

Digital Patent Decline

The Economic and Political Costs of Europe's Shrinking ICT Patent Share

In cooperation with



Vodafone Institute
for Society and
Communications

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Foreword

This policy brief forms part of a series aimed at analyzing Europe's digital dependencies and the associated challenges and opportunities. The series results from a one-year collaboration between the Vodafone Institute and the University of Bonn. Through this collaboration, we aim to provide innovative assessments of how Europe's digital capabilities are developing and identify the implications of these trends for Europe's economic and political autonomy.

Our previous policy brief unpacked Europe's digital trade deficit, showing how hidden trade dependencies on the US and China fundamentally challenge the effectiveness of current European strategies. This second policy brief looks into the future, examining the growing costs and implications of Europe's shrinking share of global technology patents. An additional fact sheet will explore Europe's diminishing edge in 5G connectivity. The series will conclude with a policy study and website presenting the Digital Dependence Index 2.0 – a comprehensive tool for comparing the digital dependencies of 51 countries – as well as several strategic priorities to increase Europe's digital autonomy.

Executive Summary

While policymakers in Brussels focus on advancing digital innovation, greater attention should be paid to the underlying drivers of Europe's innovation decline – particularly the global performance of European firms in creating digital intellectual property (IP). Overlooking IP creation weakens the global competitiveness of European companies and may ultimately undermine Europe's digital sovereignty.

This brief highlights Europe's weak position in information and communications technology (ICT) patents. Global ICT patent data shows that European firms lag significantly behind other leading patent holders and that this gap is likely to widen. Europe's growing dependence on IP developed in other countries – especially by firms in the United States and East Asia – carries substantial costs. It reduces the influence of European companies, increases Europe's political vulnerability, and constrains its ability to shape global ICT standards and technological outcomes.

Just as we demonstrated in relation to Europe's digital trade relations,¹ Europe must act immediately and effectively in the IP dimension to ensure its digital sovereignty and economic opportunities are not further eroded. This brief provides insights into Europe's digital patent decline and explores the options for getting Europe back on track.

Key recommendations include:

- **CORRECTING THE ICT PATENT BLIND SPOT**

Europe must systematically incentivize European ICT patenting. The Commission should also invest more in research that helps translate scientific know-how into commercial opportunities for European businesses, as suggested by the Draghi report two years ago.

- **COPING WITH IP DEPENDENCIES**

ICT patent dependence is inevitable in the short- to medium-term. Europe must choose partners strategically to ensure European businesses maintain uninterrupted access to the digital technologies they need.

- **EXPANDING AND COORDINATING INPUT FACTORS**

Europe must expand and coordinate its investments in IP-relevant R&D, long-term assets and STEM education as soon as possible. Policies should focus on building on Europe's existing strengths and facilitating industrial-academic collaboration to address IP knowledge gaps, generate momentum in digital ecosystems and advance commercialization of – and related gains from – European technologies.

¹ Please see the first policy brief in this series for more details: Maximilian Mayer, Laura Mahrenbach, Rogelio Madrueño, and Yen-Chi Lu, "A Wake-Up Call for the EU's Digital Decade: Digital Trade Trap?" Vodafone Institute for Society and Communications / University of Bonn, March (2026), accessed June 10, 2026, www.vodafone-institut.de/wp-content/uploads/2026/03/wake-up-call-for-the-eus-digital-decade.pdf.

Europe's ICT patenting challenge

While policymakers in Brussels focus on deregulation as the key to unlocking innovation, less attention is given to how well Europe performs in digital innovation and how its firms compare globally in creating digital intellectual property (IP). Patents are a central metric for measuring these trends and (indirectly) Europe's digital dependence. Yet they are often ignored in discussions about digital sovereignty.²

The problem with digital IP in Europe is well-known. The much-cited 2024 Draghi report on European competitiveness showcased how severely Europe is falling behind in this area.³ Draghi warned that financial and regulatory barriers may push many young tech companies to operate outside the EU. The absence of major tech firms from Europe further weakens the region's ability to create digital IP (Figure 1). A lack of IP in the information and communications technology (ICT) sector is particularly dangerous, given that digital technologies are now integrated across all areas of political, economic and social activity worldwide and digital trade dependencies are deepening.⁴

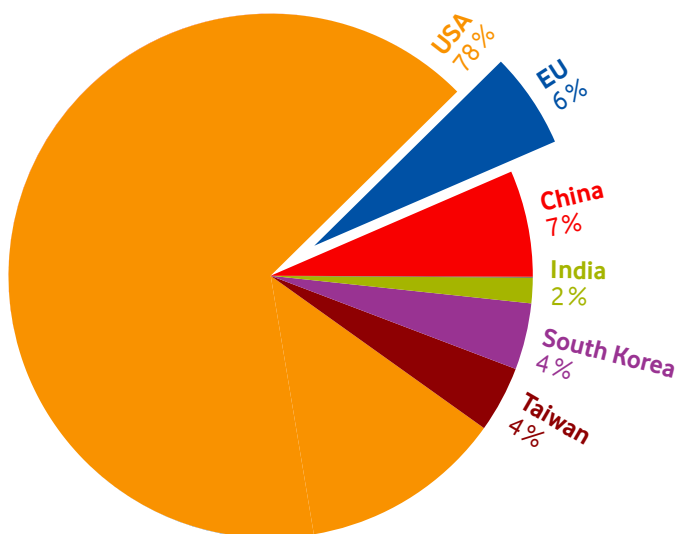


FIGURE 1
Market capitalization share (%) of top 100 tech companies by country and region, 2019

Data sourced from PricewaterhouseCoopers.⁵

² Admittedly, not all inventions are patented. Other useful innovation metrics include research and development (R&D) spending and publications on key technologies. See Rikap, Cecilia, "Intellectual Monopolies as a New Pattern of Innovation and Technological Regime," *Industrial and Corporate Change* 33, no. 5 (2024): 1037–62, for more information.

³ This reflects a broader issue. Even in clean technology – one of Europe's stronger areas – progress is slowing due to financial and regulatory barriers that make it harder for companies to grow (see Mario Draghi, *The Future of European Competitiveness: Part A – A Competitiveness Strategy for Europe*, Brussels: European Commission, 2024, 46). Europe performs even worse in ICT patents, where scaling barriers are higher (*Ibid.*, 30, 40).

⁴ Mayer et al., "A Wake-Up Call for the EU's Digital Decade."

⁵ PricewaterhouseCoopers, "Global Top 100 Companies by Market Capitalisation," May 2020, accessed May 3, 2026, see:

www.pwc.es/es/auditoria/assets/global-top-100-companies-2020.pdf.

Please note: all patent data refers to patents secured rather than to patent applications. Focusing on granted patents allows for a better estimation of the current global patent distribution as well as its economic and political implications since only patents that are held can translate into economic and political power.

Yet despite these dangers, the clear recommendation to increase digital IP generation appears to be largely ignored to date. The EU Digital Decade has not directly addressed the issue. Attempts to encourage and increase transparency about so-called standard essential patents (SEPs)⁶ were shelved due to disagreements in the Commission.⁷ The SME Fund, launched in 2021 to decrease the costs of acquiring patents and other trademarks, seems more promising but has only reached 100,000 businesses Europe-wide in its first 5 years.⁸

This brief deconstructs this situation by examining Europe's weak global position in ICT patents. Economically, the costs of this situation are growing through higher licensing fees, rent extraction, and supply chain risks linked to export restrictions. Politically, relying on foreign IP makes Europe vulnerable to pressure from countries that control most ICT patents, especially the United States (US) and China. It also limits Europe's ability to shape technical standards that could benefit its own companies in the long-term.⁹ It may even undermine Europe's digital sovereignty, as major ICT patent holders can exert legal control over parts of Europe's economic activity.

Because patents offer exclusive rights to IP holders for 20 years, these economic and political costs are likely to keep rising. Lock-in effects could occur as growing dependencies on patent holders make it too expensive to switch suppliers and geopolitical and economic behaviors adjust to Europe's growing insignificance in ICT patenting.

Europe must act immediately and effectively to ensure its digital sovereignty and economic opportunities are not further eroded in the IP realm. Three recommendations seem relevant, namely,

- systematically incentivizing European ICT patenting and improved translation of scientific know-how into commercial opportunity;
- coping with IP dependencies via carefully crafted strategic partnerships; and
- coordinated expansion of investments in IP-relevant research and development (R&D), long-term assets and science, technology, engineering, and mathematics (STEM) education.

6 SEPs are "patents that protect the technology incorporated in a standard." See: Tambiana Madiega, Standard Essential Patents Regulation, PE 754.578 (Brussels: European Parliamentary Research Service, 2023), 2. Also see discussion below.

