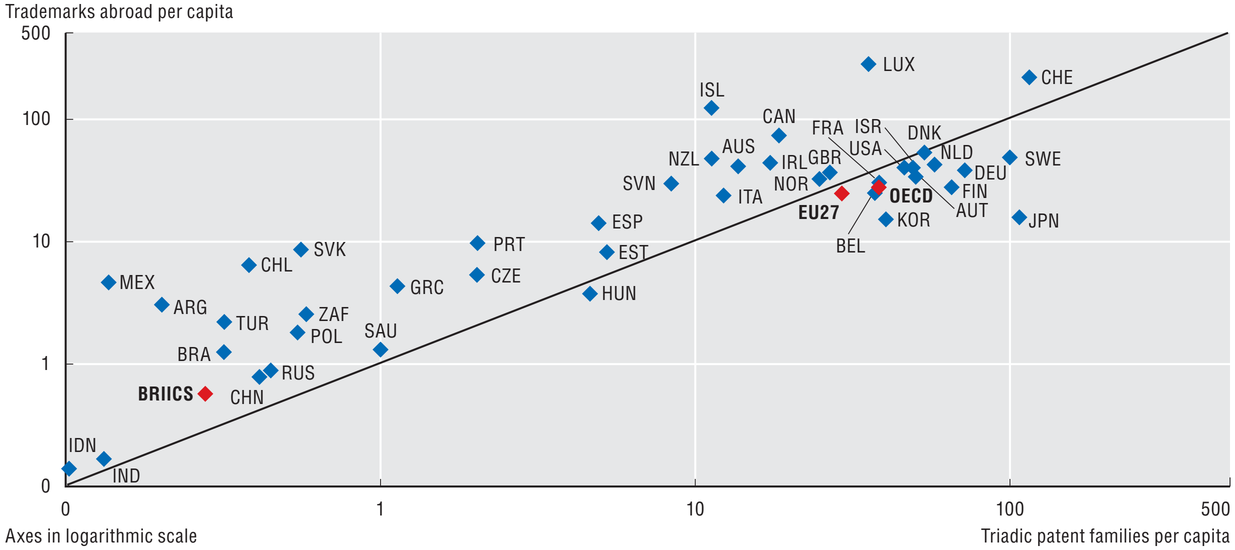
Innovation everywhere

New indicators on trademarks point to large numbers of incremental and marketing innovations and suggest that countries perform both technological and non-R&D-based innovation. Countries with a large manufacturing sector or an ICT specialisation have a greater propensity to patent than to "trademark". Countries with a large services sector tend to engage more in trademark protection. Countries in the process of catching-up have a lower propensity to innovate or to seek protection for their innovations (via patents or trademarks) than OECD countries.

Patents and trademarks per capita, 2007-09

Average number per million population, OECD and G20 countries



Source: OECD, Patent Database, May 2011; US Patent and Trademark Office (2011), "The USPTO Trademark Casefile Dataset (1884-2010)"; OHIM Community Trademark Database; CTM Download, April 2011; *JPO Annual Reports 2008-2010*. See chapter notes.

StatLink http://dx.doi.org/10.1787/888932485386

What is a triadic patent?

Triadic patent families are defined as patents applied for at the European Patent Office (EPO), the Japan Patent Office (JPO) and the US Patent and Trademark Office (USPTO) to protect a same invention. Triadic patents are typically of higher value and eliminate biases from home advantage and the influence of geographical location.

What is a trademark "abroad"?

Trademark counts are subject to home bias, as firms tend to file trademarks in their home country first. Trademarks abroad correspond to the number of applications filed at the USPTO, the Office for Harmonisation in the Internal Market (OHIM) and the JPO, by application date and country of residence of the applicant. For the United States, EU members and Japan, counts exclude applications in their domestic market (USPTO, OHIM and JPO respectively). Counts are rescaled taking into account the relative average propensity of other countries to file in those three offices.

Why use trademarks as indicators of innovation?

