European Commission

EUROPEAN INNOVATION SCOREBOARD 2022

Innovation

European Innovation Scoreboard 2022

European Commission

Directorate-General for Research and Innovation
Directorate G - Common Policy Centre
Unit G1 - Common R&I Strategy & Foresight Service
Contact Alexandr Hobza, Chief Economist and Head of Unit G1
Athina Karvounaraki, Team Leader, Coordinator of European Innovation Scoreboard 2022, Unit G1
Tiago Pereira, Coordinator of European Innovation Scoreboard 2022, Unit G1
Email RTD-STATISTICS@ec.europa.eu
RTD-PUBLICATIONS@ec.europa.eu

Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
Directorate A - Strategy and Economic Analysis
Unit A1 - Chief Economist
Contact Román Arjona, Chief Economist and Head of Unit A1
Xosé-Luís Varela-Irimia, Coordinator of European Innovation Scoreboard 2022, Unit A1
Email GROW-A1@ec.europa.eu

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European Commission
B-1049 Brussels

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EUROPEAN COMMISSION

European Innovation Scoreboard 2022

This report was prepared and coordinated by

Deloitte Consulting & Advisory BV/SRL, Maastricht University/UNU-MERIT, Valdani Vicari & Associati (VVA)

The report was written by
Hugo Hollanders, Nordine Es-Sadki, and Aishe Khalilova, Maastricht University (UNU-MERIT)

as part of the **Development of the European Innovation Scoreboard** project for the European Commission, Directorate-General for Research and Innovation

Foreword

"The future of our children needs both that we invest in sustainability and that we invest sustainably. We must finance the transition to a digital and net-zero economy", State of the Union 2022 speech by the President of the European Commission Ursula von der Leyen, at the European Parliament, 14 September 2022.

The EU is going through challenging times. The past two years have been dominated by the COVID-19 pandemic with severe economic and social consequences. The ongoing Russian war of aggression against Ukraine is expected to bear significant consequences for the years to come. A pressing concern is the impact on the European energy market and implications for households and companies. These events come on top of long-term environmental and socio-economic challenges, such as climate change, ageing population or a new geopolitics.

Innovative activities have a unique capacity to offer solutions to many of these challenges. The European Innovation Scoreboard provides a state of play of innovation performance in Europe. It supports the design and implementation of research and innovation-friendly policies. Each year, policymakers can find in the Scoreboard a wealth of data and benchmark analysis to help them identify significant trends and needs for action.

The 2022 European Innovation Scoreboard confirms that year after year the EU remains a good place to innovate. Innovation performance has increased for the EU by about 10%-points since 2015 and there has been noticeable progress in the EU's global position. The EU has overtaken Japan and has closed part of its performance gap to South Korea and the United States.

But significant divergences remain among the Member States, and are even widening. We need to take action to address this innovation divide at EU, national and regional level. For this to happen, we need to boost public and private investments in R&D, set the right framework conditions to allow innovation to flourish, and ensure that innovative solutions find their way to the market to benefit people and the planet.

To address this challenge, the Commission adopted in July 2022 the New European Innovation Agenda. It puts an important focus on closing the innovation divide in Europe and aims to position Europe at the forefront of the new wave of deep tech innovation and start-ups. Building on Europeans' entrepreneurial mindset, scientific excellence, the strength of the Single Market and democratic values, the New Innovation Agenda presents five flagship actions: improve access to finance for European start-ups and scale-ups; improve the conditions for innovators to experiment with new ideas through regulatory sandboxes; help create "regional innovation valleys" that will strengthen and better connect innovation players through Europe; attract and retain talent in Europe, and improve policy-making tools.

In parallel, the European Research and Innovation Framework Programme Horizon Europe will continue supporting excellent projects from top researchers and innovators across the EU with a budget of €14.3 billion for 2023. In addition, the NextGenerationEU plan, through its Recovery and Resilience Facility, is allocating around €44.4 billion for research and innovation. The actions of the national Recovery and Resilience Plans have a key role to play in the development and transformation of the Member States' research and innovation systems. Mobilising substantial public and private investments at EU, national and regional level, including through the work of industrial alliances and the support of Member States to Important Projects of Common European Interest (IPCEIs) will remain indispensable for our common future.

Small and medium sized enterprises are a primary vehicle of innovation across the various EU industrial ecosystems. They are central to strengthen the resilience of European industry. In this regard, the Single Market - one of Europe's greatest success stories - offers immense opportunities for innovations to be generated and diffused. It grants businesses a large reserve of domestic demand and differentiated supply sources. The EU's updated Industrial Strategy proposed new measures to strengthen the resilience of our Single Market, curb dependencies, strengthen Europe's own capacity and preserve strategic value chains. The Annual Single Market Report 2022 stressed the relevance of a resilient and predictable business and regulatory environment to support innovation, growth and job creation, and step up the green and digital industrial transformation of Europe's industrial ecosystems.

As you can see, the European Innovation Scoreboard informs our policy action. We will be with you – businesses, researchers, innovators, investors, and policymakers – to withstand the current crisis and accelerate the sustainable recovery for all Europeans, with research and innovation leading the way for a brighter future, leaving no one behind.

Mariya Gabriel
European Commissioner
for Innovation, Research,
Culture, Education and Youth

Thierry Breton
European Commissioner
for Internal Market

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Executive summary

The annual European Innovation Scoreboard (EIS) provides a comparative assessment of the research and innovation performance of EU Member States and selected third countries, and the relative strengths and weaknesses of their research and innovation systems. It helps countries assess areas in which they need to concentrate their efforts in order to boost their innovation performance.

The EIS 2022 report is the second edition published using the new measurement framework introduced in 2021.

Almost all EU Member States have increased their innovation performance since 2015 but the lowest performing countries are falling further behind

The innovation performance of the EU has increased by 9.9 percentage points since 2015. Innovation performance increased in 26 EU Member States. Performance has increased most in Cyprus, Estonia, and Greece. The following indicators recorded the highest improvements: Business process innovators, International scientific co-publications, Innovative SMEs collaborating with others, Job-to-job mobility of Human Resources in Science & Technology, Public-private scientific co-publications, and Venture capital expenditures.

Between 2015 and 2022, performance differences between the Member States have narrowed, in particular within the groups of Innovation Leaders, Strong Innovators and Moderate Innovators. The Emerging Innovators, as a group, are not catching up.

Compared to 2021, innovation performance has declined for eight Member States

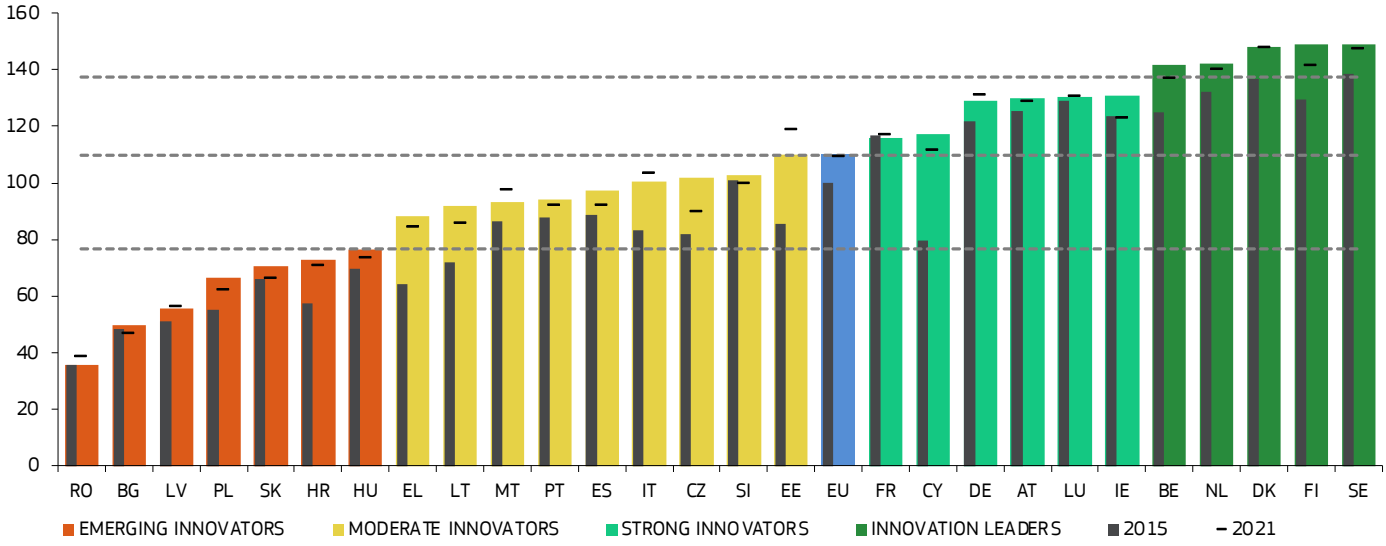
Between 2021 and 2022, performance has improved in 19 Member States, most strongly in Czechia, Ireland, and Finland (at 7.5%-points or more), and has declined for eight Member States, including Estonia, France, Germany, Italy, Latvia, Luxembourg, Malta, and Romania, with performance declining strongest in Estonia (-8.9%-points).

Countries fall into four performance groups

Based on their average performance (relative to the EU in 2022), Member States fall into four different performance groups (Figure 1).

Belgium, Denmark, Finland, the Netherlands, and Sweden are Innovation Leaders with innovation performance well above the EU average. Austria, Cyprus, France, Germany, Ireland, and Luxembourg are Strong Innovators with performance above the EU average. The performance of Czechia, Estonia, Greece, Italy, Lithuania, Malta, Portugal, Slovenia, and Spain is below the EU average. These countries are Moderate Innovators. Bulgaria, Croatia, Hungary, Latvia, Poland, Romania and Slovakia are Emerging Innovators with performance well below the EU average.

Figure 1: Performance of EU Member States' innovation systems



Coloured columns show countries' performance in 2022, using the most recent data for 32 indicators, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data, relative to that of the EU in 2015. Grey columns show countries' performance in 2015 relative to that of the EU 2015. The dashed lines show the threshold values between the performance groups, where the threshold values of 70%, 100%, and 125% have been adjusted upward to reflect the performance increase of the EU between 2015 and 2022.

Compared to the results of the EIS 2021, three Member States have changed performance group

Compared to the results in the EIS 2021 report, three countries have changed performance group. The Netherlands has become an Innovation Leader, Cyprus a Strong Innovator, and Estonia a Moderate Innovator. For both Cyprus and the Netherlands, the upward move to a higher performance group is mainly due to data revisions for several indicators. Based on the EIS 2022 data, both countries would have been classified into a higher performance group already last year. Estonia has fallen marginally below the EU average due to the declines in several indicators.[1]

At the global level, the EU has overtaken Japan and has closed part of its performance gap to some of its other competitors

The EU has a performance lead over Brazil, Chile, China, India, Japan, Mexico and South Africa, and a performance gap with Australia, Canada, South Korea and the United States (Figure 2).
Between 2015 and 2022, the EU has improved its relative position towards all global competitors, except China. The performance gap with Australia, Canada, South Korea and the United States has become smaller and the performance lead over Chile, India, Japan, Mexico and South Africa has increased. The performance lead over China has become smaller and the performance gap with Japan has been transformed into a performance lead (Figure 3).

More recently, between 2021 and 2022, only the EU, Chile and South Africa have shown an improvement in their innovation performance, for all other global competitors performance declined (Figure 3).

Impact of Covid-19 pandemic

The Covid-19 pandemic seems to have negatively affected several of the indicators used for measuring overall innovation performance, such as Innovation expenditures, Innovative sales and Venture capital expenditures, all of which show a decline in 2020. There is also an adverse effect on those indicators including GDP in the denominator as GDP fell in 2020 compared to 2019 for 22 Member States. Covid-19 also negatively impacts exports, but the impact is less on both exports of medium- and high-tech products and knowledge-intensive services exports than on total exports, creating an overall positive effect on the export shares of both. Available evidence does not allow to draw firm conclusions on the impact of the Covid-19 pandemic yet.

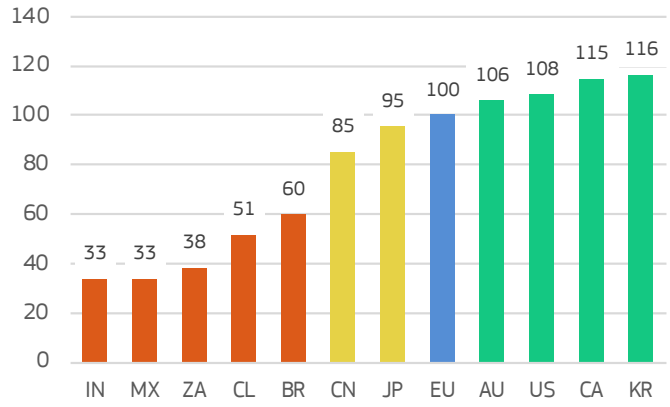
Methodological continuity and refinement

After the revision of the measurement framework in 2021, no fundamental changes have been made to the methodology in this year's report.

This year, Albania has been included for the first time in the European analysis, with data being collected for 23 indicators (out of 32 in the full framework) with the support of the Albanian statistical office.

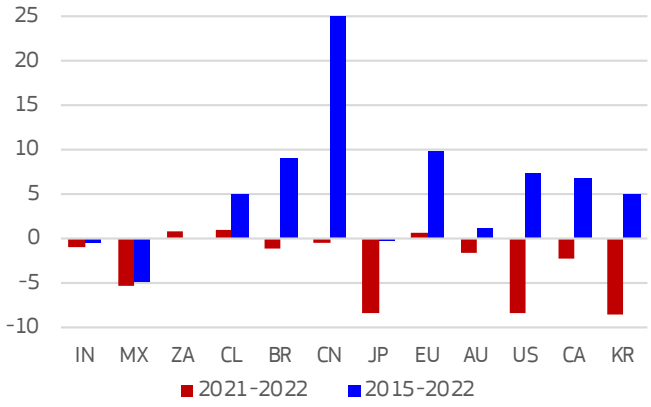
For the global competitors, two new countries are included in the calculation: Chile and Mexico. For Chile, data are available for all 19 indicators used in the global comparison, for Mexico, data are available for 17 indicators.

Figure 2: Global performance



Coloured columns show performance in 2022 relative to that of the EU in 2022. For all years, the same measurement methodology has been used.

Figure 3: Global performance change



Blue coloured columns show performance change between 2015 and 2022, both measured relative to the EU in 2015. Red coloured columns show performance change between 2021 and 2022, both measured relative to the EU in 2015.

[1] For several of these indicators, provisional data have been used. As in previous versions of the EIS report, provisional data are used to ensure the utilisation of the most recent information. However, provisional data can be different from the final data, and these differences may have an impact on the results. As a result, the performance group could be different if final data would have been available for the calculations, especially when a country is very close to the threshold of a performance group.

1. Introduction

The annual European Innovation Scoreboard (EIS) provides a comparative assessment of the research and innovation performance of EU Member States and the relative strengths and weaknesses of their research and innovation systems. It helps Member States assess areas in which they need to concentrate their efforts to boost their innovation performance. This year's edition follows the revised measurement framework introduced in the 2021 edition of the EIS.

1.1 Measurement framework

The EIS 2022 distinguishes between four main types of activities – Framework conditions, Investments, Innovation activities, and Impacts – with 12 innovation dimensions, capturing in total 32 indicators. Each main group includes an equal number of indicators and has an equal weight in the average performance score, or the Summary Innovation Index (SII).

Within each group every indicator has the same weight. Indicators that are included in the measurement framework are presented in Table 1.Within each group every indicator has the same weight. Indicators that are included in the measurement framework are presented in Table 1.

Table 1: Measurement framework

FRAMEWORK CONDITIONS

- Human resources
  - 1.1.1 New doctorate graduates (in STEM)
  - 1.1.2 Population aged 25-34 with tertiary education
  - 1.1.3 Lifelong learning
- Attractive research systems
  - 1.2.1 International scientific co-publications
  - 1.2.2 Top 10% most cited publications
  - 1.2.3 Foreign doctorate students
- Digitalisation
  - 1.3.1 Broadband penetration
  - 1.3.2 Individuals who have above basic overall digital skills

INVESTMENTS

- Finance and support
  - 2.1.1 R&D expenditure in the public sector
  - 2.1.2 Venture capital expenditures
  - 2.1.3 Direct government funding and government tax support for business R&D
- Firm investments
  - 2.2.1 R&D expenditure in the business sector
  - 2.2.2 Non-R&D innovation expenditures
  - 2.2.3 Innovation expenditures per person employed in innovation-active enterprises
- Use of information technologies
  - 2.3.1 Enterprises providing training to develop or upgrade ICT skills of their personnel
  - 2.3.2 Employed ICT specialists

INNOVATION ACTIVITIES

- Innovators
  - 3.1.1 SMEs with product innovations
  - 3.1.2 SMEs with business process innovations
- Linkages
  - 3.2.1 Innovative SMEs collaborating with others
  - 3.2.2 Public-private co-publications
  - 3.2.3 Job-to-job mobility of Human Resources in Science & Technology
- Intellectual assets
  - 3.3.1 PCT patent applications
  - 3.3.2 Trademark applications
  - 3.3.3 Design applications

IMPACTS

- Employment impacts
  - 4.1.1 Employment in knowledge-intensive activities
  - 4.1.2 Employment in innovative enterprises
- Sales impacts
  - 4.2.1 Medium and high-tech product exports
  - 4.2.2 Knowledge-intensive services exports
  - 4.2.3 Sales of product innovations
- Environmental sustainability
  - 4.3.1 Resource productivity
  - 4.3.2 Air emissions by fine particulates PM2.5 in Industry
  - 4.3.3 Development of environment-related technologies

Framework conditions captures the main drivers of innovation performance external to the firm and differentiates between three innovation dimensions:

- *Human resources* includes three indicators and measures the availability of a high-skilled and educated workforce. Human resources includes New doctorate graduates in STEM, Population aged 25-34 with completed tertiary education, and Population aged 25-64 involved in lifelong learning activities.
- *Attractive research systems* includes three indicators and measures the international competitiveness of the science base by focusing on International scientific co-publications, Most cited publications, and Foreign doctorate students.
- *Digitalisation* measures the level of digital technologies and includes two indicators: Broadband penetration among enterprises and (the supply of) Individuals with above basic overall digital skills.

Investments captures investments made in both the public and business sectors and differentiates between three innovation dimensions:

- *Finance and support* includes three indicators including private funding (Venture capital investments), R&D expenditures in universities and government research organisations and Direct government funding and government tax support for business R&D.
- *Firm investments* includes three indicators on R&D and Non-R&D investments that firms make to generate innovations including Business R&D expenditures, Non-R&D innovation expenditures, and Innovation expenditures per person employed.
- *Use of information technologies* captures the use of information technologies including two indicators: Enterprises actively increasing the ICT skills of their personnel and Employed ICT specialists.

Innovation activities captures different aspects of innovation in the business sector and differentiates between three innovation dimensions:

- *Innovators* includes two indicators measuring the share of SMEs that have introduced innovations on the market or within their organisations, covering both product and business process innovators.

- *Linkages* includes three indicators measuring innovation capabilities by looking at Collaboration efforts between innovating firms, Research collaboration between the private and public sector, and Job-to-job mobility of Human Resources in Science & Technology (HRST).
- *Intellectual assets* captures different forms of Intellectual Property Rights (IPR) generated by the innovation process, including PCT patent applications, Trademark applications, and Design applications.

Impacts captures the effects of enterprises' innovation activities and differentiates between three innovation dimensions:

- *Employment impacts* measures the impact on employment and includes two indicators: Employment in knowledge-intensive activities and Employment in innovative enterprises.
- *Sales impacts* measures the economic impact of innovation and includes three indicators: Exports of medium and high-tech products, Exports of knowledge-intensive services, and Sales resulting from innovative products.
- *Environmental sustainability* captures improvements to reducing the negative impact on the environment including three indicators: Resource productivity, Exposure to Air pollution by fine particulates PM2.5, and the Development of environment-related technologies.

