OECD Science, Technology and Innovation Outlook 2016

Policy Profile

Commercialisation of public research

Rationale and objectives

The commercialisation of public research is a major goal of national S&T policies and a key function of universities and PRIs, alongside teaching, education and the dissemination of knowledge (see also the *Policy Profile on Public Research Mission and Orientation*). Public research has been the source of many of today's innovations, sometimes as a by-product of basic research and sometimes without any prospect of a direct business application. Well-known examples are the techniques of recombinant DNA, the global positioning system (GPS), MP3 technology and Siri, Apple's voice recognition technology. Data on scientific sources of many of today's nanotechnology, ICT and biotechnology patents provide additional evidence of the linkages between technological innovations and public research (OECD, 2013a).

The rationale for public support for commercialisation has its roots in market and system failures. Weak commercialisation of public research may have several sources: asymmetric information, as potential users may not be aware of university inventions; risk or non-appropriability of the results of public R&D because ownership of university inventions may not be clear enough for industrial partners to engage in commercialisation; demand for research may be weak as companies, especially SMEs, may not carry out their own R&D; co-ordination problems among R&D participants, as firms' and universities' incentives may be misaligned because of their different missions; and lack of finance for developing prototypes and demonstration projects that would help attract private finance for commercialising academic inventions.

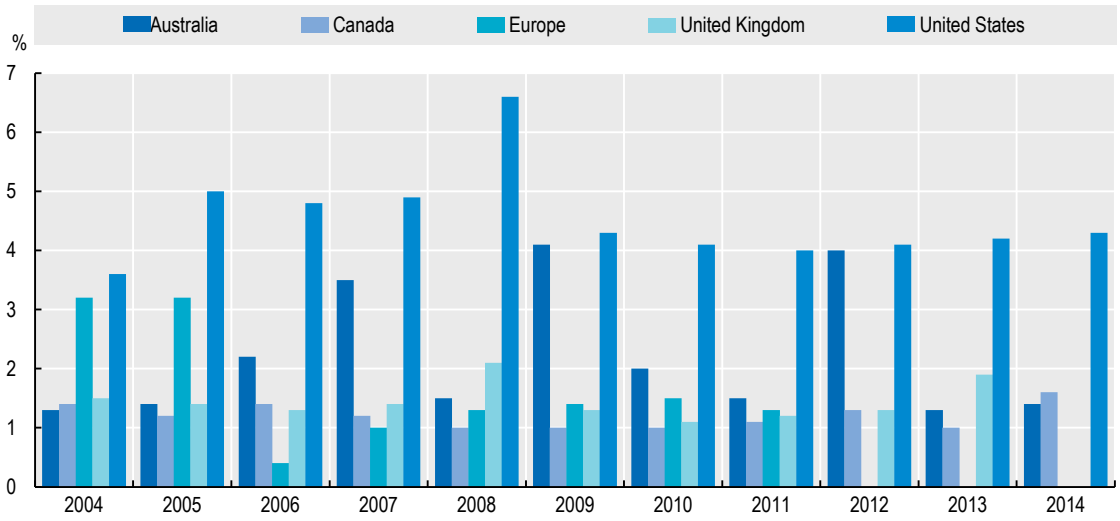
Major aspects and instruments

While some countries' universities and PRIs have succeeded in increasing the commercialisation of public research, as measured by the number of disclosed inventions, academic patents, licensing agreements or university start-ups, data show a slow growth in the main commercialisation indicators in many OECD countries. This has raised concern among policy makers and practitioners about the effectiveness of existing approaches to technology transfer and commercialisation as well as questions about the measurement of knowledge and technology transfer given that intellectual property-based channel – patents and licenses– are only one channel of knowledge and technology transfer.

Average annual growth rates of university patent applications in OECD countries fell from 11.8% between 2001 and 2005 to 1.3% between 2006 and 2010 (OECD, 2013b). PRIs experienced negative growth of -1.5% over the latter period, compared to growth of 5.3% between 2001 and 2005. As a result, patenting growth by PRIs remained modest in the OECD area over the period 2001-10 (1.9%) (OECD, 2013b). Data on disclosures of invention per USD 100 million in research expenditures shows a slight average drop from 2004-07 to 2008-11 in major OECD countries (OECD, 2013b) and remained at low levels during 2012-2014 in Austria, the United States and the United Kingdom (Austrian government, 2015).