A trademark is a sign used to distinguish the goods and services of one undertaking from those of other undertakings. Firms use trademarks to signal novelty and to appropriate the benefits of their innovations when they launch new products on the market. The number of trademark applications is highly correlated with other innovation indicators. With their very broad perimeter of applications, they convey information on product innovations but also on marketing and services innovations. Because the data relating to trademark applications are publicly available immediately after the filing, trademark-based indicators can provide very timely information on the level of innovative activity.

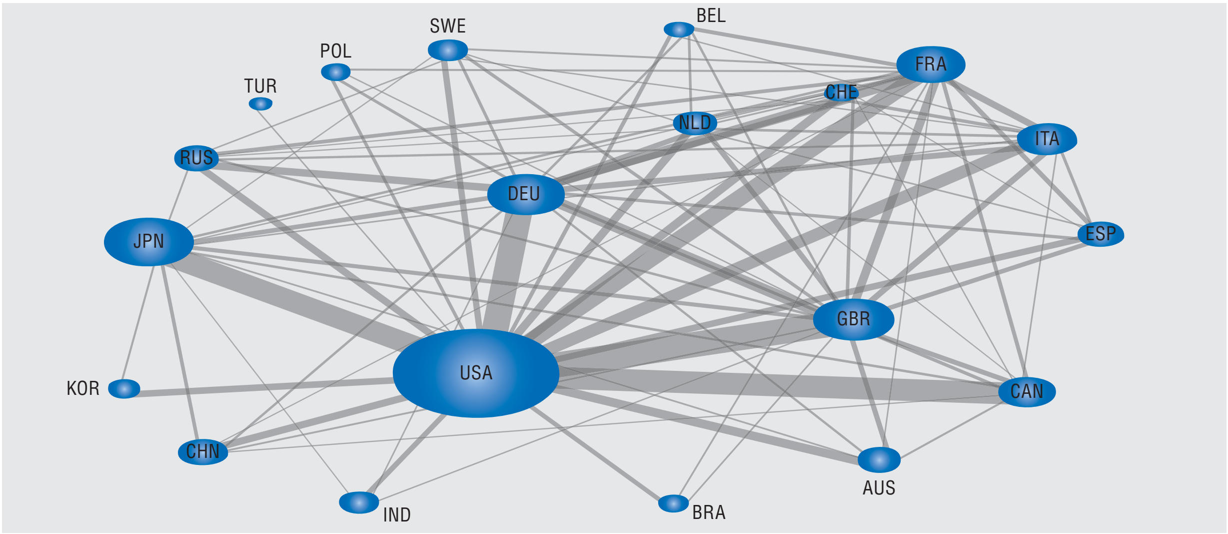
Intensifying collaboration in research

New players are emerging in the research landscape (the size of the bubble reflects the number of scientific publications) and collaboration is intensifying (the thickness of the link reflects the intensity of collaboration, *i.e.* co-authorships).

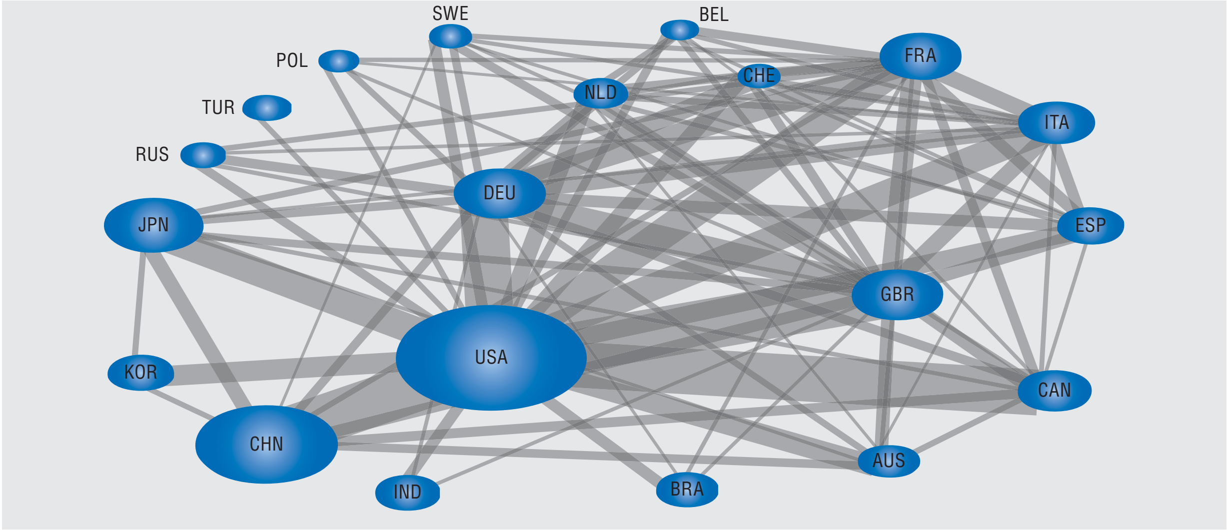
Scientific articles and co-authorship, 1998 and 2009

