Europäisches Patentamt
European Patent Office
Office européen des brevets

Patents and innovation against cancer

Evidence from patent and company data

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Executive summary

With an estimated 19.3 million new cancer cases and almost 10.0 million cancer deaths in 2020, cancer is a major global health threat. There is an ongoing race for innovations to fight this devastating disease, reduce the side effects of cancer treatment, improve the quality of life for cancer patients, and most importantly to save people from dying. These efforts help achieve the United Nations Sustainable Development Goal 3 target of reducing deaths from non-communicable diseases by one-third by 2030. Advancements in cancer diagnostic and treatment technologies have played a pivotal role in reducing cancer mortality rates, contributing to a 12% reduction in cancer-related deaths, or over 5 000 000 lives saved in the EU, between 1988 and 2022.

Rapid progress is currently being driven by advances in biotechnology and information and communication technology (ICT), as well as increased investment, international collaboration, data sharing, and regulatory incentives. Technologies such as gene therapy or immunotherapy, and targeted therapies are revolutionising cancer treatment and care. Moreover, advances in cancer diagnostics, such as new imaging and molecular biology techniques, are improving early detection rates and are crucial for effective cancer management.

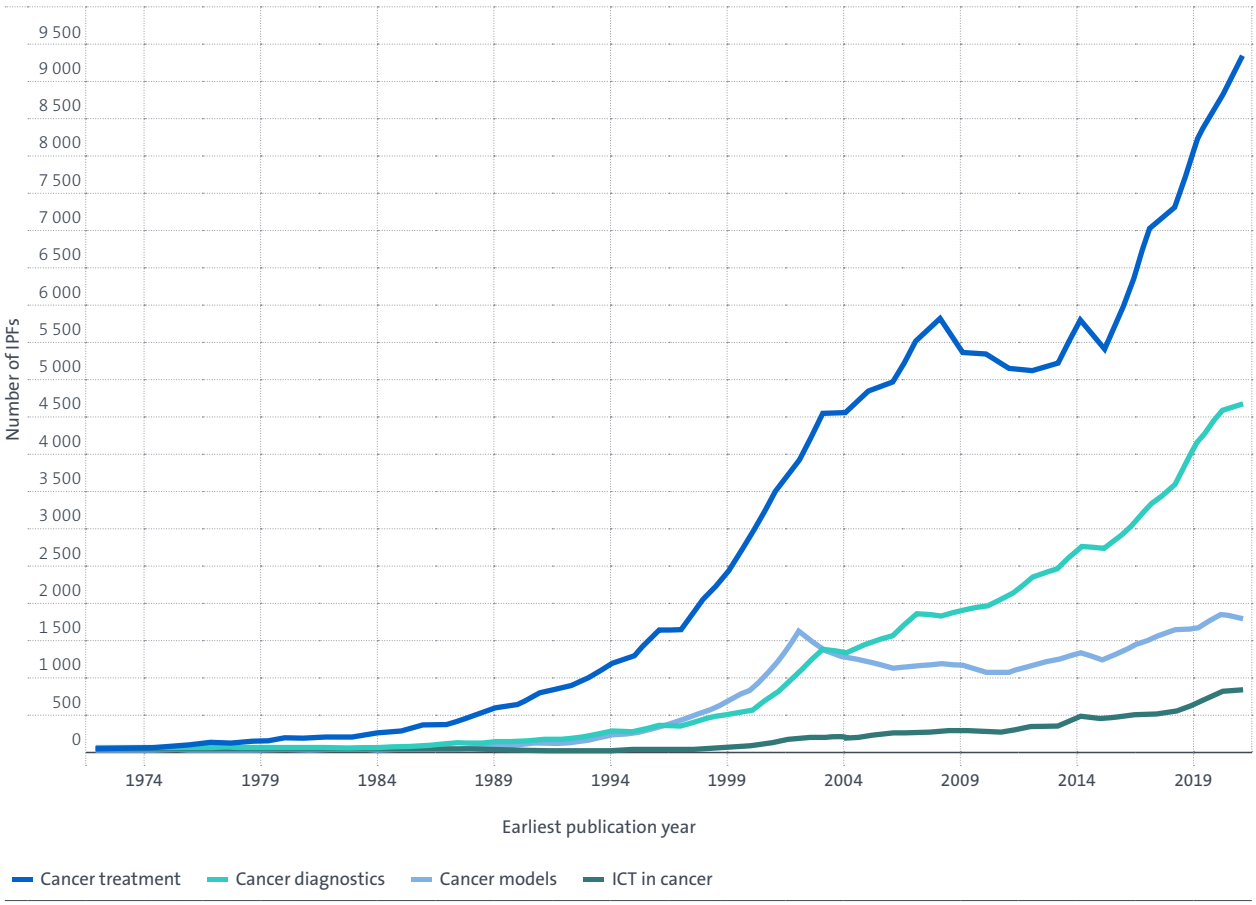
Aimed at decision-makers in both the private and public sectors, this study by the European Patent Office is a unique source of intelligence on the technology landscape and the most recent innovation trends for combatting cancer. Using global patent data as a measure of innovation, it provides the most comprehensive investigation of cancer-related patenting up to this point in time, spanning a broad range of technologies that underpin developments in the diagnosis, prevention, treatment, and, ultimately, curing of the collections of diseases that are covered by the umbrella term of cancer. Besides providing a unique window into the latest inventions that will help humanity in its fight against cancer, it documents ongoing transformations of the technology landscape, highlighting the respective contributions of the leaders in cancer-related innovation across the world.

