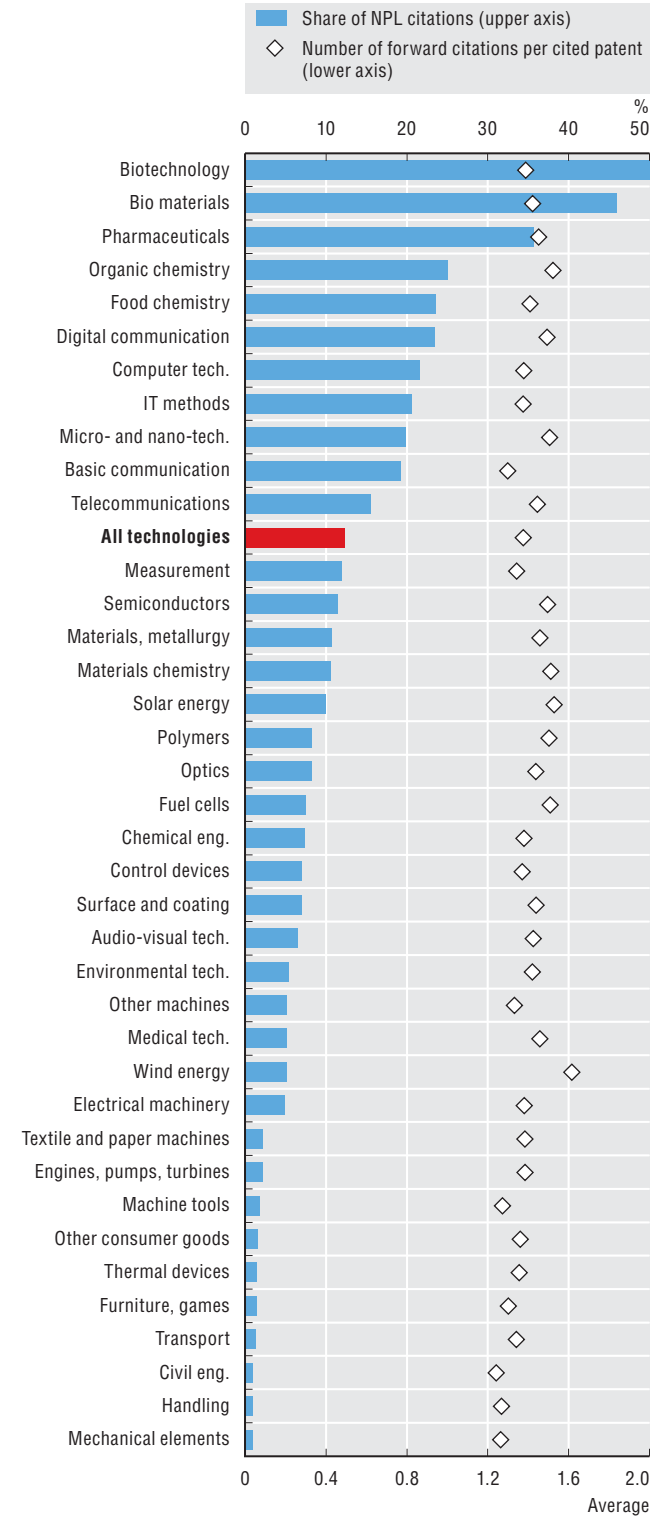
4. Technology-science linkages

Patents citing non-patent literature (NPL) and average citations received per patent cited, by technology field, 2005-10

Average share of NPL in total citations and average number of forward citations



Source: OECD, calculations based on the Worldwide Patent Statistical Database, EPO, April 2011. See chapter notes.

StatLink http://dx.doi.org/10.1787/888932486317

The degree to which applied technological developments, in the form of patented inventions, are linked to basic science is difficult to determine. However, most patent applications include a list of references – citations – to earlier patents and to non-patent literature (NPL), *e.g.* scientific papers, that set the boundaries of patents' claims for novelty, inventive activity and industrial applicability. References are added by the applicant or the patent examiner to reflect the "prior art" that inventions have built upon. Backward citations to NPL can show how close a patented invention is to scientific knowledge, whereas forward patent citations can show the importance of a patent for the development of other technologies.

The percentage of NPL cited in patent documents varies considerably across sectors. More than 30% of citations in biotechnology, biomaterials and pharmaceuticals patents refer to scientific papers, while patents in machinery and transport seem to rely less on basic science. Regardless of reliance on basic or applied knowledge, all sectors seem to receive the same average number of forward citations per cited patent – about 1.4.

On average, 20% of citations to patents are to those containing NPL. This is much higher in biotechnology, pharmaceuticals and digital communications reflecting the relevance of scientific knowledge for subsequent developments. Patents that rely less on scientific knowledge are typical of mature technologies.