1.2 Contextual analysis on the impact of structural differences between countries

In response to a need for contextual analyses to better understand performance differences between the innovation indicators used in the main measurement framework, a set of contextual indicators is included in the two-page country profiles available on the EIS website. As an introduction, the following sections discuss the relevance of these structural aspects to provide a better understanding of differences between countries in the performance of individual indicators. Full definitions of all performance indicators and contextual indicators are provided in the EIS 2022 Methodology Report. The list of contextual indicators, the years for which average performance has been calculated, and data sources used are shown in Table 2. The EIS does not include any indicators on gender as such data are not available for most of the indicators used to measure structural differences.

Table 2: Contextual indicators in the European Innovation Scoreboard

	Period	Source
PERFORMANCE AND STRUCTURE OF THE ECONOMY		
GDP per capita (PPS)	Average 2019-2021	Eurostat
Average annual GDP growth (%)	Between 2019 and 2021	Eurostat
Employment share Manufacturing (NACE C) (%)	Average 2019-2021	Eurostat
of which High and Medium high-tech (%)	Average 2019-2021	Eurostat
Employment share Services (NACE G-N) (%)	Average 2019-2021	Eurostat
of which Knowledge-intensive services (%)	Average 2019-2021	Eurostat
Turnover share SMEs (%)	Average 2017-2019	Eurostat
Turnover share large enterprises (%)	Average 2017-2019	Eurostat
Foreign-controlled enterprises – share of value added (%)	Average 2017-2019	Eurostat
BUSINESS AND ENTREPRENEURSHIP		
Enterprise births (10+ employees) (%)	Average 2017-2019	Eurostat
Total early-stage Entrepreneurial Activity (TEA) (%)	Average 2019-2021	Global Entrepreneurship Monitor
FDI net inflows (% GDP)	Average 2018-2020	World Bank: World Development Indicators
Top R&D spending enterprises per 10 million population	Average 2018-2020	EU Industrial R&D Investment Scoreboard
Buyer sophistication (1 to 7 best)	Average 2017-2019	World Economic Forum
INNOVATION PROFILES		
In-house product innovators with market novelties	2018	Eurostat, National Statistical Offices
In-house product innovators without market novelties	2018	Eurostat, National Statistical Offices
In-house business process innovators	2018	Eurostat, National Statistical Offices
Innovators that do not develop innovations themselves	2018	Eurostat, National Statistical Offices
Innovation active non-innovators	2018	Eurostat, National Statistical Offices
Non-innovators with potential to innovate	2018	Eurostat, National Statistical Offices
Non-innovators without disposition to innovate	2018	Eurostat, National Statistical Offices
GOVERNANCE AND POLICY FRAMEWORK		
Ease of starting a business (0 to 100 best)	Average 2018-2020	World Bank: Doing Business
Basic-school entrepreneurial education and training (1 to 5 best)	Average 2019-2021	Global Entrepreneurship Monitor
Government procurement of advanced technology products (1 to 7 best)	Average 2017-2019	World Economic Forum
Rule of law (-2.5 to 2.5 best)	Average 2018-2020	World Bank: Worldwide Governance Indicators
CLIMATE CHANGE		
Circular material use rate	Average 2018-2020	Eurostat
Greenhouse gas emissions intensity of energy consumption	Average 2018-2020	European Environment Agency (EEA), Eurostat
Eco-Innovation Index	2022	EC, DG Environment
DEMOGRAPHY		
Population size	Average 2019-2021	Eurostat
Average annual population growth (%)	Between 2019 and 2021	Eurostat
Population density	Average 2017-2019	Eurostat

Performance and structure of the economy

GDP per capita in purchasing power standards (PPS)[1] is a measure for interpreting real income differences between countries. Higher income can increase the demand for new innovative goods and services. Economic growth is captured by the average annual growth rate of GDP for 2019-2021. In economies that grow faster, increasing demand may provide more favourable conditions for enterprises to sell their goods and services.

Differences in economic structures are important. Differences in the share of manufacturing industry in GDP, and in high-tech activities in manufacturing and services, are important factors that explain why countries can perform better or worse on indicators like business R&D expenditures, PCT patents, and innovative enterprises. Medium-high and high-tech industries have higher technological intensities than other industries. These industries, on average, will have higher R&D expenditures, more patent applications, and higher shares of innovative enterprises. Countries with above-average shares of these industries are expected to perform better on several EIS indicators. For example, for the EU on average, 85% of R&D expenditures in manufacturing are accounted for by medium-high and high-technology manufacturing industries[2 3]. Also, the share of enterprises that introduced a product and/or business process innovation is higher in medium-high and high-technology manufacturing industries compared to all core industries covered in the Community Innovation Survey[4].

Foreign ownership, including ownership from both other EU Member States and non-Member States, is important as, on average, about 30% of business R&D expenditures in EU Member States is made by foreign affiliates, which is significantly higher compared to Japan and the United States and comparable to Australia and Canada[5]. The share of foreign-controlled enterprises in value-added serves as a proxy for differences in the impact of foreign ownership on the economy.

Business and entrepreneurship

Entrepreneurship is important for introducing new innovations on the market. The degree of entrepreneurship is measured by two contextual indicators measuring the share of new enterprise births in the economy and Total early-stage Entrepreneurial activity (TEA), which measures the share of the adult population aged 18–64 years who are in the process of starting a business (a nascent entrepreneur) or who started a business which is not older than 42 months at the time of the respective survey (owner-manager of a new business).

Inflows of new technologies are important as they add to a country's economic and technological capacities. Inward Foreign direct investment (FDI) can have a positive impact on innovation performance, although there are differences depending on the complexity of the receiving industry, political and economic framework conditions as well as the quality of the institutions of the receiving countries. Inward FDI flows are measured over a three-year period, as average net inflows of investments to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor.

Enterprise characteristics are important for explaining differences in R&D spending and innovation activities. Large enterprises, defined as enterprises with 250 or more employees, account for almost 80 percent of EU business R&D expenditures, whereas SMEs, defined as enterprises with 10 to 249 employees, account for only one-fifth. The presence of large R&D spending enterprises is captured by the *EU Industrial R&D Investment Scoreboard*, which provides economic and financial data and analysis of the top 1000 corporate R&D investors from the EU and top 2500 corporate R&D investors elsewhere in the world[6].

Demand is an important driver of innovation. According to the Oslo Manual[7], demand factors shape innovation activity in two major ways: for the development of new products, as firms modify and differentiate products to increase sales and market share; and for the improvement of the production and supply processes to reduce costs and lower prices. A robust indicator measuring the demand for innovation is currently not available. The Executive Opinion Survey of the World Economic Forum includes an indicator that provides a measure of the preferences of individual consumers for innovative products. The degree of Buyer sophistication measures, on a scale from 1 (low) to 7 (high), whether buyers focus more on price or quality of products and services.

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[1] The purchasing power standard (PPS) is an artificial currency unit. Theoretically, one PPS can buy the same amount of goods and services in each country. However, price differences across borders mean that different amounts of national currency units are needed for the same goods and services depending on the country. PPS are derived by dividing any economic aggregate of a country in national currency by its respective purchasing power parities. PPS is the technical term used by Eurostat for the common currency in which national accounts aggregates are expressed when adjusted for price level differences using PPPs. Thus, PPPs can be interpreted as the exchange rate of the PPS against the Euro.

[2] Based on NACE Rev. 2 three-digit level, manufacturing industries can be classified into high-technology, medium-high technology, medium-low-technology, and low-technology. The high-technology and medium-high technology industries include: Chemicals and chemical products (20); Basic pharmaceutical products and pharmaceutical preparations (21); Weapons and ammunition (25.4*); Computer, electronic and optical products (26); Electrical equipment (27); Machinery and equipment not elsewhere classified (28); Motor vehicles, trailers and semi-trailers (29); Other transport equipment (30) excluding Building of ships and boats (30.1); Air and spacecraft and related machinery (30.3); and Medical and dental instruments and supplies (32.5**). If data are only available at the NACE Rev. 2 two-digit level, industries identified with an * are classified as medium-low-technology, and industries identified with an ** are classified as low-technology, and thus excluded from the high-technology and medium-high technology industries (Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:High-tech_classification_of_manufacturing_industries).

[3] Average results for 2015-2017 for 24 Member States for which data are available for at least one year. Data were extracted from Eurostat (Business enterprise R&D expenditure in high-tech sectors - NACE Rev. 2 [htec_sti_exp2].

[4] In In accordance with Commission Regulation No 995/2012, the following industries and services are included in the Core target population covered in the CIS: Core Industry (excluding construction): Mining and quarrying (B), Manufacturing (C) (10-12: Manufacture of food products, beverages and tobacco; 13-15: Manufacture of textiles, wearing apparel, leather and related products; 16-18: Manufacture of wood, paper, printing and reproduction; 20: Manufacture of chemicals and chemical products; 21: Manufacture of basic pharmaceutical products and pharmaceutical preparations; 19-22 Manufacture of petroleum, chemical, pharmaceutical, rubber and plastic products; 23: Manufacture of other non-metallic mineral products; 24: Manufacture of basic metals; 25: Manufacture of fabricated metal products, except machinery and equipment; 26: Manufacture of computer, electronic and optical products; 25-30: Manufacture of fabricated metal products (except machinery and equipment), computer, electronic and optical products, electrical equipment, motor vehicles and other transport equipment; 31-33: Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment, Electricity, gas, steam and air conditioning supply (D), Water supply, sewerage, waste management and remediation activities (E) (36: Water collection, treatment and supply; 37-39: Sewerage, waste management, remediation activities). Core Services: Wholesale trade, except of motor vehicles and motorcycles (46), Transport and storage (H) (49-51: Land transport and transport via pipelines, water transport and air transport; 52-53: Warehousing and support activities for transportation and postal and courier activities); Information and communication (J) (58: Publishing activities; 61: Telecommunications; 62: Computer programming, consultancy and related activities; 63: Information service activities), Financial and insurance activities (K) (64: Financial service activities, except insurance and pension funding; 65: Insurance, reinsurance and pension funding, except compulsory social security; 66: Activities auxiliary to financial services and insurance activities), Professional, scientific and technical activities (M) (71-73: Architectural and engineering activities; technical testing and analysis; Scientific research and development; Advertising and market research).

[5] Average results for 2010-2016 for 14 Member States for which data were available (Austria, Belgium, Czechia, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Poland, Slovenia Spain, and Sweden). Source of the data: OECD Main Science and Technology Indicators, Volume 2018 Issue 2 (more recent data are not available).

[6] https://iri.jrc.ec.europa.eu/scoreboard

[7] The Oslo Manual is the foremost international source of guidelines for the collection and use of data on innovation activities in industry. OECD/Eurostat (2018), Oslo Manual: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, OECD Publishing, Paris. DOI: https://doi.org/10.1787/9789264304604-en

Innovation profiles

Innovation is a highly diverse activity. Enterprises can innovate through product or business process innovation, with the latter including process, marketing and organisational innovation. Enterprises can adopt new technologies developed by other enterprises or they engage in intensive in-house research and innovation activities. The capabilities needed by enterprises to innovate are very different in kind and size. Building on earlier work by academics and the OECD, Eurostat, UNU-MERIT (Maastricht University), ZEW – Leibniz Centre for European Economic Research, in collaboration with National Statistical Offices, developed a taxonomy of innovating and non-innovating enterprises based on CIS micro data. The following characteristics were used to identify seven mutually exclusive detailed innovation profiles: The degree of novelty of product innovations, own in-house capacities to innovate, and R&D activities. Of these, four innovation profiles capture different types of enterprises that have introduced an innovation (product or business process) and three innovation profiles capture non-innovators, of which one profile captures non-innovators with innovation activities, one profile captures non-innovators with an interest in innovation, while the other captures non-innovators without any innovation activities or interest:

- In-house product innovators with market novelties, including all enterprises that introduced a product innovation that was developed by the enterprise and that was not previously offered by competitors.
- In-house product innovators without market novelties, including all enterprises that introduced a product innovation that was developed by the enterprise but that is only new to the enterprise itself.
- In-house business process innovators, including all enterprises that did not introduce a product innovation, but that did introduce a business process innovation that was developed by the enterprise.
- Innovators that do not develop innovations themselves, including all enterprises that introduced an innovation of any kind but did not develop it themselves (enterprises without significant own innovation capabilities).
- Innovation active non-innovators, including all enterprises that did not introduce any innovation but that either had ongoing or abandoned innovation activities.
- Non-innovators with potential to innovate, including all enterprises that did not introduce any innovation, and which had no ongoing or abandoned innovation activities but that did consider to innovate.
- Non-innovators without disposition to innovate, including all other enterprises, those that neither introduced an innovation nor had any ongoing or abandoned innovation activities nor considered to innovate.

Governance and policy framework

Institutional and legal differences between countries may make it more difficult to engage in business activities. The World Bank's Doing Business report provides an index, Ease of starting a business, which measures the distance of each economy to the "frontier" economy providing the most lenient regulatory framework for doing business. Countries with more favourable regulatory environments will obtain scores closer to the maximum score of 100.

Entrepreneurial skills are important for successfully transforming ideas and inventions into innovations. These skills can be acquired on the job but also by formal schooling. Basic-school entrepreneurial education and training measures the extent to which training in creating or managing SMEs is incorporated within the education and training system at primary and secondary levels.

Governments play an important role in enhancing the innovation capacities of an economy. Government procurement of advanced technology products measures the extent to which government procurement decisions foster technological innovation – from 1 (not at all) to 7 (extremely effectively). Trust is important for creating a business environment for undertaking risky innovative activities. Rule of law captures differences in the extent to which people have confidence in and abide by the rules of society. Rule of law measures differences in the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

Climate change

As the natural environment increasingly suffers from the loss of biodiversity, pollution and climate change, the relationship between innovation performance and environment sustainability grows in importance. EU level policy developments, such as the European Green Deal and the Recovery plan for Europe, underline the need to take account of the pivotal role of research and innovation in contributing to societal challenges. Three indicators are included in the Contextual indicators relevant for measuring climate change and the role of innovation.

The circular material use rate measures, in percentages, the share of material recovered and fed back into the economy - thus saving extraction of primary raw materials - in overall material use. The circular material use rate is defined as the ratio of the circular use of materials to the overall material use. It covers households, the private and the public sector. A higher circular material use rate value indicates more secondary materials substituting for primary raw materials, thereby avoiding the environmental impacts of extracting primary material.

Greenhouse gas emissions intensity of energy consumption is an indicator that is part of the EU Sustainable Development Goals (SDG) indicator set. It is used to monitor progress towards Goal 13 on climate action and SDG 7 on affordable and clean energy. The indicator is calculated as the ratio between energy related GHG emissions and gross inland consumption of energy. It expresses how many tonnes CO2 equivalents of energy related GHGs are being emitted in a certain economy per unit of energy that is being consumed. Lower scores on this indicator imply an improvement in environmental performance.

The Eco-Innovation index is a composite indicator based on 16 sub-indicators in five thematic areas: eco-innovation inputs, eco-innovation activities, eco-innovation outputs, resource efficiency outcomes and socio-economic outcomes. The overall score of an EU Member State is calculated by the unweighted mean of the 16 sub-indicators. It shows how well individual Member States perform in eco-innovation compared to the EU average, which is equated with 100 (index EU=100). The index is part of the Eco-Innovation Scoreboard.[9]

Demography

Structural data also includes population size and the average annual growth rate of population for 2019-2021. Increasing demand following an increasing population may provide more favourable conditions for enterprises to sell their goods and services. Densely populated areas are more likely to be more innovative for several reasons. Firstly, knowledge diffuses more easily when people and enterprises are located closer to each other. Secondly, in more densely populated areas there tends to be a concentration of government and educational services. Densely populated areas provide better training opportunities and employ above-average shares of highly educated people. Furthermore, the amount of natural assets per capita tends to decline with population density. This positively impacts on the share of Medium and high-tech product exports and the share of employment in knowledge intensive activities.

1.3 Data sources, data availability and comparisons with the EIS 2021

The EIS uses the most recent statistics from Eurostat and other internationally recognised sources, such as the OECD and the United Nations, available at the time of analysis, with the cut-off day of 15 July 2022. International sources have been used wherever possible to improve comparability between countries. The data relates to the actual performance in 2021 for 12 indicators, 2020 for 14 indicators, 2019 for four indicators, and 2018 for two indicators (these are the most recent years for which data are available, cf. Annex E). Data availability is complete for 26 Member States. For Ireland, data is not available for Job-to-job mobility in Human Resources in Science & Technology.

For several indicators, among others, the two indicators on R&D expenditures and six indicators using data from the Community Innovation Survey (CIS), provisional data have been used. As in previous versions of the EIS report, provisional data are used to ensure the utilisation of the most recent data for calculating Member States' innovation performance. However, provisional data can be different from the final data, and these differences may have an impact on the results. This year provisional CIS 2020 data have been used for the first time in the benchmarking analysis as past results have shown that for most Member States, there were no or only small differences between provisional and final CIS data. Nevertheless, the rank position or even the performance group of a Member State could be different if final data would have been available for the calculations, in particular for countries positioned very close to the threshold between two performance groups.

For four indicators, Eurostat has released more recent data but indicated a break in the series. These most recent data are not comparable with those from the years before the break was introduced. Similarly, for two indicators, Eurostat has released a new data series, which is no longer comparable with the data series used in the EIS 2021. For one of these two indicators, the new data series includes results for only one year, for the other indicator for two years. To address the lack of comparability across years, performance changes over time for these indicators are based on these most recent data only. More details are provided in the Methodology report 2022. Performance changes for the Summary Innovation Index, which measures Member States' average innovation performance, are, therefore, on average, smaller than what they would have been if there had been no breaks in series or new data series.

Finally, it has to be stressed that comparisons with results from the EIS 2021 report are not possible, not even for the same years in different reports. Although the methodology in this year's report is the same as in the EIS 2021, results for the same year, e.g. 2021 in the EIS 2021 and 2021 in this year's report, are different due to several reasons:

- For four indicators, data for the most recent year have been used for all years due to breaks in series.
- For two indicators, due to the release of new data series, data for the most recent year or most recent two years have been used.
- There are indicators for which timeliness has been updated with more than one year. For example, for one indicator, the data timeliness has improved with three years. Timeliness refers to the year for which the most recent data are available.
- Some indicators with skewed data distributions are treated differently in this year's report than in the EIS 2021 due to changes in their statistical properties.
- By adding new data at the end of the time series for each indicator and removing data at the start of the time series, the highest and lowest data scores used for calculating normalised scores across all countries and years for an indicator can change, directly impacting these normalised scores.

Consequently, one should only use the results for older years in this report to compare performance over time.