7 Garrigues, "The European Commission Withdraws the Proposal for a Regulation on Standard Essential Patents (SEPs) and FRAND Licenses," February 12, 2025, accessed April 22, 2026, see: www.garrigues.com/en_GB/new/european-commission-withdraws-proposal-regulation-standard-essential-patents-seps-and-frand.

8 European Union Intellectual Property Office (EUIPO), "Driving SME Growth and Competitiveness: 100,000 SMEs Financially Supported by the SME Fund," January 30, 2026, accessed March 21, 2026, see: www.euiipo.europa.eu/de/news/driving-sme-growth-and-competitiveness-100-000-smes-financially-supported-by-the-sme-fund.

9 Susann Lüdtkke, The Secret of Lobbying in China: Who Influences Building Energy Efficiency Standards? (Baden-Baden: Nomos, 2020).

Why ICT patents matter for Europe

The ownership of IP and especially ICT patents¹⁰ matters greatly for Europe's future prosperity, productivity and competitiveness. The economic impact of patents in general is highly significant, with patent-intensive industries contributing 18.4% of the EU's GDP between 2021 and 2023.¹¹ The magnitude of global cross-border payments due to intellectual property is more than 1 trillion USD per year,¹² meaning royalties and license payments also hugely impact national balance of payments accounts. Globally, all leading tech firms own a huge number of patents, making their IP and market capitalization strongly correlated.

Patents and patenting processes also have substantial political implications. These range from facilitating international collaboration on innovation to enhancing governments' standard setting power¹³ to weaponizing patent-related interdependencies across supply chains.¹⁴ Hence pursuing patents appears to have clear benefits for both firms and the countries that host them.¹⁵

European firms have demonstrated strong patent filings in areas like clean technology, and its patent-intensive industries are quite diverse, spanning metallurgy, fuel, machinery, sporting goods, dyes, mattresses and perfumes, just to name a few.¹⁶ These speak positively for innovation in Europe. But Europe's relative lack of ICT patents is striking and needs to be addressed immediately for two reasons.

From an economic perspective, digital technologies are already pervasive in European businesses and encouraging greater uptake is a core goal of the European Commission's Digital Decade program.¹⁷ ICT patents "have a significant positive impact on economic growth in the long run," and this effect is especially pronounced for advanced economies, like many EU countries.¹⁸ Hence ICT patents offer Europe an opportunity to gain more ownership of its economic future by securing more control over the technological base of production across multiple sectors. This also implies greater economic benefits for European citizens in the future via license receipts and cheaper imports.

10 Patents are one of many categories of IP, including trademarks and copyrights. They constitute "an exclusive right granted for an invention." By offering patent holders the exclusive right to capitalize on that invention for 20 years, patents incentivize innovation. In addition, technical information in patent applications and granted patents are made publicly available, increasing transparency about new technologies. See WIPO, "Frequently Asked Questions: Patents," 2026, accessed April 14, 2026, see: www.wipo.int/en/web/patents/faq_patents.

11 European Union Intellectual Property Office and European Patent Office, IP and Innovation in European Sectors (Alicante and Munich: EUIPO and EPO, January 29, 2026).

12 WIPO, "International Trade in Ideas, Know-how and Intellectual Property Surpasses 1 trillion in 2023; the US and Japan, as Well as Ireland and China Lead," June 26, 2025, accessed May 3, 2026, see: www.wipo.int/en/web/global-innovation-index/w/blogs/2025/international-trade.

13 Tim Rühlig, "Chinese Influence through Technical Standardization Power," *Journal of Contemporary China* 32, no. 139 (2023): 54–72.

14 See JianQin Xiang, Feichang Ma, and Haiyan Wang, "The Effect of Intellectual Property Treaties on International Innovation Collaboration: A Study Based on USPTO Patents during 1976–2017," *Library Hi Tech* 41, no. 2 (2023): 666–682; Teva Meyer, "Patents for Power: Intellectual Property and the Geopolitics of Nuclear Energy Technologies," *Nuclear Engineering and Technology* 57, no. 7 (2025).

15 In fact, UN agencies have adjusted their methodology to reflect the growing importance of 'intangible' economic elements, including IP. According to WIPO assessments, intangible investments are generally growing fast, see WIPO, "World Intangible Investment Highlights 2025," accessed May 12, 2026, see: www.wipo.int/en/web-publications/world-intangible-investment-highlights-2025/en/world-intangible-investment-highlights-2025.html.

16 EU IPO and European Patent Office 2026.

17 European Commission, State of the Digital Decade 2025 Report (Brussels: European Commission, June 16, 2025).

18 Canh Phuc Nguyen and Nadia Doytch, "The Impact of ICT Patents on Economic Growth: An International Evidence," *Telecommunications Policy* 46, no. 5 (2022): 1–19.

From a political perspective, technologies and infrastructure are increasingly used as tools of geopolitical and strategic control.¹⁹ Growing reliance on digital technology for cross-sectoral economic production leaves European businesses vulnerable to political manipulation by foreign governments. The US and China have already shown their willingness to weaponize these dependencies in the areas of semiconductors and rare earths.²⁰ Both countries can be expected to do so again in the future. ICT patents are also the basis of many crucial global ICT standards, helping patent holders lock-in favorable conditions and related market gains over and beyond the duration of the patent.²¹ A lack of ICT patents not only represents more vulnerability to strategic manipulation. It is also a missed political opportunity to shape global standards and capitalize on related market developments.

Reversing Europe's worsening ICT patenting position is consequently a crucial step in securing Europe's long-term digital sovereignty and its economic prosperity. Unfortunately, as noted in the Draghi report, this may prove quite a challenge.

19 See: Harry Oppenheimer, "Digital Interdependence and Power Politics," *British Journal of Political Science* 55 (2025): e93; Daniel W. Drezner, Henry Farrell, and Abraham L. Newman, eds., *The Uses and Abuses of Weaponized Interdependence* (New York: Bloomsbury Publishing, 2021).

20 Guillaume Beaumier and Madison Cartwright, "Cross-Network Weaponization in the Semiconductor Supply Chain," *International Studies Quarterly* 68, no. 1 (2024): 1–18.; Reuters, "China Curbs Rare Earth Exports to Japanese Companies After Dual-Use Ban, WSJ Reports," January 9, 2026, accessed May 12, 2026; www.reuters.com/world/asia-pacific/china-curbs-rare-earth-exports-japanese-companies-after-dual-use-ban-wsj-reports-2026-01-08/.

21 Giuseppe Colangelo, "The Politicization of IP Protection: The Case of Standard Essential Patents," *International Center for Law & Economics White Paper*, December 6, 2024; Tim Rühling, "Transatlantic Tech De-Risking from China: The Case of Technical Standard-Setting," *Testimony before the U.S.-China Economic Security Review Commission*, June 15 (2023).

Mapping how far Europe lags behind in ICT patenting

Europe's current ICT patent data²² is bleak in global comparison. The shares of ICT patents granted globally each year have shifted significantly since 2000. Japan has seen a sharp decline, while the US has dropped more moderately. In contrast, China has grown rapidly, reaching over 50% of global ICT patents in 2023. Even allowing for the necessary caution in interpreting China's share,²³ Europe is in a weak position. Its share is small and falling – below 5% in 2023 – and it consistently lags behind the US, Japan, and South Korea (see Figure 2).

