UNIVERSITY-INDUSTRY COLLABORATION: **NEW EVIDENCE AND POLICY OPTIONS**

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Structure of the report

Key findings and recommendations

Main project findings & policy recommendations

A. Documenting impacts of public research institutions

Empirical analysis of channels of knowledge transfer

B. Policy instruments and the policy mix for knowledge transfer

In-depth analysis of policy mix and instruments

Main findings of the report (i)

The impacts of knowledge transfer on innovation

- **Assessing impacts** of knowledge transfer **remains challenging:**
  - Methods often capture only specific channels of knowledge transfer
  - Data quality, comparability, causality and assessment of broader societal challenges remain important challenges
- The report provides **new evidence**:
  - **Patenting** of public research institutions:
    - Has increased, although overall contributions to patenting are modest
    - Engage more in joint patent activity with industry, reflecting co-creation
  - **Geography matters**: universities and inventive industry collocate
  - **Academic start-ups** are becoming more important, accounting for 20% of total start-ups (registered in Crunchbase)
  - Labour force surveys provide new insights on **contributions of social scientists** to innovation

Main findings of the report (ii)

The policy mix and governance system for knowledge transfer

- **Policy mixes** for knowledge transfer include financial, regulatory & soft instruments.
- Assessing **interactions** (positive & negative) among instruments is critical.
- Current **policy trends** include:
  - Creating intermediary organisations
  - Fostering co-creation between university and industry
  - Adapting existing policies to the digital age
- New policies to **support spin-offs** encourage student entrepreneurship.
- Research institutions pay more attention to **in-house business incubation**
- **New survey data** shows:
  - Trend towards greater **autonomy** of universities over knowledge transfer
  - **Industry's** and **civil society's** increasing participation in the governing boards of universities

Policy recommendations

No "one-size-fits-all"

The role of specific knowledge transfer channels varies not only across science fields and industry sectors but also across research institutions and businesses. Thus, countries need to consider those dimensions and design specific knowledge transfer policies that capitalise on areas of public research and business strengths.

Support co-creation leveraging digital technologies

Policies should move away from knowledge transfer to "co-creation" models where knowledge is jointly created by research and industry. Online communities of experts, crowdsourcing and digital platforms can support co-creation.

Improve the effectiveness of the policy mix for knowledge transfer

Policy makers should consider the interactions and combined effects of individual policy instruments when designing and evaluating knowledge exchange policies, as well as potential redundancies and contradictions.

Allow for diversified knowledge transfer practices

Giving research institutions more autonomy in how they collaborate with industry, including e.g. in decisions over academic spin-offs or IP revenues allows for diversification of approaches according to their capacities and research strengths.

(1) Recommendations

- **No "one-size-fits-all"**

  The role of specific knowledge transfer channels varies across disciplines, sectors, and research institutions.

  Countries need to consider these dimensions and design specific policies that capitalize on areas of public research and business strength.

- **Support co-creation leveraging digital technologies**

  Policies should move away from knowledge transfer to "co-creation" models.

  Online communities of experts, crowdsourcing and digital platforms can support co-creation.

(2) Recommendations

- **Improve the effectiveness of the policy mix for knowledge transfer**

  Policy makers should consider the interactions and combined effects of individual policy instruments, as well as potential redundancies and contradictions.

- **Allow for diversified knowledge transfer practices**

  Giving research institutions more autonomy in how they collaborate with industry revenues allows for diversification of approaches according to their capacities and research strengths,

  including e.g. in decisions over academic spin-offs or IP

A. DOCUMENTING IMPACTS OF PUBLIC RESEARCH INSTITUTIONS

A. Documenting impacts of public research institutions

Chapter 1. Assessing the impacts of knowledge transfer on innovation: Channels and challenges

Overview of the different channels of knowledge transfer and the main challenges for impact assessment

Chapter 2. How does public research affect industry innovation and entrepreneurship? New evidence

Empirical analysis of the impacts of public research institutions on patenting and entrepreneurship

Chapter 3. Gauging social science graduates' contributions to knowledge exchange with industry

Empirical analysis of the contribution of the mobility of graduates from social sciences to different industries

Chapter 1. Introduction

- Assessing impacts of public research on innovation is difficult given the many channels of knowledge transfer.
- This chapter describes:
  - **channels of knowledge transfer**,
  - different **methods and data** sources available,
  - methodological **challenges** to impact assessment.

Channels for knowledge transfer

Direct channels

- Collaborative research
- Contract research
- Academic consultancy
- IP transactions
- Academic spin-offs
- Labour mobility

Indirect channels

- Publication of research results in scientific journals
- Conferencing & networking
- Facility sharing
- Continuing education

Challenges in assessing knowledge transfer

DATA QUALITY

Data gathered for analysis needs to be representative of research & industry, also allow to exploring the impacts at micro and macro levels

COMPARABILITY

Qualitative studies provide rich information on specific cases, but concerns regarding external validity arise

Quantitative studies allow for comparability but capture only a limited number of knowledge transfer channels (e.g. patenting)

CAUSALITY

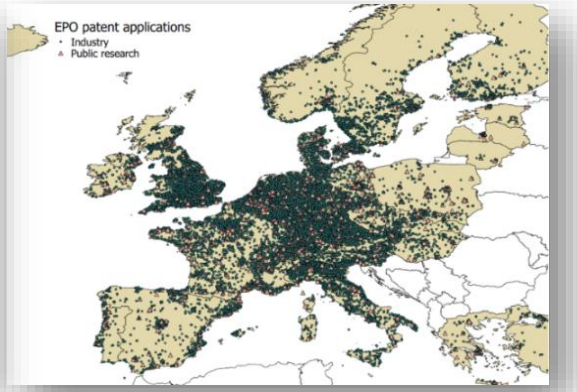
Establishing whether public research caused an observed effect is challenging (e.g. identifying whether impacts are due to research policies in place or local business dynamics)

