



# **University-Industry Collaboration:**

## New Evidence and Policy Options

Highlights of the 2017-18 OECD  
Knowledge Transfer and Policies project



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## Table of contents

<b>1. About the project .....</b>	<b>4</b>
<b>2. University-Industry Collaboration: New Evidence and Policy Options report .....</b>	<b>5</b>
Main findings and recommendations .....	7
Chapter 1. Assessing the impacts of knowledge transfer on innovation: Channels and challenges .....	15
Chapter 2. How does public research affect industry innovation and entrepreneurship? New evidence	17
Chapter 3. Gauging social science graduates' contributions to knowledge exchange with industry .....	19
Chapter 4. Policy instruments and policy mixes for knowledge transfer .....	21
Chapter 5. New policy practice to support spin-offs.....	23
Chapter 6. Governance of public research and its implications for knowledge transfer .....	24
<b>3. Policy papers.....</b>	<b>25</b>
How is research policy across the OECD organised? Insights from a new policy database .....	25
Public research and innovative entrepreneurship - preliminary cross-country evidence from micro data .....	25
What role for social sciences in innovation? Re-assessing how scientific disciplines contribute to different industries .....	26
Science-industry knowledge exchange: Mapping policy instruments and their interactions .....	26
Assessing the impacts of public research institutions on industry inventions (forthcoming) .....	26
<b>4. Case studies .....</b>	<b>27</b>
Studies on the policy mix for science-industry knowledge transfer .....	27
Accounts of spin-off support schemes of European RTOs .....	27
Analyses of instruments in support of knowledge transfer .....	28
<b>5. Project workshops.....</b>	<b>29</b>
Stimulating knowledge transfer: challenges and policy responses .....	29
Semantic analysis for innovation policy .....	29
Boosting knowledge transfer between science and industry: new models and business practices .....	30
Towards effective science-industry co-creation.....	30
University-Industry Collaboration: New Policy Perspectives .....	31

## 1. About the project

**What are the impacts of public research on innovation performance? How can we best stimulate university-industry collaborations for innovation?** The Knowledge Transfer and Policies project, conducted by the OECD Working Party on Innovation and Technology Policy (TIP) between 2017 and 2018, addressed those questions. This brochure presents the [final report and additional materials](#) (case study contributions from different countries, policy papers and expert workshops) produced in the context of the OECD Knowledge Transfer and Policies project.

The [OECD Knowledge Transfer and Policies project \(2017-18\)](#) was conducted by the OECD Working Party on Innovation and Technology Policy (TIP). The project was a collaborative initiative effort steered by an OECD team with guidance from the project's steering group – composed of country delegates. Experts and delegates to the OECD Working Party on Innovation and Technology Policy (TIP) and the OECD Committee for Scientific and Technology Policy (CSTP) provided regular comments on the project's direction, engaged in several expert workshops and provided country case studies.

The project was led by Caroline Paunov. The principal authors of the report 'University-Industry Collaboration: New Evidence and Policy Options' were Martin Borowiecki, José Guimón, Caroline Paunov and Sandra Planes-Satorra. The team supporting the project also included Greta Ravelli, Blandine Serve and Maria Fernanda Zamora. Dominique Guellec served in an important advisory capacity of the project.



## 2. University-Industry Collaboration: New Evidence and Policy Options report

The report '**University-Industry Collaboration: New Evidence and Policy Options**' discusses challenges and opportunities in assessing the impacts of science-industry knowledge exchange on innovation. The report provides **new evidence on joint industry-science patenting activity and academic start-ups**, as well as on the impact of geographical proximity between research institutions and industry on local innovation. The report explores the **complex set of knowledge-transfer channels**, such as collaborative research, co-patenting, academic spinoffs, and their relative importance across science fields and industry sectors. It also experiments with using labour force survey data to assess the contributions of graduates in social sciences to different industries.

**Different policy mixes are used in OECD countries to stimulate science-industry knowledge transfer.** This report presents a taxonomy of 21 policy instruments, which include grants for collaborative university-industry research and financial support to university spin-offs, and discusses their possible positive and negative interactions. Based on a number of country case studies, the report also sheds light on **new policy approaches to support spin-off creation**. The report also explores recent trends on the governance of public research of high relevance to science-industry knowledge transfer using newly developed policy indicators for 35 OECD countries.



The **report** and other project materials are available at: <https://oe.cd/2xx>



## Main findings and recommendations

### Challenges in assessing the impacts of science-industry knowledge transfer on innovation and new approaches

**Science-industry knowledge transfer unfolds through various formal and informal channels**, the relative importance of which varies across science fields and industry sectors. Formal channels include collaborative and contract research, academic consultancy, intellectual property transactions, labour mobility and academic spin-offs. Informal channels of interaction include conferencing and networking, facility sharing, and continuing education provided by universities to enterprises, to name a few.

Given such diverse channels and the differences in knowledge transfer across economic sector and research disciplines, **assessing the impact of science-industry knowledge transfer on innovation to reach specific socio-economic objectives is challenging**. Other difficulties arise for impact analysis, such as establishing the causal impacts of public research on innovation. Such efforts require gathering representative data to investigate the impact factors of interest, and applying the right analytical tools.

The impacts of science-industry knowledge transfer have typically been assessed using case study evidence, patent data and publications data. Such analyses, however, capture only specific channels, and tend to be biased towards certain disciplines and sectors (e.g. technical innovation in the case of studies based on patent data).

**Several new approaches can help improve the evidence on knowledge transfer and its impacts.** Evidence from labour force surveys can help provide a more complete picture of knowledge transfer, given that i) they capture the flow of human capital from university to industry, often considered one of the most important channels of science-industry interaction, and ii) they capture the full spectrum of science fields and industry sectors.

**New datasets and tools can also provide fresh insights into knowledge transfer.** These include data on innovative start-ups and venture capital deals (e.g. provided by Crunchbase, a commercial database on innovative companies that contains information on their funders and founders). Semantic analysis also provides opportunities for innovation policy analysis, as explored in a recent OECD-TIP workshop.

“The report provides new indicators to capture new dynamics of science-industry linkages, going further than other works in this field. It convincingly explores the complexity of knowledge transfer”

- *Tiago Santos Pereira*

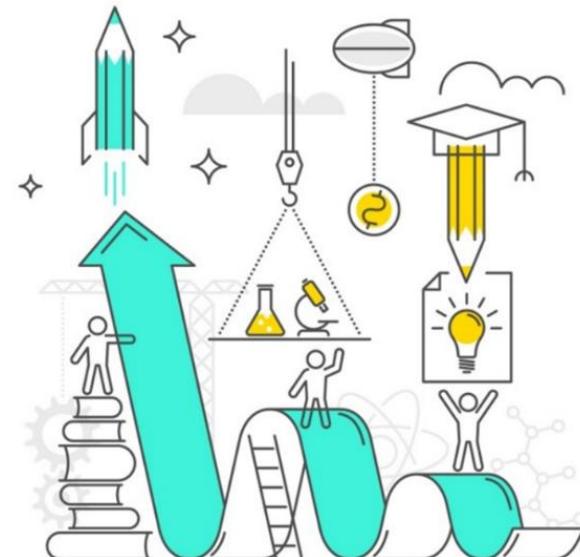
*Vice chair of the OECD-TIP Working Party*

*Centre for Social Studies, University of Coimbra,  
Portugal*

## New evidence regarding science-industry knowledge transfer and its impacts

A combination of different methods and data sources is necessary to assess the impact of knowledge transfer. New evidence presented in this report shows that:

- **The direct contributions of universities and PRIs to patenting remain modest, but are growing faster than those of inventions from firms.** Data on patent applications to the European Patent Office (EPO) show that the proportion of those filed by universities and PRIs represented 1.3% of total EPO patent applications over the period 1992-2014. However, the number of patent applications by universities and PRIs increased more than fivefold during that same period, while the number of patent applications of industry doubled.
- **Universities and PRIs increasingly engage in research collaboration with industry.** The number of EPO patent applications jointly filed by public research institutions and industry grew faster than university-owned patent applications. In 2014, the number of co-patent applications with industry made up 43% of all patents applications of universities and PRIs, compared to 24% in 1992.
- **Proximity to universities and PRIs matters for industry inventions.** Data on more than 2.5 million EPO patent applications for 35 OECD countries and China over 1992-2014 show that 50% of all inventive activity by industry occurred within a 30-kilometre distance from a research university. Results from an econometric analysis suggest proximity to universities has a positive significant effect on the growth rate of local industry EPO patent applications is moreover irrespective of local business dynamics or annual time trends.
- **Start-up firms founded by students or academics significantly contribute to commercialising knowledge developed through public research.** Academic start-ups account for around 15% of overall start-up activity. The share of academic start-ups is particularly high in science-based technological fields – for instance, they account for 23% of all innovative start-ups in biotechnology. Start-ups founded by PhD students and academic researchers are significantly more likely to patent than non-academic start-ups.
- **Labour mobility is a key channel of science-industry knowledge transfer,** particularly in some disciplines and industry sectors. New evidence based on labour force surveys provides insights on the contributions of social scientists to industry. Evidence shows that graduates in social sciences (which include economics, political science, sociology, geography, business studies and law) contribute to innovation in a wide range of service sectors, including highly dynamic ICT sectors.