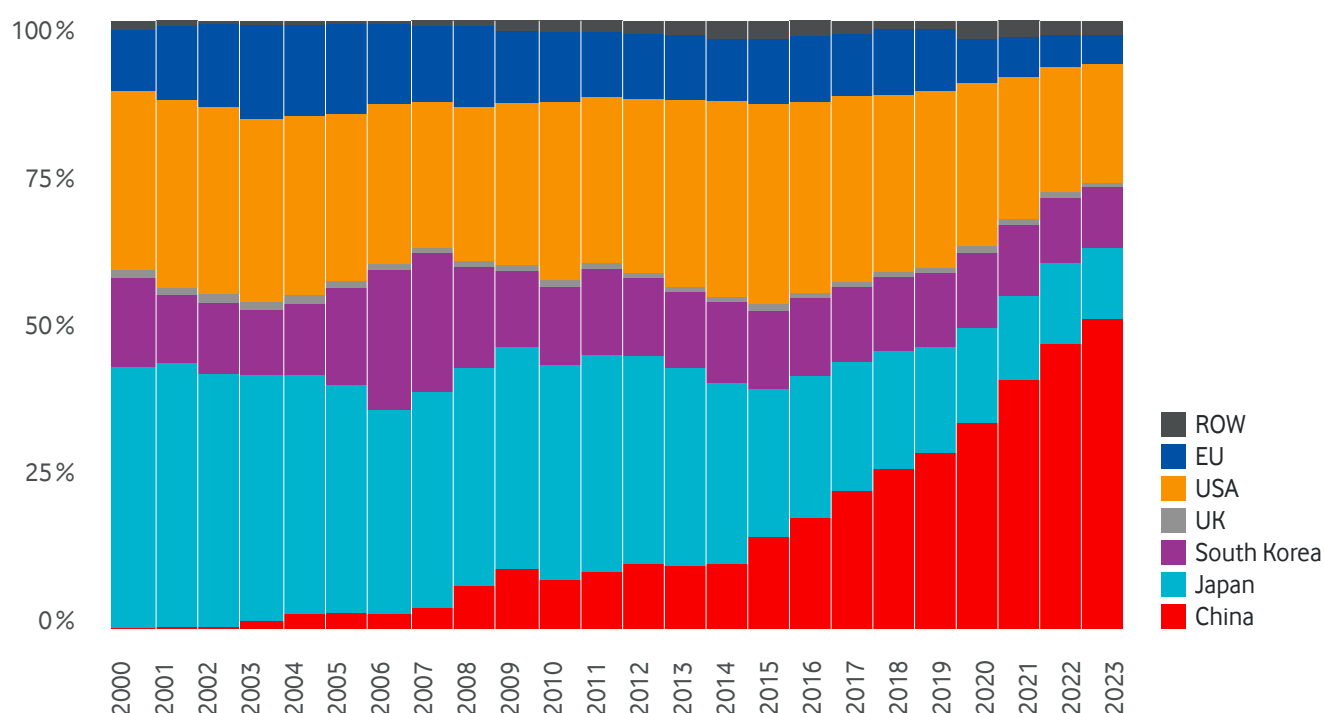


FIGURE 2
ICT leader shares (%) of global ICT patents, 2000-2023

Data sourced from WIPO²⁴

²² References to a specific country's share of global ICT patents does not imply those patents belong to or are a result of that country's policies. Rather, this is just shorthand for patents acquired by firms or residents of those countries which is used to increase the readability of this brief.

²³ There has been significant discussion regarding the quality of Chinese patents, with some analysts questioning the market value of these patents and others even calling a great portion of Chinese patents "worthless." However, recent research suggests patent quality may be improving. See Alex He, "What Do China's High Patent Numbers Really Mean?" CIGI, April 20 (2021); Lulu Yilun Chen, "China Claims More Patents Than Any Country – Most Are Worthless," Bloomberg, September 26 (2018); and Howei Wu, Jia Lin, and Ho-Mou Wu, "Investigating the Real Effect of China's Patent Surge: New Evidence from Firm-Level Patent Quality Data," *Journal of Economic Behavior & Organization* (2022): 422–442.

²⁴ For this and all references to WIPO as a data source: WIPO, "WIPO IP Statistics Data Center," 2026, accessed March 28, 2026, see: www3.wipo.int/ipstats/ips-search/patent.

Europe also has a weak position in terms of cumulative ICT patent data. All 27 EU states together secured only a 7% share of all ICT patents granted between 2000 and 2023. In contrast, South Korea (11%), Japan (15%), the US (24%) and China (39%) secured significantly larger shares on their own (Figure 3).²⁵

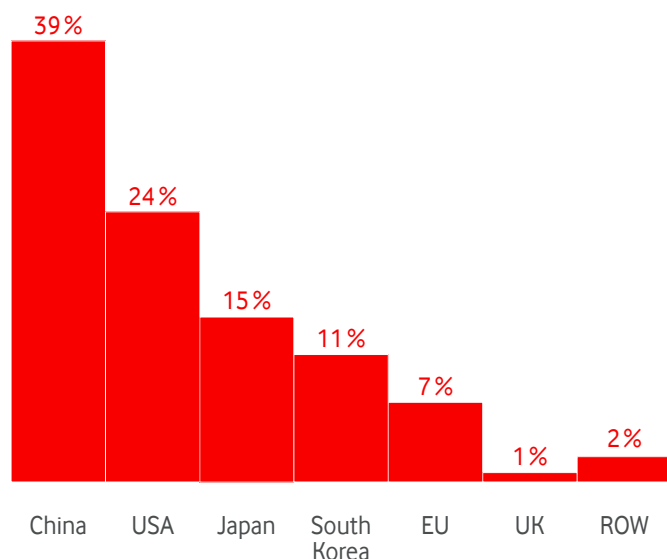


FIGURE 3
Share (%) of cumulative global ICT patents, 2018-2023

Data sourced from WIPO

Europe does poorly when zooming in to examine patents for the various ICT sub-categories as well. Even at its best – in basic communication processes – Europe trails Japan, US and China by a significant margin (Figure 4).

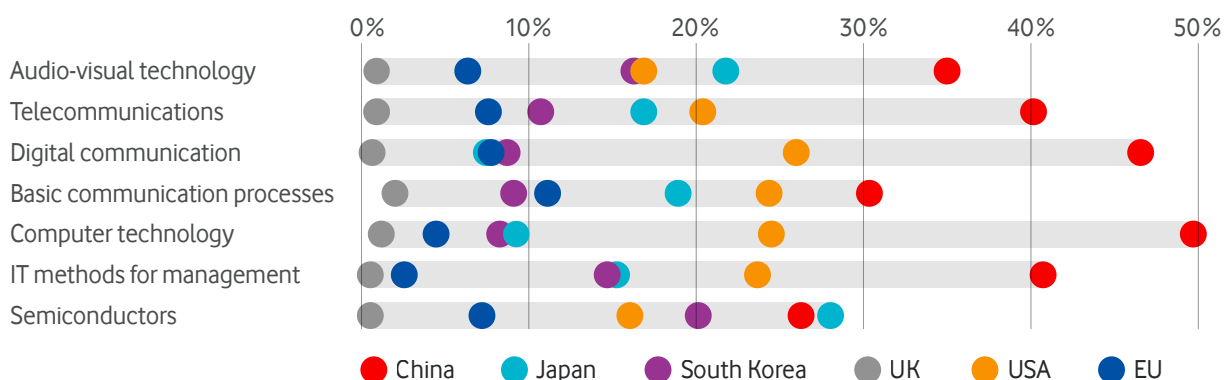


FIGURE 4
Global share (%) by ICT patent group, average 2020-2023

Data sourced from WIPO

²⁵ As Chinese patents are mainly filed domestically, the numbers for Chinese filings under WIPO's Patent Cooperation Treaty are still leading but comparatively lower. See World Intellectual Property Organization (WIPO), "IP Facts and Figures: Patents," accessed June 10, 2025, www.wipo.int/en/ipfactsandfigures/patents.

Nor does digital innovation appear to be a European focus when looking at patents held. Comparing ICT with non-ICT patents shows that Europe has a much smaller share of ICT patents than other leading countries (Figure 5). Although EU firms perform strongly in areas like renewable energy and biochemistry (as highlighted in the Draghi report), they lag behind China, the US, Japan, and South Korea in ICT patents: only about 15% of EU-held patents are ICT-related. European firms consequently appear less focused on securing patents in this key field than their global competitors.

This problem is particularly severe given that patent protection generally lasts 20 years.²⁶ A lack of ICT patents today will affect Europe's ability to convert domestic innovation into market gains in the future. Immediate action is required to minimize related political and economic consequences. Yet European governments must also be patient in waiting for results. As the industrial policies of other leading countries demonstrate, digital innovation success is often the product of short-term action combined with long-term thinking.

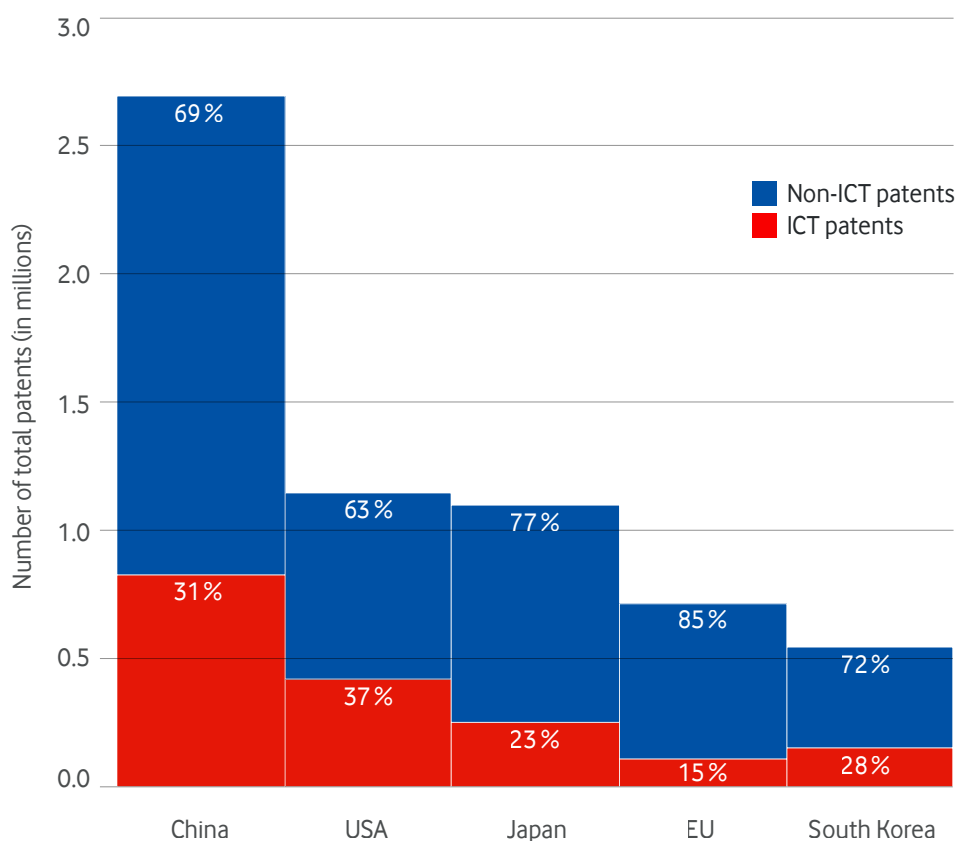


FIGURE 5
Cumulative ICT patents as share (%) of total patents by applicant's country of residence, 2020-2023 (in millions)