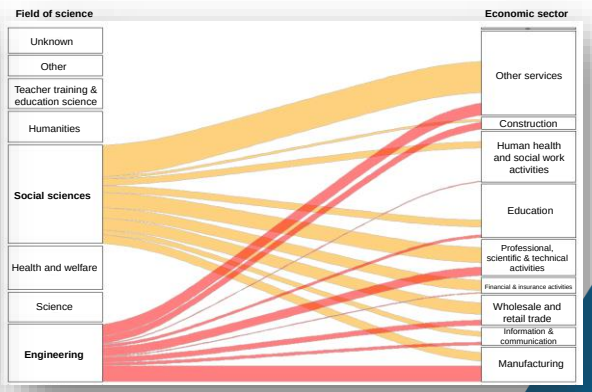
BROADER SOCIETAL IMPACTS

Impact analysis should also consider societal impacts of public research (such as impacts on public health or the environment) , in addition to economic impacts

Data sources for the assessment

Impact assessment requires the **combined use of different data sources**, including case studies, patent data, publication data, and labour force survey data





Conclusions

- Different **data sources** are used to measure impacts of public research (patents, surveys,…)
- **Challenges** to impact assessment are
  - data quality
  - comparability of results
  - identification of causal impacts
  - and the assessment of societal impacts.
- Combining different **methods and data sources** is necessary to assess the overall impacts of public research.

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Chapter 2. Introduction

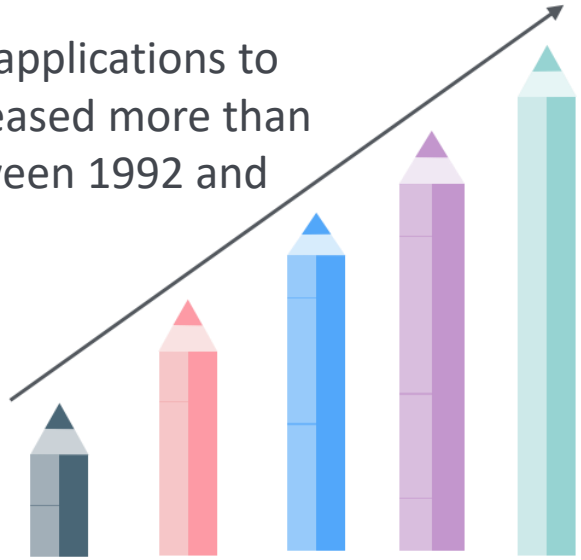
- **Public research** contributes to innovation and entrepreneurship.
- This chapter provides new evidence on
  - **Patenting** activities of HEIs and PRIs
  - Impacts of **proximity** to HEI\PRI on business inventions
  - **Academic start-up activity** of university researchers and students.

Contribution of public research to technical invention

Results based on data on patent applications to the European Patent Office (EPO) from 35 OECD countries & China between 1992 and 2014

1 Public research institutions have become more active in patenting

Their patent applications to the EPO increased more than **fivefold** between 1992 and 2014



2 Public research institutions collaborate more with industry

Patents **jointly** filed by public research institutions & industry have grown faster than university-owned applications between 1992 and 2014.

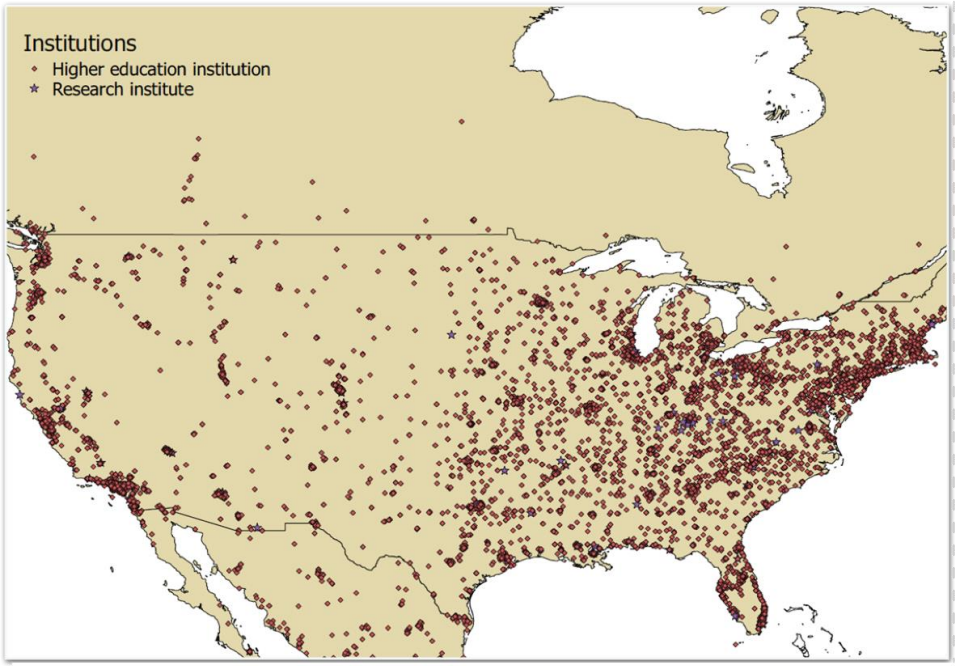
Co-patent applications with industry made up **43% of all patents** applications of research institutions