Numbers based on whole counts

1998



2009



Source: OECD, calculations based on Scopus Custom Data, Elsevier, December 2010.

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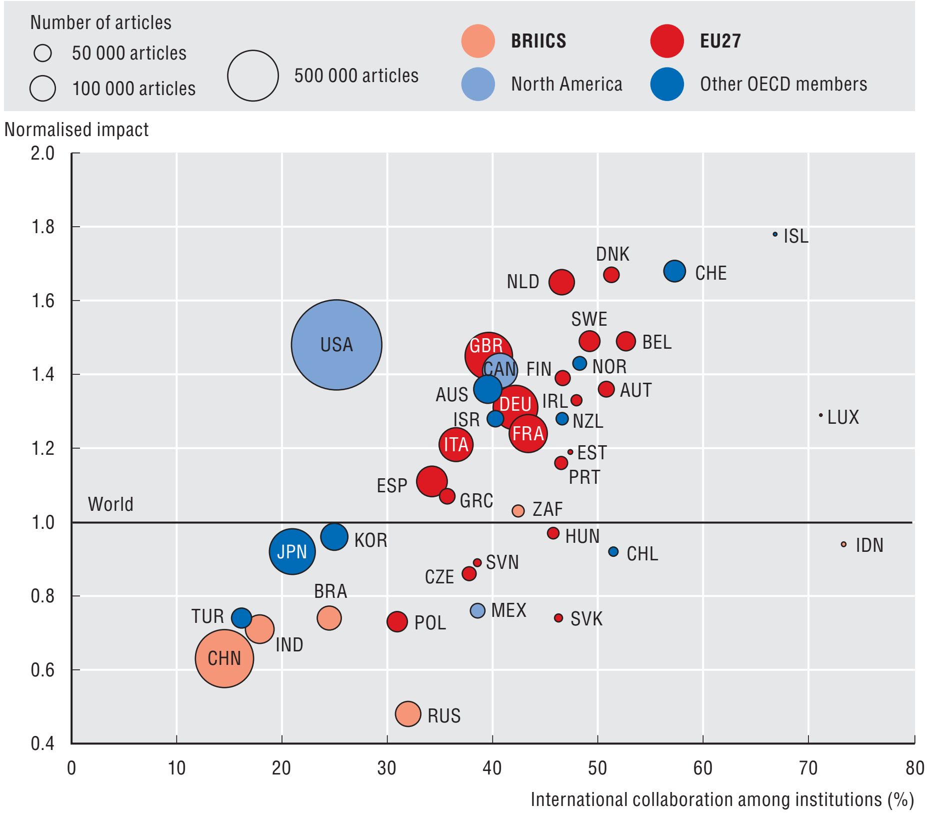
The impact of scientific collaboration

The production of scientific knowledge is shifting from individuals to groups, from single to multiple institutions, and from a national to an international scope. Researchers are increasingly networked across national and organisational borders. Greater scientific specialisation and cross-border collaboration can result in increased innovation. Because they draw on a larger pool of expertise, international research collaborations can be expected to have a bigger impact in terms of citations of scientific publications. Differences across countries suggest a positive relationship between measures of research openness and scientific impact, the latter proxied by the average normalised citation index.