## A diversity of policy instruments are used for knowledge transfer

OECD countries use a **range of policy instruments to support science-industry knowledge transfer**. Examples include grants for collaborative university-industry research; tax incentives for firms that purchase services from universities; mobility schemes for researchers; and networking events. This report identifies 21 specific policy instruments that can be classified according to: i) whether they are financial, regulatory or soft instruments; ii) whether they target primarily firms, universities/PRIs, or individual researchers and research groups; iii) the type of knowledge transfer channels being addressed; and iv) the supply- or demand-side orientation of policy instruments.

While countries tend to use similar sets of policy instruments to support knowledge transfer, **differences across countries appear in the relative importance accorded each type of policy instrument** (e.g. in terms of budget or number of initiatives), and in the detailed design or implementation of each policy instrument (e.g. in terms of target groups, eligibility criteria, time horizon, monitoring methods, etc.).

The impacts of single instruments depend not only on the features of the instrument but also on other policies in place. Besides the composition of the policy mix, the **interactions (both positive and negative) among its elements are critical to outcomes**. Synergies reinforce positive outcomes while trade-offs may counteract any positive impacts of policies. This means that a country's choice of financial, regulatory and soft instruments to promote knowledge transfer needs to be coherent so that the different policy instruments reinforce each other rather than result in contradiction, confusion or excessive complexity (Table 1).

"This is a comprehensive and concise report.  
Its value lies in new data sources and new  
policy taxonomies."

- Agni Spilioti

Vice chair of the OECD-TIP Working Party

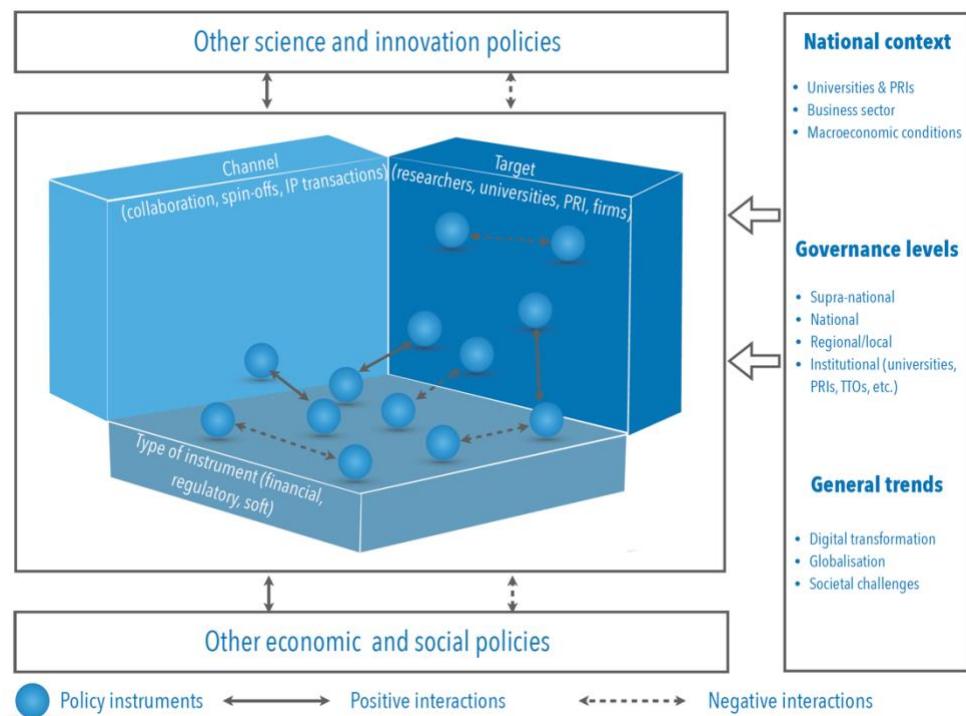
Director, S&T Policy Planning Directorate, General Secretariat for Research and Technology, Ministry of Education, Research & Religious Affairs, Greece

Table 1. Types of interactions between policy instruments

Type of interaction	Description
<b>Positive interactions</b>	
Precondition	X is necessary in order to implement Y (i.e. the sequence by which policy instruments are introduced matters).
Facilitation	X increases the effectiveness of Y, but Y has no impact on X.
Synergy	X increases the effectiveness of Y, and vice versa.
<b>Negative interactions</b>	
Contradiction	X decreases the effectiveness of Y, and vice versa.
Complexity	Using too many policy instruments results in confusion for target groups, operational difficulties, and increased administrative costs.

Case study evidence illustrates the **synergies and trade-offs** at play among policy initiatives that support academic spin-offs. Business support – including in the form of marketing or training support – can enhance the effectiveness of financial support measures for spin-offs. In terms of trade-offs, an overly complex set of instruments creates complexity and raises administrative costs, and thus can prove less effective than single policies.

## Conceptual framework



Key trends affecting science-industry knowledge transfer include the following:

- **Creation of new intermediary organisations** – Such organisations include, among others, R&D centres for science-industry collaboration, business incubators, and regional technology transfer organisations. These aim at building bridges between science and industry and differ widely, e.g. in terms of their funding structure, functions and organisational profiles. New approaches include building larger technology transfer offices formed in alliance with several universities and more specialised intermediaries to cater for specific business needs. These TTOs pool services to improve the efficiency and quality of knowledge transfer services with a sectoral or regional focus. Several countries have also developed specific intermediary organisations specializing in the needs of SMEs.
- **Greater emphasis on knowledge co-creation** – Public support for science-industry collaboration is shifting towards more intense “co-creation” relations, which involve the joint creation of knowledge by industry, civil society and research. These may take different forms, such as the creation of joint infrastructures, sharing of resources and engagement in joint research projects. Besides strategic long-term research partnerships and joint labs, co-creation may involve knowledge transfer channels such as the mobility of human capital. This entails building conditions allowing for two-way mobility of researchers from public research institutes and higher education institutions to temporarily join industry, and for industry researchers to temporarily participate in university activities.
- **Adapting knowledge transfer policies to the digital transformation** – New forms of open digital innovation enable more intense collaboration between firms and universities. These include online communities of experts, tournaments, open calls and crowdsourcing. Digital platforms help match supply of and demand for technology by connecting firms with global networks of public research centres, individual scientists and freelancers to solve specific technological problems. In addition, research results and data are becoming more easily (and freely) available through open data and open access practices, while interactions between science and civil society are being enhanced through open science.

## Governance mechanisms to promote knowledge transfer

The effectiveness of the policy mix for knowledge transfer depends on the quality of the governance of public research (i.e. the institutional arrangements that govern policy action regarding publicly funded research in universities and PRIs). Instruments will operate differently depending on how universities and PRIs are empowered (or not) in shaping their own ways of reaching the targets set. Interaction among different levels of governance (e.g. national vs. regional) may create synergies but may also lead to duplications and unnecessary complexity in the absence of efficient co-ordination mechanisms. Therefore, when assessing a country's policy mix for knowledge transfer, it becomes critical to analyse the institutions and governance systems that determine how policy instruments are designed and implemented.

The new OECD Database on Governance of Public Research Policy ([stip.oecd.org/resgov](http://stip.oecd.org/resgov)), built for this TIP project, shows evidence of the following key governance practices that influence science-industry knowledge transfer:

- **Universities and PRIs are autonomous in a large number of OECD countries.** This allows them to deploy their own support programmes for knowledge transfer, on top of those offered across the board by the national or regional governments. In particular, universities and PRIs across many OECD countries can create their own functional units (e.g. technology transfer offices) and legal entities (e.g. spin-offs); decide on the recruitment and promotion of academic staff; and establish the rules that determine the share of IP revenues that researchers may receive.
- **Performance contracts set out the contributions of autonomous universities and PRIs to national innovation objectives as set out in STI strategies.** Performance-based funding systems often include targets related to knowledge transfer, such as collaborative research projects, income from patent licensing, the number of spin-off companies created or income from contract research.
- **The private sector and civil society are participating in shaping how universities engage with industry** and are also engaging more actively in policy decision making. In 25 of 34 OECD countries (or 74%), representatives from industry (e.g. large firms and, increasingly, smaller private firms) are participating in the governing boards of universities. In 26 of 31 OECD countries with research and innovation councils (or 84%), they also participate in policy decision making by participating in research and innovation councils.