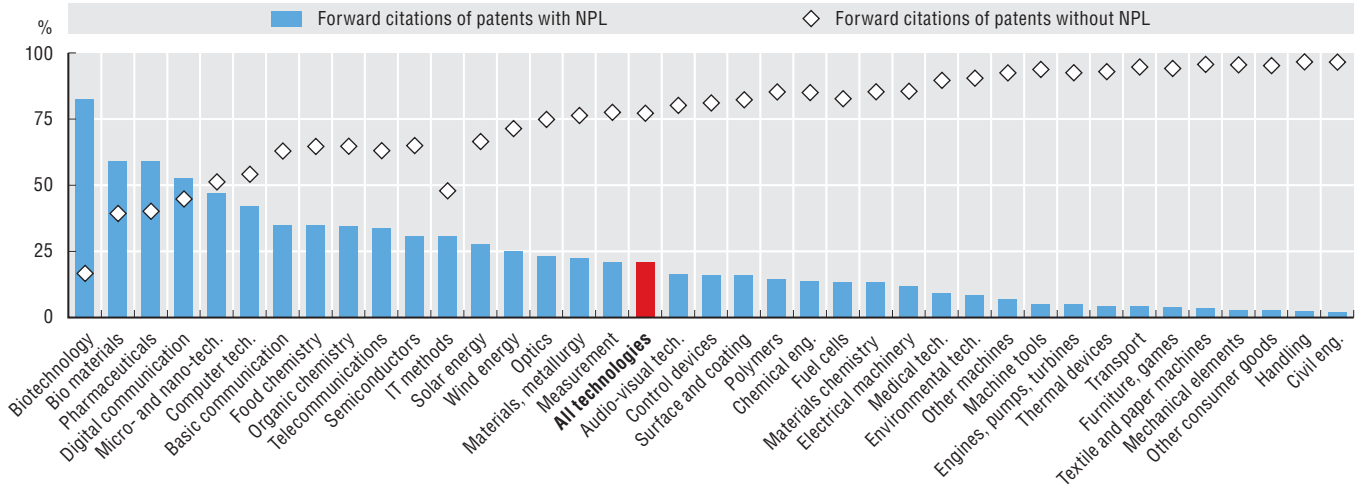
In general, the share of NPL in backward citations has increased over time, suggesting that patented inventions increasingly rely on scientific knowledge. Differences in country and sector patterns can reflect the maturity of technologies and countries' stage of economic development. Reliance on scientific knowledge is highest for biotechnology and in the BRIICS (Brazil, the Russian Federation, India, Indonesia, China and South Africa) during 2005-10.

Definition

Non-patent literature consists of peer-reviewed scientific papers, conference proceedings, databases (*e.g.* DNA structures, gene sequences, chemical compounds, etc.) and other relevant literature. *Backward citations* are references to patents and NPL contained in a patent document, whereas *forward citations* are citations received by a patent. A patent's share of NPL citations is calculated as the ratio between the number of NPL citations and the overall number of citations contained in a patent document. References to certain types of NPL such as patent abstracts and commercial patent databases are excluded. *Technology fields* are defined according Schmoch's classification (WIPO, 2010) and rely on the International Patent Classification (IPC) codes in the patent document.

Citations to patents that include non-patent literature (NPL), by technology field, 2005-10

As a percentage of total forward citations



Source: OECD, calculations based on the Worldwide Patent Statistical Database, EPO, April 2011. See chapter notes.

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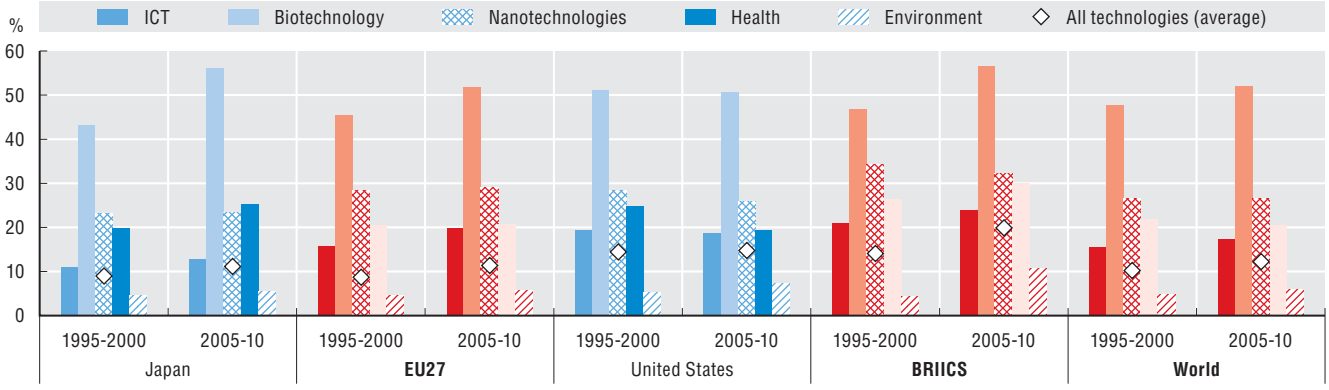
Patents citing non-patent literature (NPL), selected technologies, 1995-2000 and 2005-10

Share of citations to NPL in backward citations, average



Source: OECD, calculations based on the Worldwide Patent Statistical Database, EPO, April 2011. See chapter notes.

StatLink http://dx.doi.org/10.1787/888932486355

Measurability

Only patents published by the European Patent Office (EPO) are considered. Forward citation counts are based on EPO patents cited and take into account patent equivalents, that is, patent documents protecting the same invention at several patent offices. Only forward citations deemed particularly relevant for the examined patent – *i.e.* citations that examiners classify as X or Y (see *OECD Patent Statistics Manual*, 2009) – are considered. Forward citations are counted over a period of 5 years after the publication date (typically 18 months after the application filing date). This should allow observation of the different citation patterns in the technologies considered. Backward counts instead consider all NPL cited in the patent document and are not restricted to X or Y classes. Fractional counts are used to assign patents to technology fields and to countries for both backward and forward citations. All citation counts include self-citations. The results shown may be contingent upon the data source used, the citation and counting methods used and the observation period.