The impact of scientific production and the extent of international scientific collaboration, 2003-09



Source: OECD and SCImago Research Group (CSIC) (forthcoming), *Report on Scientific Production*, based on Scopus Custom Data, Elsevier, June 2011. See chapter notes.

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How to measure the impact of scientific collaboration

To measure the impact of scientific publications it is possible either to use the citations received by an article or to assess its quality on the basis of the level of citations relative to the record of the journal in which the article is published. Here, the focus is on publications and citations received in 2003-09. The normalised impact is the ratio between the average number of citations received by the documents published by a specific unit (country, institution and author) and the world average of citations of the same time period, document type and subject area. The normalisation of citation values is item-oriented, *i.e.* carried out at the level of the individual article. If an article belongs to several subject areas, a mean value of the areas is calculated. The values show the relationship of the unit's average impact to the world average, which is 1, *i.e.* a score of 0.8 means the unit is cited 20% below average and 1.3 means the unit is cited 30% above average. Although article citation has the advantage of focusing directly on the impact of the articles examined, citation takes time, particularly in some disciplines. The more time allowed to measure the impact, the less timely the indicator becomes.

How to read this figure

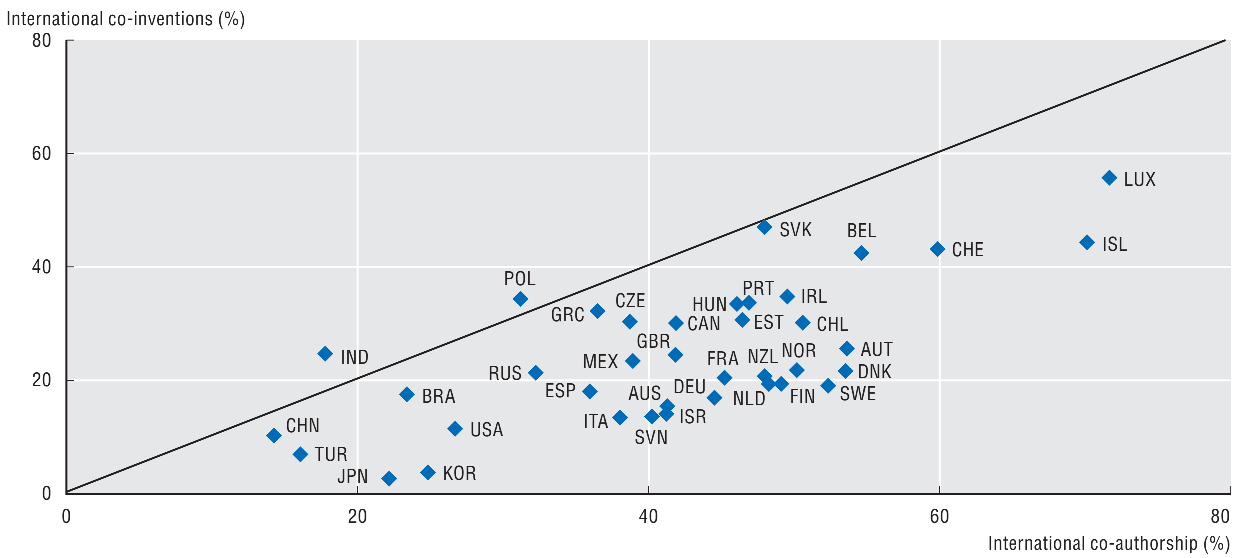
Bubbles plot a country's share of articles resulting from international collaboration – as implied by the share of domestic articles co-authored with individuals affiliated with foreign institutions – against the normalised impact of its publications. The size of the bubbles represents the volume of scientific production, with the United States and China the largest producers of scientific output. Switzerland has both a high share of international scientific collaboration and average impact, although its total output volume is smaller than that of countries such as France or the United Kingdom.