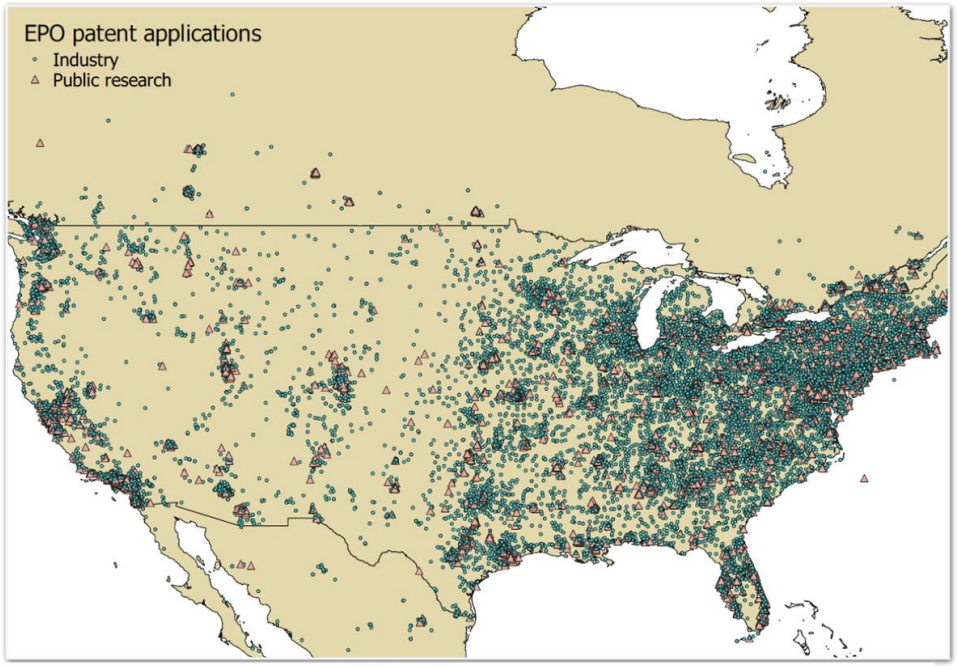
3 But the **overall contributions** of public research institutions to patenting **remain modest** compared with industry, accounting for 1.6% (2,200) of total applications in 2014

Universities and inventive industry collocate

4

Geography matters: universities & inventive industry collocate



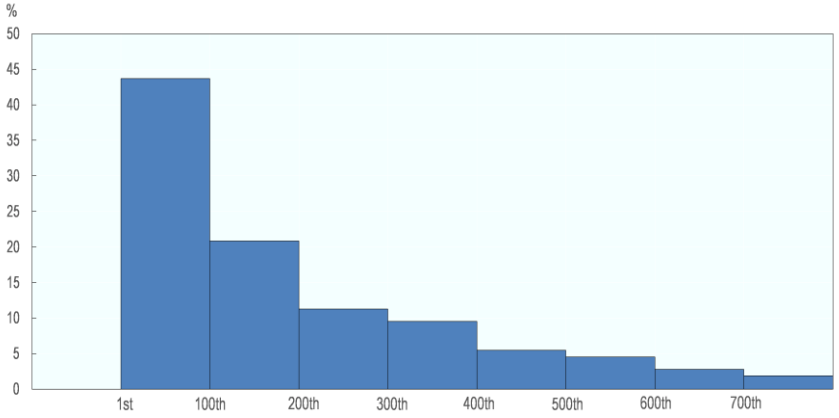


Proximity to university is positively associated with **local industry patent applications**, irrespective of local business dynamics

Public research and innovative entrepreneurship

- **Start-up firms founded by students or academics** significantly contribute to commercialising knowledge developed through public research
- Academic entrepreneurship is **concentrated in a few top universities:** The leading 100 universities (in CWTS Leiden ranking) produce 45% of all academic founders

Percentage of academic founders of start-ups by rank of their home university (2011-2016)

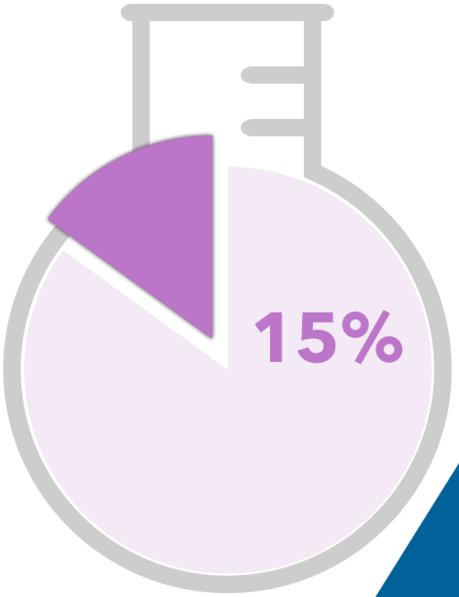


Rank in the University Leiden ranking

Source: Breschi et al. (2018).

ACADEMIC START-UPS

Start-ups founded by students & academics account for **15%** of all start-ups registered on Crunchbase and **20%** of start-ups in science-based fields (e.g. biotechnology)



Conclusions

- Data on patents shows that HEIs and PRIs contribute to innovation by **patenting** their own technical inventions
- They also engage in joint patent activity with industry.
- **Proximity to universities** is positively associated with local industry patenting.
- HEIs and PRIs also contribute to innovative ecosystems by stimulating **academic entrepreneurship**.

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Chapter 3. Introduction

- The **contributions of social sciences** to innovation are difficult to capture.
- **Labour mobility** is an important channel of knowledge transfer in social sciences.
- This chapter provides **evidence from labour surveys** on graduate mobility in social sciences and other disciplines to different industries.

Why is it difficult to assess the contribution of social scientists to innovation?

Diversity of contributions to innovation

Social scientist contribute critically to the diffusion and adaptation of innovation, as well as the implementation of process and organizational innovations. However, these are challenging to quantify.

Soft skills

Social scientists often provide soft skills that are key for innovation, but are difficult to fully capture (e.g. creative & critical thinking, communication skills)

How to assess their contribution to innovation?

PATENT DATA ANALYSIS

Mainly capture contributions to technical innovation, thus underestimating contributions of social sciences

CASE STUDIES

May capture social sciences contributions, but most mainly document contributions of science, technology, engineering, and mathematics (STEM fields)

LABOUR FORCE SURVEYS

Allow identifying the sector of employment of graduates in all fields, an indicator of science-industry knowledge transfer, but do not assess involvement in innovation