"The report provides a good overview of key issues surrounding knowledge transfer, including multi-stakeholder collaboration, governance, and steering of policy initiatives. The follow-up work on co-creation is promising"

- Kai Husso

Vice chair of the OECD-TIP Working Party

Chief Planning Officer, Enterprise and Innovation Department, Ministry of Economic Affairs and Employment, Finland

## Policy recommendations

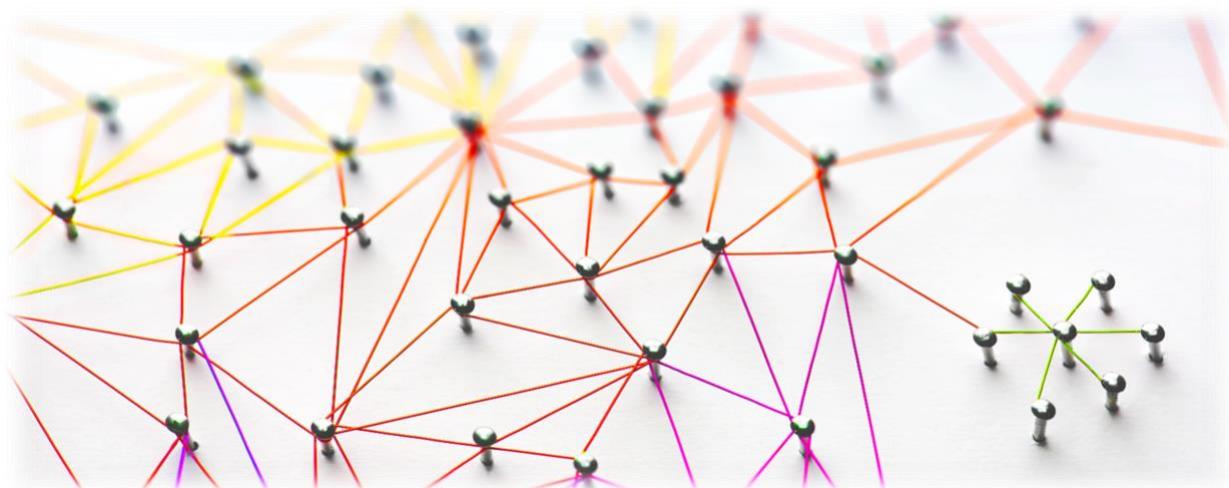
The following are core policy recommendations for knowledge transfer policies to support innovation and socio-economic development goals:

### Set knowledge transfer policies that respond to industry and research needs

- **There is no “one-size-fits-all” policy approach to knowledge transfer.** The importance of specific knowledge transfer channels varies across countries, science fields and industry sectors, and over time. Countries thus need to consider their economic structures and areas of public research strengths when designing knowledge transfer policies. For example, patenting and academic start-ups are relevant knowledge transfer channels in science-based technological fields (e.g. biotechnology), whereas social scientists contribute to a wide range of service sectors through labour mobility.
- **Policies should support public research institutions in developing knowledge transfer activities that are aligned with their research strengths.** Overemphasis on specific channels – often encountered with patenting – may neglect certain strengths, such as the potential to promote student entrepreneurship and academic spinoffs. Patenting and academic start-ups, while very useful for science-based sectors, are concentrated in leading academic institutions, with the leading 100 universities worldwide producing 45% of all academic start-ups. Other institutions may be better at developing student start-ups (which are less science-based) and supporting knowledge transfer through the mobility of students to industry. In the latter case, it is important that academic curricula are regularly revised to respond to emerging industry needs.
- **Policies should take advantage of opportunities for knowledge transfer offered by digital technologies.** Most innovative approaches to open innovation, enabled by digital technologies, include online communities of experts, open calls and crowdsourcing. Such opportunities can help spur new collaborations and bolster the international competitiveness of the research base.
- **Policies should support strategic, long-term-oriented forms of co-creation.** New policy approaches to promote science-industry links are progressively shifting away from the linear short-term model of knowledge transfer between industry and research in support of economic priorities, and toward a more interactive, longer-term model of knowledge “co-creation” that involves multiple stakeholders from industry, civil society, research and government, and that additionally aims to solve wider societal challenges. Policy initiatives relevant to co-creation include joint research laboratories (e.g. CoLABS in Portugal); the two-way mobility of researchers across organisational boundaries (e.g. through industrial PhDs); the establishment of new intermediary institutions (e.g. Catapult Centres in the United Kingdom); and the development of new guidelines for intellectual property management.

## Strengthen the policy mix for knowledge exchange

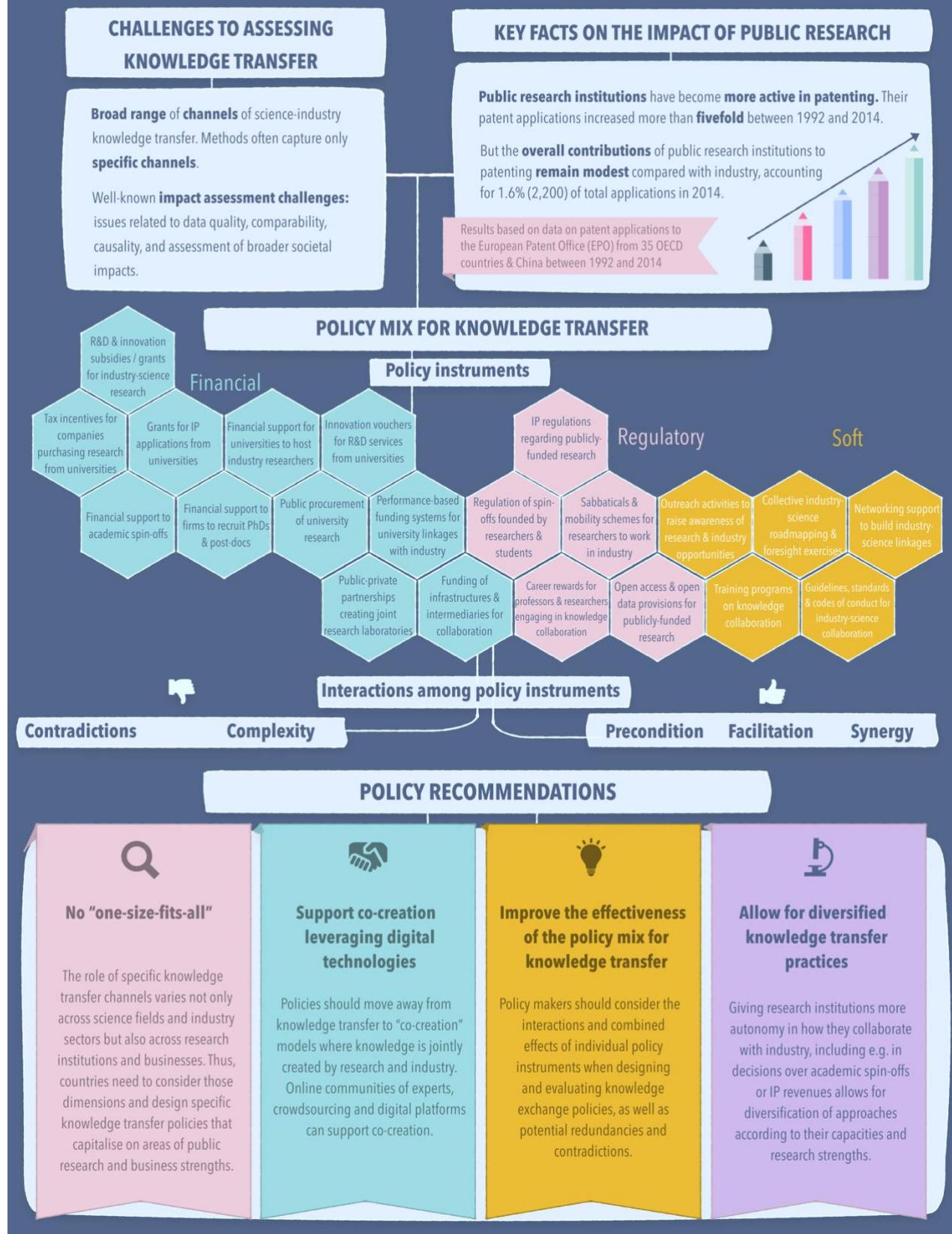
- **Countries should increase synergies and reduce complexity in the policy mix for knowledge exchange.** Synergies can be created when different policy instruments complement and mutually reinforce each other. This may be the case with different programmes that support different stages of commercialisation and business support measures, including entrepreneurial training for young start-ups. It is also important to streamline the policy mix, as employing too many policy instruments often results in confusion for target groups, operational difficulties, and increased administrative costs.
- **Policy makers should consider the interactions among policy instruments** when designing and evaluating knowledge exchange policies. Greater efforts are necessary to move towards policy design and evaluation methods that consider the combined effects of policy instruments, as well as potential redundancies and contradictions.
- **Giving HEIs and PRIs more autonomy** in how they organise knowledge exchange allows for diversification of approaches, reflecting differences across institutions.
- **New regulatory frameworks should be revised to facilitate the participation of industry and civil society in the governing boards of HEIs and PRIs**, and to promote stakeholder consultations in the decision-making processes of these institutions. Such revision would ensure that the interests and demands of industry and civil society are taken into consideration, including those relating to research directions, teaching curricula, and the local engagement of institutions. This can help make institutions more responsive to business and societal needs.
- **Exploit the potential of new data sources and methodologies to assess knowledge transfer.** Better metrics are necessary to better assess knowledge transfer. This includes combining commonly used data sources and methodologies (e.g. patent and publications data) with new data sources and techniques. For example, text-mining may allow more systematic analysis of the content of scientific publications and patents, revealing the extent to which a publication is truly novel, or whether a patent is related to a particular social concern. More can also be learned from using more labour force and employer-employee surveys to unveil the contributions of labour mobility to knowledge transfer – often considered the main channel of science-industry interaction.