[9] https://ec.europa.eu/environment/ecoap/indicators/index_en

2. Possible impact of the Covid-19 pandemic

This chapter explores the possible impact of the Covid-19 pandemic on the individual EIS indicators in the years 2020 and 2021. Where appropriate, a more detailed analysis will discuss separate effects on the numerator and denominator of the indicator. The indicators can be divided into different groups:

- Indicators for which data are not recent enough, i.e. at best available until 2019, and where there is thus no observable impact of Covid-19
- Indicators for which available time series are too short, due to breaks in series, to make any comparisons over time and where there is thus no observable impact of Covid-19
- Indicators where there is a positive impact on the indicator values in 2020 due to a decline in GDP in 2020 due to reduced economic activities as a result of economic lockdowns
- Indicators using data from the 2020 Community Innovation Survey
- Indicators where there is no observable difference in the number of Member States with increasing or decreasing indicator values compared to previous years
- Indicators where there is a substantial increase in the number of Member States with declined indicator values compared to previous years in 2020 and/or 2021 which *could be* attributable to Covid-19

Indicators for which data are not recent enough to assess the impact of Covid-19

For the following six indicators, data are older than 2020 and not recent enough to observe any possible impact of Covid-19: (most recent year between brackets):

- 1.2.2 Scientific publications among the top-10% most cited publications worldwide (2019)
- 2.1.3 Direct government funding and government tax support for business R&D (2019)
- 2.2.3 Innovation expenditures per person employed (2018)
- 3.3.1 PCT patent applications (2018)
- 4.3.2 Air emissions by fine particulate matter (PM2.5) in the Manufacturing sector (2019)
- 4.3.3. Development of environment-related technologies (2019)

Indicators for which time series are too short due to breaks in series to assess the impact of Covid-19

Due to breaks in series, and the exclusion of all data from before these breaks in the EIS 2022, time series are too short for the following six indicators (years for which data are available between brackets):

- 1.1.2 Population aged 25-34 having completed tertiary education (2021)
- 1.1.3 Lifelong learning (2021)
- 1.3.1 Broadband penetration (2020, 2021)
- 1.3.2 Individuals who have above basic overall digital skills (2021)
- 2.3.2 ICT specialists (2021)
- 4.1.1 Employment in knowledge-intensive activities (2021)

Indicators positively affected by a decrease in GDP in 2020 due to Covid-19

For both GDP in Euros and GDP in Purchasing Power Standards (PPS), values declined for many Member States in 2020. GDP in Euros declined for only one Member State in 2015, two in 2016 and one in 2018, but then for 22 in 2020. GDP in PPS declined for two Member States in 2016 and then for 23 in 2020. Reduced levels of GDP, as a result of the Covid-19 pandemic, have a positive impact in 2020 on five indicators which are expressed as a percentage share of GDP or per billion GDP, including:

- 2.1.1 R&D expenditures in the public sector
  In 2020, the volume of R&D expenditures in the public sector decreased for six and increased for 21 Member States, whereas the indicator value decreased for only two and increased for 22 Member States. The decrease in the volume of R&D expenditures in 2020 for six Member States is higher[11] than in 2019 and 2018 (respectively no and one Member State), but differences seem to be too small to assume a possible impact of Covid-19 on R&D expenditures in the public sector.

- 2.1.2 Venture capital expenditures
  In 2020 indicator values decreased for 14 and increased for 13 Member States. In 2021 indicator values decreased for six and increased for 21 Member States. The larger number of Member States for which the indicator declined in 2020 is a result of a decline in the volume of VC expenditures for 15 Member States, a decline which is only partly compensated by the decline in GDP for a large number of Member States. In 2021 the volume of VC expenditures decreased for only three Member States. The increase in the number of Member States for which the volume of VC expenditures declined in 2020 might be due to the Covid-19 pandemic but could also be due to other reasons as strong annual fluctuations in the volume of VC expenditures have been seen before (among others in 2017 with decreasing VC expenditures for 18 Member States).

- 2.2.1 R&D expenditures in the business sector. In 2020, the volume of R&D expenditures in the business sector decreased for six and increased for 21 Member States, whereas the indicator value decreased for only two and increased for 22 Member States. The decrease in the volume of R&D expenditures in 2020 for six Member States is higher than in 2019 and 2018 (respectively no and two Member States), but differences seem to be too small to assume a possible impact of Covid-19 on the volume of &D expenditures in the business sector.

- 3.3.2 Trademark applications

Compared to 2019, more Member States experienced annual performance increases in the indicator scores in 2020 and 2021, which, for 2020, are partly the result of the decline in GDP. The number of trademark applications increased for 22 Member States in 2019, for 20 in 2020 and for 26 in 2021. The only slightly higher number of Member States where the number of trademark applications decreased in 2020, suggests that there is no direct impact of Covid-19 on the numerator of the indicator, only on the denominator by reduced volumes of GDP.

Trademarks per billion GDP

	Increased	Decreased
2015	19	8
2016	21	6
2017	16	11
2018	11	16
2019	17	10
2020	24	3
2021	22	5

Number of trademarks

	Increased	Decreased
2015	24	3
2016	25	2
2017	23	4
2018	9	8
2019	22	5
2020	20	7
2021	26	1

- 3.3.3 Design applications
  Compared to 2019, more Member States experienced annual performance increases in the indicator scores in 2020 and 2021 which, for 2020, are partly the result of the decline in GDP. Looking at the number of design applications, they increased for 10 Member States in 2019, for 16 in 2020 and for 14 in 2021. These results suggest that there is no direct impact of Covid-19 on the numerator of the indicator, only on the denominator by reduced volumes of GDP.

Designs per billion GDP

	Increased	Decreased
2015	11	1
2016	16	11
2017	14	13
2018	8	19
2019	7	20
2020	17	10
2021	11	16

Number of designs

	Increased	Decreased
2015	11	15
2016	16	11
2017	15	12
2018	10	17
2019	10	16
2020	16	11
2021	14	15

Indicators using data from the 2020 Community Innovation Survey

For six of the indicators coming from the innovation survey data, a differentiation has to be made between those indicators measuring results over the full three-year CIS survey period (2018-2020) and those indicators measuring results in the final year (2020) only. For the following three indicators, measuring the share of enterprises involved in a certain type of innovation activity, the latest results for 2020 measure activities in the three-year 2018-2020 survey period:

- 3.1.1 SMEs with product innovations
- 3.1.2 SMEs with business process innovations
- 3.2.1 Innovative SMEs collaborating with others

As two of these three years are from before the start of the pandemic, it is not to be expected that there is any substantial impact on the results for these three indicators.

For the following three indicators data are for 2020 as responses to the related survey questions are asked for one year:

- 2.2.2 Non-R&D innovation expenditures
- 4.1.2 Employment in innovative enterprises
- 4.2.3 Sales of innovative products

Compared to the results of the CIS 2018, in 2020 Non-R&D innovation expenditures decreased for 18 Member States and improved for seven, Employment in innovative enterprises decreased for eight Member States and improved for 14, and Sales of innovative products decreased for 13 Member States and improved for 12. Despite that the indicator values for the two indicators using innovation expenditure data decline for more than half of the Member States for which CIS 2020 results are available, it is not clear if there is relation with the Covid-19 pandemic as innovation expenditures are usually linked to investment plans spanning multiple years and it seems less likely that these plans would be more severely affected in 2020 as a result of reduced economic activities. It is more likely that there would be an observable impact in the years following 2020. .[11]

[11] Some Member States, e.g. Belgium, France and Germany, included questions on the possible impact of the Covid-19 pandemic in their national CIS 2020. Results to these questions could provide more insights if there has been an impact and the extent of this impact.

Indicators with no observable change in the annual growth performance of Member States

For 1.1.1 New doctorate graduates, for 12 Member States indicator values declined in 2020, and for only one Member State it increased (Finland). This result is worse than in 2019, the last year before the Covid-19 pandemic, when indicator values declined for only six Member States. However, also in 2016 there was an increase in the number of Member States for which performance declined and in 2017 this number was also high. Considering that completing a doctorate degree is the result of various years of study, the increase in 2020 in the number of Member States showing a decline in the indicator is not likely to be related to the Covid-19 pandemic as this would be too early to observe any possible impact.

Indicator value

	Increased	Decreased
2014	7	4
2015	9	1
2016	4	11
2017	8	11
2018	4	8
2019	6	6
2020	1	12

For 1.2.1 International scientific co-publications, for no Member State the indicator value has decreased in either 2020 or 2021. There is no observable impact of the Covid-19 pandemic on the aggregate share and number of these publications, although it could be possible that in certain science fields the number of publications is affected (e.g. in Health it is expected that more research will result, in due time, in an increase in the number of publications).

Indicator value

	Increased	Decreased
2015	25	2
2016	26	1
2017	27	0
2018	27	0
2019	25	2
2020	27	0
2021	27	0

For 1.2.3 Foreign doctorate students, there is no difference for 2019 and 2020 in the number of Member States for which the indicator value increased (21 Member States) and decreased (five Member States). The same is observed when looking at the absolute number of Foreign doctorate students, which increased for 22 Member States and decreased for four Member States in both years. There is no observable impact of the Covid-19 pandemic on this indicator.

Indicator value

	Increased	Decreased
2014	17	5
2015	17	5
2016	20	4
2017	20	5
2018	22	3
2019	21	5
2020	21	5

For 3.2.2 Public-private scientific co-publications, indicator values decreased for seven Member States in 2020 and for no Member State in 2021. Although the number of Member States with decreasing performing in 2020 is more than twice as high as in 2019, this number is still below that in 2017, when performance decreased for nine Member States.

Indicator value

	Increased	Decreased
2015	25	2
2016	26	1
2017	18	9
2018	27	0
2019	24	3
2020	20	7
2021	27	0

Indicators where there is a substantial increase in the number of Member States with declined indicator values

For 2.3.1 Enterprises providing training to develop or upgrade ICT skills of their personnel, the number of Member States for which performance decreased (15) is much higher in 2020 than in any other year. In 2020 the indicator also increased for only four Member States, well below the numbers in the preceding years. One possible explanation could be that on-site training activities have been postponed due to strongly increasing numbers of home workers.

Indicator value

	Increased	Decreased
2014	13	9
2015	12	7
2016	7	10
2017	11	10
2018	13	6
2019	16	4
2020	4	15

For 3.2.3 Job-to-job mobility of Human Resources in Science & Technology, the number of Member States for which performance decreased (15) is much higher in 2020 than in any other year. In 2020 the indicator also increased for only seven Member States, well below the numbers in the preceding years. One possible explanation could be that during the first lockdowns it was more difficult for workers to switch jobs either because workers lost their job or because it was difficult to change job when working from home.

Indicator value

	Increased	Decreased
2014	n/a	n/a
2015	16	4
2016	17	3
2017	18	3
2018	16	5
2019	16	9
2020	7	15

For 4.2.1 Medium and high-tech product exports, results in 2020 appear to be comparable to those in 2019 with indicator values decreasing for seven Member States. In 2021 indicator values even decreased for 25 Member States. A closer look at the numerator and denominator shows that in 2020 there was a strong negative effect on both with the volume of Medium and high-tech product exports decreasing for 20 Member States and the volume of total product exports decreasing for 24 Member States. In 2021 for no Member States either the numerator or denominator decreased.

These results show that Covid-19 most likely had a negative effect on product exports as a result of reduced economic activities in 2020, but that this effect was stronger on the denominator (total product exports) than on the numerator (Medium and high-tech product exports), thereby softening the negative impact on the indicator with only seven Member States experiencing a decline in the indicator value. In 2021 the opposite seems to occur, with total product exports recovering faster than Medium and high-tech product exports, thereby reducing the indicator value for as many as 25 Member States.

Indicator value

	Indicator value decreased	MHT product exports decreased	Total product exports decreased
2015	2	3	5
2016	3	4	8
2017	15	6	2
2018	13	1	1
2019	5	2	2
2020	7	20	24
2021	25	0	0

For 4.3.1 Resource productivity, which is defined as the ratio of GDP and Domestic Material Consumption (DMC), the number of Member States for which the indicator values decreasing rose from five in 2019 to 15 in 2020. A closer look at the numerator (GDP) and denominator (DMC) shows that both were decreasing for a substantially higher number of Member States. Covid-19 seems to have had a negative impact on both GDP and DMC and, as GDP on average decreased more than DMC, also on Resource productivity.

Indicator value

	Indicator value decreased	GDP decreased	DMC decreased
2014	11	5	12
2015	9	1	12
2016	8	2	15
2017	12	0	7
2018	9	1	9
2019	5	0	11
2020	15	22	20

Indicators where there is a substantial increase in the number of Member States with declined indicator values

For 4.2.2 Exports of knowledge-intensive services, at first glance there appears to be a positive impact of Covid-19 on performance on 2020 as the number of Member States for which export shares decreased is zero and much lower than in the preceding years. Looking at the numerator (volume of Exports of knowledge-intensive services) and denominator (volume of total services exports), results are different, with both volumes decreasing for a large number of Member States. As the negative impact on total service exports is higher than that on Exports of knowledge-intensive services, the combined results show a positive impact of Covid-19 on the share of Exports of knowledge-intensive services.

Indicator value

	Indicator value decreased	KIS exports decreased	Total services exports decreased
2014	15	2	2
2015	12	0	1
2016	8	4	4
2017	12	2	0
2018	10	4	1
2019	10	1	0
2020	0	21	25

3. Innovation performance and trends

3.1 Most recent innovation performance

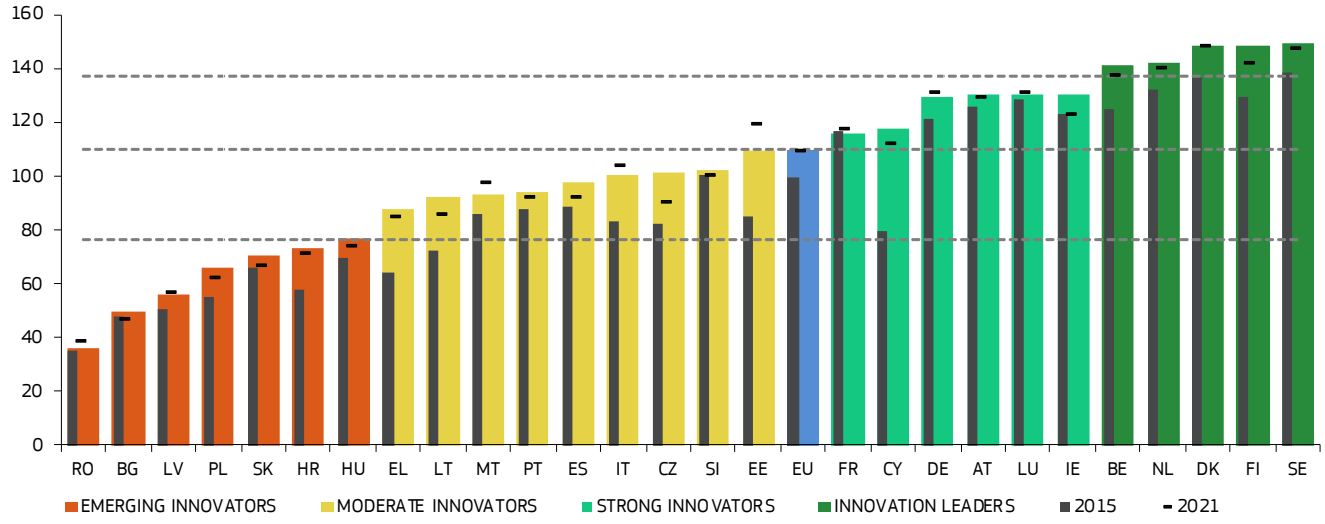
The performance of EU national innovation systems is measured by the Summary Innovation Index, which is a composite indicator obtained by taking an unweighted average of the 32 indicators (cf. Table 1)[11] . Figure 4 shows the scores for the Summary Innovation Index for all EU Member States in 2022 or the most recent year, in 2021, and the reference year 2015. Based on the 2022 results, the Member States fall into four performance groups[12]:

- The first group of **Innovation Leaders** includes five Member States where performance is above 125% of the EU average. This group includes (in alphabetical order) Belgium, Denmark, Finland, the Netherlands, and Sweden.
- The second group of **Strong Innovators** includes seven Member States with a performance between 100% and 125% of the EU average. This group includes Austria, Cyprus, Estonia, France, Germany, Ireland, and Luxembourg.
- The third group of **Moderate Innovators** includes eight Member States where performance is between 70% and 100% of the EU average. This group includes Czechia, Greece, Italy, Lithuania, Malta, Portugal, Slovenia, and Spain.
- The fourth group of **Emerging Innovators** includes seven Member States that show a performance level below 70% of the EU average. This group includes Bulgaria, Croatia, Hungary, Latvia, Poland, Romania, and Slovakia.

Compared to last year's EIS 2021 edition, two countries moved up to a higher performance group: the Netherlands is an Innovation Leader, and Cyprus a Strong Innovator.

Figure 4 illustrates that performance in 2022, when compared to 2015, has increased for almost all Member States. Compared to 2021, performance in 2022 has improved for 19 Member States and worsened for eight Member States. Section 2.3 discusses the performance changes in more detail. As shown on the map in Figure 5, the performance groups tend to be geographically concentrated, with the Innovation Leaders and most of the Strong Innovators located in Northern and Western Europe, and most of the Moderate and Emerging Innovators in Southern and Eastern Europe.

Figure 4: Performance of EU Member States' innovation systems

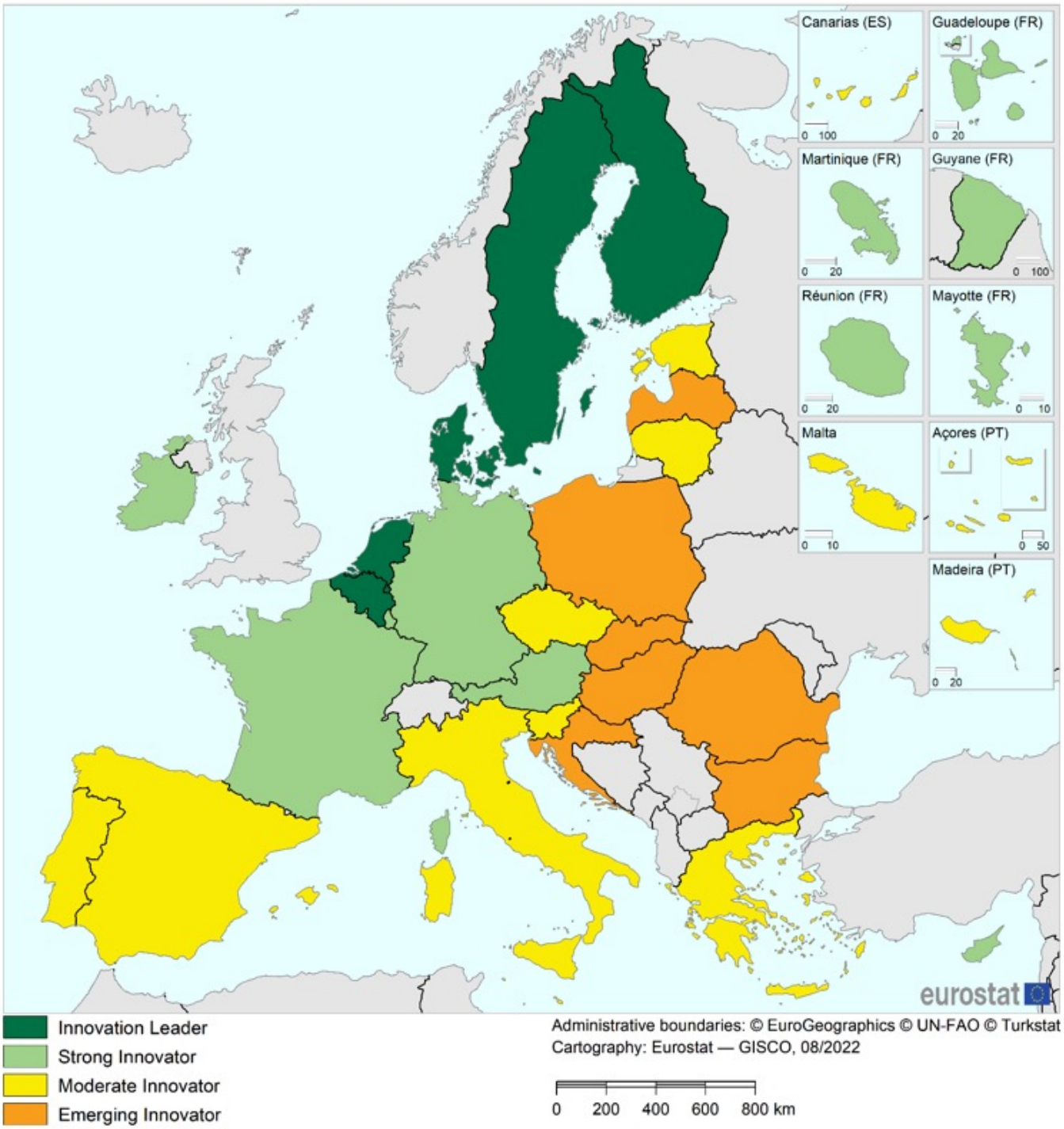


Coloured columns show countries' performance in 2022, using the most recent data for 32 indicators, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data, relative to that of the EU in 2015. Grey columns show countries' performance in 2015 relative to that of the EU 2015. The dashed lines show the threshold values between the performance groups, where the threshold values of 70%, 100%, and 125% have been adjusted upward to reflect the performance increase of the EU between 2015 and 2022.

[12] Chapter 7 gives a brief explanation of the calculation methodology. The EIS 2022 Methodology Report provides a detailed explanation.