International collaboration in science and innovation

Collaboration across institutions has become a more pervasive feature of research activities in most countries. This is apparent in the affiliations and geographic locations of co-authors and co-inventors in scientific publications and patent documents. International co-authorship is more widespread for scientific publications than for patented inventions, except in Poland and India. There is a positive correlation between the indicators for international scientific collaboration and patent applications across countries, an indication of common underlying factors. Smaller countries tend to have higher rates of international collaboration, which may be partly driven by the need to overcome limited opportunities to collaborate domestically and, in some cases, by proximity to external centres of knowledge.

International collaboration in science and innovation, 2007-09

Co-authorship and co-invention as a percentage of scientific publications and PCT patent applications



Source: OECD, Patent Database, May 2011; OECD and SCImago Research Group (CSIC) (forthcoming), *Report on Scientific Production*, based on Scopus Custom Data, Elsevier, June 2011. See chapter notes.

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What are international co-authorship and international co-invention?

International co-authorship of scientific publications is based on the share of articles with authors affiliated with foreign institutions in total articles produced by domestic institutions. Co-inventions are measured as the share of patent applications with at least one co-inventor located abroad in total patents invented domestically.

How to read this figure

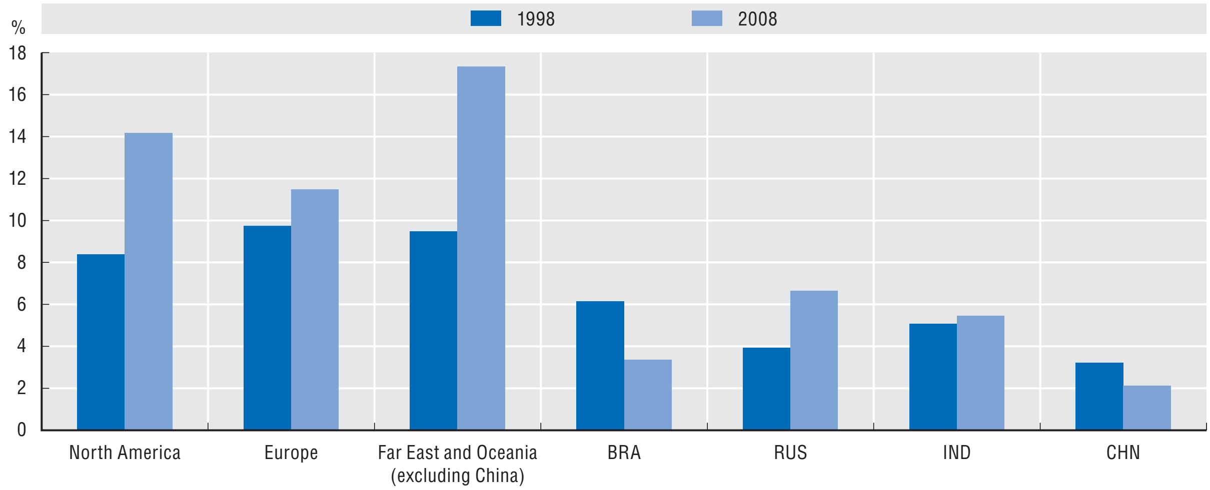
For Switzerland, 60% of publications featuring Swiss institutions involve co-authorship with institutions based abroad. For Japan, scientific co-authorship is at just above 20% but this is still higher than its international patent co-invention, at less than 5%. Most countries lie below the 45 degree line; this indicates that international scientific co-authorship is more prevalent than patent co-invention. Judging by the upward sloping cloud of data points, there appears to be a positive correlation between international scientific co-authorship and patent collaboration. This needs not imply a causal effect from science to patents, but the possible presence of common factors driving research openness.

Collaboration with new players

Geographical and cultural proximity, among other factors, is known to influence international scientific collaboration. The widespread use of English, as well as information and communication technologies, have helped to extend the scope of international research collaboration. Co-inventions are an indication of formal R&D co-operation and knowledge exchange among inventors located in different countries. International co-inventorship is affected by countries' skills endowment and by appropriability conditions, especially intellectual property rights regimes. International co-invention typically takes place in multinational corporations with units in several countries and through joint research ventures between firms and institutions of various types (*e.g.* universities, public research organisations). Europe increases scientific collaboration in the European research area and the rest of the world reaches out to emerging economies.