## Synthesis of the report

# University -Industry Collaboration

## New Evidence and Policy Options



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

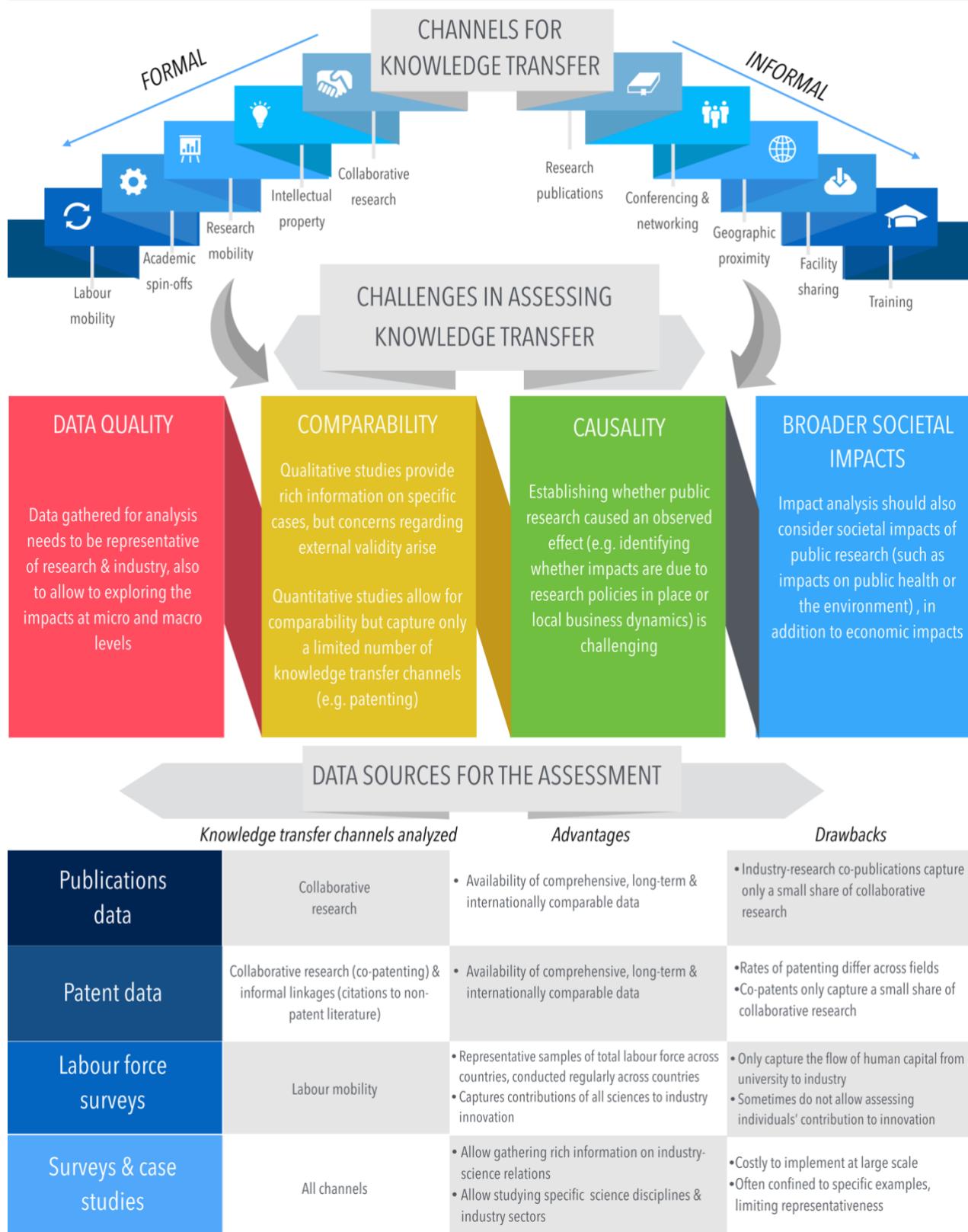
With sizeable public investment in research and mounting budgetary pressures, governments of OECD countries have placed increasing emphasis on enhancing the impact of their investments, specifically concerning their contributions to innovation. Science is a key contributor to building the seeds for innovation and, accordingly, to innovation-driven growth; however, assessing the exact contributions of these investments is a complex process, as the degree of effectiveness is necessarily affected by the efficiency of different knowledge transfer channels in facilitating interactions between industry and science. Accounting for the effectiveness of knowledge transfer is consequently an important but challenging task.

This chapter describes the **core channels for knowledge transfer, the methods that have been used to measure impacts, and how these methods perform in tracing the effectiveness of knowledge transfer**. The chapter goes on to explain how different methods and sources for measuring knowledge transfer can help shed at least partial light on effective transfer. It also summarises the main challenges in assessing impacts that render effective assessments complex.

The discussion emphasises that this complexity arises from diversity – the very different nature and characteristics of knowledge transfer channels. The limitations of methods to assess this transfer caution against simplistic uses of results. When it comes to assessing impacts, well-known challenges – including causality and limitations to cross-country comparability – need to be taken into account.

## Synthesis of chapter 1

# HOW TO ASSESS THE IMPACTS OF KNOWLEDGE TRANSFER ON INNOVATION?



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

Assessment of the impacts of universities and public research institutions (PRIs) on commercial innovations and innovative entrepreneurship is at the top of the policy agenda, due to increasing demands for effective public investment. There is agreement that **public research** (which refers to universities and PRIs unless otherwise indicated) **contributes to innovation and entrepreneurship via different channels of knowledge transfer**, including university inventions, academic start-ups, and informal science-industry linkages, all of which are facilitated by the proximity of universities and firms.

Several statistical analyses have investigated impacts of universities on productivity and innovation, generally using data for a single country. However, to date little cross-country evidence exists to document the contributions of higher education institutions (HEIs) and PRIs to inventions, start-ups, and research institutions' contributions to local innovation and entrepreneurship.

This chapter provides **fresh evidence on the patenting activities of universities and their impacts on local business inventions**. It also discusses evidence on academic start-ups as identified in Crunchbase (a commercial database of start-ups that is increasingly used by the venture capital industry as a “the premier data asset on the tech/startup world”). The sample used for this chapter contains **40 363 start-ups**. These firms are matched to HEIs and PRIs using information on the founders’ educational history. The database covers OECD and BRICS countries for the period 2001-16.

The following main findings emerge from these analyses:

- **Universities and PRIs themselves have become more active in patenting** over the past two decades: the number of European Patent Office (EPO) patent applications of research institutions increased more than fivefold in the period 1992-2014.
- **Some of the patenting activity of universities and PRIs takes place in collaboration with industry.** EPO patent applications jointly filed by public research institutions and industry – reflecting knowledge co-creation between science and industry – grew faster than university-owned patent applications.
- Data on more than 2.5 million EPO patent applications for 35 OECD countries and China over 1992-2014 show that **50% of all inventive activity by industry occurred within a 30-kilometre distance from a research university**. Results from an econometric analysis suggest proximity to universities has a positive significant effect on the growth rate of local industry EPO patent applications is moreover irrespective of local business dynamics or annual time trends.
- **Academic start-ups** – defined as start-ups established by students, PhDs and researchers – **account for around 14-15% of overall start-up activity** registered on Crunchbase between 2001 and 2016. The share of academic start-ups is particularly high in science-based technological fields, for example accounting for 23% of all innovative start-ups in biotechnology.