Figure 1. Licensing income from public research, 2004-14

As a percentage of research expenditures



Source: Based on calculations and data from Australian government (2015), "Summary of selected commercialisation metrics for Australia, Canada, Israel, US and UK 2004-2014", in Australian National Survey of Research Commercialisation; European Commission (2012), "Knowledge Transfer Study 2010-2012: Final Report"; OECD (2013b), "Commercialising public research: New Trends and Strategies".

StatLink http://dx.doi.org/10.1787/888933445171

Licensing income from public research per total research expenditures has not expanded in OECD countries between 2004 and 2014 (Figure 1), although a small percentage of PROs accounts for the bulk of licensing income. In Europe, the top 10% respondents at universities (35 universities) earn 86.5% of the total license income earned by all universities in the sample and the top 10% of respondents at other research organisations (7 organisations) earn 89.9% of the total license income earned by other research organisations (EC, 2013).

Public research spin-offs are an effective mechanism for the exploitation and commercialisation of publicly developed R&D. Rates of new public research spin-offs and start-ups appear to be increasing in a few countries after having fallen following the financial crisis. Data on start-up companies per USD 100 million in research expenditures in major OECD countries generally hit a low in 2008, with the ratio stabilising in 2009-11 at pre-2008 levels (OECD, 2013b). In Japan, the number of university-oriented start-ups formed hit a peak in FY2004 and FY2005 (252 start-ups formed), dropped in FY2008 (90 start-ups formed) and stabilised at a low level in FY2009-FY2014 (Ministry of Education, Culture, Sports, Science and Technology, 2015), on the other hand a moderate increase is shown in the United States and Canada in 2014 (AUTM, 2015a; AUTM, 2015b); in the United States, the 914 new companies born of technology transfer activities represent a 12% increase over the prior year.

While the situation may be due in part to the changing ecology of innovation, such as the fact that modern technological innovations are complex and rely not only on patents but also on other types of intellectual property, the slow adjustment of institutional and public policies has also played a role. Many governments and institutions have focused mainly on patenting and licensing as a channel for commercialisation. This has led to a rise in the number of patents filed and a narrow emphasis on exclusive licensing of inventions. Many institutions have also focused on the role of professors in commercialisation and less on student entrepreneurs. Governments, universities and PRIs are now experimenting with new strategies to improve the commercialisation of public research. Furthermore, universities themselves are developing additional indicators to measure knowledge flows and transfer as well developing "narratives" or stories of academic inventions that result into new products or services so as to allow stakeholders to visualise the impact of academic research.

While knowledge and research generated by the public research system diffuses through a variety of channels – mobility of academic staff, scientific publications, conferences, contract research with industry, and licensing of university inventions – much policy attention in OECD countries has centred on promoting knowledge transfers through publications, the patenting and licensing of academic inventions, and the promotion of academic start-ups. More recently, these channels are complemented by public-private partnerships, open science initiatives and entrepreneurial channels, such as student-based start-ups and related financing and mobility schemes. Anecdotal data from the United States, for example, show that start-ups created by university graduates are more numerous and more dynamic than those founded by teachers and researchers.