Data sourced from WIPO

²⁶ World Intellectual Property Organization (WIPO), "Frequently Asked Questions: Patents," 2026, accessed May 12, 2026, www.wipo.int/en/web/patents/faq_patents.

Industrial and tech policies have yet to yield patenting results

To understand Europe's IP position, it is important to consider shifts in the global digital IP landscape, particularly with regard to changes in the tech and industrial policies of other major players. Figure 6 illustrates the connections between patent trends and the industrial policies adopted by leading ICT patent holders over the past twenty years.

We find a considerable dynamism in the global ICT patent domain. Japan, the US and China have all been the global leader in ICT patents at some point in time since 2000. China's ICT patent shares have been continuously rising since 2002 and especially fast since 2014, while the Japanese and the US shares have been in decline since 2001 and 2016, respectively. South Korea maintains a stable share, which is now double the EU's share. The EU's share was relatively stable between 2010 and 2019 but has declined sharply since then (Figure 6).

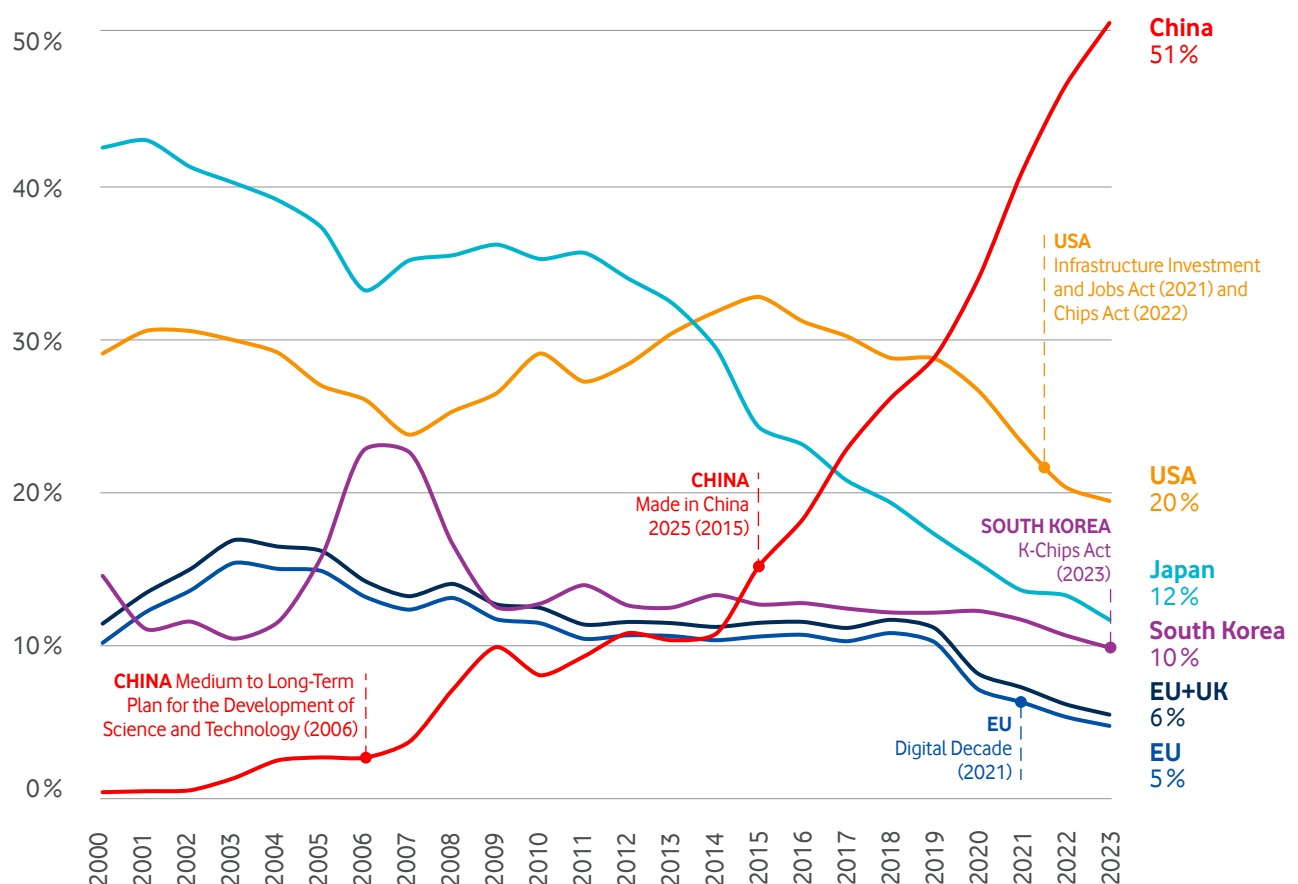


FIGURE 6
Global share (%) of ICT patents granted and key tech and IP policies, selected patent leaders, 2000-2023

Data sourced from WIPO
Note: Patents sorted by applicants' country of residence

Key industrial policies in ICT patent leader states

CHINA China's ICT patents plateaued between 2009 and 2014 but began to increase again in 2014 and 2015. China has been the world leader in ICT patents since 2020, with a more than 50% share in 2023.²⁷ Chinese industrial policies appear particularly focused on incentivizing digital infrastructure, software, and data-driven technologies²⁸ – and with some success. For instance, the Medium-to Long-Term Plan for the Development of Science and Technology (2006–2020) and President Xi Jinping's Made in China 2025 (2015) policy correspond to positive upturns in China's ICT patent acquisition.

US The US assumed the lead in global ICT patent shares in 2014, overtaking Japan shortly before the introduction of China's Made in China 2025. The US has demonstrated decreasing shares since 2017, losing its lead to China in 2020. The industrial policies enacted under US President Joe Biden in the early 2020s, including the Infrastructure Investment and Jobs Act (2021) and the CHIPS and Science Act (2022), appear to be, in part, a response to the US's declining global innovation position. They strongly incentivize private investments in technology manufacturing and energy infrastructure as well as expanding public funding for STEM education and for R&D of high-tech and national security-critical technologies.

SOUTH KOREA AND JAPAN Although their global share is shrinking, firms in both countries demonstrate strong and persistent ICT patenting activity and continue to top the number of digital patents secured by European firms. Supportive industrial policies are evident here as well. Examples include South Korea's K-Chips Act (2023), which encourages investment in semiconductor-relevant infrastructure, and Japan's 2026 amendment of the Industrial Competitiveness Enhancement Act to boost R&D for "priority industrial technologies."²⁹

EU The EU's ICT patent share has been at the bottom of the pack among ICT leaders since China surpassed it in 2014. The EU demonstrates a sharp decrease starting in 2019, likely motivating the Commission to try and bolster Europe's digital capabilities via the Digital Decade program starting in 2021. The Industrial Accelerator Act (IAA) currently under discussion contains IP-accelerating components but it remains to be seen whether it will materialize and in which form. Even if it passes as is (which is unlikely),³⁰ it is questionable whether the IAA alone can quickly increase the amount of digital tech IP generated by European actors.

In other words, the EU seems to be trying to use industrial policies to boost its industrial and innovative capacity, as other ICT patent leaders have done. However, patents and IP in general have been given less emphasis in EU policies than in those of other patent leaders, and none of these attempts have so far reversed the trend of growing Chinese IP dominance.³¹ Nor do they appear to be improving Europe's ICT patenting position.

27 These data mirror the Chinese share of patent filings, see: World Intellectual Property Organization (WIPO), "Patents and Utility Models," IP Facts and Figures 2025, accessed June 10, 2026, www.wipo.int/web-publications/ip-facts-and-figures-2025/en/patents-and-utility-models.html.