[13] The EIS performance groups are relative performance groups with countries' group membership depending on their performance relative to that of the EU. With the improved EU innovation performance, the absolute thresholds between these groups will also increase over time, explaining why the dashed horizontal lines cross the vertical axis at higher percentage scores.

Figure 5: Map showing the performance of EU Member States' innovation systems



Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the European Union.

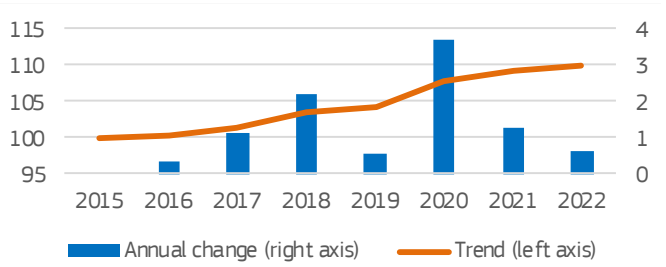
Source: European Commission – European Innovation Scoreboard 2022

3.2 Performance of the EU innovation system

Performance of the EU innovation system has improved by 9.9 percentage points over between 2015 and 2022, showing a modest increase between 2015 and 2017, a more rapid increase in 2018, an even stronger increase in 2020, followed by a continued increase at a lower rate in 2021 and 2022 (Figure 6).

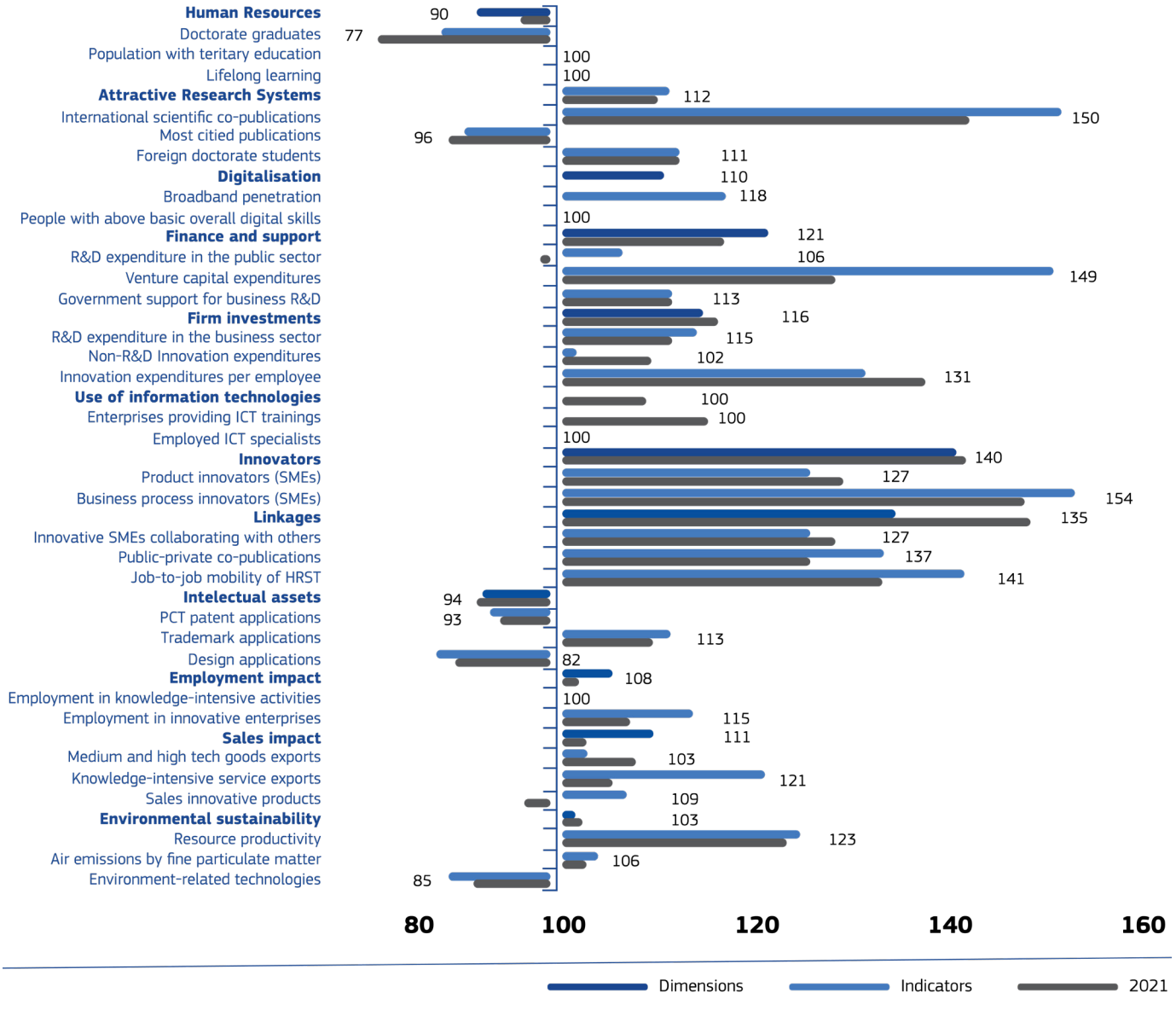
There are substantial differences in performance change for the different dimensions and indicators. Figure 7 shows the performance in 2022 for each dimension (dark blue coloured bars) and indicator (light blue coloured bars) and in 2021 (grey coloured bars) compared to performance in 2015. The difference between the respective blue and grey coloured bar shows the change in the most recent year. Performance changes are defined as the difference between the respective relative-to-EU scores shown in Figure 7 and 100, EU score in 2015 for each indicator and dimension).

Figure 6: Improvement in performance of the EU



Performance is measured relative to that of the EU in 2015. The orange line shows the results over time measured on the left axis starting at 100 in 2015. The blue bars show the annual changes between two consecutive years.

Figure 7: EU Performance change by dimension and indicator



Normalised scores in 2022 (blue coloured bars) and 2021 (grey coloured bars) relative to those in 2015 (=100). Bars will not be visible when relative results are very close to 100.

Compared to 2015, performance has improved most in **Innovators** (39.8%-points) due to strong performance increases in both indicators, in **Linkages** (35.0%-points) due to strong performance increases in all three indicators, and in **Finance and support** (21.5%-points), due to a very strong increase in Venture capital expenditures. Performance increased in most other dimensions but at lower rates. Performance declined in **Human resources** (-9.7%-points) due to a strong decline in New doctorate graduates, and in **Intellectual assets** (-5.6%-points) due to a decline in Patent applications and Design applications. Individual indicators showing a strong increase include Business process innovators (53.8%-points), International scientific co-publications (49.6%-points), Venture capital expenditures (49.5%-points), and Job-to-job mobility of Human Resources in Science and Technology (41.2%-points). Indicators showing a strong decline compared to 2015 include New doctorate graduates (-22.9%-points), Design applications (-18.5%-points), and Environment-related technologies (-15.0%-points).

Compared to 2021 performance has improved in seven dimensions and strongest in **Digitalisation** (9.5%-points) and **Finance and support** (9.2%-points), and decreased in five dimensions, most strongly in **Linkages** (-11.1%-points). For the individual indicators, the highest increase is in Venture capital expenditures (20.1%-points) and Broadband penetration (18.2%-points) and the highest decrease in Job-to-job mobility of HRST (-23.5%-points) and Enterprises providing ICT training (-18.8%-points).

3.3 Member States' changes in innovation performance

This section discusses performance changes over time for each of the innovation performance groups and the Member States included in each of the groups. For the EU, performance between 2015 and 2022 improved by 9.9 percentage points. Performance improved for 26 Member States (Figure 8). For 13 Member states performance has grown faster than that of the EU:

- For three Member States performance improved by 20 percentage points or more: Cyprus (37.9%-points), Estonia (24.4%-points), and Greece (24.1%-points).
- For six Member States performance improved between 15 and 20 percentage points: Lithuania (19.9%-points), Czechia (19.8%-points), Finland (19.5-points), Italy (17.4%-points), Belgium (16.8%-points) and Croatia (15.5%-points).
- For three Member States performance improved between 10 and 15 percentage points: Poland (11.3%-points), Denmark (11.3%-points), and Sweden (10.5%-points).
- For the Netherlands performance improved just below 10 percentage points (9.9%–points).[14]

For 13 Member States performance has grown slower than that of the EU:

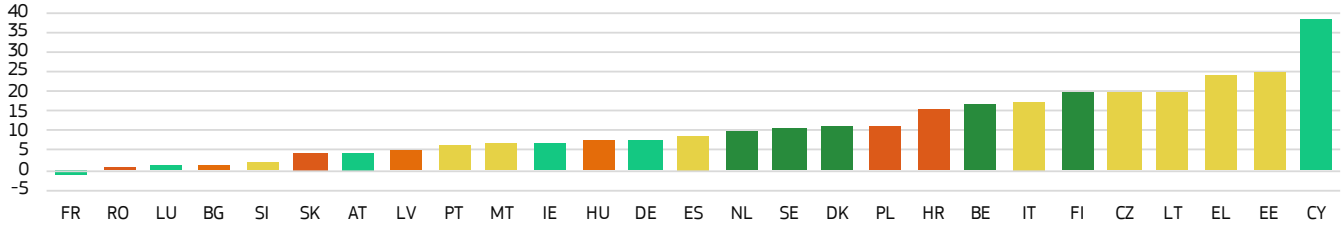
- For six Member States performance improved between 5 and 10 percentage points: Spain (8.6%-points), Germany (7.4%-points), Hungary (7.1%-points), Ireland (7.1%-points), Malta (6.7%-points) and Portugal (6.4%-points).
- For seven Member States performance improved between 0 and 5 percentage points: Latvia (4.7%-points), Austria (4.6%-points), Slovakia (4.6%-points), Slovenia (2.0%-points), Bulgaria (1.5%-points), Luxembourg (1.4%) and Romania (0.2%-points).

For only one Member State, France, performance worsened (-1.0%-points).

Between 2015 and 2022, performance differences between Member States are decreasing but this is mostly driven by reduced performance differences within the groups of Innovation Leaders, Strong Innovators and Moderate Innovators, and the rapid improvement for some Strong and Moderate Innovators (Cyprus, Estonia, Greece, and Malta). At the same, time, the Emerging Innovators are not catching up and the lowest performing Emerging Innovators (Bulgaria, Romania) even see their gap to most of the other Member States increasing.

Compared to 2021, performance in 2022 has improved for 19 Member States, most strongly for Czechia (11.7%-points), Ireland (7.7%-points), Finland (7.5%-points), Lithuania (6.3%-points), Cyprus (5.9%-points) and Spain (5.5%-points), and performance has declined for eight Member States, most strongly for Estonia (-8.9%-points), Malta (-4.6%)-points, Romania (-2.9%-points) and Italy (-2.9%-points) (Figure 9).

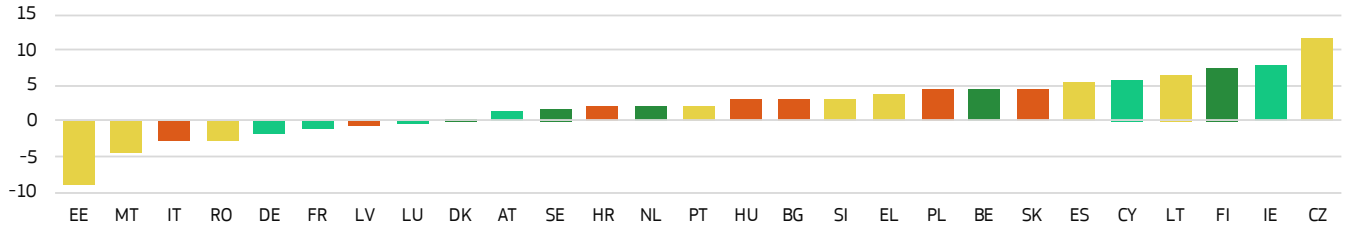
Figure 8: Performance change between 2015 and 2022



Performance change is measured as the difference between the 2022 and 2015 scores relative to that of the EU in 2015.

[14] The Netherlands is included among the Member States growing faster than the EU as the rate of its performance change is above that of the EU at 2 digits after the decimal point (9.91%-points vs 9.89%-points).

Figure 9: Performance change between 2021 and 2022



Performance change is measured as the difference between the 2022 and 2021 scores relative to that of the EU in 2015.

3.4 Innovation performance groups

This section will explore differences in performance over time within each of the four performance groups, allowing a closer comparison of performance and performance changes between Member States in the same performance group.

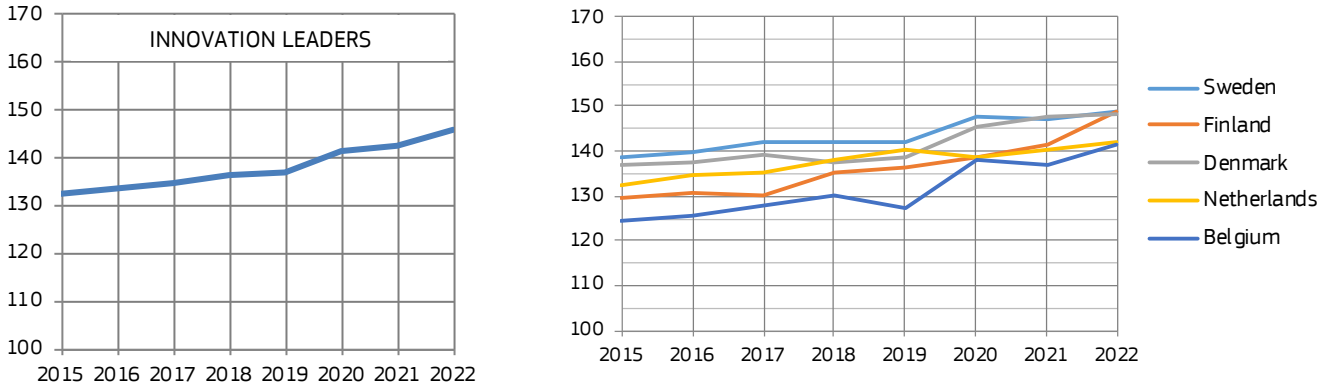
Innovation Leaders

Performance of the Innovation Leaders improved from 2015 onwards, with an acceleration since 2020. Compared to 2015, performance has improved by 13.6 percentage points , which is above the average of the EU. Performance has improved the most in Finland (19.5%-points), with high annual increases in 2018 and 2022 (in both years among others due to strong increases in SMEs with product innovations, SMEs with business process innovations, and Sales of innovative products). Finland has almost closed the performance gap with Sweden, the best performing EU Member State.

Performance has also improved at a rate above that of the EU average for all other Innovation leaders. For both Belgium (16.8%-points) and Denmark (11.3%-points), performance increased very strongly in 2020. For Belgium this was due to substantial increases in 2020 in Foreign doctorate students, Non-R&D innovation expenditures, Innovation expenditures per employee, and SMEs with business process innovation. For Denmark this was due to substantial increases in 2020 in Venture capital expenditures, Innovation expenditures per employee, SMEs with product innovations, SMEs with business process innovation, and Employment in innovative enterprises.

For Sweden (10.5%-points), performance improved strongest in 2020, due to substantial increases in 2020 in SMEs with product innovations, SMEs with business process innovation, and Sales of innovative products. For the Netherlands (9.9%-points), performance declined in 2020, almost recovered in 2021 and continued to grow in 2022.

Figure 10: Performance Innovation Leaders



Performance is relative to that of the EU in 2015. The graph on the left shows the average performance of the Innovation Leaders, calculated as the unweighted average of the respective Member States.

[15] Performance change for each of the performance groups is calculated as the unweighted average of the performance changes of the group members. In the text, for simplicity, all changes are shown as percentage changes, but these are percentage point changes.

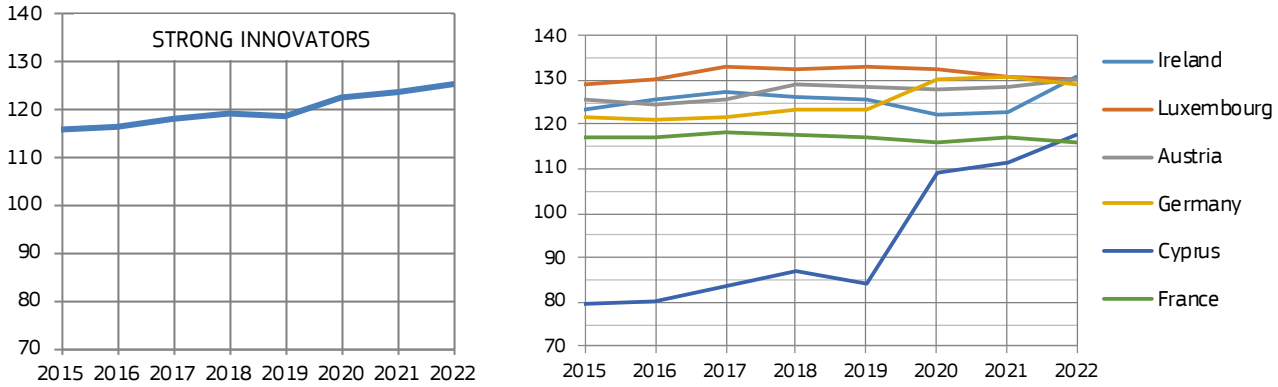
Strong Innovators

For the Strong Innovators performance increased by 9.6 percentage points, a rate below that of the EU and that of the Innovation Leaders. The performance gap to the Innovation Leaders has widened over time. Cyprus shows a rapid improvement over time (37.9%-points. For Cyprus performance improved strongly in 2020 (24.7%-points), due to substantial increases in SMEs with product innovations, SMEs with business process innovations, Innovative SMEs collaborating with others, Environment-related technologies, and Venture capital expenditures.

Performance increased but below the rate of the EU for Germany (7.4%-points), Ireland (7.1%-points), Austria (4.6%-points), and Luxembourg (1.4%-points). For Germany performance increased strongest in 2020 (6.8%-points) due to higher shares of SMEs with product innovations, SMEs with business process innovations, and Innovative SMEs collaborating with others. On the contrary, performance declined in 2022 (-1.8%-points). For Ireland performance increased strongly in 2022 (7.7%-points) due to improved performance on Government support for business R&D, SMEs with business process innovations, Employment in innovative enterprises and Sales of innovative products. For Austria annual performance changes are relatively small except for 2018 (3.5%-points-points). In 2022 performance increased by 1.5%-points. For Luxembourg peak performance was reached in 2019 followed by three years of performance declines.

Performance declined for France (-1.0%-points) with peak performance in 2017 followed by annual decreases for all years except an increase in 2021.

Figure 11: Performance Strong Innovators



Performance is relative to that of the EU in 2015. The graph on the left shows the average performance of the Strong Innovators, calculated as the unweighted average of the respective Member States.