Scientific collaboration with BRIC countries, 1998 and 2008

As a percentage of total international co-authored articles

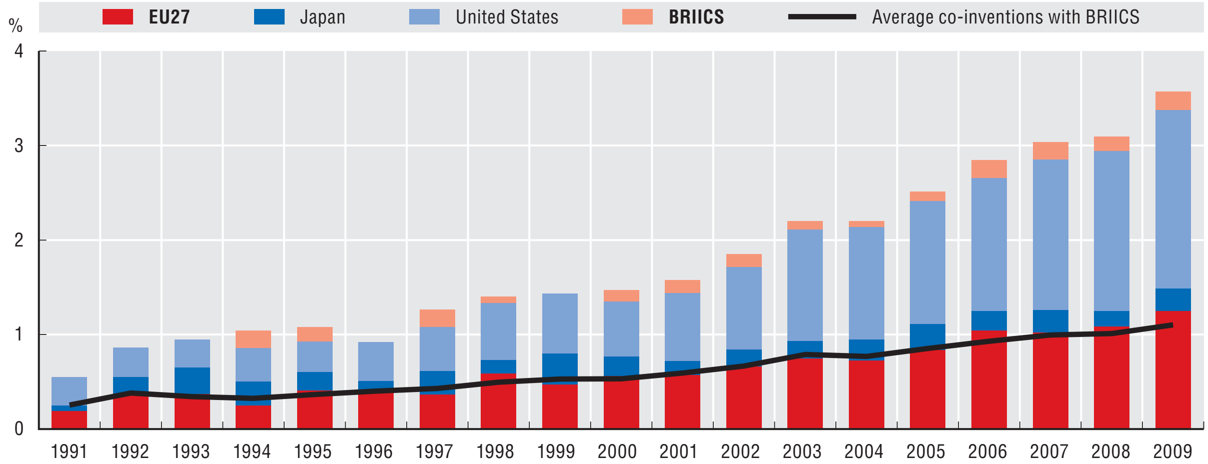


Source: OECD, calculations based on Scopus Custom Data, Elsevier, July 2009.

StatLink http://dx.doi.org/10.1787/888932485462

Co-inventions with BRIICS countries, 1991-2009

As a percentage of total patents filed by countries



Source: OECD, Patent Database, May 2011. See chapter notes.

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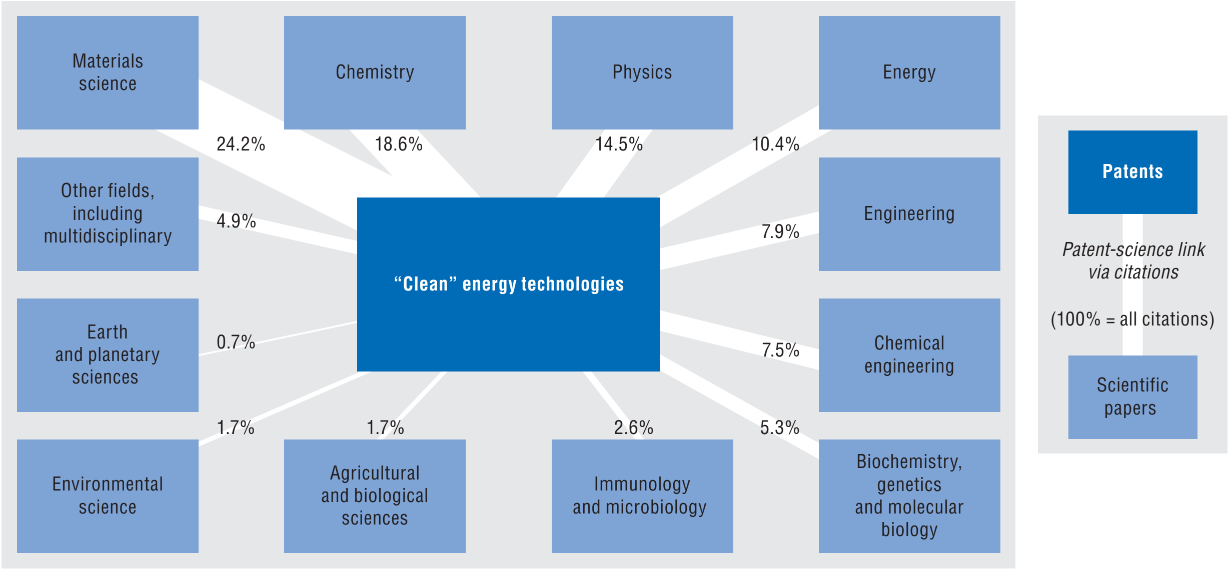
Science for green innovation