FUTURE AVENUES

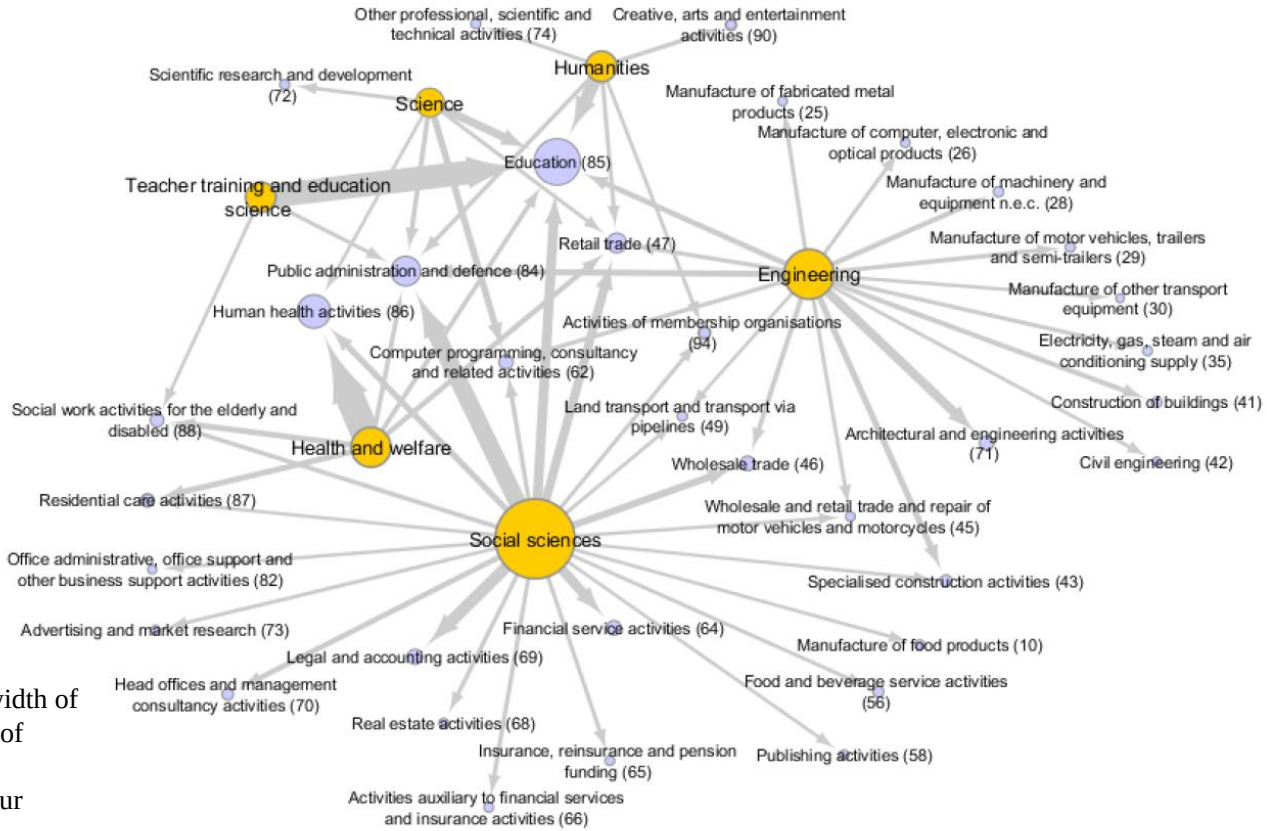
New data and big data analysis offers new opportunities (e.g. web scraping of online job advertisements allows exploring demand for social scientists)

Approach of this chapter

Labour force surveys help provide a more complete picture of knowledge transfer

- Capture the **flow of human capital** from university to industry
- Cover **all science and industry fields**

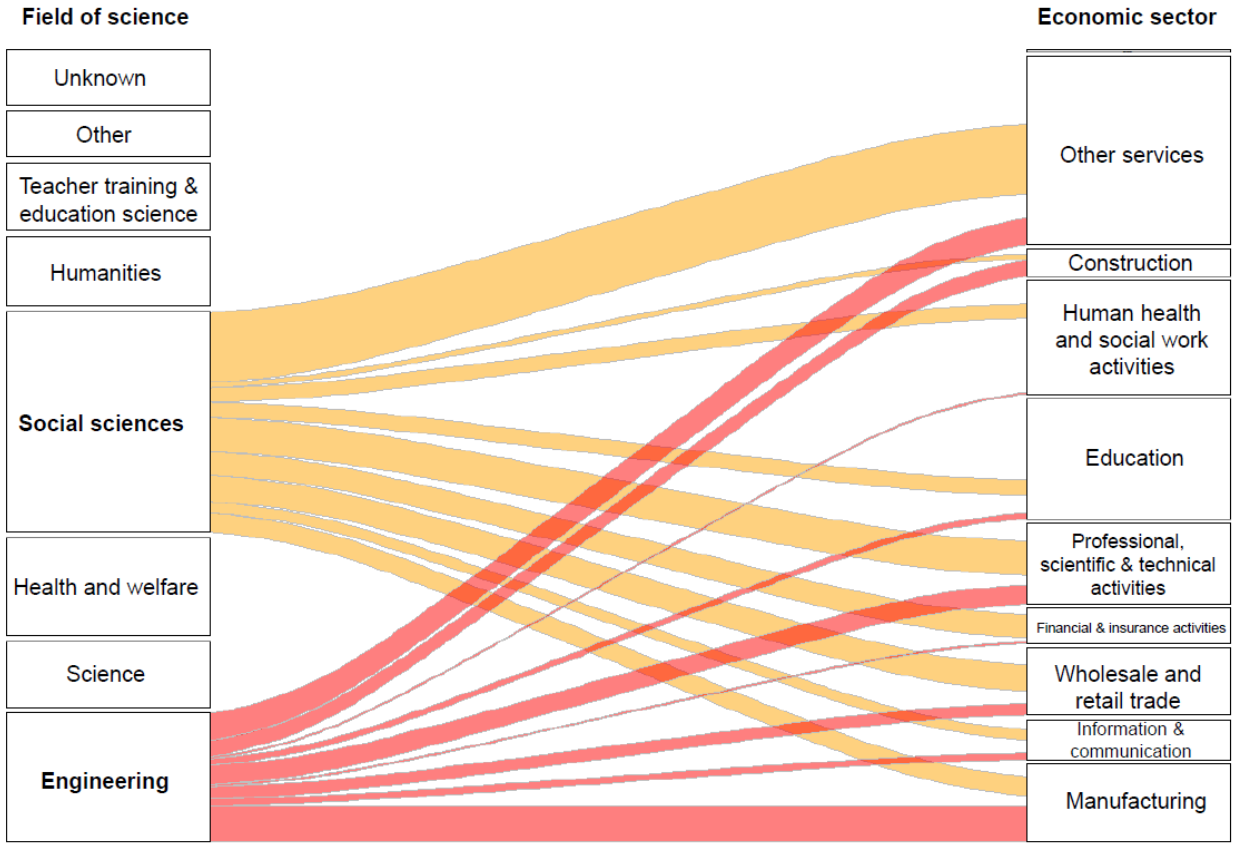
Economic sector destinations of graduates in different fields of study, EU-28, 2013



Note: The size of circles and width of arrows reflect the relative size of disciplines and connections.
Source: European Union Labour Force Survey, 2013.