1. Dramatic surge of 70% for innovation against cancer since 2015

Since the 1970s, over 140 000 inventions against cancer have been disclosed to the public. Between 2015 and 2021, the annual count of international patent families (IPFs[1]) rose by more than 70%, equivalent to a compound annual growth rate (CAGR) of 9.34%, and exceeded 13 000 IPFs in 2021. This growth was driven by accelerated new technology developments in cancer treatment technologies such as immunotherapy, gene therapy, and non-coding nucleic acids, but also in cancer diagnostics, especially in liquid biopsies, and healthcare informatics. Cancer-related IPFs constituted over 3% of worldwide patenting in 2021.

Figure E1

Trends in IPFs in cancer-related technologies, 1972–2021



Source: EPO

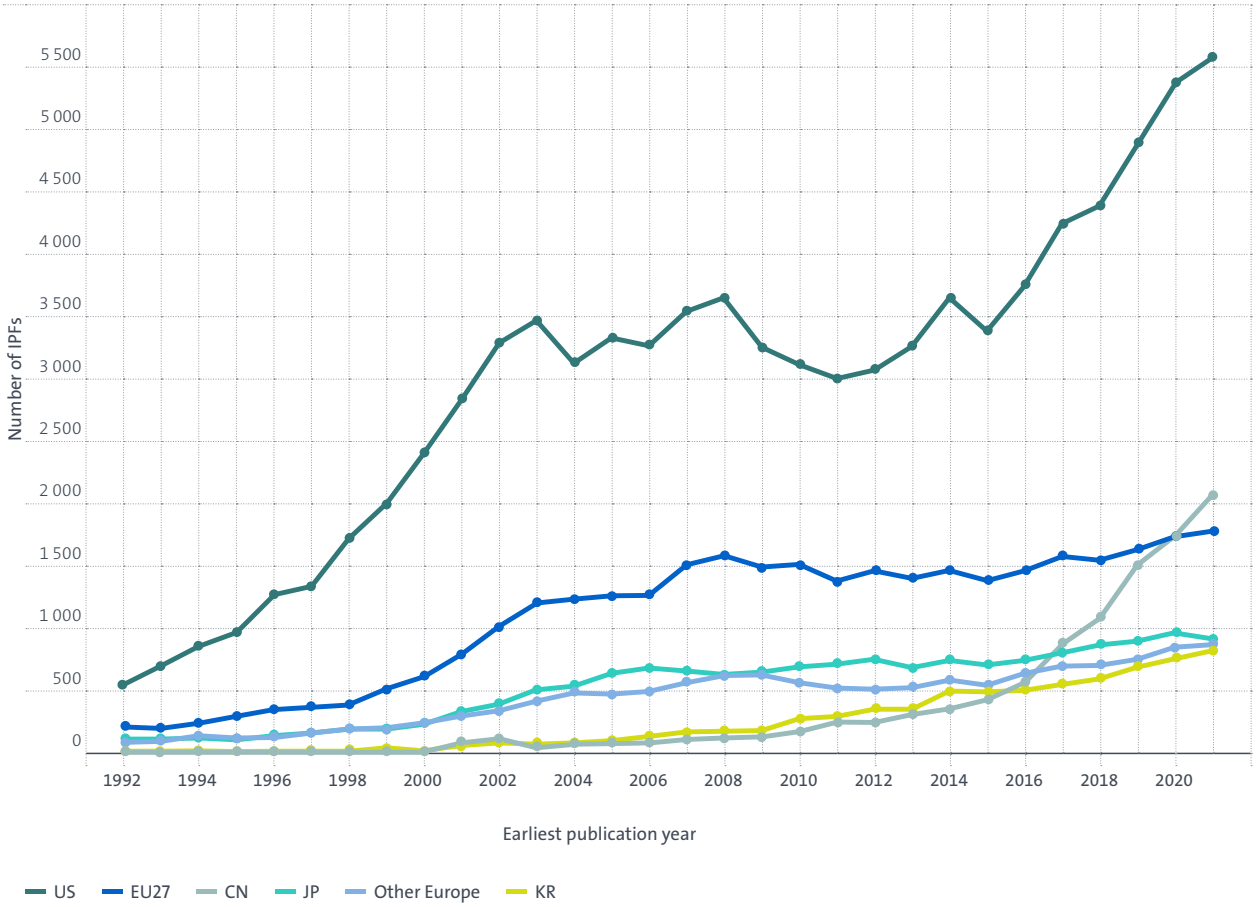
1 Each IPF covers a unique invention and includes patent applications targeting at least two countries. More specifically, an IPF is a set of applications for the same invention that includes a published international patent application, a published patent application at a regional patent office, or published patent applications at two or more national patent offices. It is a reliable proxy for inventive activity because it provides a degree of control for patent quality by only representing inventions for which the inventor considers the value sufficient to seek protection internationally.

