R&D gap largely related to the EU industrial structure: A matter of industrial change and dynamics
- Need for targeted policies to support strategic technologies and industrial value chains
- Support to new and young technology based companies, in new sectors (disruptive innovation) –[EIC]
- EU needs to broaden the basis of R&D innovators. Support to non-R&D intangible assets (training, design, marketing, management, IT/data) in SMEs and traditional sectors is crucial