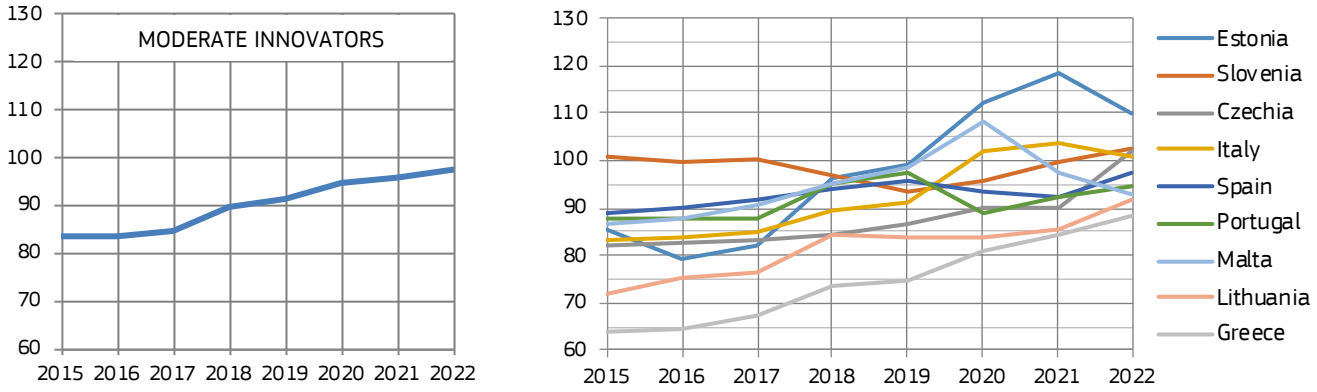
Moderate Innovators

For the Moderate Innovators, performance has been increasing continuously since 2015. Compared to 2015, average performance has improved by 14.3 percentage points, i.e. at a higher rate than the Strong Innovators and the Innovation Leaders. The performance gap to the Strong Innovators has become smaller over time, which is an indication of converging performance between the two groups. For almost all Moderate Innovators performance has increased. For Estonia (24.4%-points), Greece (24.2%-points), Lithuania (19.9%-points), Czechia (19.8%-points), and Italy (17.5%-points), performance has increased faster than that of the EU. For Estonia performance declined in 2022 mostly due to worsened performance on all indicators using innovation survey data. For both Greece and Czechia performance has improved consistently with annual performance increases between 2015 and 2022. Compared to 2021, Czechia's performance in 2022 increased by 11.7%-points) due to improved performance on SMEs with product innovations, SMEs with business process innovations, and Venture capital expenditures.

For the other Moderate Innovators performance increased at a rate below that of the EU. For Spain (8.6%-points), performance increased strongly in 2022 (5.5%-points) after two years of performance declines. The increase in 2022 was due to improved performance on SMEs with product innovations, SMEs with business process innovations, Knowledge-intensive services exports, and Sales of innovative products. For Malta (6.7%-points), peak performance was reached in 2020 when the country was the best performing Moderate Innovator. The strong increase of almost 10%-points in 2020 was followed by an even stronger decline in 2021 of almost 11%-points (due to reduced performance on Venture capital expenditures and Environment-related technologies) and a further decline in 2022 of almost 5%-points. For Portugal (6.4%-points), peak performance was reached in 2019. Performance declined strongly in 2020 (about 8%-points, due to reduced performance on Non-R&D innovation expenditures, SMEs with product innovations, SMEs with business process innovations, and Employment in innovative enterprises) followed by annual increases in 2021 and 2022 which did not make up for the decline in 2020.

For Slovenia (2.0%-points) performance increased at a relatively low rate due to performance decreases in 2018 and 2019 (-7.0%-points combined). More recently, performance improved with more than

Figure 12: Performance Moderate Innovators



Performance is relative to that of the EU in 2015. The graph on the left shows the average performance of the Moderate Innovators, calculated as the unweighted average of the respective Member States.

Emerging Innovators

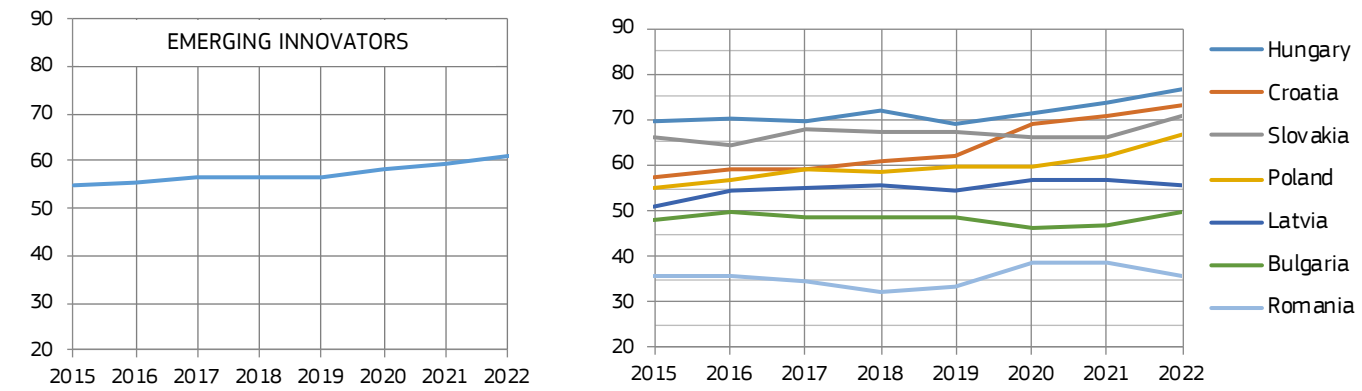
For the Emerging Innovators, overall performance improved by 6.4 percentage points over time, which is below the average rate of increase for the EU and below that for the other performance groups. The performance gap to the Moderate Innovators widened. Two Emerging Innovators had a performance increase above that of the EU: Croatia (15.5%-points) and Poland (11.3%-points). For Croatia performance has improved consistently with annual performance increases between 2015 and 2022. The highest annual increase was in 2020 (7.0%-points) due to much higher performance for SMEs with product innovations. For Poland performance increased in all years except a small decline in 2018. In 2020 performance increased by 4.3%-points, as a result of very strong performance increases for Foreign doctorate students, SMEs with business process innovations, and Employment in innovative enterprises.

For Hungary (7.1%-points), Latvia (4.7%-points), Slovakia (4.6%-points), Bulgaria (1.5%-points), and Romania (0.2%-points). performance increased at a rate below that of the EU. For Hungary performance declined in both 2017 and 2019 and increased in all other years. Performance increased in 2022 due to strong improvements for SMEs with business process innovations and Employment in innovative enterprises.

For Latvia performance declined in both 2019 and 2022 and increased in all other years. The decline in 2022 is due to lower performance for Most-cited scientific publications, Non-R&D innovation expenditures, Innovation expenditures per employee, and Employment in innovative enterprises. For Slovakia performance declined in both 2016, 2018 and 2020 and increased in all other years. In 2022 the performance increase is strong (4.6%-points) as a result of higher performance for SMEs with business process innovations and Employment in innovative enterprises.

Bulgaria and Romania show both the lowest performance levels and very low performance increases compared to the EU average, thereby widening their performance gap to the EU and most of the Member States. For Bulgaria performance decreased in 2017, 2019 and 2020 and increased in all other years. The performance increase in 2022 (3.0%-points) is due to improved performance for SMEs with business process innovations and Innovative SMEs collaborating with others. For Romania performance decreased in 2016, 2017, 2018 and 2022, resulting in the same performance level in 2022 as in 2015. Performance declined in 2022 most strongly for Innovation expenditures per employee and Innovative SMEs collaborating with others.

Figure 13: Performance Emerging Innovators



Performance is relative to that of the EU in 2015. The graph on the left shows the average performance of the Emerging Innovators, calculated as the unweighted average of the respective Member States.

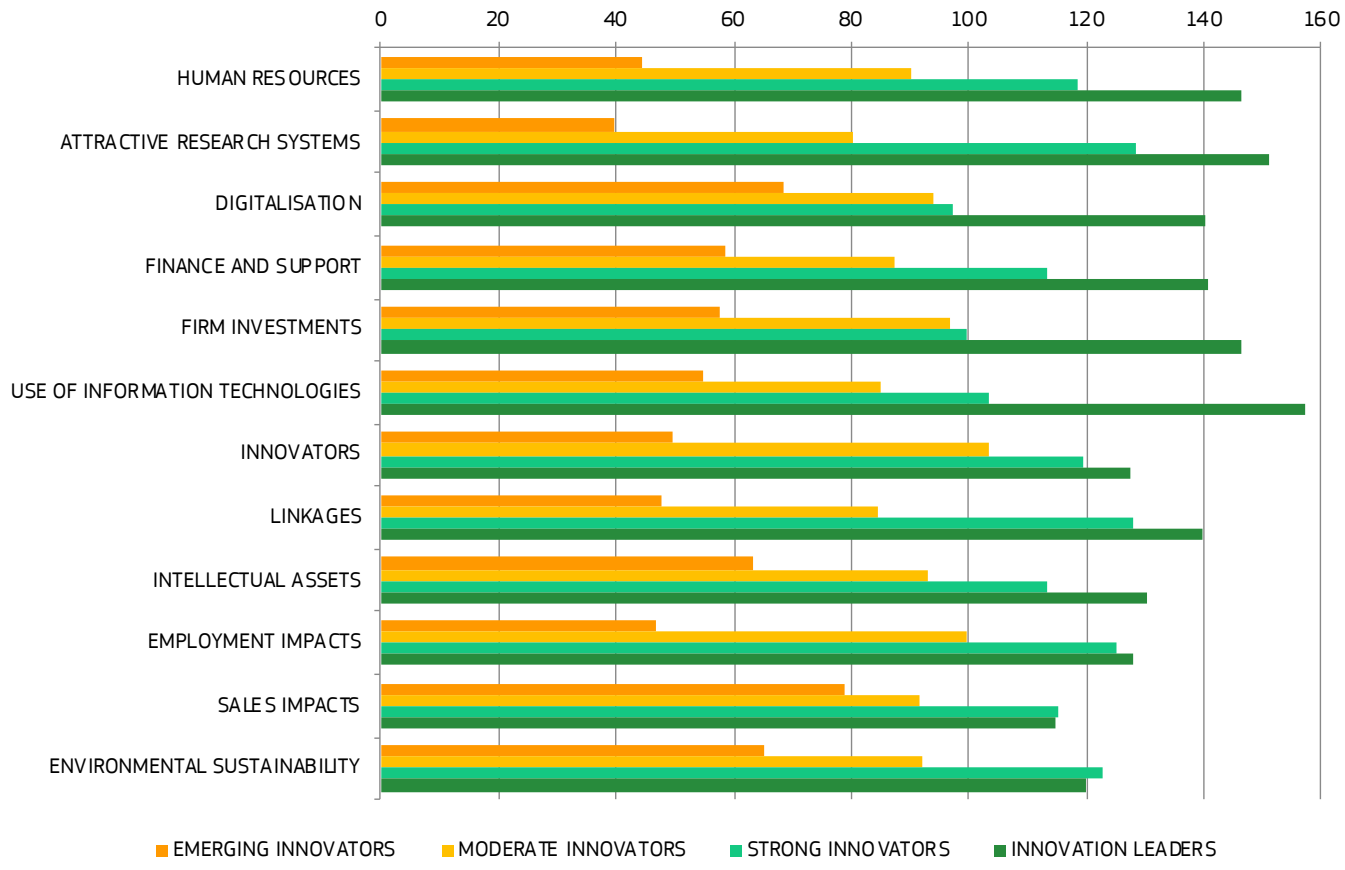
4. Innovation dimensions

This chapter provides a comparative analysis of the performance groups and the individual Member States for each of the 12 innovation dimensions. The order of performance groups (Leaders – Strong – Moderate – Emerging Innovators) observed for average innovation performance also applies to almost all dimensions. Only in Sales impacts and Environmental, the Strong Innovators outperform the Innovation Leaders (Figure 14). Average performance for group has been calculated as the unweighted average of the innovation index scores for the Member States in that performance group. The performance difference is 20%-points between the Innovation Leaders and Strong Innovators, 28%-points between the Strong and Moderate Innovators, and 37%-points between the Moderate and Emerging Innovators.

In several innovation dimensions, performance differences are much higher between the performance groups. The performance difference between the Innovation Leaders and the Strong Innovators is 54%-points in Use of information technologies, 47%-points in Firm investment, and 43%-points in Digitalisation. Between the Strong and Moderate Innovators, performance differences are high for Attractive research systems (48%-points), Linkages (44%-points) and Environmental sustainability (31%-points). Between the Moderate and Emerging Innovators, performance differences are high for Innovators (54%-points), Employment impacts (53%-points) and Human resources (46%-points).

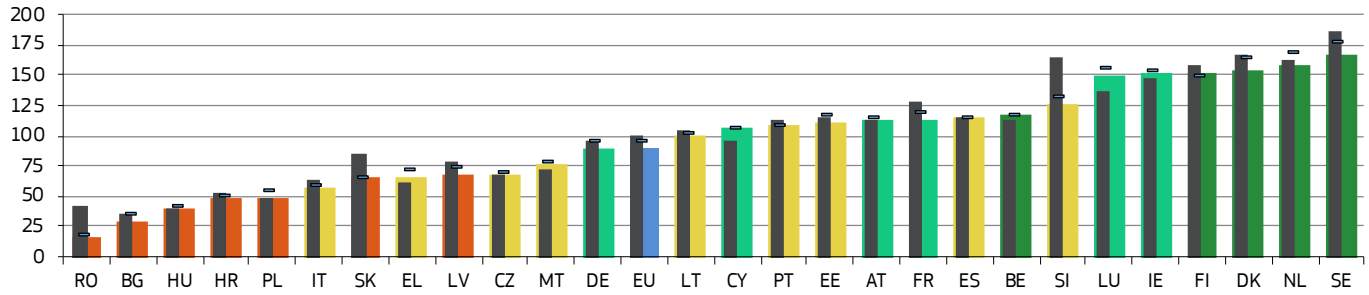
Performance differences between the Innovation Leaders and the Strong Innovators are small in Environmental sustainability (-3%-points), Sales impacts (0%-points) and Employment impacts (3%-points). Performance differences between the Strong and Moderate Innovators are small in Firm investments (3%-points) and Digitalisation (4%-points). Performance differences between the Moderate and Emerging Innovators are relatively small in Sales impacts (13%-points).

Figure 14: Performance groups: innovation performance per dimension



Average scores for each performance group are defined as the unweighted average of the relative-to-EU scores of the Member States within that group. As these unweighted averages do not consider differences in country size, results are not directly comparable. For this reason, average scores for the performance groups have been adjusted such that the unweighted average of the four groups for each dimension equals 100.

Human resources



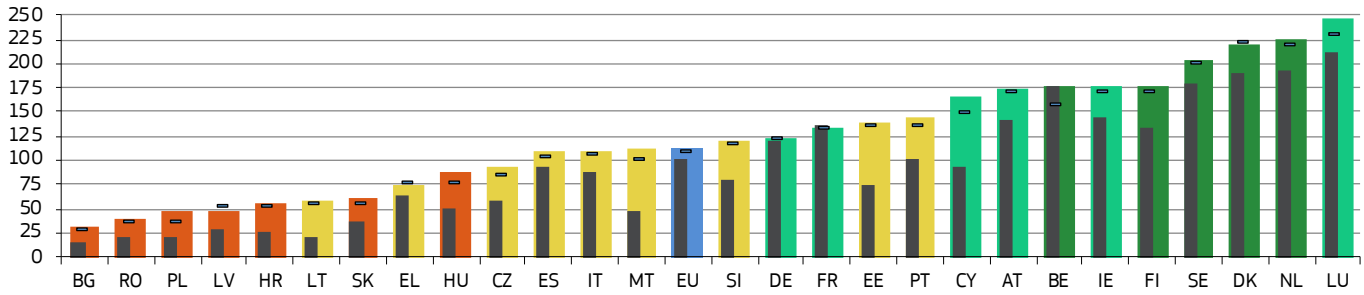
Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

The top 5 is composed by four Innovation Leaders (Denmark, Finland, Netherlands, Sweden) and one Strong Innovator (Ireland). All Innovation Leaders perform above the EU average. All Strong Innovators also perform above the EU average, except for Germany. Five of the nine Moderate Innovators perform above the EU average (Estonia, Lithuania, Portugal, Slovenia, Spain). All Emerging Innovators perform below the EU average, with lowest performance for Romania.

For six Member States, performance has improved between 2015 and 2022. The highest performance increase is for Luxembourg (14.5%-points), followed by Cyprus (9.7%-points). For five Member States performance did not change and for 16 Member States performance has declined, most strongly for Slovenia (-38.8%-points) and Romania (-24.2%-points). The EU average declined by 9.7%-points.

In comparison to 2021, performance has improved for only one Member State: Finland (4.8%-points). For 14 Member States performance did not change. Performance declined for 12 Member States, most strongly for Denmark, the Netherlands and Sweden (-9.7%-points each). The EU average declined by 4.8%-points.

Attractive research systems



Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

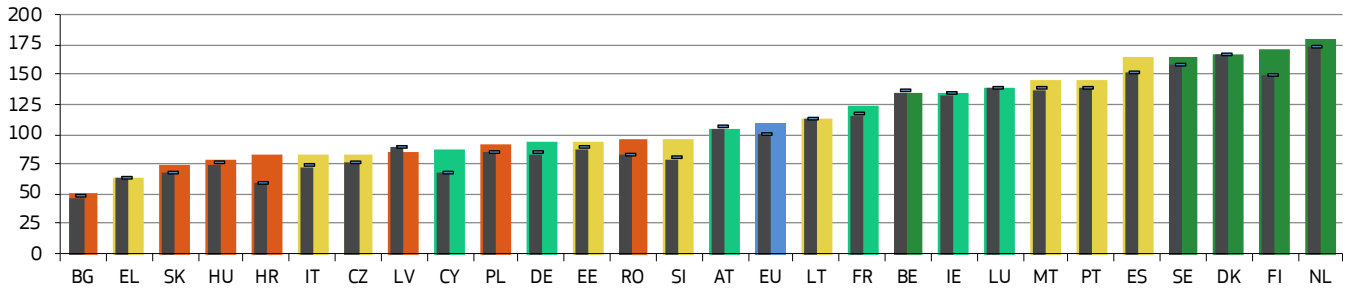
The Innovation Leaders perform well above the EU average. The top 5 is formed by one Strong Innovator, Luxembourg, and four Innovation Leaders (Denmark, Finland, the Netherlands and Sweden). Only three Moderate Innovators Estonia, Portugal and Slovenia, perform above the EU average.

For 25 Member States, performance has improved between 2015 and 2022. The highest rate of performance increase is for Cyprus (70.2%-points), followed by Estonia (64.3%-points) and Malta (64.1%-points). In all three countries International scientific co-publications doubled and Foreign doctorate students had a 3.5 to fivefold increase. Only for France (-2.3%-points) and Belgium (-0.8%)-points performance has declined. The EU average increased by 11.8%-points.

Compared to 2021, performance has improved for 24 Member States, with the highest rate of performance increase for Luxembourg (19.1%-points) and Belgium (19.0%-points). Performance declined for three Member

States, for Latvia (-2.4%-points), Greece (-1.2%-points) and Denmark (-1.1%-points). The EU average increased by 2.9%-points.

Digitalisation

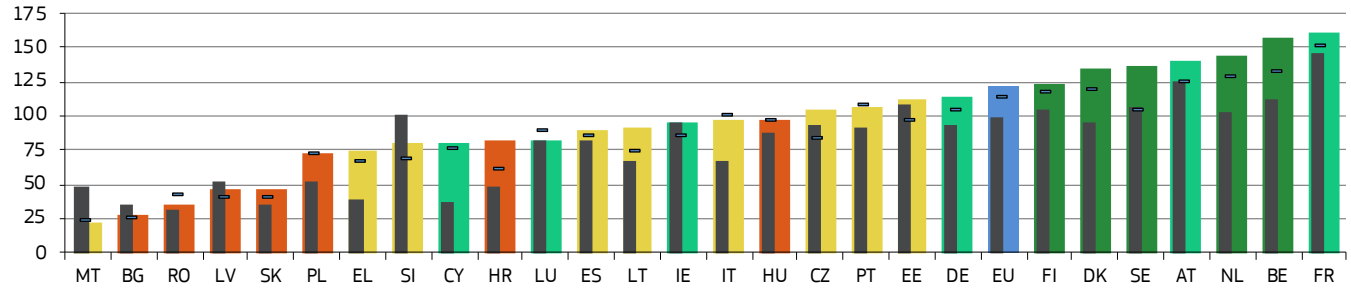


Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

The top 5 is formed by four Innovation Leaders and one Moderate Innovator (Spain). All Innovation Leaders perform above the EU average. Only three Strong Innovators perform above the EU average. Four Moderate Innovators perform above, and five Moderate Innovators perform below the EU average. All Emerging Innovators perform below the EU average, with Romania showing the best performance.

For 21 Member States, performance has improved between 2015 and 2022. The highest rate of performance increase is for Croatia (23.8%-points), Finland (22.2%-points) and Cyprus (20.6%-points). Performance did not change for five Member States and decreased only for Latvia (-4.8%-points). The EU average increased by 9.5%-points.
Results for the change between 2021 and 2022 are identical to those between 2015 and 2022 as due to breaks in series data from before 2021 are identical to those for 2021.