## Synthesis of chapter 2

### 5 KEY FACTS ABOUT THE IMPACTS OF PUBLIC RESEARCH ON INNOVATION

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



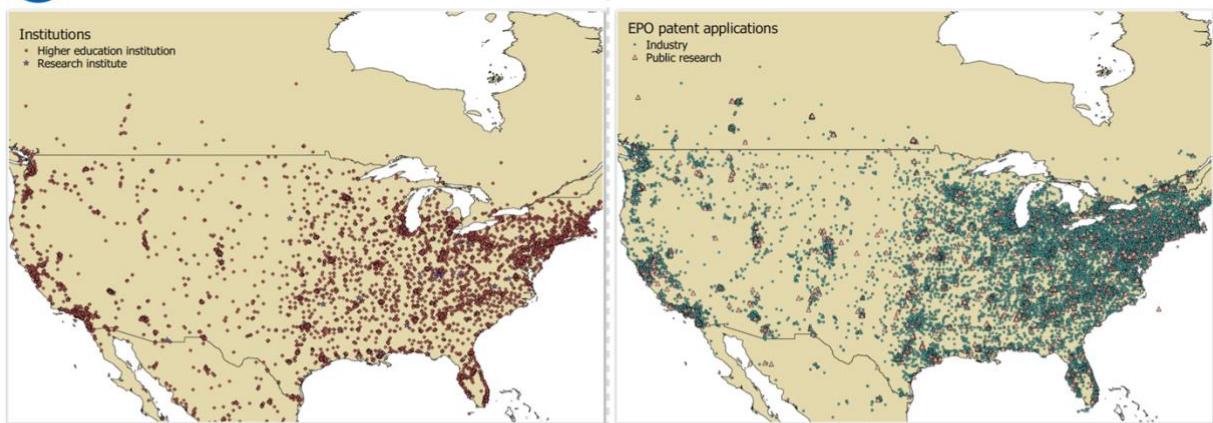
#### 2 Public research institutions collaborate more with industry

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



#### 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

#### 4 Geography matters: universities & inventive industry collocate

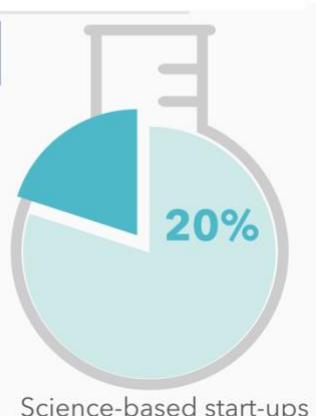
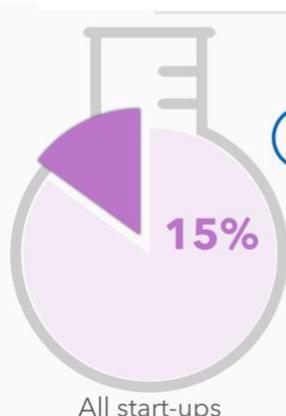


**Proximity to university** is positively associated with **local industry patent applications**, irrespective of local business dynamics

#### ACADEMIC START-UPS

##### 5

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)



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

**The importance of specific knowledge transfer channels varies across science fields and industry sectors.** Some studies show that patenting and licensing are very important for researchers in materials science and chemical engineering, but considerably less so for those in computer sciences. Contract and collaborative research and the flow of students from university to industry have been found to be highly relevant in engineering disciplines, while personal contacts and labour mobility have greater relevance in social sciences.

**Measuring knowledge transfer between all different science fields and economic sectors is thus a challenging task,** given that academic disciplines engage differently with industry. Furthermore, some channels are particularly difficult to capture. Existing studies assessing the links between science and industry – mostly using patent data or case study evidence – mainly capture formal channels of interaction. Studies based on patent data in particular tend to be biased towards technical innovation and disregard the contributions of social sciences. Case studies have also mainly focused on exploring the contributions of STEM (science, technology, engineering, math) fields.

This chapter examines the **role of social science graduates in science-industry knowledge transfer** compared to individuals with other academic backgrounds, based on new evidence from labour force surveys.

The chapter finds **that evidence from labour force surveys helps provide a more complete picture of knowledge transfer** between science and industry, given that i) they capture the flow of human capital from university to industry, often considered one of the most important channels of science-industry interaction, and ii) they capture the full spectrum of science fields and industry sectors. An important caveat, however, is that those surveys do not directly allow identification of personnel involved in innovation activities, especially when individuals with postgraduate degrees cannot be distinguished.

### Synthesis of chapter 3

## HOW DO SOCIAL SCIENCES CONTRIBUTE TO INNOVATION?

### WHY IS IT DIFFICULT TO ASSESS THE CONTRIBUTION OF SOCIAL SCIENTISTS TO INNOVATION?

#### Diversity of contributions to innovation

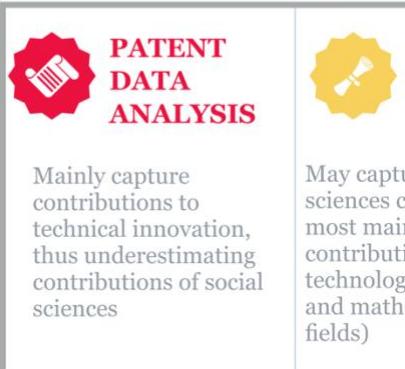
Social scientist contribute critically to the diffusion and adaptation of innovation, as well as the implementation of process and organizational innovations. However, these are challenging to quantify.

#### 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?

#### Traditional approaches



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



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

#### New methods

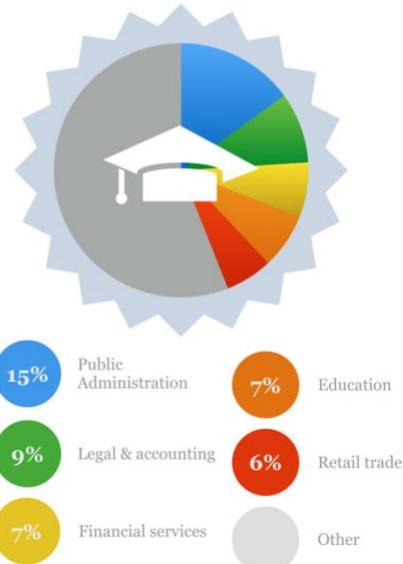


**FUTURE AVENUES**

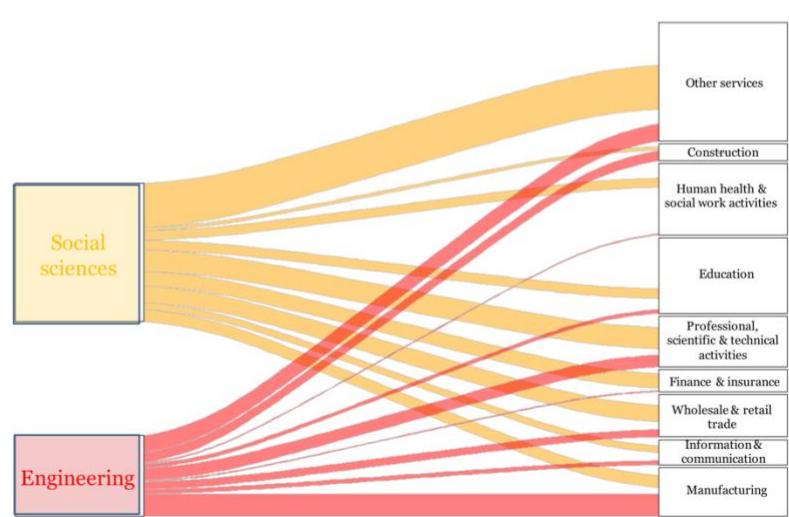
New data and big data analysis offers new opportunities (e.g. web scraping of online job advertisements allows exploring demand for social scientists)

### SECTORS OF ACTIVITY OF GRADUATES IN SOCIAL SCIENCES (EU-28, 2013)

#### Main sectors of activity for graduates in social sciences



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



## Chapter 4. Policy instruments and policy mixes for knowledge transfer

**OECD countries use various policy instruments to stimulate science-industry knowledge transfer.** Examples include grants for collaborative university-industry research, tax incentives for firms that purchase services from universities, financial support to university spin-offs, mobility schemes for researchers and networking events, among others. The impacts of single instruments depend not only on the features of the instrument but also on other instruments in place. For instance, grant programmes to support collaborative research work better when accompanied by networking services and guidelines for IP management. Yet, the prevalent approach in policy analysis has been to evaluate instruments in isolation, providing little insights on the policy mix.