28 Marco Richter and Holger Zimmer, "Analysis of Strategic Behaviours Spotlights China's Dominance in Patent Publications," IAM Media, July 16 (2025), accessed May 14, 2026: www.iam-media.com/article/analysis-of-strategic-behaviours-spotlights-chinas-dominance-in-patent-publications.

29 Chris H. Park, "How South Korea's K-Chips Act Balances Strategic Priorities and Foreign Affairs," Korea Pro, April 19 (2023), accessed May 14, 2026, koreapro.org/2023/04/how-south-koreas-k-chips-act-balances-strategic-priorities-and-foreign-affairs/; Blackbox, "Japan Moves to Strengthen Strategic Tech R&D with New Industrial Competitiveness Bill," March 24 (2026), accessed May 12, 2026, www.blackboxip.com/news/japan-moves-to-strengthen-strategic-tech-r-d-with-new-industrial-competitiveness-bill.

30 Philip Blenkinsop and Kate Abnett, "EU Proposes 'Made in EU' Rules for Strategic Sectors to Curb China Reliance," Reuters, March 4 (2026), accessed April 22, 2026, www.reuters.com/world/china/eu-lay-out-local-content-rules-strengthen-manufacturing-cut-china-reliance-2026-03-04/.

31 We are using IP as shorthand for innovation or patents and vice versa for simplicity's sake. Note that while IP, patents and innovation are used interchangeably here, they are actually different elements with complex relationships.

How Europe's weakening ICT patent position generates long-term harm

Economic costs

ICT patents are a particular problem for Europe. One way of examining these costs is to consider the licensing fees that accompany patent possession. European businesses collect these fees for EU-based patents but must pay these fees to access technologies whose patent holders are located outside of Europe. Overall, the EU's balance of payments in IP licensing is a deep and increasing deficit, reaching US\$138 billion in 2024. This means Europe is paying US\$138 billion more in licensing fees than it is collecting.

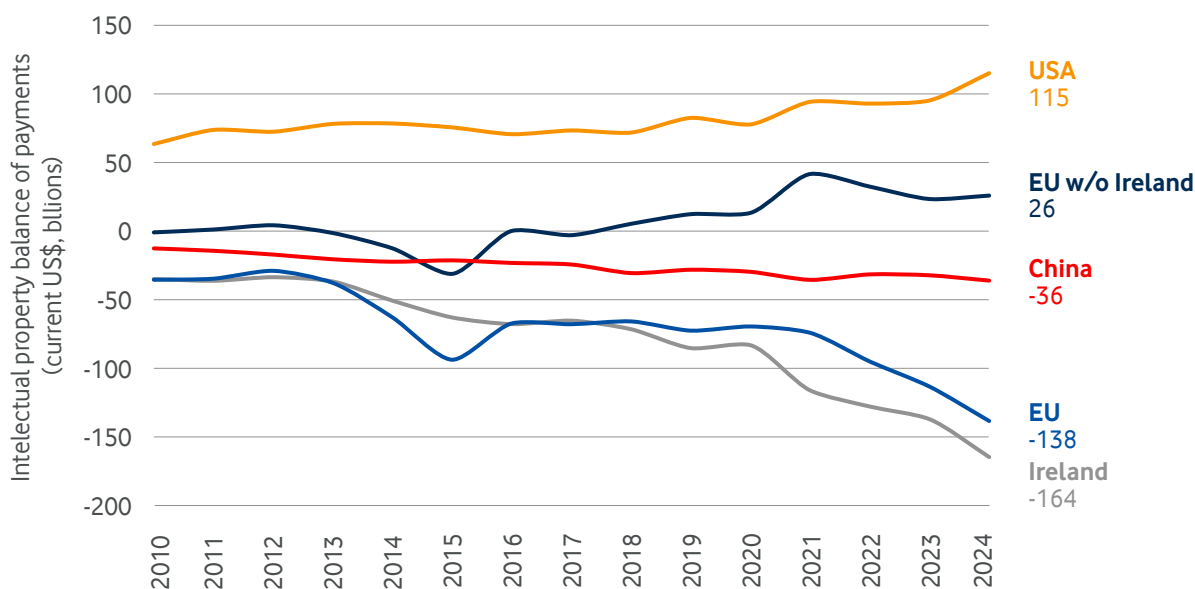


FIGURE 7
Balance of payments for IP (current US\$, billions),
2010-2024, key countries³²

Data sourced from World Bank³³

³² This calculation represents the difference between receipts and payments for using, reproducing or distributing products protected by proprietary rights like trademarks, copyrights and patents.

³³ For this and all references to World Bank as a data source: World Bank, "World Development Indicators," 2026, accessed April 1, 2026, see: databank.worldbank.org/reports.aspx?source=2&series=SI.POV.GINI&country=

A closer look suggests that the ICT patent portion of this general IP deficit is substantial. Ireland's close relationship with US Big Tech is well-documented and our previous policy brief demonstrated the political and economic costs of not taking this relationship seriously when considering Europe's digital trade.³⁴ This appears true for IP as well.

For example, the "double Irish" strategy of American companies transferring IP to Ireland to lower IP-related tax burdens has been popular among US Big Tech since the 1990s. Between 2015 and 2020, the Irish government revised its tax codes to eliminate this possibility.³⁵ As a result, intra-firm licensing paid by Irish subsidiaries to use US patented technology increased drastically starting in 2020. Ireland's IP balance of payments deficit reached US\$164 billion in 2024 (Figure 7).³⁶

When Ireland's deficit is removed from the EU's IP balance of payments, Europe actually carried a surplus of \$26 billion in 2024 (Figure 7). This means that IP ownership is paying off for Europe: the patents held by European firms create economic income. However, the costs of the patents Europe lacks are significantly greater in scale and continue to cost Europe mightily: licensing fees for the ICT patents at play in Ireland were more than 6 times the amount earned via license receipts collected for all of Europe's other patents that year.

Economic costs for Europe can also arise from supply chain marginalization as a limited number of countries assume dominance over an entire technology supply chain. For instance, China and Japan dominated lithium-ion battery (LIB) patents in 2021, albeit with China's share increasing and Japan's decreasing. All other country shares were below 10%.³⁷ This dependence on East Asian suppliers is already costly for European manufacturers.³⁸ It could become even more expensive in the future: Chinese battery producers, particularly Brunp, are not only expanding patent acquisition across the length of the battery supply chain. They are also increasingly seeking patents outside of China.³⁹

The consequences of these developments are twofold. Securing patents along the entire supply chain enables Chinese companies to use cost and scale advantages to cut European participants out of supply chain sections where Europeans excel, such as battery recycling. Securing patents outside China offers Chinese companies the opportunity to lock in their competitive advantages in over 150 countries. Both of these consequences will improve China's position and harm Europe's position as green transitions worldwide increase demand for batteries.⁴⁰

34 Mayer et al., "A Wake-Up Call for the EU's Digital Decade."

35 Carlos Waters, "Why Apple, Microsoft, Pfizer and Other U.S. Multinational Corporations Set Up Shop in Ireland," CNBC, June 12 (2025), accessed May 10, 2026, www.cnbc.com/2025/06/12/apple-microsoft-pfizer-net-tax-breaks-from-ireland-operations.html.

36 The IP balance of payments is not part of the trade balance, but an additional component of the overall national balance of payments account.

37 Tim Greitemeier and Simon Lux, "The Intellectual Property Enabling Gigafactory Battery Cell Production: An In-Depth Analysis of International Patenting Trends," *Journal of Energy Storage* 108, no. 1 (2025): 1–11; Tim Greitemeier, Achim Kampker, Jens Tübke, and Simon Lux, "China's Hold on the Lithium-Ion Battery Supply Chain: Prospects for Competitive Growth and Sovereign Control," *Journal of Power Sources Advances* 32 (2025).

38 Carly Page, "Brussels Urged to Pay 'Sovereignty Premium' to Narrow China Battery Gap," *The Register*, March 3 (2026), accessed April 24, 2026, www.theregister.com/2026/03/03/europes-ev-battery-cost-gap-with-china-could-shrink-to-30/4597710.

39 European Patent Office (EPO), "Battery Recycling Innovation Surging as Countries Seek to Strengthen Critical Mineral Supply and Energy Security," press release, April 29 (2026), accessed April 24, 2026, www.epo.org/en/news-events/press-centre/press-release/2026/1362371.

40 Kjeld van Wieringen, "The Future of European Electric Vehicles," European Parliamentary Research Service, November (2024), accessed June 10, 2026, [www.europarl.europa.eu/RegData/etudes/IDAN/2024/762873/EPRS_IDA\(2024\)762873_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2024/762873/EPRS_IDA(2024)762873_EN.pdf).