How do sectors of activity of social scientists compare to those of engineers?

How do sectors of activity of social scientists compare to those of engineers?



Social scientists are particularly contributing to services **sectors**… including highly dynamic ones, such as **ICT sector**

Engineers contribute more to **manufacturing** sectors

Source: European Union Labour Force Survey, 2013.

Conclusions

- **Labour force surveys** can provide a more complete picture of knowledge transfer.
- They capture **flow of human capital** from universities to different industry sectors.
- Data shows that **social science graduates'** are active in highly dynamic sectors such as e.g. ICT.

B. POLICY INSTRUMENTS AND THE POLICY MIX FOR KNOWLEDGE TRANSFER

B. Policy instruments and the policy mix for knowledge transfer

Chapter 4. Policy instruments and policy mixes for knowledge transfer

Overview of the main policy instruments for knowledge transfer and their interactions

Chapter 5. New policy practice in support of spin-offs

In-depth analysis of the policy mix in support of spin-offs

Chapter 6. Governance of public research and its implications for knowledge transfer

Empirical analysis of governance of public research policy across OECD countries

Chapter 4. Introduction

- OECD countries use various policy instruments to stimulate knowledge transfer.
- The impact of a single instrument depends also on other instruments in place (**policy mix**)
- This chapter:
  - provides a **taxonomy of policy instruments** for knowledge transfer,
  - discusses **interactions** between policy instruments,
  - and provides insights into **recent trends** in knowledge transfer policies.

What policy instruments are in place to promote knowledge transfer?

Financial instruments

- R&D and innovation subsidies or grants
- Tax incentives
- Financial support to academic spin-offs
- Grants for IP applications
- Financial support to recruit PhDs or post-docs
- Financial support to host industry researchers
- Public procurement of technology
- Innovation vouchers
- Public-private partnerships creating joint research laboratories
- Performance-based funding systems
- Funding of infrastructures and intermediaries

Regulatory instruments

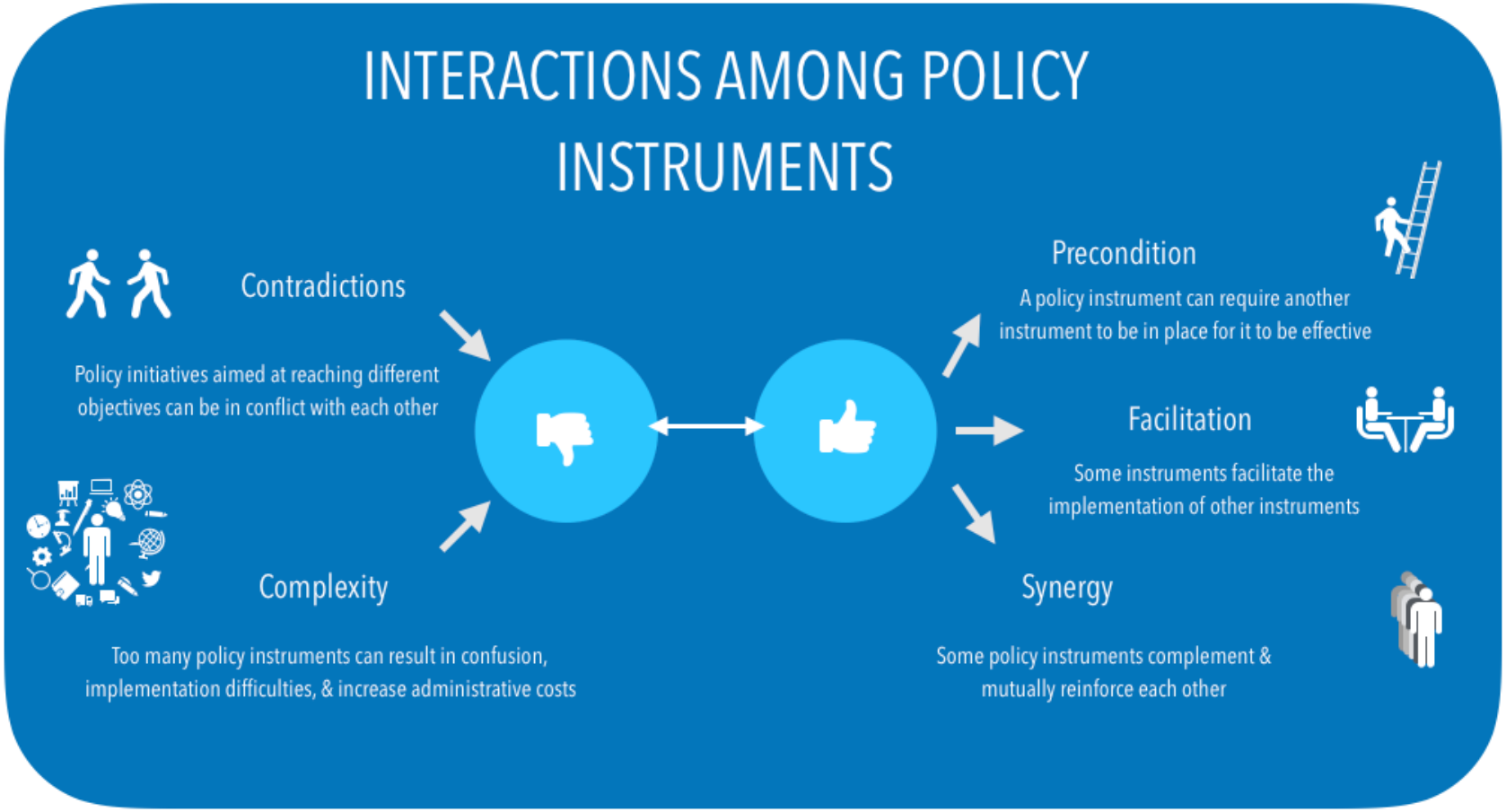
- IP rights regime
- Regulation of spin-offs founded by researchers and students
- Regulations on career rewards for professors and researchers
- Sabbaticals and mobility schemes

Soft instruments

- Awareness-raising
- Training programmes
- Networking
- Voluntary guidelines, standards and codes of conduct

How to assess interactions within the policy mix?