This chapter provides a **comprehensive overview of the policy instruments used to support knowledge transfer** and different possible categorisations of these policies. It also discusses the interactions between policy instruments and how the policy mix has changed over time. Since policies to promote knowledge transfer are a subset of a country's overall science, technology and innovation (STI) policies, the broader innovation, economic and social policies are also taken into consideration.

The chapter identifies **21 policy instruments**, which can be classified by: i) whether they are financial, regulatory or soft instruments; ii) whether they target primarily firms/industry, researchers or universities/public research institutes (PRIs); iii) the type of knowledge transfer channels being addressed; and iv) the supply- or demand-side orientation of policy instruments. While OECD countries tend to use the same type of policy instruments, differences across countries appear in the relative importance accorded each type of policy (e.g. in terms of budget or number of initiatives) and in the detailed design or implementation of the policy instrument (e.g. target groups, eligibility criteria, etc.).

In addition to the composition of the policy mix, **the interactions (both positive and negative) among its elements are critical to outcomes**. This means that a country's choice of financial, regulatory and soft instruments to promote knowledge transfer needs to be coherently aligned, so that the different policy instruments reinforce and complement each other rather than resulting in contradiction, confusion or excessive complexity. Potential interactions with broader economic and social policies also need consideration.

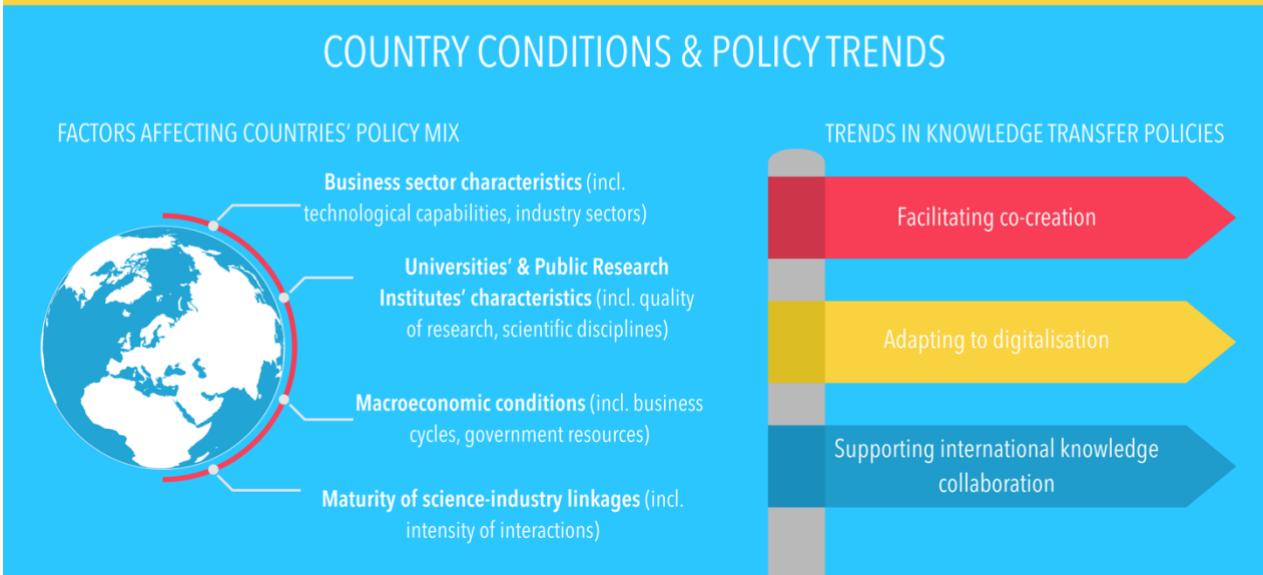
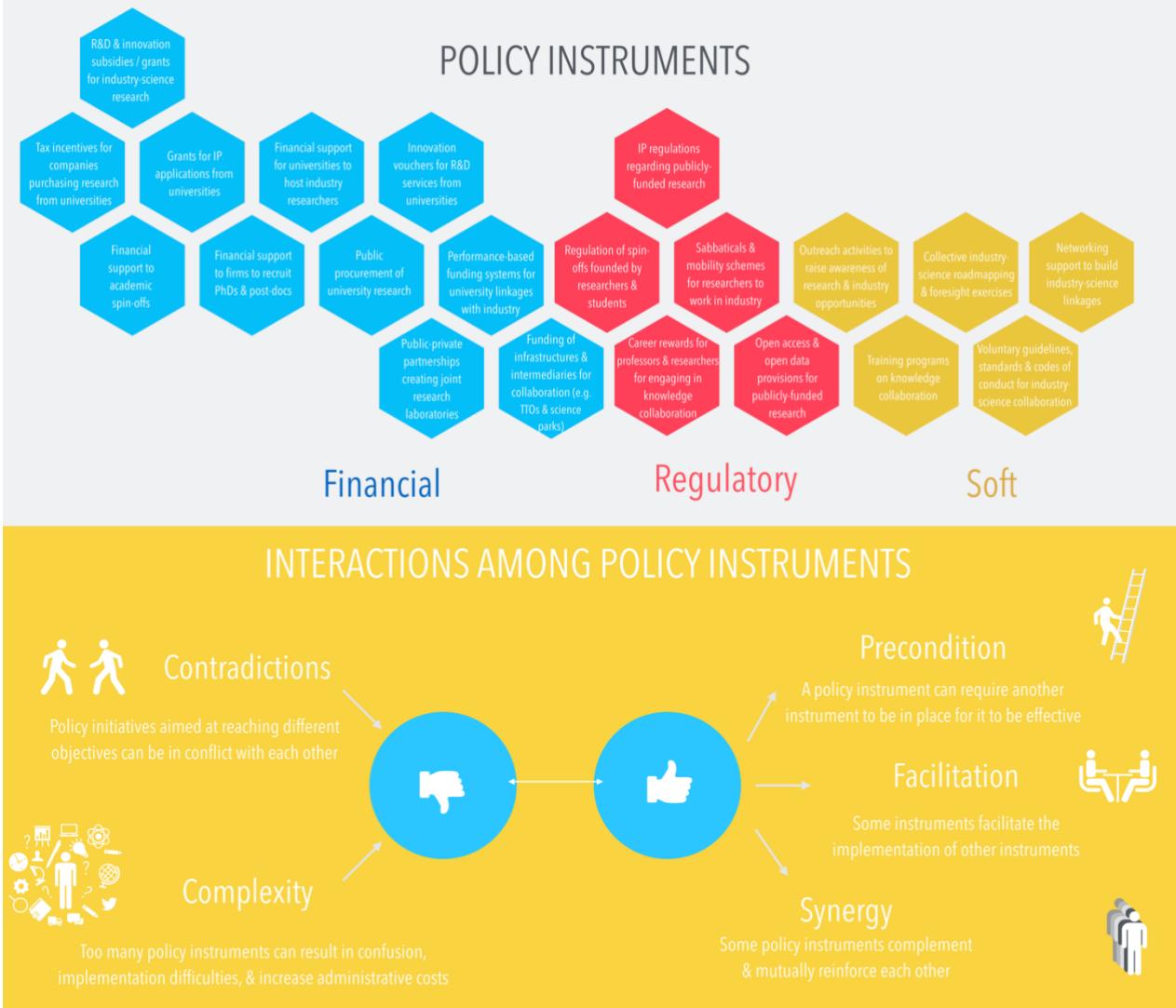
Changes in policy mix over time reflect policy learning and respond to new demands on industry-science knowledge transfer. **Recent trends** include i) a shift from a linear model of knowledge transfer towards an interactive model of knowledge co-creation; and ii) new policy approaches in response to digitalisation and globalisation.

The following conclusions can be drawn regarding setting policy mixes for knowledge transfer:

- Given the diversity of channels through which knowledge transfer unfolds, **various policy instruments targeting alternative channels need to be adopted** to avoid focusing only on channels relevant to specific sectors, disciplines, or actors.
- **Systematically assessing combined effects of instruments**, as well as potential redundancies, contradictions and remaining problems that could be addressed with new instruments, can help improve the policy mix.
- A country's **policy mix should reflect its specific structural and institutional characteristics**, including its level of socio-economic development, macroeconomic conditions, R&D intensity, industrial specialisation, and characteristics of universities and PRIs, among other factors.