Much can be learned from citations to scientific articles by patents in specific technology areas. This new indicator shows how innovations in "clean" energy technologies draw on a broad base of scientific knowledge. The single largest field is materials science, with nearly a quarter of all scientific publications cited. This confirms the importance of new materials research for areas such as solar energy (*e.g.* photovoltaic cells) and energy storage (*e.g.* better-performing batteries). Chemistry and physics follow with a combined 33%, while energy and environmental science only account for 10% and 1.7% respectively. The diversity of scientific sources highlights the impossibility of identifying a single major scientific contributor to innovation in this area. It also underlines the dependence of "clean" energy innovation on fields of science that lack well-defined technological applications.

The innovation-science link in "clean" energy technologies, 2000-09

Share of scientific fields cited in total non-patent literature cited in patents for "clean" energy technologies



Source: OECD, calculations based on Scopus Custom Data, Elsevier, December 2010; and EPO, Worldwide Patent Statistical Database, April 2011. See chapter notes.

StatLink http://dx.doi.org/10.1787/888932485500

What is a "clean energy" technology?

The European Patent Office (EPO) has established a new classification for technical attributes of technologies that can be loosely referred to as "clean" energy technologies, a subsector of climate change mitigation technologies. The new categories were defined with the help of experts from both the EPO and the Intergovernmental Panel on Climate Change (IPCC). The Y02 subclasses already available relate to clean energy technologies, namely Y02C (greenhouse gases: capture and storage/sequestration or disposal) and Y02E (greenhouse gases: emissions reduction technologies related to energy generation, transmission or distribution).

What is a patent-science link?

Analysis of the link between patents and scientific literature is based on the "non-patent literature" (NPL) listed as relevant references in patent documents published by the EPO, the US Patent and Trademark Office (USPTO) or through the Patent Cooperation Treaty (PCT) that meet the "clean energy" definition. The NPL was matched with the scientific literature database (Scopus), to determine whether the cited NPL article corresponds to an article published in a scientific journal. For linked articles it is possible to extract bibliographical information, including field of science, not otherwise available in the patent's NPL source.

How to read this figure

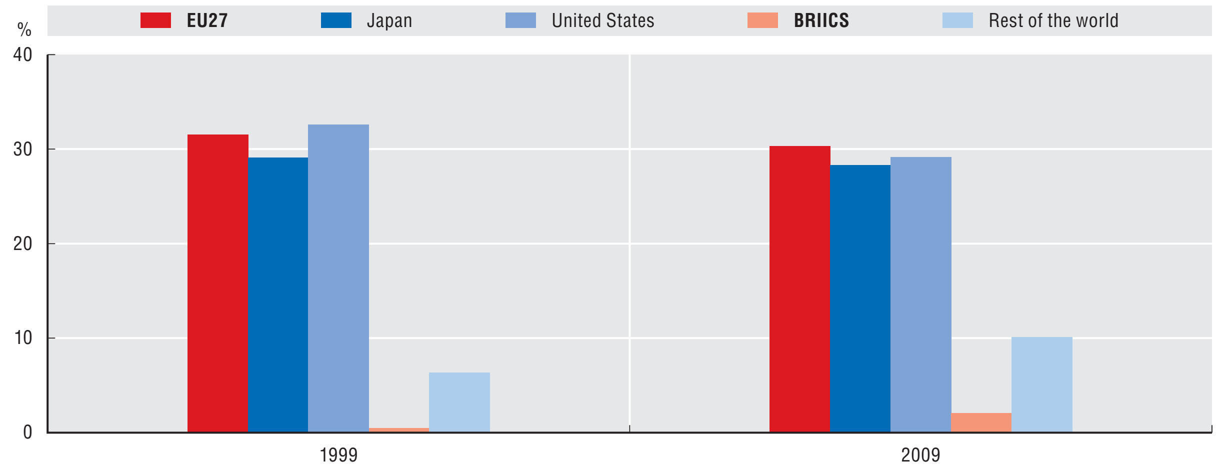
"Clean" energy technologies draw on scientific knowledge that comes from materials science (24.2%), chemistry (18.6%), physics (14.5%) and energy (10.4%).