Political costs

Political costs arise from growing future dependence on East Asian firms with regard to ICT patents and digital IP as well. ICT patents held in China, Japan and South Korea far exceed those of the rest of the world, including IP leaders such as the US (see Figure 8). This is not only a financial matter.⁴¹ It could also create political vulnerability as Europe attempts to bring ICT production back home.

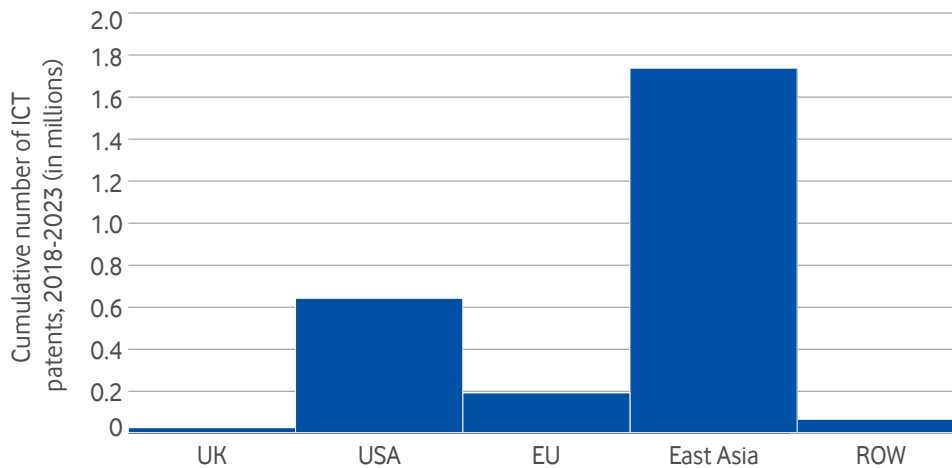


FIGURE 8
Cumulative number of ICT patents by selected country or region, 2018-2023 (in millions)

Data sourced from WIPO

Those vulnerabilities are particularly pronounced when it comes to China. While most Chinese ICT patents are acquired in China, Chinese tech companies are increasingly filing digital and energy technology patents in Europe, accounting for a 10.9% share of these patent applications in 2025 and garnering 15% of ICT patents granted by the European Patent Office between 2020 and 2023 (Figure 9).⁴² In contrast, Europeans hold only 2% of patents granted by the China National Intellectual Property Administration over the same period. This suggests that European companies operating in China will increasingly have to rely on Chinese digital IP, while Chinese tech companies are among the largest IP owners in European markets.⁴³ In fact, the two Chinese companies ranking in the top 10 of European patent filings in 2025 are both in the ICT realm.⁴⁴ According to media reports, one of them – battery giant Contemporary Amperex Technology Co. Limited (CATL) – secured a 20% jump in its share of the European battery market in the first half of 2025,⁴⁵ making future dependence on CATL products more likely as competitors are squeezed out of the market.

41 In order to boost its digital capabilities in line with the ambitions of the Digital Decade, Europe will need to import more intermediary ICT goods from Asia. It must also rely on supply chains increasingly shaped by East Asian IP (see: European Patent Office (EPO), "Battery Recycling Innovation Surging as Countries Seek to Strengthen Critical Mineral Supply and Energy Security," press release, April 29 (2026), accessed June 10, 2026, www.epo.org/en/news-events/press-centre/press-release/2026/1362371). Dependence on East Asian ICT imports could become more expensive due to IP ownership, further shifting the terms of trade against European participants and reducing the domestic added value of the European ICT sector; see Mayer et al 2026.

42 European Patent Office (EPO), "Demand for European Patents in 2025 Exceeded 200,000 for First Time," March 24 (2026), accessed April 25, 2026, www.epo.org/en/news-events/news/demand-european-patents-2025-exceeded-200-000-first-time.

43 This situation is true, albeit not quite as extreme, for European companies operating in the US and for American company ownership of IP in the European market as well.

44 Xinhua, "China Rises to 3rd Place in European Patent Applications in 2025," March 25 (2026), accessed June 8, 2026, english.cnipa.gov.cn/art/2026/3/25/art_3090_205503.html.

45 AI Invest, "CATL's European Market Share Surges 20% Amid Industry Challenges," September 12 (2025), accessed June 8, 2026, www.ainvest.com/news/catl-european-market-share-surges-20-industry-challenges-2509/.

This situation can lock European IP users into one-sided IP dependencies which can be exploited by the Chinese government. Chinese government comments on Europe's proposed IAA suggest this possibility is not far-fetched as the Chinese Commerce Ministry recently threatened "countermeasures" if the IAA retained "mandatory transfer of IP rights and technology requirements."⁴⁶

Not holding ICT patents additionally costs Europe the opportunity to shape how technology standards and markets develop. Technical standards are "universally accessible specifications that ensure interoperability and basic safety" in technological systems worldwide.⁴⁷ Given the speed of technological development, standards often rely on new patents.⁴⁸ Patent holders can shape rules for technological safety and interoperability. This can favor their own technologies, giving them long-term market advantages and higher profits. However, because Europe has relatively few ICT patents, it misses the chance to set these rules and secure such benefits for its own companies.

The interaction between patents and standards can also undermine Europe's digital sovereignty. For instance, sometimes standards require companies to use a particular patented technology to comply with that standard. Holding these standard-essential patents (SEPs) allows patent holders to secure additional revenue via licensing fees that can then be re-invested in technology development, maintaining their technological edge over the competition. Europe and the US have long been leaders in SEPs, but China and other East Asian economies like Korea are increasingly prioritizing their development.⁴⁹ In China's case, this shift is helping China establish itself as a central jurisdiction for resolving international SEP disputes.⁵⁰ Some of these legal decisions – such as setting global royalty rates for specific SEPs – not only contradict normal European jurisprudence. They also give Chinese courts a de facto right to set the legal conditions for economic activity in Europe and beyond.

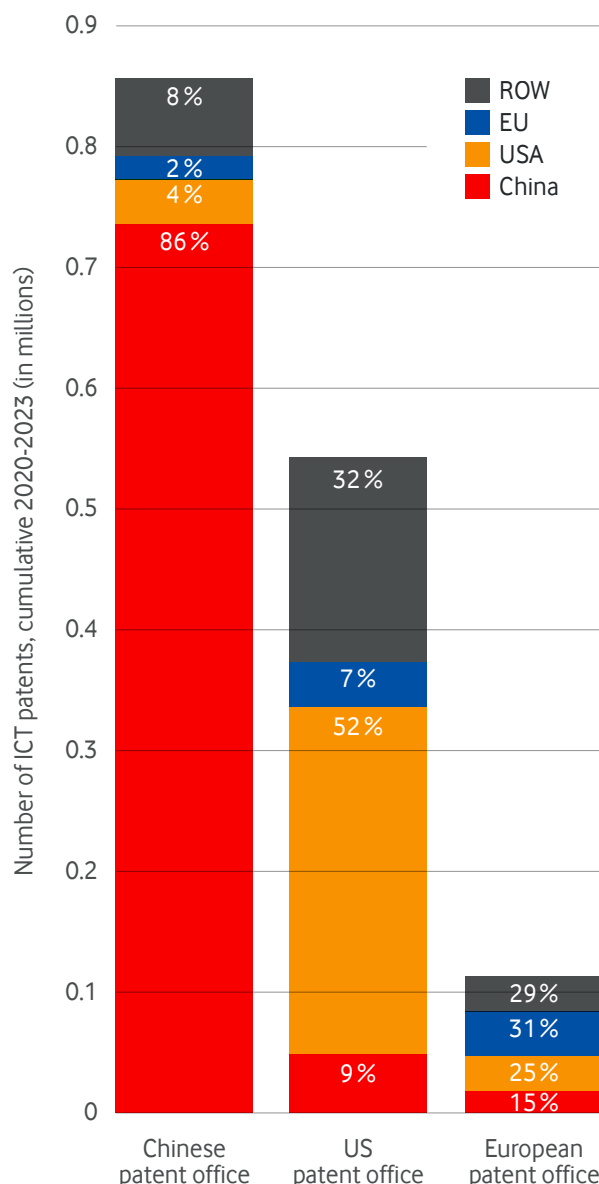


FIGURE 9
ICT patent holder shares in key patent offices by country of origin (% of cumulative ICT patents 2020-2023 and number of ICT patents in millions)

Data sourced from WIPO

46 Joe Leahy and Wenjie Ding, "China Warns EU over Proposed 'Made in Europe' Law," Financial Times, April 27 (2026), accessed May 16, 2026, www.ft.com/content/f4925d94-bd09-43bb-b0e6-8d066fcd317?syn-25a6b1a6=1.

47 Tim Rühl, "The New Geopolitics of Technical Standardisation: A European Perspective," Future Europe 3, no. 1 (2023): 102–109.