## Synthesis of chapter 4

# POLICY INSTRUMENTS & POLICY MIXES FOR KNOWLEDGE TRANSFER

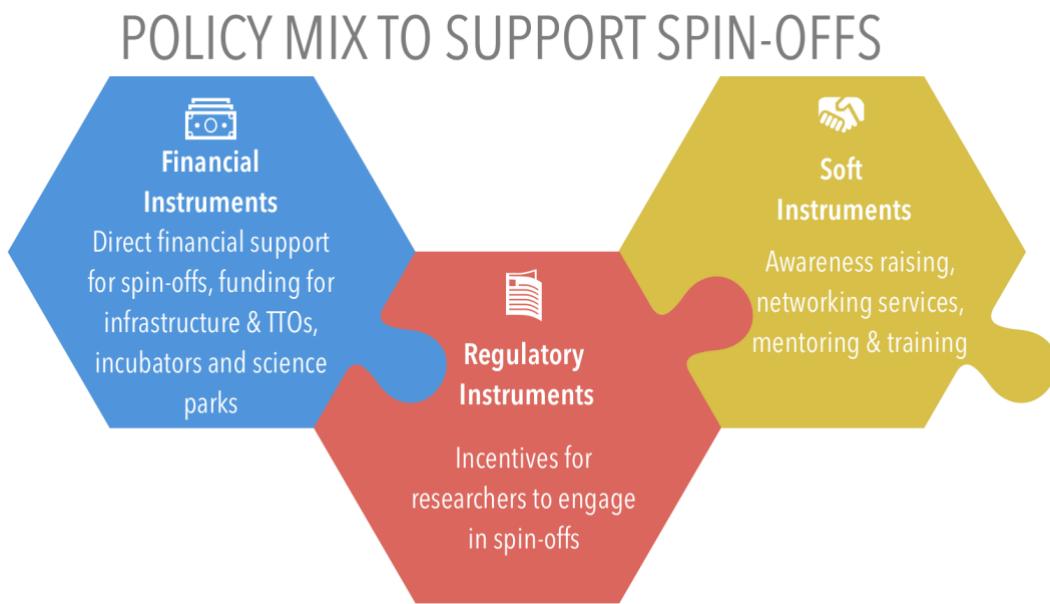


## Chapter 5. New policy practice to support spin-offs

One important channel for knowledge transfer is the creation of spin-off companies born of technology developed at universities or public research institutions (PRIs). Spin-off dynamics are seen as critical drivers of national competitiveness in the knowledge-based economy. Support to spin-offs can also help create jobs for highly skilled personnel and offer career opportunities to students and young researchers where the economy generates few such opportunities.

Consequently, the promotion of academic spin-offs has attracted attention across OECD countries as a means for rapidly transferring new scientific knowledge into commercial use (OECD, 2013). **Specific funding schemes have been introduced, incubators and science parks created, and incentive schemes put in place for scientists to create and work in spin-offs.** Universities and PRIs have also invested in promoting spin-offs as both a source of income for them and an opportunity for more returns.

This chapter provides an overview of the policy options to support spin-offs and explores recent trends, including the greater attention paid to promoting the quality and not just the quantity of spin-offs, and the increased focus on student entrepreneurship.



The analysis builds upon a set of **case studies** developed in the course of the TIP project on knowledge transfer (2017-18). These include eight case studies on recent policy programmes to support spin-offs developed by different OECD countries, and six case studies focusing on how research and technology organisations (RTOs) contribute to spin-off development.

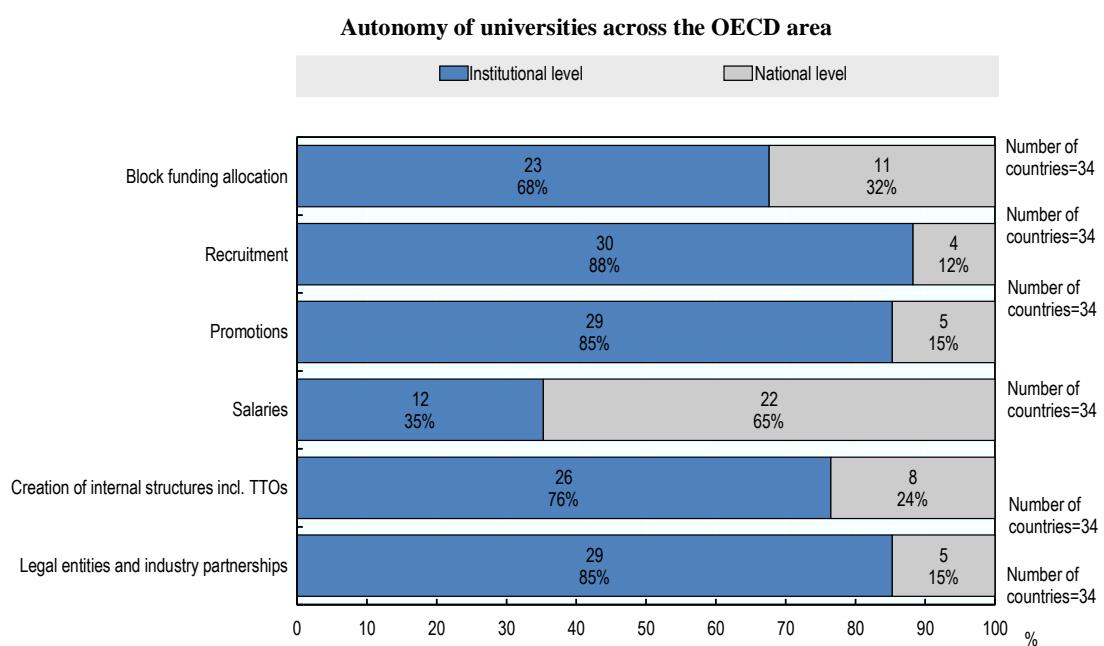
## Chapter 6. Governance of public research and its implications for knowledge transfer

The effectiveness of the policy mix for knowledge transfer depends on the quality of the governance of public research, i.e. the institutional arrangements that govern policy action regarding publicly funded research in universities and public research institutions (PRIs). Instruments will operate differently depending on how universities and PRIs are empowered (or not) in shaping their own ways of reaching set targets. Interaction among different levels of governance (e.g. national with regional) may create synergies but may also lead to duplications and unnecessary complexity in the absence of efficient coordination mechanisms. Therefore, when assessing a country's policy mix for knowledge transfer it is important to analyse the institutions and governance systems that determine how policy instruments are designed and implemented.

The focus in this chapter is on recent trends in the governance of public research in relation to science-industry knowledge transfer, based on a new survey conducted in 2017-18 across 35 OECD countries for this project.

The chapter notes the following important characteristics of the governance of public research across the OECD area that shape knowledge transfer.

- With regard to policy implementation, **universities and PRIs have achieved autonomy** across many member countries, allowing them to deploy their own support programmes for knowledge transfer.
- As to contributions to knowledge transfer, an increasing number of OECD countries have established **performance contracts between national ministries/agencies and universities/PRIs**. Such contracts can stimulate knowledge transfer by including not only traditional targets related to teaching and research, but also other targets associated with their engagement with firms and the commercialisation of their research results.
- Private firms are increasingly participating in the governing boards of universities**, PRIs and research councils to offer their perspectives. This may lead to a greater orientation of such institutions towards innovation and knowledge transfer.



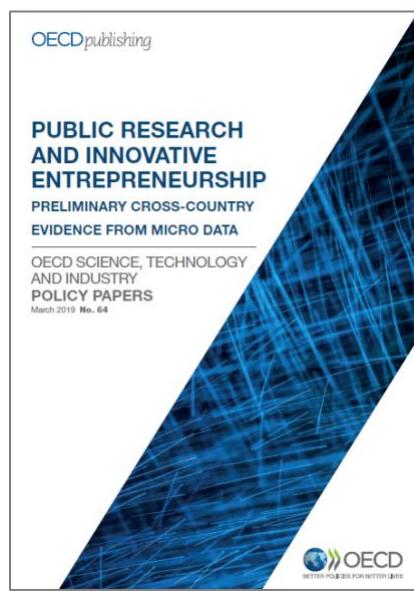
### 3. Policy papers



#### How is research policy across the OECD organised? Insights from a new policy database

This policy paper provides a first systematic comparison of the governance of public research policy across 35 OECD countries from 2005 to 2017, using a newly created policy indicator database (<https://stip.oecd.org/resgov/>). The paper shows that diverse mechanisms of policy action regarding higher education institutions (HEIs) and PRIs are in place across these countries.

Borowiecki, M. and C. Paunov (2018), "How is research policy across the OECD organised?: 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>.