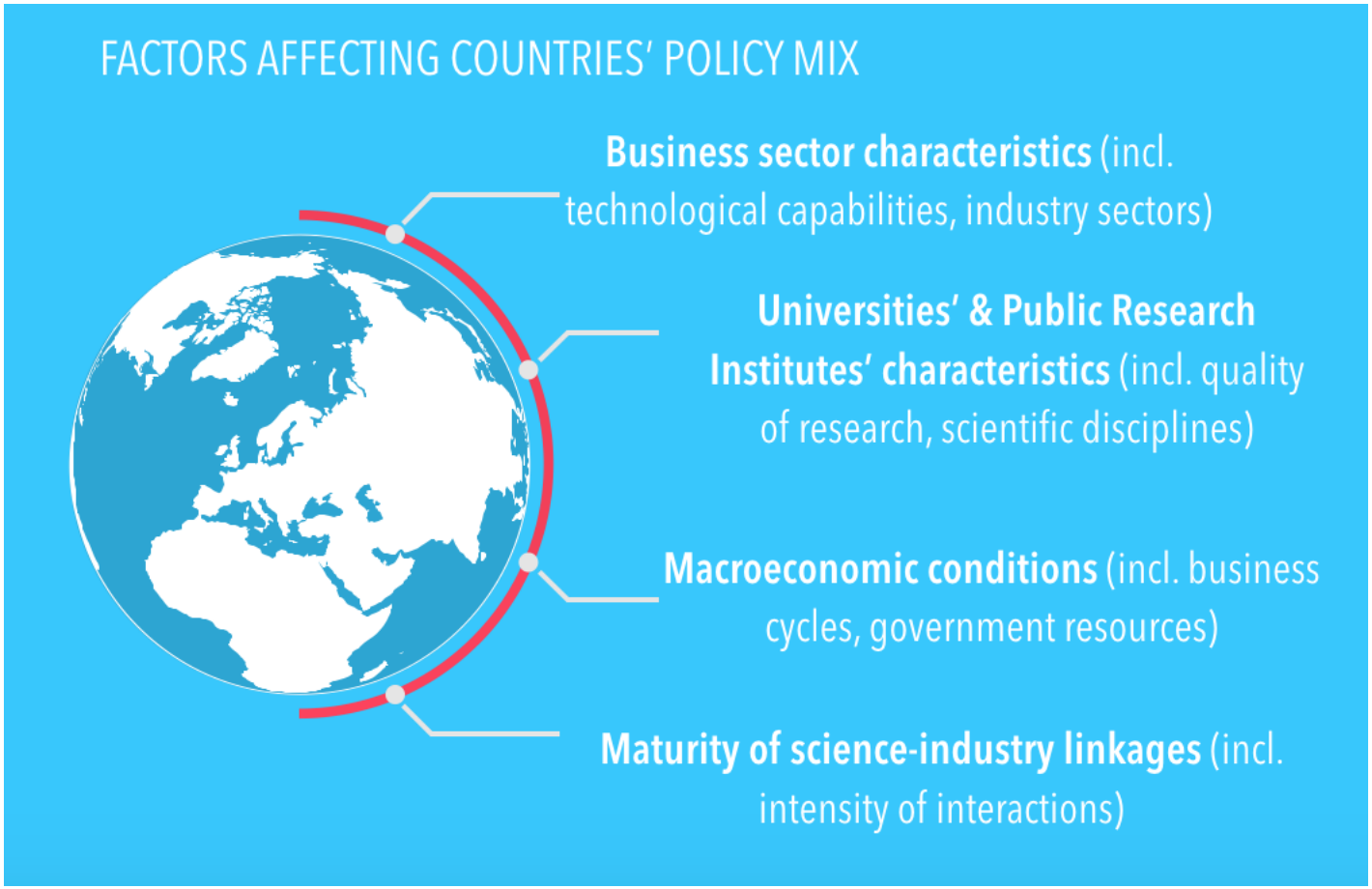
Impact of policy instruments depends on interactions with other instruments



Examples of interactions

- **Regulatory** reforms may be a *precondition* for **financial** instruments to support spin-offs to work (Colombia, Greece)
- Different policy programmes to support spin-offs create *synergies* when they target **different stages** of the spin-off life cycle (Finland, Greece)
- **Number of policy instruments** may be reduced to avoid *complexity* (Canada)
- Interactions between instruments developed by **national government** and those developed by **universities** (Norway)
- New policy instruments aim to **address observed gaps** in the policy mix (Austria)

Country conditions also have an impact on the effectiveness of the policy mix



Current trends and emerging policy approaches

1. Facilitating **knowledge co-creation:**
   - Public-private partnership, e.g. Catapult centres in the UK
   - Joint research laboratories, e.g. Portugal's CoLABs
2. Adapting knowledge transfer policies to the **digital age**
3. Supporting **international knowledge collaboration**

Conclusion

- Countries' **policy mixes** for knowledge transfer consist of financial-, regulatory-, and soft instruments.
- It is critical to assess the **interactions** (both positive and negative) among policy instruments.
- Current **policy trends** include intermediary organisations, greater emphasis on co-creation, and adapting existing policies to the digital age.

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Chapter 5. Introduction

- **Spin-offs** are one important channel of knowledge transfer.
- This chapter
  - provides an overview of **policy options** to support academic spin-offs,
  - and gives insights into **recent trends** in policies supporting spin-offs.

New policy practice in support of spin-offs

1. Focus is on **quality** and **student entrepreneurship**
   - Recent policy approaches provide support to **spin-offs with high potential**
   - Greater attention is also placed on promoting **spin-offs initiated by students**
2. **Public research institutions** have developed programmes to support academic spin-offs
   - **In-house business incubation** programmes
   - **Specialized training on entrepreneurship** (marketing, business plan, etc.)