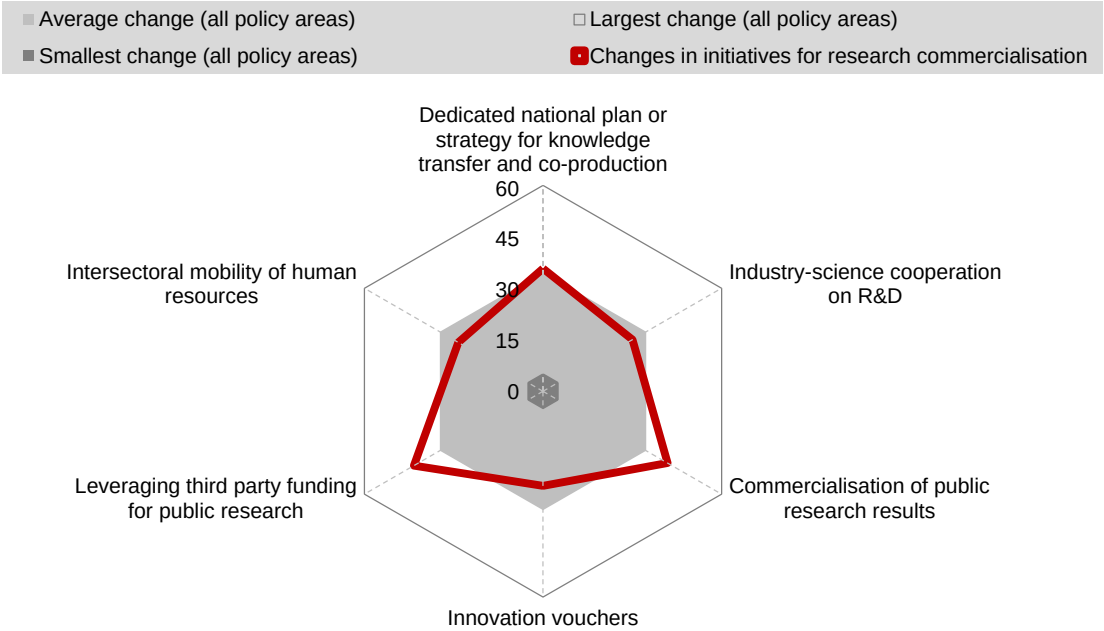
Recent policy trends

Governments continue to introduce legislation and national strategies for commercialisation and for collaboration on R&D between academia and industry (Figure 2). Turkey developed the 2015-18 *Public-University-Industry Partnership Strategy and Action Plan*, specifically addressing academic-industry linkages and setting out a roadmap to enhance cooperation. Also centred on commercialisation of public research is Korea's 2014-16 *5th Action Plan for Promoting Technology Transfer Commercialisation*.

New national directives for leveraging public research are also often embedded in wider STI strategies, including smart specialisation strategies (Croatia, France, Greece, Latvia, Lithuania and Portugal) that focus investments in certain technology areas and business sectors. Denmark's 2015-19 *Strategy for Growth and Development* highlights partnerships between research institutions and the business environment that intensify knowledge sharing. Ireland recently introduced the 2015-20 *Innovation 2020* strategy, setting out a policy framework for the direction for knowledge transfer and emphasising labour mobility to this effect.

Figure 2. Commercialisation of public research among other areas of STI policy change, 2014-16

Percentage of policy initiatives that have been newly introduced, revised or repealed over the period



Source: Based on EC/OECD (forthcoming), International Database on STI Policies (STIP); and Kergroach et al. (forthcoming b).

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Note: The EC/OECD STI Policy survey 2016 aims to review major changes in national policy portfolio and governance arrangements for STI. The survey builds on the conceptual work carried on under the aegis of the OECD Committee for Scientific and Technological Policy (CSTP) for mapping the policy mix for innovation and therefore covers a broad range of policy areas (Kergroach et al., forthcoming-a). 54 economies participated in 2016, including OECD countries, key emerging economies (e.g. Argentina, Brazil, the People's Republic of China, Colombia, Costa Rica, Egypt, India, Indonesia, Malaysia, Peru, the Russian Federation, South Africa and Thailand), non-OECD EU Member States, and the European Commission. Taken together, countries covered in the STIP survey 2016 account for an estimated 98% of global R&D. Responses are provided by CSTP Delegates and European Research and Innovation Committee (ERAC) Delegates for EU non-OECD countries.

This is an experimental indicator that accounts for the number of major policy initiatives implemented, repealed or substantially revised during 2014-16 as a share of total policy initiatives active at the beginning of the period (Kergroach et al., forthcoming-a). Although simple counts do not account for the magnitude and impact of policy changes, this ratio reflects STI policy focus and activity in specific policy areas and over specific periods of time. The chart above shows the intensity of changes in the policy area(s) under review as compared to the whole mapping. Changes in the whole mapping are represented by the smallest, the largest and the average change policy area that changed the less, the policy area that change the most.

Efforts continue to professionalise technology transfer through TTOs and TLOs in several countries. Since 2014 Colombia has fostered the creation of 6 TTOs settled as alliances between universities, research centres and companies. Similarly, starting 2015 Croatia has sought to strengthen the role of TTOs at HEIs and PRIs, with funds provided by a World Bank loan. Norwegian TTOs, partly funded by the FORNY-2020 programme, continue to play a central role in HEIs' knowledge transfer and commercialisation activities. Slovenia plans to establish TTOs in major universities and R&D institutions during 2015-20 while the Netherlands continues to intensify the creation of Centres of Expertise as stated in its *Strategic Agenda for Higher Education 2015-20*.