2. The US is a strong leader, far ahead of Europe and China

The US stands out as the pre-eminent leader in cancer-related innovation, with nearly 50% of all IPFs being attributed to US applicants from 2002 to 2021. US applicants have further reinforced their lead since 2015, contributing disproportionately to the acceleration of cancer-related innovation in the period 2015–2021. The EU27 is second with an 18% share, followed, at a distance, by Japan with 9%. In recent years, the dynamic growth in cancer-related IPFs has primarily been driven by applicants from the US and P.R. China. In 2021, Chinese applicants took a significant step, surpassing the EU27 with an impressive tally of over 2 000 IPFs, thereby securing China's position as the world's second-largest contributor to cancer innovation for the year.

Figure E2

Trends in IPFs in cancer-related technologies by country of origin, 2002–2021



Source: EPO

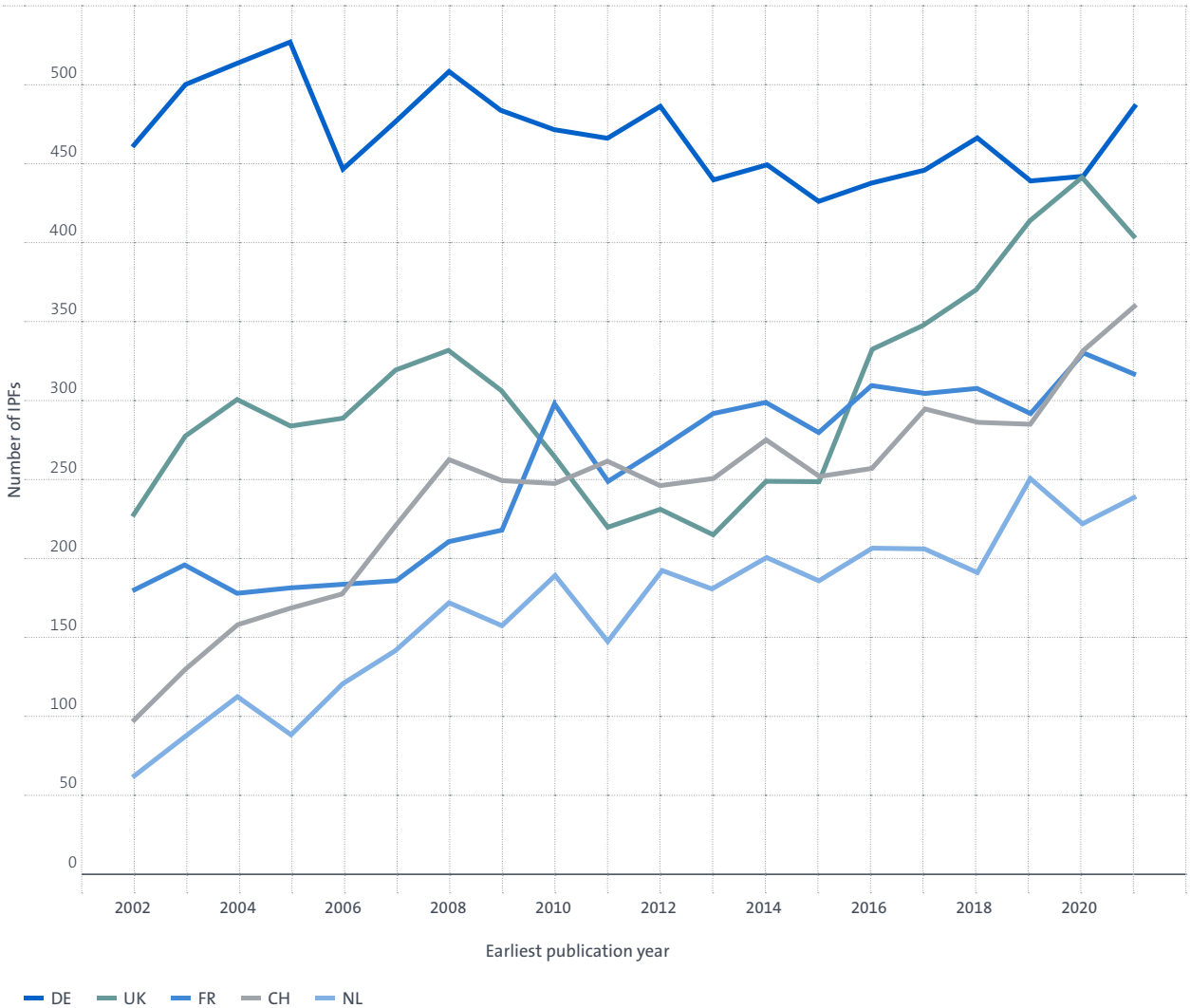
3. Germany remains in the lead among the European countries, but the UK, France, Switzerland and the Netherlands are catching up quickly