Finance and support



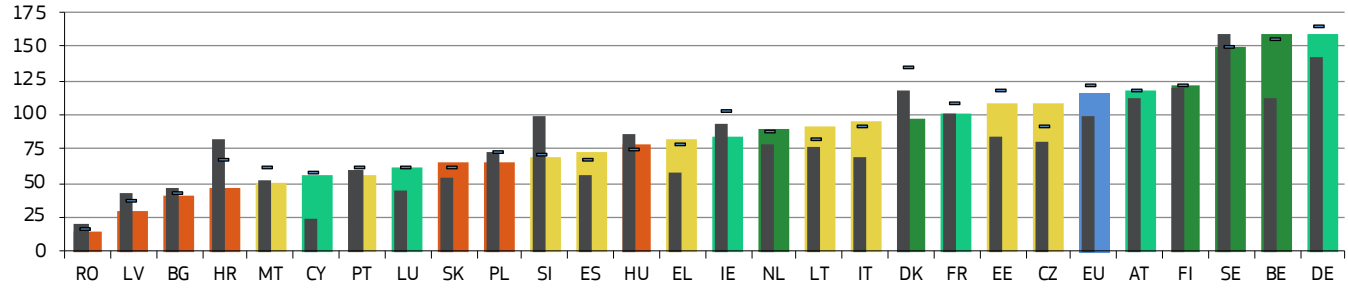
Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

All Innovation Leaders perform above the EU average. The top 5 is formed by three Innovation Leaders (Belgium, Netherlands, Sweden) and two Strong Innovators (Austria, France). France shows best performance overall. Due to the high average performance of the EU, four Strong Innovators perform below the EU average. All Moderate and Emerging Innovators perform below the EU average.

Performance has increased for 22 Member States between 2015 and 2022. The highest rates of performance increase are for Belgium (44.5%-points), Cyprus (43.1%-points) and the Netherlands (41.4%-points). For five Member States performance has declined, most strongly for Malta (-26.8%-points) and Slovenia (-22.1%-points). The EU average increased by 21.5%-points.
Compared to 2021, performance has improved in 22 Member States, with the highest rate of performance increase for Sweden (32.8%-points).

Performance decreased for five Member States, with the strongest decline for Luxembourg (-6.1%-points) and Romania (-5.1%-points). The EU average increased by 9.2%-points.

Firm investments



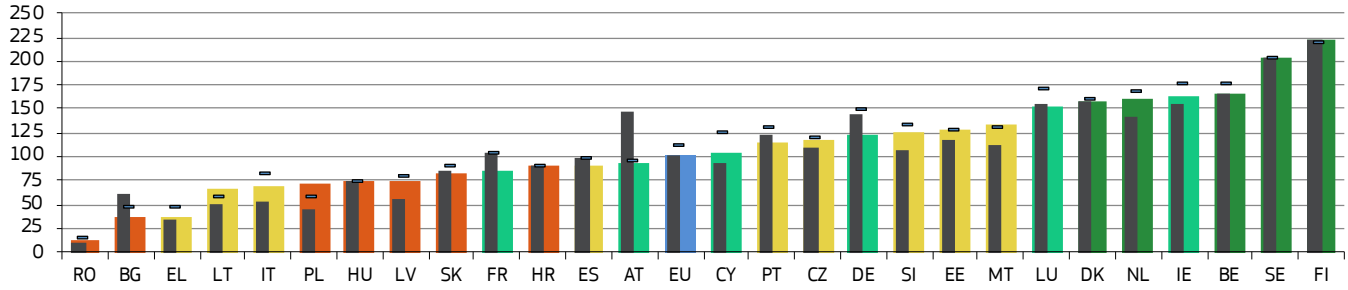
Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

The top 5 is formed by three Innovation Leaders and two Strong Innovators., Germany, the overall best performing country, and Austria. As the EU average is high, most Member States perform below the EU average. All Innovation Leaders, except for Denmark and the Netherlands, perform above the EU average. Only two Strong Innovators – Austria and Germany – perform above the EU average. All Moderate and Emerging Innovators perform below the EU average.

For 14 Member States, performance increased between 2015 and 2022. The highest rate of performance increase is for Belgium (47.4%-points), followed by Cyprus (32.0%-points). The EU average increased by 15.9%-points. For 13 Member States, performance declined, most strongly for Croatia (-35.9%-points), Slovenia (-29.9%-points) and Denmark (-21.9%-points).

Compared to 2021, performance has improved for 14 Member States, with the highest rate of performance increase for Czechia (19.0%-points) and Lithuania (10.3%-points). Performance declined for 13 Member States, with the strongest decline in Denmark (-37.4%-points), followed by Croatia (-19.2%-points) and Ireland (-17.6%-points). The EU average declined by 5.3%-points.

Use of information technologies



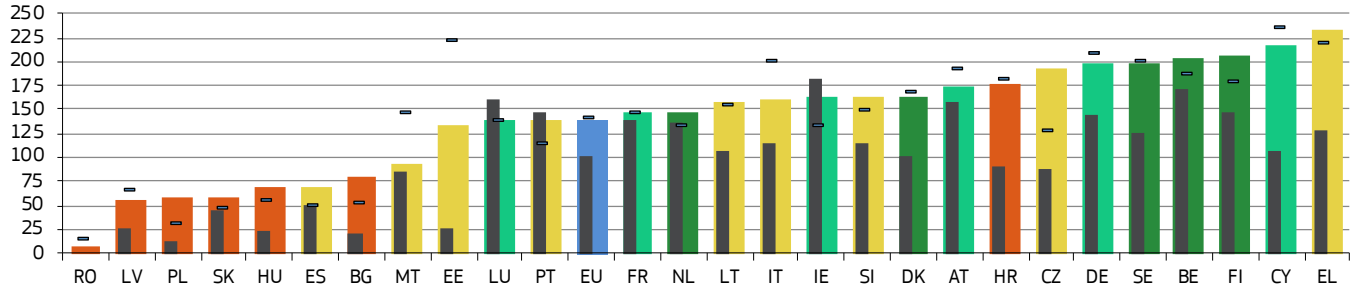
Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

Four Innovation Leaders and one Strong Innovator (Ireland), make up the top 5. All Innovation Leaders perform above the EU average. Two Strong Innovators perform below the EU average, Austria and France. Five Moderate Innovators perform above, and four Moderate Innovators perform below the EU average. All Emerging Innovators perform below the EU average, of which Croatia shows the highest performance.

For 13 Member States performance increased between 2015 and 2022. The highest rate of performance increase is for Poland (26.1%-points), followed by Malta (22.8%-points). For six Member States and the EU performance did not change. For eight Member States, performance declined, most strongly for Austria (-52.2%-points), Bulgaria (-26.1%-points) and Germany (-22.8%-points).

Compared to 2021, performance has increased for only four Member states: Poland (16.3%-points), Lithuania (9.8%-points), Malta (6.5%-points) and Finland (3.3%-points). For seven Member States performance did not change. For 16 Member States performance declined, most strongly for Germany (-26.1%-points) and Cyprus, France and Luxembourg (all -19.6%-points). The EU average declined by 9.8%-points.

Innovators



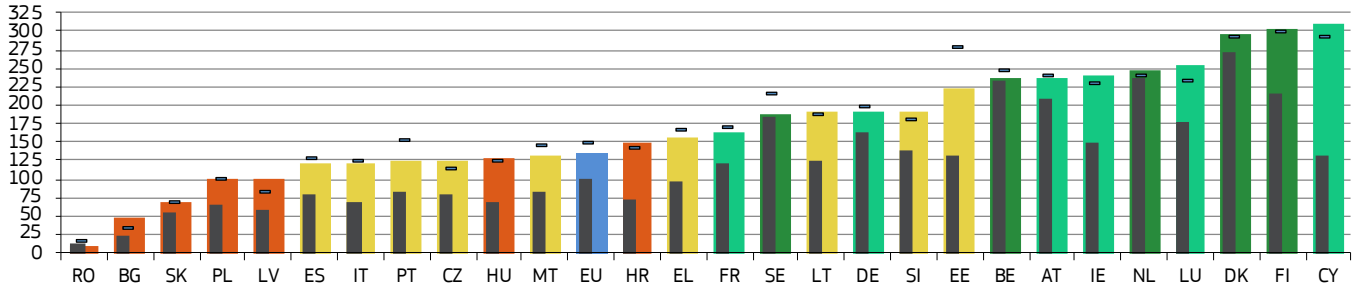
Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

The top 5 includes three Innovation Leaders, one Strong and one Moderate Innovator. Greece is the overall best performing country. All Innovation Leaders perform above the EU average. Five Strong Innovators perform above the EU average, only Luxembourg performs below the EU average. Five Moderate Innovators perform above and four perform below the EU average. The only Emerging Innovator performing above the EU average is Croatia. There is a strong break in performance between Estonia and Malta and between Latvia and Romania.

For 24 Member States performance increased between 2015 and 2022. The highest rate of performance increase is for Cyprus (109.0%-points), Estonia (107.8%-points), Greece (106.9%-points) and Czechia (104.6%-points). For three Member States performance declined, for Luxembourg (-20.9%-points), Ireland (-18.8%-points) and Portugal (-9.2%-points). The EU average increased by 39.8%-points.

Compared to 2021, performance has increased for 15 Member States, and most strongly in Czechia (65.9%-points). For 11 Member States performance declined, most strongly for Estonia (-88.4%-points) and Malta (-52.1%-points). The EU average declined by 0.6%-points.

Linkages



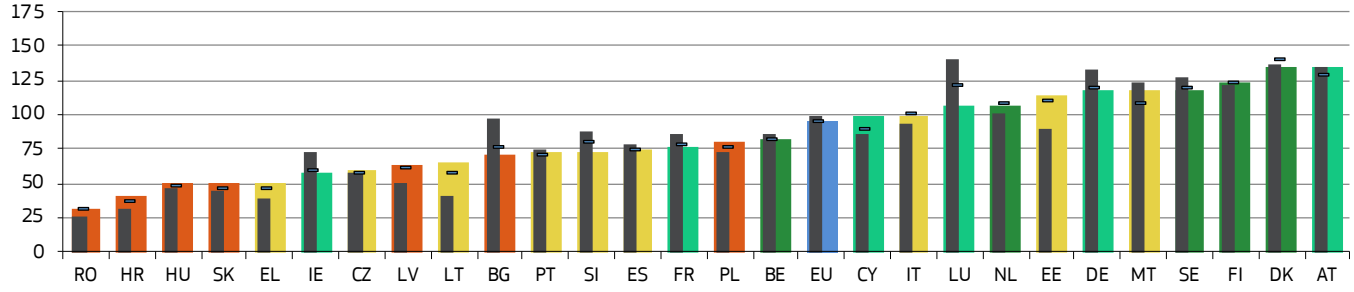
Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

All Innovation Leaders and Strong Innovators perform above the EU average. The top 5 is formed by three Innovation Leaders (Denmark, Finland, Netherlands) and two Strong Innovators (Cyprus, the overall best performing Member State, and Luxembourg). Four Moderate Innovators perform above the EU average. The other Moderate Innovators and all Emerging Innovators perform below the EU average.

For 26 Member States performance increased between 2015 and 2022. The highest rate of performance increase is for Cyprus (177.2%-points). The EU average increased by 35.0%-points. The lowest performance increase is in Belgium (1.9%-points) and Sweden (5.1%-points) and performance declined in Romania (-1.4%-points).

Compared to 2021, performance has increased for 14 Member States, with the highest rate of performance increase for Luxembourg (22.5%-points) and Latvia (20.9%-points). Performance declined for 13 Member States, with the strongest declines for Estonia (-57.3%-points), Portugal (-27.9%-points) and Sweden (-24.1%-points). The EU average declined by 11.1%-points.

Intellectual assets



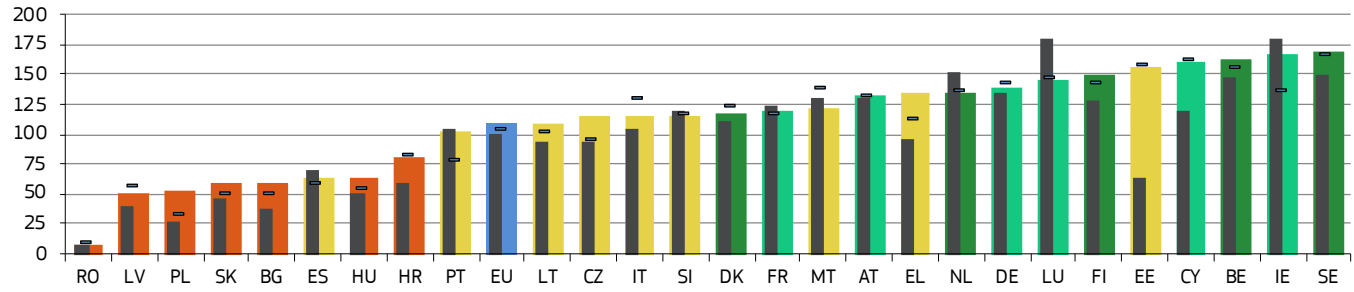
Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

Austria, a Strong Innovator, is the overall best performing country. Other countries in the top 5 include three Innovation Leaders (Denmark, Finland, Sweden) and one Moderate Innovator (Malta). All Innovation Leaders perform above the EU average, except for Belgium. Most Strong Innovators are performing above the EU average, except for France and Ireland. Only three Moderate Innovators, Estonia, Italy and Malta, are performing above the EU average. All Emerging Innovators perform below the EU average, but Poland is relatively close to the EU average.

For 14 Member States, performance has increased between 2015 and 2022. The highest rate of performance increase is for Estonia (24.8%-points) and Lithuania (24.6%-points). Performance has declined for 13 Member States, most strongly for Luxembourg (-35.6%-points) and Bulgaria (-27.8%-points). The EU average has declined by 5.6%-points.

Compared to 2021, performance has improved for 18 Member States, with the highest rate of performance increase for Malta and Cyprus (9.7%-points each) and Lithuania (8.9%-points). Performance has declined for nine Member States, with the strongest decline for Luxembourg (-14.8%-points). The EU average has marginally increased by 0.1%-points.

Employment impacts



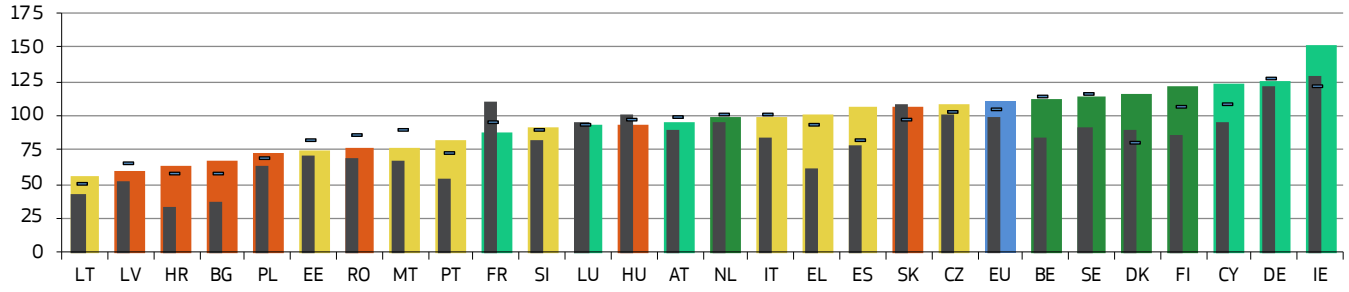
Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

All Innovation Leaders and Strong Innovators perform above the EU average. The top 5 is formed by two Innovation Leaders (Sweden, the overall best performing Member State, and Belgium), two Strong Innovators (Cyprus, Ireland) and one Moderate Innovator (Estonia). Seven Moderate Innovators perform above and two perform below the EU average. All Emerging Innovators perform below the EU average, with only Croatia performing relatively close to the EU average.

For 18 Member States, performance has increased between 2015 and 2022. The highest rate of performance increase is for Estonia (92.9%-points), due to an increase in the share of Employment in innovative enterprises from 34% to almost 80%. Performance did not change for Romania and decreased for eight Member States, and most strongly in Luxembourg (-33.6%-points). The EU average increased by 8.1%-points.

Compared to 2021, performance has improved for 14 Member States, and most strongly in Ireland (29.5%-points). Performance did not change for seven Member States and declined for six Member States, with the strongest decline in Malta (-16.5%-points). The EU average increased by 4.2%-points.

Sales impacts



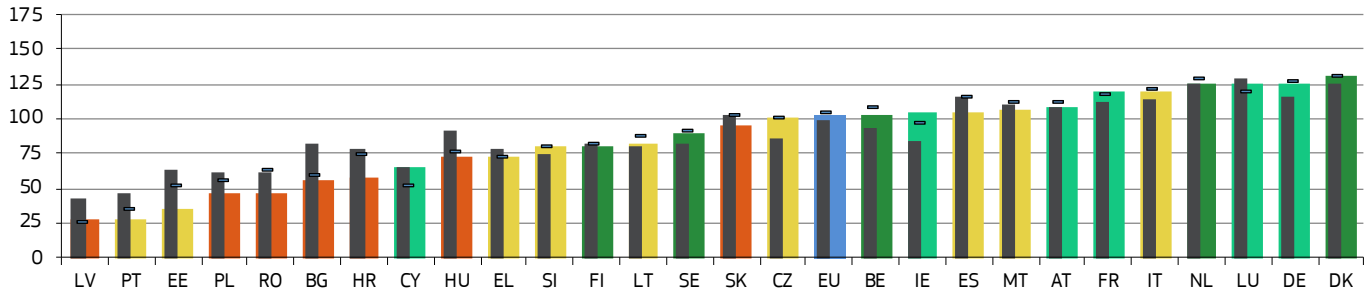
Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

All Innovation Leaders perform above the EU average, except for the Netherlands. The top 5 best performing countries include three Strong Innovators (Ireland, the overall best performing Member State, and Germany and Cyprus) and two Innovation Leaders (Denmark and Finland). All other Strong Innovators and all Moderate and Emerging Innovators perform below the EU average. The EU average is relatively high, due to the high score of Germany, the largest EU economy.

Performance between 2015 and 2022 has increased for 23 Member States. The highest rate of performance increase is for Greece (39.6%-points), Finland (35.2%-points) and Bulgaria (31.1%-points). For four Member States performance declined, most strongly for France (-21.8%-points) and Hungary (-7.6%-points). The EU average increased by 11.0%-points.

Compared to 2021, performance has improved for 14 Member States, with the highest rate of performance increase for Denmark (37.1%-points) and Ireland (30.8%-points). Performance declined for 13 Member States, with the strongest declines for Malta (-11.4%-points) and Romania (-8.4%-points). The EU average increased by 7.1%-points.

Environmental sustainability



Coloured columns show Member States' performance in 2022, using the most recent data for the indicators in this dimension, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2015. Grey columns show performance in 2015 relative to that of the EU in 2015.

The top 5 best performing countries includes two Innovation Leaders (Denmark, the overall best performing Member State, and the Netherlands), two Strong Innovators (Germany, Luxembourg) and one Moderate Innovator (Italy). Two Innovation Leaders perform below the EU average, Finland and Sweden. Of the Strong Innovators, five perform above and Cyprus performs below the EU average. Three Moderate Innovators perform above, and six perform below the EU average. All Emerging Innovators perform below the EU average, with Slovakia performing closest to the EU average.

Performance between 2015 and 2022, has increased for 12 Member States. The highest rate of performance increase is for Ireland (20.0%-points) and Czechia (15.2%-points). For 15 Member States performance decreased, most strongly in Estonia (-29.4%-points), Bulgaria (-26.6%-points) and Croatia (-20.5%-points). The EU average increased by 2.6%-points.

Compared to 2021, performance increased for 11 Member States, most strongly in Cyprus (13.6%-points). Performance decreased for 16 Member States, with strongest declines in Estonia (-17.4%-points), Romania (-14.8%-points) and Croatia (-14.6%-points). The EU average decreased by 1.4%-points.