48 WIPO Magazine, "IP for Business: Patents in Technical Standards," November 30 (2005), accessed May 12, 2026, www.wipo.int/en/web/wipo-magazine/articles/ip-for-business-patents-in-technical-standards-35054.

49 Chris Borges, "RAI Explainer: Standard Essential Patents and National Security," Center for Strategic & International Studies (CSIS), July 10 (2024), accessed May 15, 2026, www.csis.org/blogs/perspectives-innovation/rai-explainer-standard-essential-patents-and-national-security; Tim Pohlmann, Magnus Buggenhagen, and Marco Richter, "Huawei and Qualcomm Lead the 5G SEP Race," IAM Media, October 11 (2023), accessed May 15, 2026, www.iam-media.com/article/huawei-and-qualcomm-lead-the-5g-sep-race.

50 Kirti Gupta and Mark Cohen, "The New SEP Powerhouse: How China Is Shaping Global Patent Disputes," CSIS, May 7 (2025), accessed May 15, 2026, www.csis.org/blogs/perspectives-innovation/new-sep-powerhouse-how-china-shaping-global-patent-disputes.

Addressing Europe's ICT patenting dilemma

Two approaches appear to be promising for improving Europe's ICT patenting performance. The first, derived from the industrial policies of ICT leader states, relates to digital ecosystem input factors that could improve structural conditions and facilitate ICT patenting. The second relates to the interconnection of global supply chains, national industrial policies, and the intersection of technology and geopolitics, all of which make partnerships crucial. Each of these will be discussed in turn.

Strengthening input factors

The industrial policies discussed share common goals: improving STEM education, supporting technological R&D, and investing in long-term assets like energy grids and broadband networks. The key question is whether strengthening these areas in Europe can help close its gap in ICT patents.

How might this work? Investments in STEM could potentially improve Europe's position by ensuring a greater supply of human capital to narrow the ICT patent gap. Investment in long-term, tech-relevant assets (measured as gross fixed capital formation) provides the basis for patents and innovation by supplying physical and digital infrastructure, equipment and other productive assets required by European firms and researchers. Examples include telecommunications networks, smart energy grids, data centers, satellites, cloud infrastructure, and industrial robots to name a few. Finally, private and public sector R&D investment offers flexibility for European researchers to experiment and push innovation boundaries to expand the technologies Europe produces, improve how and where these technologies are applied and ensure Europe benefits from its own innovations.

Figure 10 illustrates changes in all three inputs as well as in two output metrics – compound annual ICT patent growth between 2000 and 2023 and changing global ICT patent share – for patent and technological leaders. Two findings stand out. First, the EU and China are the only actors showing positive changes across all input factors. Yet their performance in the output category varies drastically, with China posting a huge share improvement and high growth rate, while the EU's growth rate is modest and its share declining. Second, despite positive ICT patent growth rates across all included countries, only in two cases – China and India – did this correspond to an improvement in global ICT patent share.

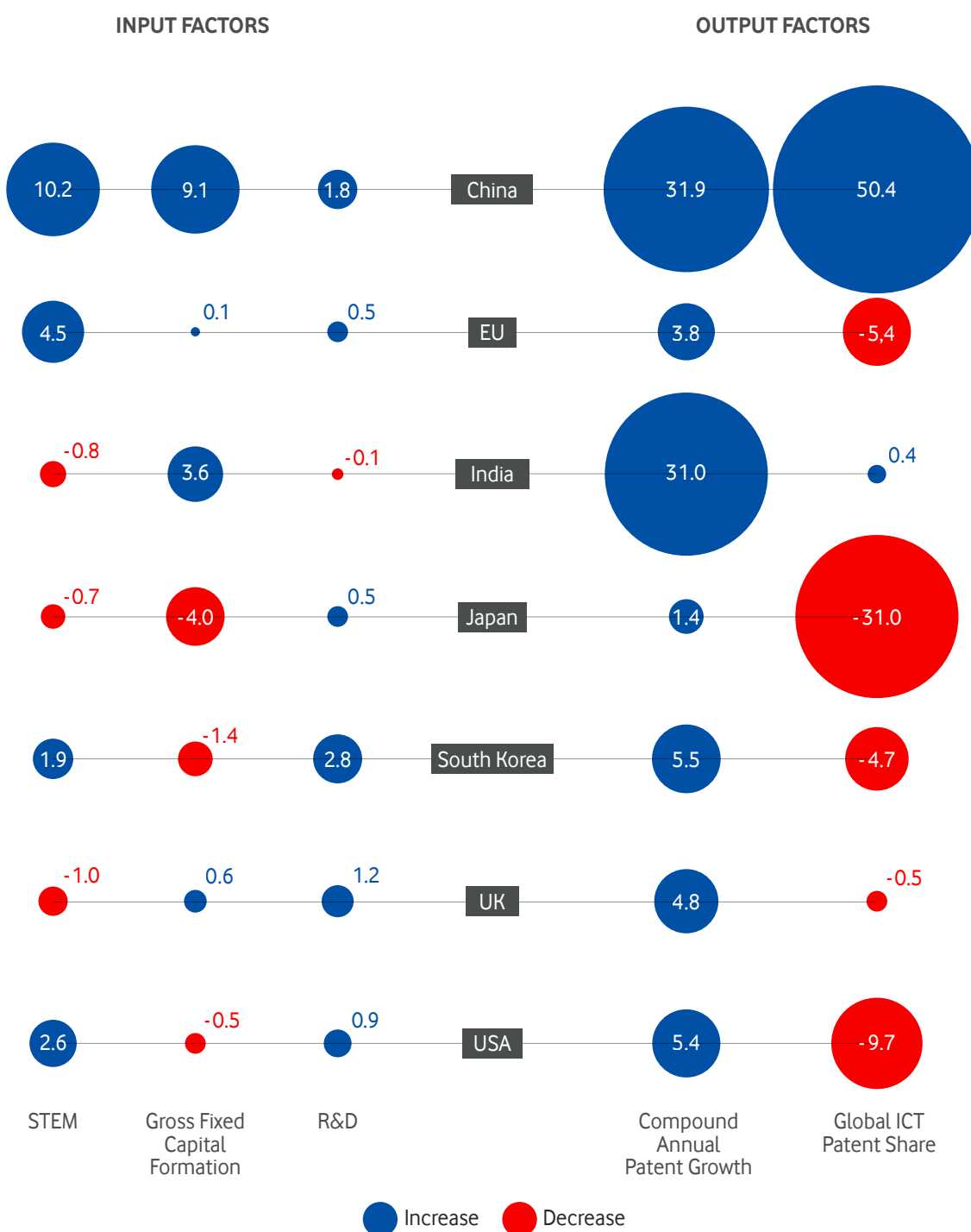


FIGURE 10
% Change in input and output factors over time,
selected states⁵¹

Data sourced from World Bank, Zwetsloot et al 2021, WIPO and the OECD⁵²
Note: STEM: 2014, 2021. Thousands of STEM PhDs. Gross fixed capital formation and R&D: 2000, 2023, % of GDP. Compound annual growth rate: 2000-2023. Global ICT patent share: 2000, 2023, % of global share.

⁵¹ All values in the figure show how input and output factors have changed over time, but the measurement is different for different factors. In most cases (STEM, GFCF, R&D, global patent share), we calculate the % change across two years. We use a "." to separate the years to indicate that this is not change over the entire period but rather simply a comparison of two points in time. In the final one (compound annual patent growth), the calculation provides a steady rate of growth over the entire period, hence the "-" in that instance. The STEM years differ from the other factors for data availability reasons.

⁵² For this and all references to Zwetsloot et al or OECD as data sources: Remco Zwetsloot, Jack Corrigan, Emily Weinstein, Dahlia Peterson, Diana Gehlhaus and Ryan Fedasiuk, "China is Fast Outpacing U.S. STEM PhD Growth," Center for Security and Emerging Technology (CSET) Data Brief, accessed April 1, 2026, see: cset.georgetown.edu/wp-content/uploads/China-is-Fast-Outpacing-U.S.-STEM-PhD-Growth.pdf; and OECD, OECD Data Explorer, 2026, accessed April 16, 2026, see: data-explorer.oecd.org/.

Examining how input factors correlate with output changes provides more details but little immediate clarity about how Europe can facilitate an improved global position. STEM and R&D investments show a strong, positive correlation with more granted ICT patents in most patent leaders, but the impact of investing in long-term assets is less clear (Table 1a). The evidence is even more idiosyncratic when focused on global patent share (Table 1b). Chinese investment in all three inputs corresponds to an improved global share position. Positive correlations are also evident related to STEM (EU, Japan) and gross fixed capital formation (Japan). But strikingly, R&D investment demonstrates a negative impact on global ICT patent share across most patent leaders (Table 1b).