Among European nations, German applicants have maintained their position as leaders in cancer-related innovation over the past two decades, amassing over 9 000 IPFs from 2002 to 2021. However, the annual numbers of IPFs originating from German applicants decreased slightly over this period.

In contrast, the UK has recorded strong growth over the last decade (a doubling) to emerge in recent years as the second-largest contributor of IPFs, closely behind Germany. Additionally, France, Switzerland and the Netherlands have also recorded steady increases in cancer-related innovation.

Figure E3

Trends in IPFs in cancer-related technologies for the top five European countries, 2002–2021



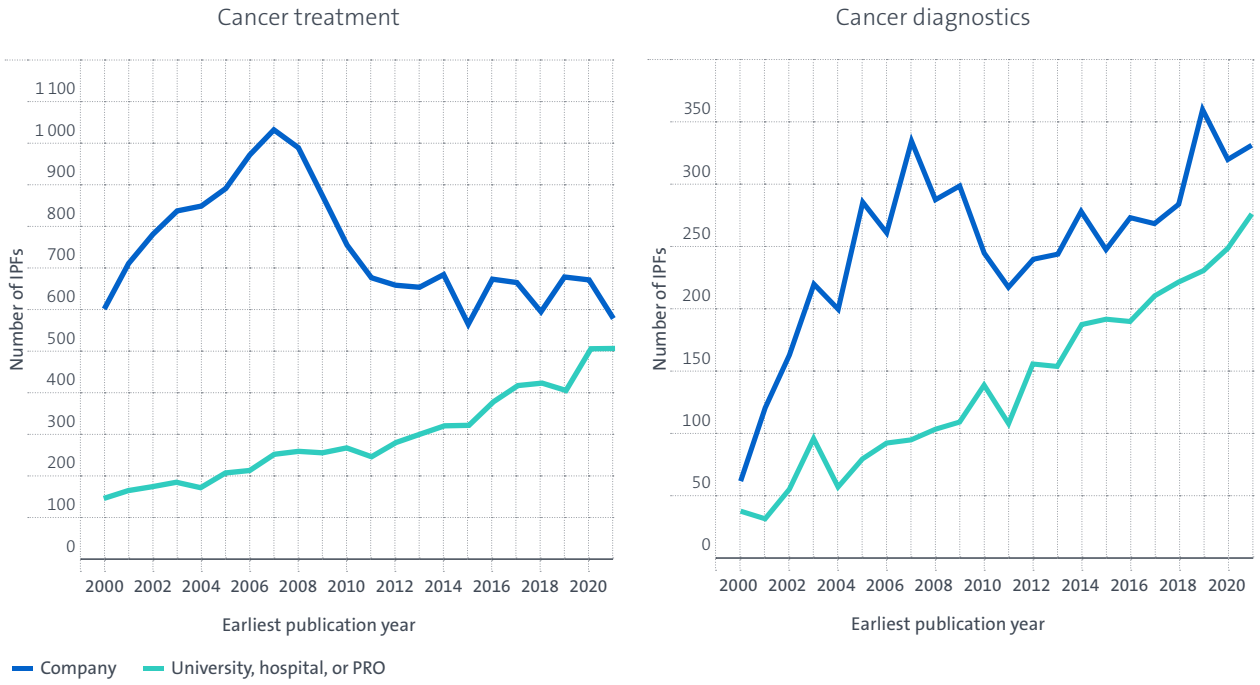
Source: EPO

4. Universities and public research organisations play an increasing role in cancer-related innovation

Universities and public research organisations (PROs) generate an impressive proportion of all IPFs in cancer-related technologies. Between 2002 and 2021, they accounted for almost one in three IPFs in these technologies at a global level, and for up to 35% of all IPFs in the US. They are also well represented among the top applicants, with seven institutions (including five US ones) featuring in the global top 20 for the period 2002–2021. These top scientific institutions generated almost half of the global top 20 applicants' IPFs in 2021 in both cancer treatment and cancer therapy, with a steady growth of IPFs over the last 20 years. Interestingly, the trend for top corporate applicants in cancer treatment diverges from that for top scientific institutions. It shows a strong decrease in the annual number of IPFs from corporate applicants after 2007 followed by a stagnation over the last decade. This suggests a shift in the organisation of innovation in cancer treatment, with pharmaceutical companies increasingly reliant on science-based pre-clinical research stemming from universities and PROs.