5. Benchmarking innovation performance with non-EU countries

5.1 Benchmarking against other European countries and regional neighbours

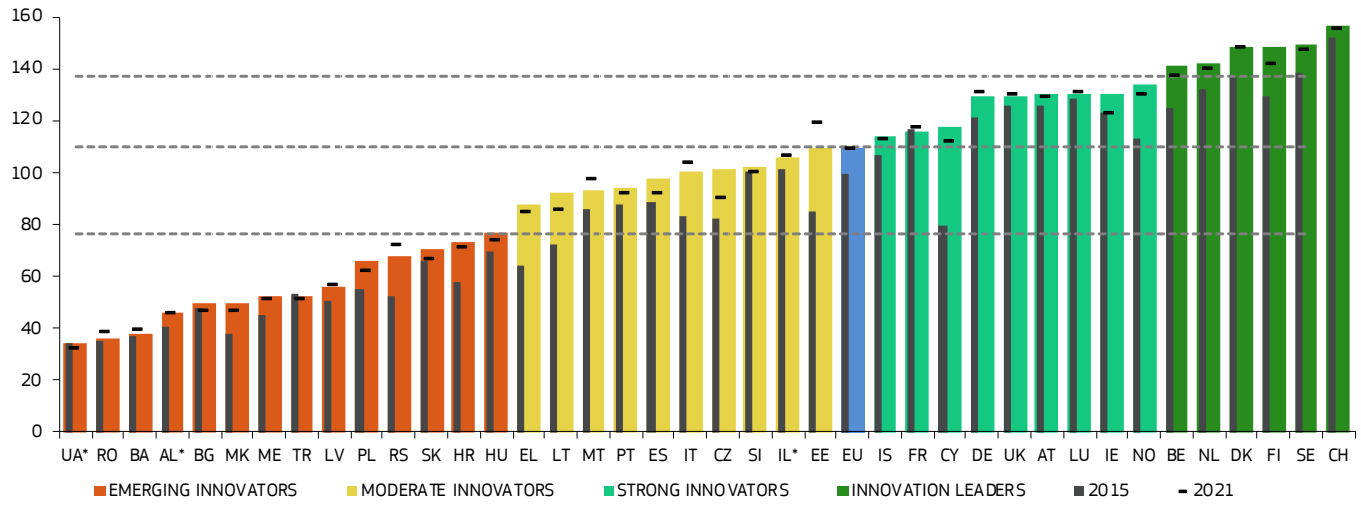
This section discusses the results for 12[16] more European countries or regional neighbours using the same methodology as used for the EU Member States.[17] The performance groups for all European countries or regional neighbours are shown on a map in Figure 18. Switzerland (CH) is the overall best performing country in Europe, outperforming all EU Member States (Figure 15). Switzerland has the highest performance in six indicators: New doctorate graduates, International scientific co-publications, Foreign doctorate students, Public-private co-publications, Medium- and high-tech product exports, and Resource productivity.

Iceland (IS), Norway (NO), and the United Kingdom (UK) are Strong Innovators. Iceland and Norway share with Switzerland the highest performance in International scientific co-publications and Public-private co-publications. Norway also performs best on Innovative SMEs collaborating with others. The United Kingdom has the highest performance on five indicators, of which two are shared with Switzerland: New doctorate graduates, Venture capital expenditures, Government support for business R&D, Job-to-job mobility of Human Resources in Science & Technology, and Resource productivity.

Israel (IL) is a Moderate Innovator, but results need to be interpreted with care as data are not available for 14 indicators.[18] Israel has the highest performance in four indicators: Business R&D expenditures, ICT specialists, PCT patent applications, and Employment in knowledge-intensive activities.

Bosnia and Herzegovina (BA), Montenegro (ME), North Macedonia (MK), Serbia (RS), Turkey (TR), and Ukraine (UA) are Emerging Innovators. Several of these countries show (shared) highest performance on at least one indicator: Albania on Sales of innovative products and Environment-related technologies, Bosnia and Herzegovina on Environment-related technologies, and Servia on Non-R&D innovation expenditures.

Figure 15: Performance of European and neighbouring countries' systems of innovation



Coloured columns show countries' performance in 2022, using the most recent data for 32 indicators, relative to that of the EU in 2015. The horizontal hyphens show performance in 2021, using the next most recent data, relative to that of the EU in 2015. Grey columns show countries' performance in 2015 relative to that of the EU 2015. The dashed lines show the threshold values between the performance groups, where the threshold values of 70%, 100%, and 125% have been adjusted upward to reflect the performance increase of the EU between 2015 and 2022.

[16] Compared to previous editions of the EIS, data availability was sufficient to include Albania.

[17] Data are available for 32 indicators for Norway and Serbia, 31 indicators for the United Kingdom, 30 indicators for Iceland, North Macedonia, and Turkey, 29 indicators for Montenegro and Switzerland, and 25 indicators for Bosnia and Herzegovina. Data availability is relatively weak for Albania with data available for 23 indicators, and weak for Ukraine with data for 21 indicators and Israel with data for only 18 indicators.

[18] Indicators for which data are not available are not included in the calculation of the Summary Innovation Index. For Israel average innovation performance is based on the results for only 18 indicators.

Compared to 2015, the performance of three countries has improved faster than the EU (9.9%-points) (Figure 16). For Norway (21.3%-points), strong growth is in particular due to high performance increases on (in decreasing order) Public-private co-publications, International scientific co-publications, Innovative SMEs collaborating with others, and Venture capital expenditures, . For Serbia (15.6%-points), strong growth is due to high performance increases on SMEs with product innovations, Employment in innovative enterprises, Job-to-job mobility of Human Resources in Science and Technology, and Venture capital. Expenditures. For North Macedonia (12.0%-points), strong growth is in particular due to high performance increases on Foreign doctorate students, Job-to-job mobility of Human Resources in Science and Technology, and Environment-related technologies.

For seven countries performance has increased at a rate below that of the EU. For Iceland (8.0%-points), growth is in particular due to high performance increases on Foreign doctorate students, Resource productivity, and Public-private co-publications.

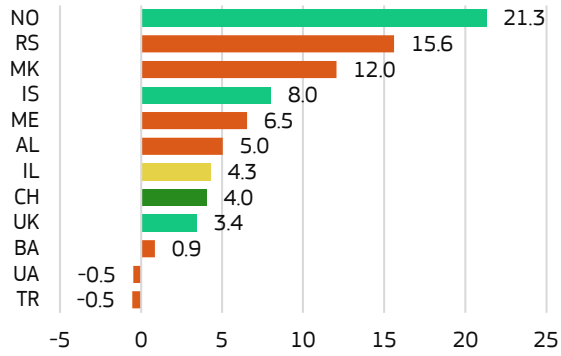
For Montenegro (6.5%-points), performance has increased strongly on International scientific co-publications, Environment-related technologies, and Public-private co-publications. For Albania (5.1%-points)), performance has increased strongly on Environment-related technologies and Most-cited publications. For Israel (4.3%-points)), performance has increased most strongly on Employed ICT specialists, International scientific co-publications, and Knowledge-intensive services exports.

For Switzerland (4.0%-points), performance has increased strongly on Venture capital expenditures and Medium and high-tech goods exports. For the United Kingdom (3.4%-points), performance has increased strongly on Government support for business R&D, Public-private co-publications, and International scientific co-publications. For Bosnia and Herzegovina (0.9%-points), performance has increased relatively strongly on Public-private co-publications and International scientific co-publications.

For both Turkey and Ukraine performance decreased at a very small rate. For Ukraine (-0.5%-points), relatively strong increases in Venture capital expenditures were offset by relatively strong decreases in Medium and high-tech goods exports and Public R&D expenditures. For Turkey (-0.5%-points), relatively strong increases in Government support for business R&D and Medium and high-tech goods exports were offset by relatively strong decreases in Non-R&D innovation expenditures and SMEs with business process innovations.

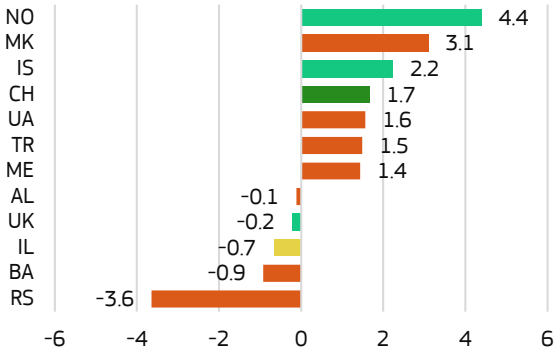
Compared to 2021, performance has increased most for Norway (4.4%-points) and North Macedonia (3.1%-points) and performance also increased for Iceland, Montenegro, Switzerland, Turkey, and Ukraine. Performance decreased for Serbia (-3.6%-points), Bosnia and Herzegovina (-0.9%-points), Israel (-0.7%-points), United Kingdom (-0.2%-points) and Albania (-0.1%-points) (Figure 17).

Figure 16: Performance change between 2015 and 2022



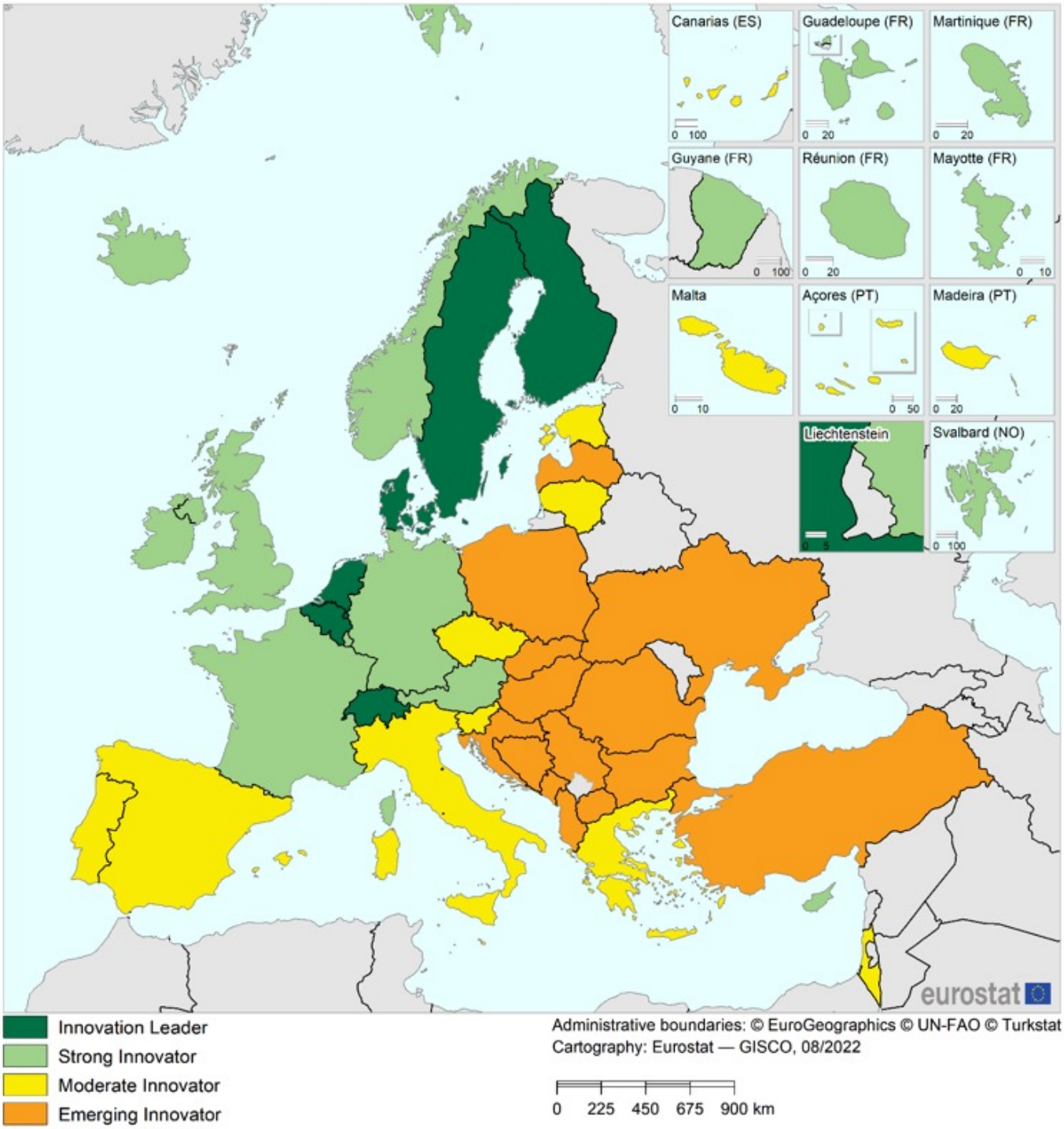
Performance change is measured as the difference between the 2022 and 2015 scores relative to that of the EU in 2015

Figure 17: Performance change between 2021 and 2022



Performance change is measured as the difference between the 2022 and 2021 scores relative to that of the EU in 2015

Figure 18: Map showing the performance of European neighbouring countries' innovation systems



Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the European Union. This designation shall not be construed as recognition of a State of Palestine and is without prejudice to the individual positions of the Member States on this issue.

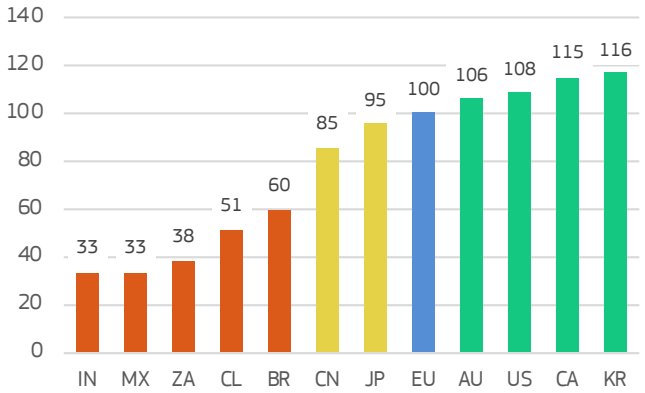
Source: European Commission – European Innovation Scoreboard 2022

5.2 Benchmarking against global competitors

This section provides a comparison of the EU to some of its main global economic competitors including Australia (AU), Brazil (BR), Canada (CA), Chile (CL), China (CN), India (IN), Japan (JP), Mexico (MX), South Africa (ZA), South Korea (KR), and the United States (US).

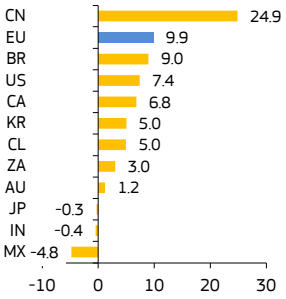
South Korea is the most innovative country (Figure 19). Australia, Canada and the United States, also have a performance lead over the EU. The EU has a performance lead over Brazil, Chile, China, India, Japan, Mexico and South Africa. Based on relative-to-EU performance in 2022, Australia, Canada, South Korea, and the United States would be Strong Innovators, China and Japan would be Moderate Innovators, and Brazil, Chile, India, Mexico, and South Africa would be Emerging Innovators. Compared to last year's results, the EU overtook Japan. Of the two newcomers, Chile is performing between Brazil and South Africa and Mexico performs slightly better than India.

Figure 19: Global performance



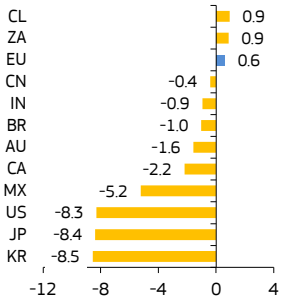
Coloured columns show performance in 2022 relative to that of the EU in 2022.

Figure 20: Performance change 2015-2022



Performance change is measured as the difference between the 2022 and 2015 scores relative to that of the EU in 2015.

Figure 21: Performance change 2021-2022



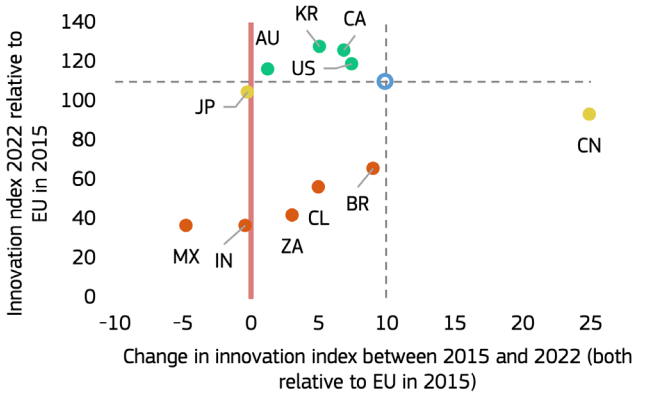
Performance change is measured as the difference between the 2022 and 2021

Performance between 2015 and 2022 has increased the most in China (24.9%-points), followed by the EU (Figure 20). For seven global competitors, performance grew but at a lower rate than that of the EU. For three global competitors - Japan, India, and Mexico - performance worsened between 2015 and 2022.

Combining current performance and performance change between 2015 and 2022 shows that Australia, Canada, South Korea, and the United States have a decreasing performance lead over the EU (Figure 22). The EU has an increasing performance lead over Brazil, Chile, India, Mexico, and South Africa.

More recently, between 2021 and 2022, performance has increased marginally for Chile, the EU and South Africa (Figure 21). Performance has decreased strongly for South Korea (mostly due to do a strong decline in Government funding of business R&D), Japan and the United States. Between 2021 and 2022, the EU has closed part of its performance gap with Australia, Canada, South Korea, and the United States. Moreover the EU overtook Japan and increased its performance lead over Brazil China, India, and Mexico, whereas Chile and South Africa closed part of their performance gap with the EU.

Figure 22: EU is catching up compared to the most innovative global competitors



The vertical axis shows countries' performance in 2022 relative to that of the EU in 2015. The horizontal axis shows the change in performance between 2015 and 2022 relative to that of the EU in 2015. The intersection of the dashed lines shows the respective score for the EU (blue circle). The red vertical line indicates no performance change.

Methodology

The economic and population size of most global competitors outweighs that of many of the individual EU Member States. Thus, innovation performance is compared to the aggregate of the Member States, i.e. the EU. Data availability is more limited for global competitors than for European countries. Therefore, a more restricted set of 19 indicators (Table 3) has been used for the international comparison of the EU with its global competitors. For some indicators, different definitions or proxy indicators have been used as compared to the previous chapters[18]:

- For Employed ICT specialists, data are not available. The indicator Employment share in information and communication services (NACE J) is used as proxy. The same proxy indicator has also been used in the 2021 edition of the Regional Innovation Scoreboard.
- For Trademark applications, comparable data on resident and non-resident applications have been used from the World Development Indicators.
- For Design applications, comparable data on resident and non-resident applications have been used from the World Development Indicators.
- For Medium and high-tech product exports and Knowledge-intensive services exports, the data for the EU exclude trade between Member States ('intra-EU trade', and only include exports to non-Member States ('extra-EU trade').
- For Knowledge-intensive services exports, data have been used from the UN Comtrade database using the older EBOPS 2002 classification and not the latest EBOPS 2010 classification.
- For Air pollution in PM2.5 in Industry, data are not available. The indicator Exposure to air pollution (PM2.5) is used as a proxy. The same proxy indicator has also been used in the 2021 edition of the Regional Innovation Scoreboard.

For each of the global competitors, the following pages briefly discuss the performance of their innovation system compared to the EU, and relative strengths and weaknesses for the different indicators. The countries are ordered according to their performance rank order. For each country, a table with contextual data is also included, similar to those used for the European and neighbouring countries in Chapter 6. Data have been extracted from various sources including Eurostat, OECD (Main Science and Technology Indicators (MSTI), Education at a Glance, Green Growth Indicators), different UN data sources (including UNESCO Institute for Statistics, United Nations (Comtrade) and UNIDO), Scopus, World Bank (World Development Indicators), and National Statistical Offices for some of the countries included in the international comparison.