Case study examples

- **Support for student entrepreneurship**
  - Equifund (Greece)
  - TUTL scheme (Finland)
  - ICURE (UK)
- **In-house incubation**
  - CEA (France)
  - Fraunhofer (Germany)
  - Tecnalia (Spain)

For more see https://oe.cd/2y9

Conclusions

- **Case studies** illustrate recent policy programmes implemented in a variety of OECD countries.
- New policy practice to support spin-offs include focus on quality and **student entrepreneurship**.
- **Public research institutions** pay attention to in-house business incubation and entrepreneurship training.

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Chapter 6. Introduction

- The effectiveness of the knowledge transfer depends on the **governance** of public research.
- This chapter provides new evidence on
  - the a**utonomy** of HEIs and PRIs to engage with industry,
  - **performance contracts** and other incentives for knowledge transfer,
  - and **industry and civil society participation** in policy councils and university governance boards.

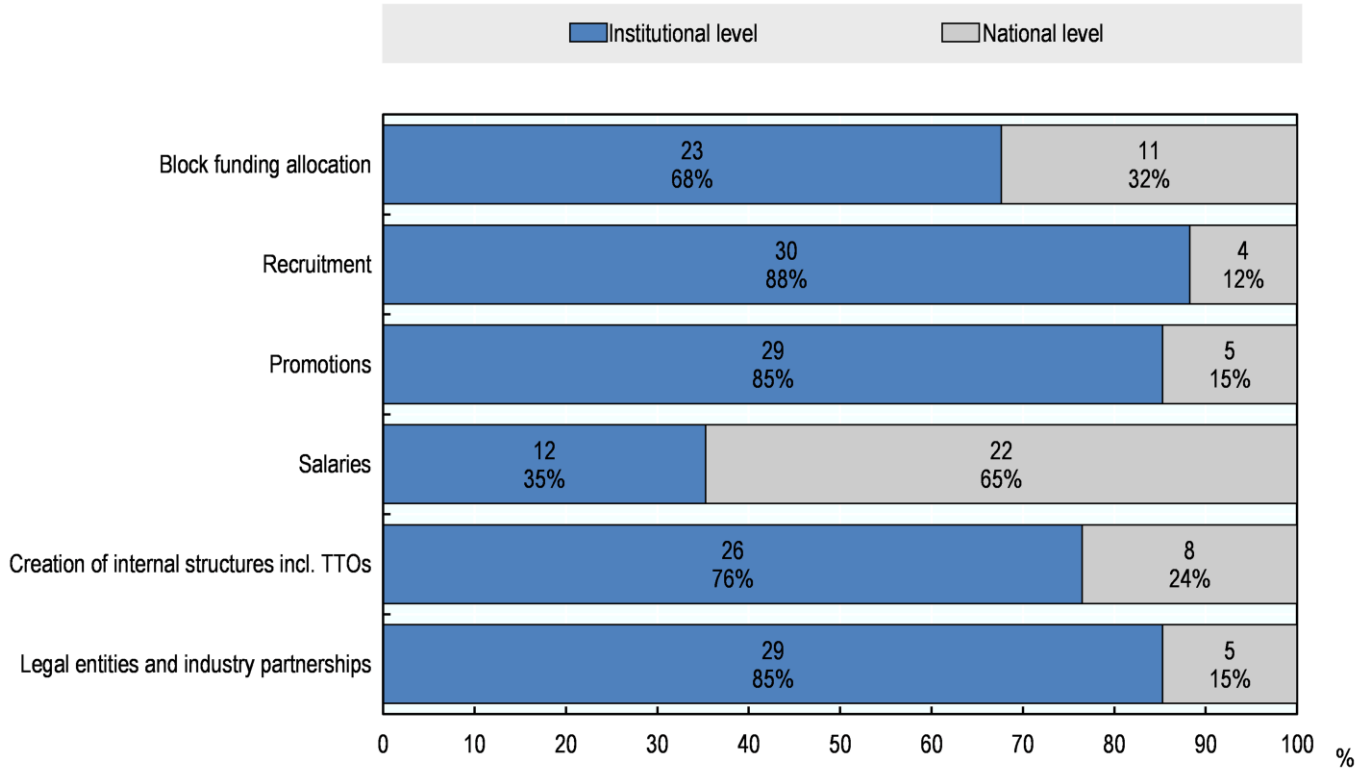
Governance of public research and its implications for knowledge transfer

- **Universities and PRIs are autonomous** in a large number of OECD countries
  - This allows them to deploy their own knowledge transfer programmes
- **Performance-based funding** often includes targets related to knowledge transfer
- **The private sector and civil society** participate in university councils, shaping how universities engage with industry

Full description of the data and findings: https://doi.org/10.1787/235c9806-en, Database: https://stip.oecd.org/resgov.