#### Public research and innovative entrepreneurship - preliminary cross-country evidence from micro data

This paper provides a first assessment of the degree to which public research contributes to innovative entrepreneurship, using data on start-ups and venture capital (VC). It looks at academic start-ups founded by recent undergraduates and doctorate students or researchers. It shows that academic start-ups represent 15% of all start-ups in the specific sample under scrutiny. As to their performance, start-ups founded by researchers are more likely to patent and those founded by students introduce innovations that are more radical compared to other start-ups. While start-ups founded by undergraduate students receive less VC funding and are less likely to exit via IPO or acquisition, those created by researchers are as successful as their non-academic counterparts.

Breschi, S., et al. (2019), "Public research and innovative entrepreneurship: Preliminary cross-country evidence from micro data", *OECD Science, Technology and Industry Policy Papers*, No. 64, OECD Publishing, Paris, <https://doi.org/10.1787/0d057da7-en>.



## What role for social sciences in innovation? Re-assessing how scientific disciplines contribute to different industries

It reviews the data sources and associated methodologies available to measure different types of science-industry interaction ([Paunov, Planes-Satorra and Moriguchi, 2017](#)). The paper also discusses the available evidence, which is mostly based on case study and patent data, and offers new statistical information from labour force and university graduate surveys. Such data allow exploring the numbers of social science graduates who move into different economic sectors; they thus capture the flow of human capital from university to industry – often considered one of the most important channels of science-industry knowledge transfer.

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>.



## Science-industry knowledge exchange: Mapping policy instruments and their interactions

This paper describes the different types of policy instruments aimed at strengthening science-industry knowledge transfer. It also discusses the positive and negative interactions between policy instruments. The paper draws on evidence from the case studies countries produced for the purposes for the purposes of this OECD-TIP project.

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

## Assessing the impacts of public research institutions on industry inventions (forthcoming)

This policy paper provides evidence on the trends in patenting of public research institutions, and on the co-location of public research and industry. The evidence builds on a dataset compiled for the purposes of this OECD-TIP project on the location and patenting activities of universities and public research institutes (PRIs) across 35 OECD countries and China for 1992-2014. The policy report also presents evidence of the impacts on local innovation of geographical proximity to universities.

## 4. Case studies

The report builds on twenty case study contributions to this project. This includes fourteen country policy studies – focusing on new policy initiatives for science-industry knowledge transfer, or a country's overall policy mix – and six studies on European research and technology organisations that provide new insights into institutional spin-off support schemes.

Find all the case studies at: <https://oe.cd/2y9>



### Studies on the policy mix for science-industry knowledge transfer

- **Policy mix for science-industry knowledge transfer**  
– **Austria** (Brigitte Ecker, Christian Reiner, Gerald Gogola)
- **Policy mix for science-industry knowledge transfer**  
– **Finland** (Kimmo Halme, Helka Lamminkoski, Vesa Salminen, Kalle Piirainen, Valtteri Härmälä, Mari Hjelt and Jari Hyvärinen)
- **The policy mix for knowledge transfer between science and industry – Norway** (Siri Brorstad Borlaug, Silje Maria Tellmann, Liv Langfeldt and Espen Solberg)

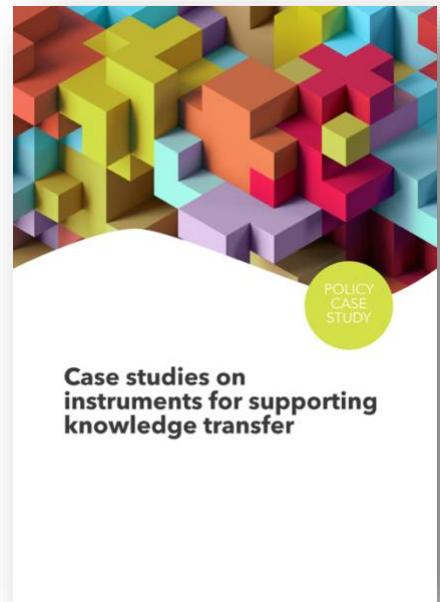
### Accounts of spin-off support schemes of European RTOs

- **The promotion of spin-off activities through VTT Ltd and VTT Ventures Ltd – Finland** (Matthias Deschryvere, Mikko Kumpulainen, Lula Rosso)
- **CEA - Alternative Energies and Atomic Energy Commission, France** (Isabelle Rivat)
- **Programmes to promote spin-offs at Fraunhofer-Gesellschaft – Germany** (Thorsten Lambertus, Julia Schmalenberg and Matthias Keckl)
- **RTO programmes to promote spin-offs: The case of TNO - the Netherlands** (Marcel de Heide, Eddy Zwier, Hans Boumans, Erik Drop, Albert van der Steen)
- **Spin-offs support at TecNALIA: Transforming technology into GDP – Spain** (Asier Rufino)
- **RTO's programs to promote spin-offs – EURECAT – Spain** (Angel Garcia and Joan Guasch)



## Analyses of instruments in support of knowledge transfer

- **The Technology Access Centre Grants - Canada** (Ryan Hampel and Ken Doyle)
- **Licensing, technology transfer offices and technology transfer hubs – Chile** (Etienne Choupay)
- **Technology Transfer Policy: Recent developments – Colombia** (Julián Pontón Silva, Elizabeth Sánchez Salazar, Mónica Botero Ospina)
- **Knowledge transfer policy instruments: Towards an open experimentation approach - Costa Rica** (Ministry of Science, Technology and Telecommunications)
- **TUTL: New Business from Research Ideas – Finland** (Anne-Mari Järvelin and Jari Hyvärinen)
- **Policy Mix for science-industry knowledge transfer – Greece** (Agnes Spilioti, Vasileios Gongolidis, Antonios Gypakis)
- **Centres for Higher Education and Industrial Cooperation – Hungary** (National Research, Development and Innovation Office)
- **A new method for evaluating universities' third mission activities – Italy** (Brigida Blasi, Sandra Romagnosi, Alessio Ancaiani, Marco Malgarini, Sandro Momigliano)
- **The Dutch Valorization Program - the Netherlands** (Martijn Janmaat, Sander Kes, Joost Dieleman, Jelle Wijnstok and Eline Castelein)
- **The ICURE pilot programme - United Kingdom** (David Legg and Chris Hale)



## 5. Project workshops

**Four workshops** have been organised in the context of this project, gathering experts, policy makers and practitioners from across OECD countries and beyond to discuss about different aspects of science-industry knowledge transfer, as well as their policy implications:

WORKSHOP  
“STIMULATING KNOWLEDGE TRANSFER:  
CHALLENGES AND POLICY RESPONSES”  
Lisbon, 7-8 November 2017

Location: Teatro Thalia, Estrada das Laranjeiras 205, Lisbon, Portugal

FCT, REPÚBLICA PORTUGUESA, OECD

The poster features a stylized illustration of a rocket launching from a stack of books, with figures working on lab equipment and a lightbulb, symbolizing innovation and knowledge transfer.

**Stimulating knowledge transfer: challenges and policy responses**

Lisbon, November 2017

[www.innovationpolicyplatform.org/Lisbonworkshop2017](http://www.innovationpolicyplatform.org/Lisbonworkshop2017)

[Summary of discussions](#)

CSTP-TIP Workshop:  
**Semantic analysis  
for innovation policy**

12-13 March 2018  
Paris, OECD Conference Centre

OECD

The poster features a background of binary code and a stack of old books in the foreground, with a modern computer monitor and a cup of coffee.

**Semantic analysis for innovation policy**

Paris, March 2018

[www.innovationpolicyplatform.org/semantics](http://www.innovationpolicyplatform.org/semantics)

[Summary of discussions](#)

**CSTP-TIP Workshop:**  
**Boosting knowledge transfer between science and industry:  
 New models and business practices**

14 March 2018  
 Paris, OECD Conference Centre



**Boosting knowledge transfer between science and industry: new models and business practices**

Paris, March 2018

<https://www.innovationpolicyplatform.org/KT>

[Summary of discussions](#)



**Towards effective science-industry co-creation**

Paris, March 2018

[www.innovationpolicyplatform.org/co-creation](https://www.innovationpolicyplatform.org/co-creation)

[Summary of discussions](#)






## Digital Innovation and University-Industry Collaboration: New Policy Perspectives

London, 11 April 2019

Event jointly organised by Digital Catapult, Innovate UK and the OECD.

### Agenda

Presentation of the OECD report 'University-Industry Collaboration: New Evidence and Policy Options'

Panel 1. Where should innovation policy go from here?

Panel 2. Innovation policy in practice: Policy experiments to foster knowledge transfer

Poster session to explore policy experiments

Find the full agenda and all information about the event at:

<https://oe.cd/2xs>





For more information visit:  
<https://oe.cd/2xx>