TABLE 1
Correlation strength between inputs and...

	STEM (2014, 2021)	Gross fixed capital formation (2000, 2023)	R&D (2000, 2023)	STEM (2014, 2021)	Gross fixed capital formation (2000, 2023)	R&D (2000, 2023)
China	Positive	Positive	Positive	Positive	Positive	Positive
EU	Positive	Negative	Positive	Positive	Unclear	Negative
India	Negative	Unclear	Negative	Negative	Unclear	Negative
Japan	Positive	Negative	Positive	Positive	Positive	Negative
South Korea	Positive	Unclear	Positive	Negative	Unclear	Negative
UK	Unclear	Positive	Positive	Unclear	Unclear	Negative
USA	Positive	Negative	Positive	Negative	Negative	Negative

1A
**... annual number of granted ICT
patents, selected states and time
periods**

Data sourced from World Bank, Zwetsloot et al 2021, WIPO and the OECD
Note: Correlation strength determined using Pearson correlation analysis.

1B
**... global ICT patent shares, selected
states and time periods**

Overall, while input factors, especially STEM and R&D, appear important contributors to increasing the number of patents secured, they seem less consistently effective in improving global ICT patent share. India's experience implies investments in long-term assets may be crucial, but the correlations left unclear whether these investments are crucial for ICT patents or for some other central element of the innovation ecosystem. Therefore, any successful industrial policy for Europe not only requires more knowledge regarding how critical inputs interact with the innovation ecosystem and one another. It must also strike a careful balance between investment, innovation and human capital.

Finding the right IP partners

Because global tech supply chains are highly interconnected and Europe has a weak position in ICT patents, it will need partners to access key technologies in the short- and medium-terms. Well-designed partnerships can also help build Europe's own innovation capacity without creating one-sided dependencies.

As a first step, Europe needs a more strategic approach to choosing partners and managing dependencies in the digital economy when it comes to IP:

DIGITAL SUPERPOWERS Current patterns suggest a risky dual reliance: on China for ICT goods and manufacturing inputs, and on the US for ICT services and platforms. Europe is dependent on both for ICT patents.⁵³ These overlapping dependencies create structural vulnerabilities, particularly in times of geopolitical tension and supply chain disruption.

NON-ASIAN LIKE-MINDED COUNTRIES Partnerships with non-Asian like-minded countries such as the UK,⁵⁴ Canada or Australia can be helpful overall in decreasing the EU's digital dependence.⁵⁵ But they currently seem ill-equipped to address Europe's needs in the realm of IP, given that their numbers of ICT patents are even smaller than Europe's (Figure 11).

ASIAN LIKE-MINDED COUNTRIES By contrast, partnerships with IP-strong countries such as Japan and South Korea seem more helpful (Figure 11). Their technological sophistication and close alignment with European regulatory and industrial policy preferences minimizes the likelihood of geopolitical coercion and should also increase the ease of doing business. Notably, the US appears to be moving in a similar direction, as reflected in the "technology prosperity deals" the US signed with Japan and Korea in late 2025.

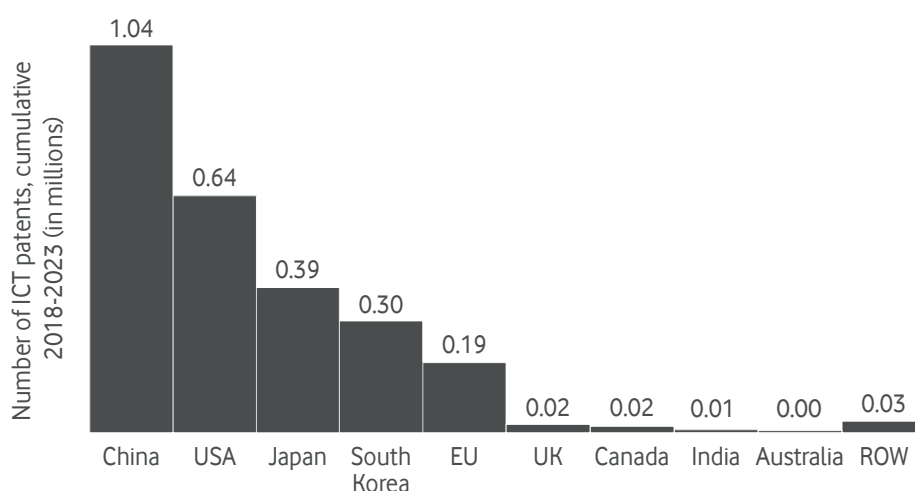


FIGURE 11
Cumulative number of ICT patents (in millions), potential partner countries (2018-2023)

Data sourced from WIPO
Note: Australia's value is 0.003, or 3,439 patents.
This rounds to '0.00' in the figure but is not actually equivalent to zero.

The content of Europe's future technology partnerships will also be critical for ensuring Europe maintains a degree of sovereignty over its own production processes and digital ecosystems. First, future agreements should go beyond market access and explicitly aim to reduce dependence on foreign ICT patents. Co-development frameworks, structured technology transfers, joint R&D investments, and workforce training initiatives could all be helpful in this respect – and many of these elements are already included in the IAA under discussion. Second, partnerships should also aim to develop and secure European positions in global technology supply chains with diversified IP ownership. More research is necessary to determine which positions should be defended and which partners will be most impactful.

⁵³ Maximilian Mayer and Yen-Chi Lu, "Global Structures of Digital Dependence and the Rise of Technopoles," *New Political Economy* 30, no. 5 (2025): 755–774.

⁵⁴ From Europe's perspective, the UK should be the ideal IP partner, given its digital ecosystem, academic excellence and financial markets. However, for that to be feasible, the UK will need to invest substantially in realizing its huge IP potential.

⁵⁵ Mayer et al., "A Wake-Up Call for the EU's Digital Decade."

Conclusion and recommendations

The key finding of this policy brief is that Europe's IP in the field of digital technologies and services is shrinking. Growing dependency on IP from the US and Asian economies, especially China, already incurs high economic and political costs. These costs will increase further due to the lock-in effects of patents.

European policymakers need to reassess Europe's digital dependencies more fundamentally. The Draghi report on European competitiveness is right that Europe struggles to turn its digital (and other) strengths into productivity. But in digital IP, Europe also lacks the underlying capabilities themselves.

This general assessment leads to three recommendations:

CORRECT THE ICT PATENT BLIND SPOT Digital patents and IP are overlooked as crucial drivers of Europe's future economic, and potentially even geopolitical, performance. While open software and non-patent-based IP are important, they cannot replace the global role of ICT patents. In this Digital Decade, ICT patents should be acknowledged as an explicit European goal and as an output of innovation and industrial policy measures. Europe should incentivize developing European IP and securing more patents in different ICT sectors and technological supply chains. Investing more in basic research about how to translate IP into commercial products and market gains is equally important.

COPE WITH IP DEPENDENCIES Current trends in ICT patenting suggest that, in the near- and medium-term, all European industries, particularly manufacturing, will depend on IP from American and East Asian patent holders, especially Chinese companies. This will not only make Europe's industrial future structurally vulnerable to potentially coercive tariffs, export restrictions and sanctions. It will also be increasingly costly, harming rather than improving the IP balance of payments and even overall terms of trade. European policymakers should choose partners strategically and craft partnerships carefully to ensure European businesses maintain uninterrupted access to the digital technologies they need.

EXPAND AND COORDINATE ALL INPUT FACTORS Investments in all three inputs need to be expanded significantly as soon as possible. This should be done strategically and in a coordinated manner. Gross fixed capital investments should integrate more intangible elements like software, apps, and digital platforms without neglecting Digital Decade commitments related to tangible assets like servers, networks and data centers. For instance, semiconductor policies should focus on future technologies and IP-heavy chip design rather than facilitating production and manufacturing.⁵⁶ R&D policies should incentivize private investment and highlight the benefits of public investment. STEM education should remain a priority but should be acknowledged as one of many inputs that must be addressed to secure Europe's economic and digital sovereignty. All investments should support expanded industrial-academic collaboration. This can not only address the knowledge gap related to Europe's IP weaknesses but also simultaneously boost commercialization of technologies in line with the Draghi recommendations, generating more funds to re-invest in inputs.

While this brief highlighted the speed and costs of Europe's digital patent decline, reversing the trend will require complex and multifaceted policy responses that extend well beyond IP alone. Our upcoming policy study will explore and identify strategic priorities for an integrated approach to reducing Europe's digital dependencies.

⁵⁶ Jan-Peter Kleinhans and Sandra Pfister, "Halbleiter-Experte: EU sollte auf Chip-Design statt auf Produktion setzen," May 6, 2026, accessed May 22, 2026, see: www.deutschlandfunk.de/plaene-zu-eu-chipfabrik-halbleiter-experte-eu-sollte-auf-100.html.

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