Technology transfers

The rate of "higher quality" patenting (triadic patent families) is rapidly increasing in non-OECD economies. On average over 40% of OECD inventions are also protected in China. These technology flows mirror the strategic behaviour of firms, the location of both subsidiaries and competitors, and the attractiveness of emerging markets.

Triadic patent families by blocs, 1999 and 2009

Share in total triadic patent families

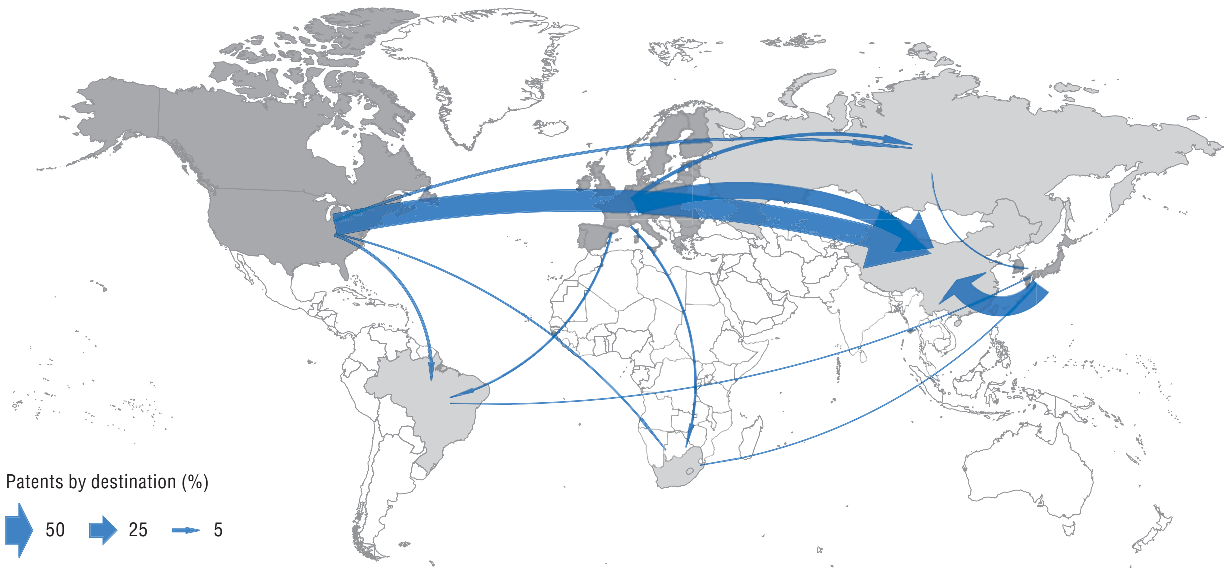


Source: OECD, Patent Database, May 2011. See chapter notes.

StatLink http://dx.doi.org/10.1787/888932485519

Technology transfers to selected BRIICS, 2005-07

Share of patents by origin of inventor and patent office of destination



Note: Figures for the Russian Federation, Brazil and South Africa may be underestimated.

Source: OECD, calculations based on the Worldwide Patent Statistical Database, EPO, April 2011; map source: ARTICQUE© – all rights reserved. See chapter notes.

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