Figure E4

Comparison of trends among top 20 applicants: company applicants versus universities, hospitals and PROs



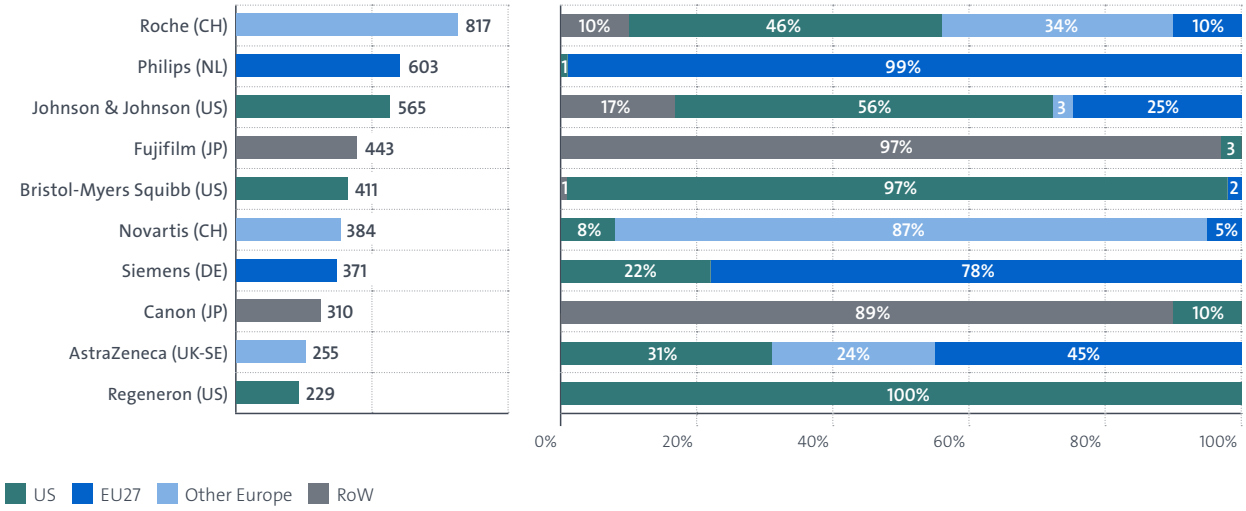
Source: EPO

5. Although top applicants have diverse geographical origins, patenting activities in cancer treatment are largely localised in the US

The list of the top 10 global corporate applicants over the period 2017–2021 includes five European, two Japanese, and three US companies. A Swiss company, Roche, tops the ranking. Most of these applicants are pharmaceutical companies focused mainly on innovation in cancer treatment. However, there are also several companies, such as Philips, Fujifilm, Siemens and Canon, which specialise in diagnostics. Although European companies are well represented in the ranking, a closer analysis shows that significant shares of the IPFs attributed to Roche (46%) and AstraZeneca (31%) originate from their US subsidiaries. Among US top companies, only Johnson & Johnson shows a sizeable share of IPFs filed from Europe, mainly by its Belgian subsidiary Janssen. In areas such as immunotherapy, up to 30% of the top applicants' portfolios consists of IPFs obtained via the acquisition of (mostly US-based) biotech startups, which confirms their transition towards an open-innovation model linking university ecosystems to the pharmaceutical industry.

Figure E5

Top 10 company applicants and the origin of their patenting activity, 2017–2021



Source: EPO

The full report is available for download at:

epo.org/trends-cancer

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