Channelling academic-industry technology transfer through national platforms

Countries have also launched platforms for technology transfer aiming to provide spaces for businesses and public research institutes. Contrary to TTOs and TLOs, which are usually located in a host university or company, these platforms aim to link different public and private initiatives within the country or region. Chile launched in 2015 the Technology Transfer Hubs, aiming to support businesses based on technologies derived from universities and national research centres in the areas of agriculture, health, manufacture and energy. New Zealand's Callaghan Innovation was created in 2013 as a government agency aiming to connect businesses with the resources and skills of research institutions and deliver technical assistance services for commercialisation. Similarly, but at a subnational regional scale, France introduced in 2013 the Regional Platforms for Technology Transfer. The 2015-17 Baltic Sea Region (BSR) Stars Project is an international initiative aiming to create strong linkages between research environments, clusters and SME networks across Denmark, Sweden, Norway, Finland, Germany, Lithuania Estonia, Latvia, Poland and Iceland. Occasionally these platforms count with web-based services, as it is the case in Argentina's *Demand and Technology Transfer Platform, Ireland's Knowledge Transfer Ireland and Italy's Public Research Patents' Showcase*).

Promoting the demand and supply of public research directed towards commercialisation

Several new and ongoing instruments share the common objective of creating demand for public research. Countries continue diversifying their commercialisation policies and promoting two-way flows between industry and science through public-private partnerships, at times in the form of funded consortia (e.g. Ireland's *Industrial Transformation Research Programme*, Peru's *Centres of Excellence* and Spain's *CIEN Strategic Business Research Consortia*), along with tax exemptions (e.g. Belgium and Ireland), innovation vouchers (e.g. the United Kingdom and Canada with its *Business Innovation Access Program*) and joint research initiatives/centres (e.g. Chile's *Technological Contracts*, Japan's *A-STEP Programme* and Slovenia's *Strategic Research Innovation Partnerships*).

While the above instruments seek to encourage firms to leverage public research, governments have also introduced supply side policies that aim to help the outcomes of public research reach markets. Germany introduced in 2015 the programme for *Validation of the Technological and Societal Innovation Potential of Researchers*. Korea created two technology holdings in 2014 (*Mirae Holdings* and *Korea Science and Technology Holdings*) aiming to develop innovations based on government-funded research through

feasibility studies, support for business planning and the financing of entrepreneurship. Also in 2014, Turkey launched the *Green Future Accelerator Fund* to help the entrepreneurial commercialisation of business ideas based on R&D outcomes, particularly those arising from universities. Funded by EU structural funds, Lithuania created the *Technostartas* and the *Inoveks* programmes in 2013. These two programmes seek to create opportunities for researchers and students for creating start-ups that commercialise results from academic research.

Encouraging the circulation of knowledge embodied in humans

In line with past OECD recommendations (OECD, 2013b), many governments are promoting researcher mobility as a key channel for technology transfer. In 2015 Australia launched the *Industrial Transformation Research Programme*, aiming to foster opportunities for tertiary education training (including postdoctoral) to gain experience through placement in industry in priority sectors including Advanced Manufacturing, Food and Agribusiness, Energy and Pharmaceuticals. The Czech Republic's 2014-20 *Operational Programme Research, Development and Education* supports the inter-sectoral mobility of researchers, from the private to the public sector. Through its *Distinguished Researchers Programme*, launched in 2016, the government of Japan selects outstanding young researchers and provides financial support to institutes that employ them, including those in the industrial sector.

Table 1. New Policy Activity in the Commercialisation of Public Research by country, 2013 or more recent

	National strategy or legislation	Platforms for technology transfer	Setting-up TTOs/TLOs	Policies creating demand for academic research	Commercialisation policies targeted to students researchers	Academic-industry labour mobility
Argentina		✓				
Australia		✓		✓	✓	✓
Austria		✓	✓			
Belgium		✓		✓	✓	✓
Canada		✓		✓		
Colombia			✓			
Chile		✓	✓	✓		
Croatia			✓	✓		
Czech Republic				✓		✓
Denmark	✓			✓		
Estonia				✓		
Finland				✓		
France	✓	✓		✓	✓	
Germany					✓	
Greece	✓			✓		
Iceland				✓		
Ireland	✓	✓			✓	✓
Italy		✓			✓	✓
Japan	✓		✓	✓		✓
Korea		✓		✓	✓	
Latvia	✓	✓				
Lithuania	✓			✓	✓	✓
Mexico						✓
Norway		✓		✓		
Netherlands	✓		✓			
New Zealand		✓				
Peru				✓		
Portugal	✓			✓		
Slovenia			✓	✓		✓
Spain	✓	✓		✓		
Sweden	✓					✓
Switzerland		✓		✓		
Turkey	✓			✓	✓	✓
United Kingdom				✓	✓	✓
United States						✓

Note: Tick indicates that by 2013 or later the country introduced a new policy or reinforced an existing one.

Source: Policy information comes from country responses to the EC/OECD International Survey on Science, Technology and Innovation Policies (STIP), edition 2016, available at https://www.innovationpolicyplatform.org/sti-policy-database.

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