Reforms increased HEIs' autonomy over industry relations

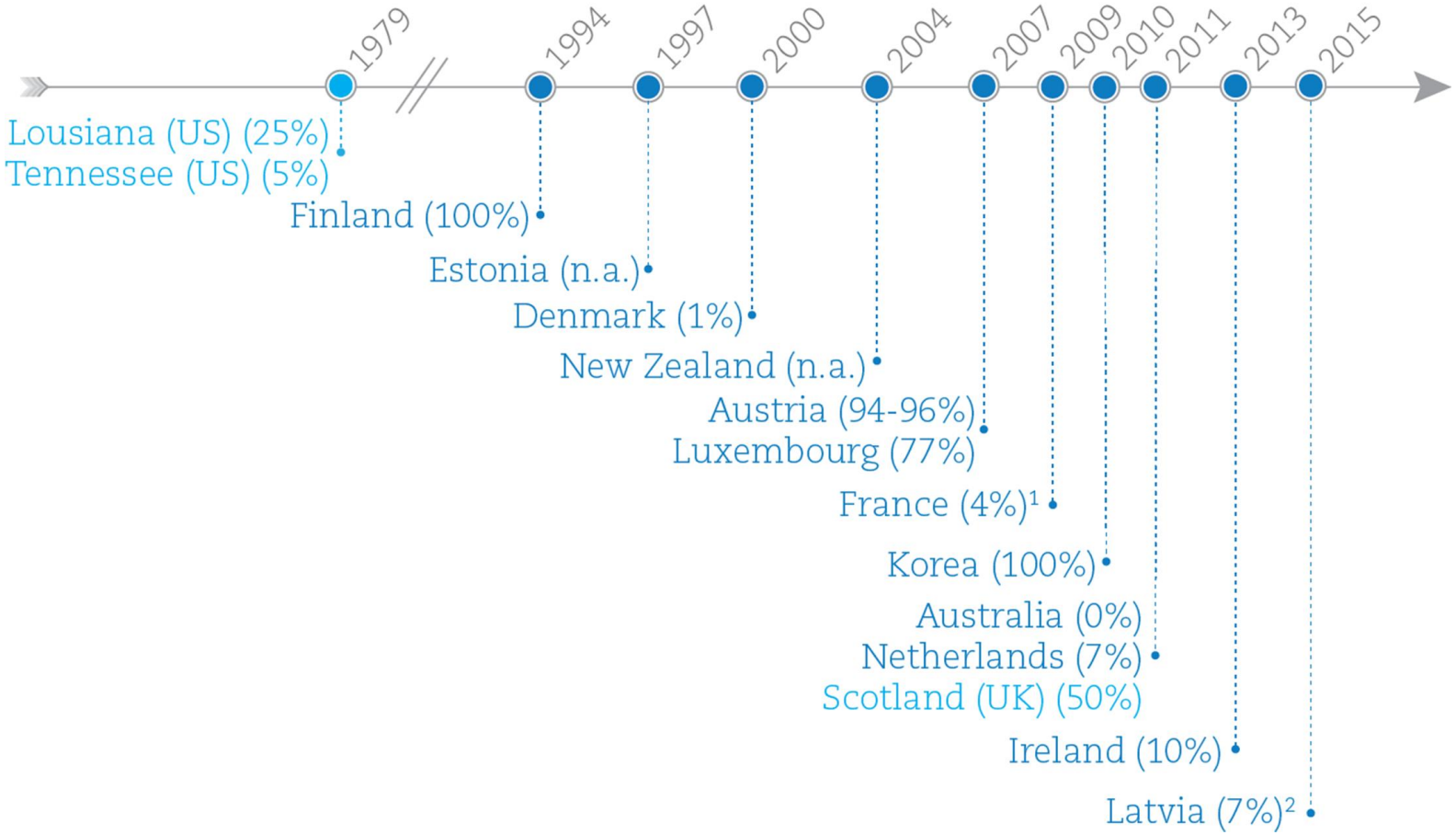
Autonomy of HEIs across the OECD-34



- Industry relations include the **creation of technology transfer offices, spin-offs,** and **industry partnerships.**

Increased use of performance contracts between ministries/agencies and individual HEIs

Year of introduction of performance contracts and share of HEI budgets involved



Stakeholder involvement in university boards has increased across the OECD

Who formally participates in public university boards?

	AUS	CHE	GBR	IRL	ISR	NZL	USA		DNK	AUT	BEL-FL	CAN	ESP	FIN	ISL	NLD	NOR	PRT	SWE	POL	DEU			FRA	HUN	JPN	SVN	SVK	ITA	KOR	GRC	CHL	CZE	LUX	LVA	MEX	TUR	Share of countries with boards
							USA-MA	USA-CA													DEU-BW	DEU-NW	DEU-BB																
Private sector	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X										74% 25 of 34
Civil society	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X								68% 23 of 34
Foreign experts	X	X	X	X	X	X	X	X	X																			X			X							29% 10 of 34
No formal representation																																X	X	X	X	X	X	18% 6 of 34

Private sector and civil society: 59%

No external stakeholder representation: 18%

- **Civil society** – members of labour unions and non-profit organisations (NGOs) – and **industry** – often large firms but also in some cases SMEs – shape policy decisions of HEIs by sitting on HEI governing boards or councils in 27 (79%) of 34 countries.

Conclusion

- New survey data shows a trend towards greater **autonomy** of universities and PRIs over industry relations and knowledge transfer.
- Increasing autonomy has been accompanied by **performance contracts** between HEIs and national ministries.
- **Industry's** and **civil society's** increasing participation in the governing boards of universities, PRIs, and research councils also has a clear influence on knowledge transfer

The report and all project materials

Website:

https://oe.cd/2xx

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https://doi.org/10.1787/a298dc87-en

Policy papers

Borowiecki, M. and C. Paunov (2018), "**How is research policy organised across the OECD? Insights from a new policy database**", OECD Science, Technology and Industry Policy Papers, No. 55, OECD Publishing, Paris, https://doi.org/10.1787/235c9806-en.

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Paunov, C., S. Planes-Satorra and T. Moriguchi (2017), "**What role for social sciences in innovation? Re-assessing how scientific disciplines contribute to different industries**", OECD Science, Technology and Industry Policy Papers, No. 45, OECD Publishing, Paris, https://doi.org/10.1787/8a306011-en.

Guimón, J. et C. Paunov (2019), "**Science-industry knowledge exchange : A mapping of policy instruments and their interactions**", OECD Science, Technology and Industry Policy Papers, No. 64, OECD Publishing, Paris, https://doi.org/10.1787/66a3bd38-en.

Borowiecki, M., N. El-Mallakh and C. Paunov (2019), "**Assessing the impacts of public research institutions on industry inventions**", OECD Science, Technology and Industry Policy Papers, OECD Publishing, Paris (forthcoming)

Case studies

All country case studies are available at:
https://oe.cd/2y9

Project events

4 workshops

Paris
December 2018

Website
Summary

Paris
March 2018

Website
Summary

Paris
March 2018

Website
Summary

Lisbon
November 2017

Website
Summary

Report launch event

London
April 2019

https://oe.cd/2xs

TIP Knowledge Transfer and Impact project

Project website: https://oe.cd/2xx

TIP Website: oe.cd/tip

Contact: Caroline.Paunov@oecd.org