Table 3: Indicators used in the international comparison

	Data source	Data not available for	Most recent year
FRAMEWORK CONDITIONS			
Human resources			
1.1.1 New doctorate graduates (STEM) (per 1000 population aged 25-34)	OECD	CN, ZA	2019
1.1.2 Population aged 25-64 having completed tertiary education	OECD		2020
Attractive research systems			
1.2.1 International scientific co-publications (per million population)	Scopus [1]	--	2021
1.2.2 Scientific publications among the top 10% most cited publications worldwide (share of total scientific publications of the country)	Scopus [1]	--	2019
Digitalisation ***No indicator included in international comparison***			
INVESTMENTS			
Finance and support			
2.1.1 R&D expenditure in the public sector (percentage of GDP)	OECD, UIS	BR	2020
2.1.3 Direct government funding and government tax support for business R&D	OECD	IN	2019
Firm investments			
2.2.1 R&D expenditure in the business sector (percentage of GDP)	OECD, UIS	BR	2020
Use of information technologies			
2.3.2 Employment in information and communication services	OECD, UNECE	CA, CN, IN, ZA	2020
INNOVATION ACTIVITIES			
Innovators			
3.1.1 SMEs introducing product innovations (%-share)	OECD	CN, IN, ZA	2018
3.1.2 SMEs introducing business process innovations (%-share)	OECD	CN, IN, MX, ZA	2018
Linkages			
3.2.1 Innovative SMEs collaborating with others (%-share)	OECD	CA, CN, IN, MX, ZA	2018
3.2.2 Public-private co-publications (per million population)	Scopus [1]	--	2021
Intellectual assets			
3.3.1 PCT patent applications (per billion GDP)	Patents: OECD GDP: World Bank	--	2018
3.3.2 Trademark applications (per billion GDP)	World Bank	--	2020
3.3.3 Design applications (per billion GDP)	World Bank	--	2020
IMPACTS			
Employment impacts ***No indicator included in international comparison***			
Sales effects			
4.2.1 Medium and high-tech product exports (share of total product exports)	UN Comtrade	--	2021
4.2.2 Knowledge-intensive services exports (share of total service exports)	UN Comtrade, OECD, JRC	--	2020
Environmental sustainability			
4.3.2 Exposure to air pollution (PM2.5)	OECD	--	2019
4.3.3 Development of environment-related technologies, % all technologies	OECD	--	2019

[1] Data provided by Science Metrix as part of a contract to the European Commission (DG Research and Innovation)

[19] Aggregate results for the EU are therefore not comparable to those used in the European benchmarking analysis.

For the international benchmarking, a comparable list of contextual indicators has been used as those in Chapter 7. However, for most indicators measuring Performance and structure of the economy and Demography data have been retrieved from other data sources (cf. Table 4). For the international comparison, the number of Unicorns is included in the Business and Entrepreneurship category. Unicorns are start-ups with a value of more than US$1 billion.

Table 4: Contextual indicators in the international comparison

	Period	Source
PERFORMANCE AND STRUCTURE OF THE ECONOMY		
GDP per capita, PPP (international dollars)	Average 2019-2021	World Development Indicators
Average annual GDP growth (%)	2019-2021	World Development Indicators
Employment share in Agriculture (%)	Average 2017-2019	World Development Indicators
Employment share in Industry (%)	Average 2017-2019	World Development Indicators
Employment share in Services (%)	Average 2017-2019	World Development Indicators
Manufacturing – share in total value-added [1]	Average 2018-2020	UNIDO
BUSINESS AND ENTREPRENEURSHIP		
Total early-stage Entrepreneurial Activity (TEA) (%)	Average 2019-2021	Global Entrepreneurship Monitor
FDI net inflows (% GDP)	Average 2018-2020	World Development Indicators
Top R&D spending enterprises per 10 million population	Average 2018-2020	EU Industrial R&D Investment Scoreboard
Top R&D spending enterprises, average R&D spending, million Euros	Average 2018-2020	EU Industrial R&D Investment Scoreboard
Number of Unicorns	July 2022	CB Insights [2]
Buyer sophistication (1 to 7 best)	Average 2017-2019	World Economic Forum
GOVERNANCE AND POLICY FRAMEWORK		
Ease of starting a business (0 to 100 best)	Average 2017-2019	Doing Business
Basic-school entrepreneurial education and training (1 to 5 best)	Average 2017-2019	Global Entrepreneurship Monitor
Government procurement of advanced technology products (1 to 7 best)	Average 2015-2017	World Economic Forum
Rule of law (-2.5 to 2.5 best)	Average 2016-2018	Worldwide Governance Indicators
DEMOGRAPHY		
Population size (millions)	Average 2019-2021	World Bank – WDI[1]
Average annual population growth (%)	2019-2021	World Bank – WDI[1]
Population density (inhabitants / km^2)	Average 2019-2021	World Bank – WDI[1]

[1] Value added data are used as employment data are not available. [2] https://www.cbinsights.com/research-unicorn-companies

Differences in contextual setting

The results for the contextual indicators on the following pages show the following differences with the EU.

Top R&D spending firms in **South Korea** spend twice as much on R&D compared to the EU. On the other hand, FDI net inflows as a percentage of GDP are lower.

Canada's economy shows a lower employment share for industry, and a higher employment share for services. Entrepreneurial activities are also at a much higher level.

For the **United States**, entrepreneurial activities are at a higher level, and top R&D spending firms spend 85% more on R&D. The number of Unicorns is more than six times that of the EU.

The relative size of **Australia's** manufacturing industry is less than half that of the EU, however FDI net inflows and entrepreneurial activities are at a higher level.

China's agricultural sector is in relative terms 5 times bigger compared to the EU, while also the relative size of the manufacturing industry is close to twice that of the EU. The number of top R&D spending firms per million population and their average expenditures are both higher in the EU compared to China. FDI net inflows, Entrepreneurial activities and the number of Unicorns in China are at a higher level.

Japan's top R&D spending firms spend more on R&D compared to EU top R&D spending firms. FDI net inflows as a percentage of GDP are lower, and Japan is also facing a declining population size.

Brazil has a relatively high share of employment in agriculture. Furthermore, entrepreneurial activities are at a higher level in Brazil, however top R&D spending firms spend less on R&D.

Chile has a relatively high share of employment in agriculture and FDI net inflows and entrepreneurial activities are also higher compared to the EU.

India's agricultural sector accounts for almost 45% of total employment, and FDI net inflows and entrepreneurial activities are at a higher level.

The structure of **South Africa**'s economy as measured by employment shares is comparable to that of the EU. FDI net inflows as a percentage of GDP and R&D spending from top R&D enterprises are relatively low but entrepreneurial activity is relatively high.

Mexico's agricultural sector is in relative terms close to 3 times bigger compared to the EU and FDI net inflows are also much higher relatively compared to the EU. Spending from top R&D enterprises is relatively low as well as the number of Unicorns.

Differences in innovation performance

Compared to its global competitors, the EU is showing strong performance in the following indicators:

+ In Knowledge-intensive services exports the EU has overall 2nd performance. The EU has shown performance improvement compared to those global competitors performing (well) below the EU. Canada and Japan have been improving at a faster rate and might overtake the EU soon.

+ In Environment-related technologies the EU has overall 2nd performance. Several countries performing below but relatively close to the level of the EU have shown a faster rate of improvement and the high rank position of the EU is at risk.

+ In New doctorate graduates the EU has overall 3rd performance. However, all global competitors have improved at a faster rate and both Canada and the United States could soon overtake the EU.

+ In Direct and indirect government funding of business R&D the EU has overall 3rd performance. The EU has improved its performance relative to most global competitors and there is no imminent threat of being overtaken by any global competitor. At the same time the gap to the United States is still too big to expect the EU to soon overtake the United States.

+ In SMEs with product innovation the EU has overall 3rd performance. The EU has improved its performance relative to most global competitors and it might soon overtake Australia.

+ In Design applications the EU has overall 3rd performance. The EU has improved its performance relative to China and South Korea but the gap to both countries is still very high. All other global competitors have improved their performance relative to the EU and it is thus more likely that the EU might be overtaken by one of these countries.

+ In International scientific co-publications, the EU has overall 4th performance. The EU is facing an increasing performance gap to both Australia and Canada. It is likely that the EU might overtake the United States or that the EU itself might be overtaken by Chile or South Korea.

+ In R&D expenditures in the public sector the EU has overall 4th performance. The EU has grown faster than six global competitors but has grown slower than 4 global competitors. The EU is at risk of being overtaken by the United States but at the same time might be able to overtake Australia and Canada.

+ In Employment in ICT the EU has overall 4th performance. The EU has grown faster than all global competitors and it might soon overtake both Australia and Japan.

- In SMEs with business process innovations the EU has overall 4th performance. Only Canada has shown a faster rate of improvement than the EU. The gap to Australia seems to be too big to expect the EU to overtake Australia soon.

The EU is showing relatively weak performance in the following indicators:

- In Trademark applications the EU has overall 9th performance. The EU performance has worsened over time and all other global competitors have improved their position relative to the EU. Trademarks seems to be the weakest element in the research and innovation system of the EU.

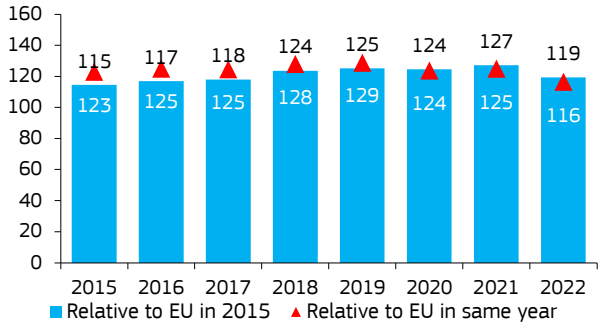
- In Innovative SMEs collaborating with others the EU has overall 8th and lowest performance (data are not available for three global competitors). The EU has shown a faster improvement than most global competitors, only Chile has grown even faster. It seems likely that the EU might soon overtake Brazil, Japan and South Korea.

- In Population with completed tertiary education the EU has overall 6th performance. The EU performance has improved but not as fast as that of Australia, Canada and the United States, with an increasing gap to all of them, and Chile, with the EU lead becoming smaller. The gap to Japan and South Korea has become smaller but remains big.

- In Exposure to air pollution the EU has overall 6th performance. The EU has seen a worsening of its performance and has also done worse than most of its global competitors. Japan and maybe also Chile, might soon overtake the EU.

South Korea, Canada, the United States and Australia perform better than the EU. These four countries all outperform the EU on Tertiary education, R&D expenditures in the business sector, and Public-private co-publications. The EU has a substantial performance gap with South Korea and the United States on R&D expenditures in the business sector, and on Intellectual Property indicators with South Korea. The performance gap on Tertiary education is substantial vis-à-vis South Korea and Canada, and the performance gap on Public-private co-publications is substantial vis-a-vis Canada and Australia. There is not one indicator where the EU outperforms all the leading global innovators, but the EU does show strengths in Exports of knowledge-intensive services vis-à-vis South Korea, Canada and Australia and in Exports of medium and high-tech products vis-à-vis Canada, the United States and Australia.

The performance of **South Korea** is well above that of the EU, and the country is a Strong Innovator. Performance has increased since 2015, in particular in 2021. South Korea's relative strengths are in Intellectual Property applications.



Columns show performance relative to EU in 2015. The red triangle and white numbers show performance relative to EU in the same year.

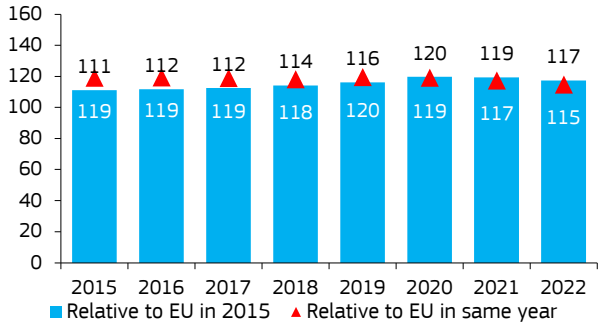
Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

South Korea	2022	Change
Doctorate graduates	115.5	30.6
Tertiary education	172.4	7.8
International co-publications	87.3	48.9
Most cited publications	82.8	0.5
R&D expenditure public sector	123.6	17.1
Government funding business R&D	165.9	-52.8
R&D expenditure business sector	263.8	56.6
Employment in ICT	90.3	14.0
Product innovators	39.0	5.2
Business process innovators	40.1	-56.0
Innovation co-operation	111.3	-146.3
Public-private co-publications	114.4	38.0
PCT patent applications	330.1	38.5
Trademark applications	239.5	30.1
Design applications	439.6	-120.3
Medium & high-tech product exports	136.4	8.5
Knowledge-intensive services exports	53.0	10.1
Exposure to air pollution	49.1	10.3
Environment-related technologies	97.0	-18.8

Best three (green) and worst (orange) three indicators highlighted.

Structural differences	KR	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	45,000	46,400
Change in GDP, %	1.6	-0.4
Employment share in Agriculture	5.0	4.5
Employment share in Industry	25.0	25.0
Employment share in Services	70.0	70.5
Manufacturing - share in total value added	25.6	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	8.7	7.3
FDI net inflows (% GDP)	0.61	1.03
Top R&D spending firms per mln population	12.2	18.3
- average R&D spending, mln Euros	516.6	233.1
Number of Unicorns (July 2021)	15	98
Buyer sophistication 1-7 (best)	5.26	3.73
Governance and policy framework		
Ease of starting a business	84.0	76.5
Basic-school entrepreneurial education and training	3.19	3.47
Government procurement of advanced technology products	3.88	3.50
Rule of law (-2.5 to 2.5 best)	1.20	1.05
Demography		
Population size, mln	51.8	447.2
Change in population, %	0.0	0.0
Share of population aged 15-64	71.7	64.1
Population density (population / km2)	531.0	111.8

The performance of **Canada** is well above that of the EU, and the country is a Strong Innovator. Performance has increased since 2015. Canada's relative strengths are in International co-publications and Exposure to air pollution.



Columns show performance relative to EU in 2015. The red triangle and white numbers show performance relative to EU in the same year.

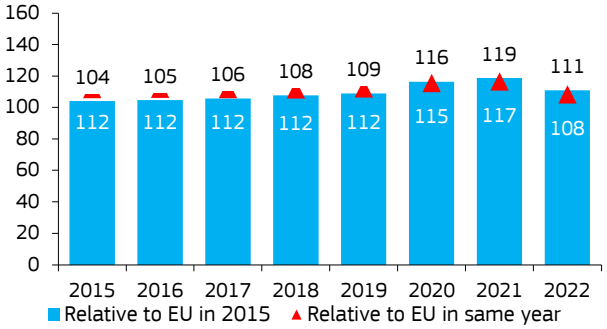
Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

Canada	2022	Change
Doctorate graduates	93.7	-0.6
Tertiary education	159.0	19.3
International co-publications	259.6	121.2
Most cited publications	115.5	-16.5
R&D expenditure public sector	111.1	0.1
Government funding business R&D	93.5	-39.0
R&D expenditure business sector	59.9	-0.6
Employment in ICT	N/A	N/A
Product innovators	181.9	54.2
Business process innovators	180.9	42.2
Innovation co-operation	181.4	0.0
Public-private co-publications	179.3	58.4
PCT patent applications	73.0	-11.0
Trademark applications	145.9	-12.9
Design applications	61.9	9.4
Medium & high-tech product exports	58.6	-5.0
Knowledge-intensive services exports	94.6	19.3
Exposure to air pollution	190.1	-3.3
Environment-related technologies	91.8	-8.0

Best three (green) and worst (orange) three indicators highlighted.

Structural differences	CA	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	49,300	46,400
Change in GDP, %	-1.3	-0.4
Employment share in Agriculture	1.5	4.5
Employment share in Industry	19.5	25.0
Employment share in Services	79.0	70.5
Manufacturing - share in total value added	9.8	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	17.9	7.3
FDI net inflows (% GDP)	2.29	1.03
Top R&D spending firms per mln population	7.4	18.3
- average R&D spending, mln Euros	164.1	233.1
Number of Unicorns (July 2021)	19	98
Buyer sophistication 1-7 (best)	4.45	3.73
Governance and policy framework		
Ease of starting a business	79.5	76.5
Basic-school entrepreneurial education and training	4.28	3.47
Government procurement of advanced technology products	3.45	3.50
Rule of law (-2.5 to 2.5 best)	1.72	1.05
Demography		
Population size, mln	38.0	447.2
Change in population, %	0.9	0.0
Share of population aged 15-64	66.1	64.1
Population density (population / km2)	4.2	111.8

The performance of the **United States** is above that of the EU, and the country is a Strong Innovator. Performance has increased in particular in 2020 and 2021 due to a very strong increase in Product innovators.



Columns show performance relative to EU in 2015. The red triangle and white numbers show performance relative to EU in the same year.

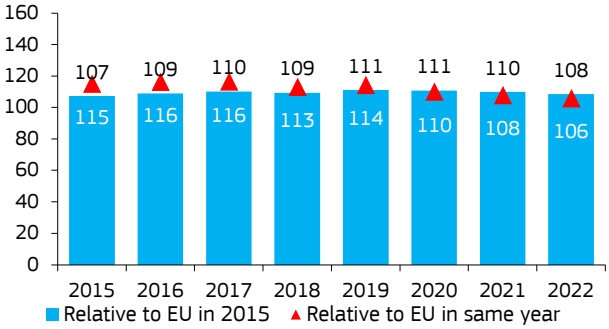
Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

United States	2022	Change
Doctorate graduates	83.4	5.0
Tertiary education	128.0	20.2
International co-publications	112.7	43.9
Most cited publications	136.8	-15.9
R&D expenditure public sector	96.1	5.3
Government funding business R&D	127.3	-23.2
R&D expenditure business sector	180.0	54.8
Employment in ICT	109.0	7.1
Product innovators	77.5	64.4
Business process innovators	74.3	-58.5
Innovation co-operation	591.5	0.0
Public-private co-publications	116.6	17.1
PCT patent applications	112.9	-16.8
Trademark applications	72.9	22.3
Design applications	35.2	3.2
Medium & high-tech product exports	93.6	1.4
Knowledge-intensive services exports	100.8	27.6
Exposure to air pollution	175.6	-7.7
Environment-related technologies	71.7	-27.0

Best three (green) and worst (orange) three indicators highlighted.

Structural differences	US	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	65,800	46,400
Change in GDP, %	0.5	-0.4
Employment share in Agriculture	1.4	4.5
Employment share in Industry	19.8	25.0
Employment share in Services	78.8	70.5
Manufacturing - share in total value added	11.1	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	16.4	7.3
FDI net inflows (% GDP)	1.16	1.03
Top R&D spending firms per mln population	23.4	18.3
- average R&D spending, mln Euros	432.1	233.1
Number of Unicorns (July 2021)	629	98
Buyer sophistication 1-7 (best)	5.02	3.73
Governance and policy framework		
Ease of starting a business	83.7	76.5
Basic-school entrepreneurial education and training	4.18	3.47
Government procurement of advanced technology products	4.52	3.50
Rule of law (-2.5 to 2.5 best)	1.45	1.05
Demography		
Population size, mln	330.6	447.2
Change in population, %	0.5	0.0
Share of population aged 15-64	65.0	64.1
Population density (population / km2)	36.1	111.8

The performance of **Australia** is above that of the EU, and the country is a Strong Innovator. Performance has increased since 2015. Australia's strengths are in International and Public-private co-publications, and Exposure to air pollution.



Columns show performance relative to EU in 2015. The red triangle and white numbers show performance relative to EU in the same year.

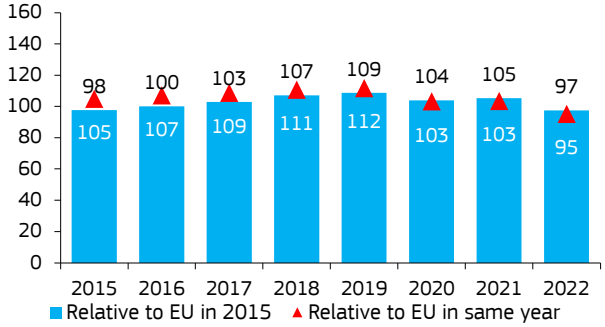
Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

Australia	2022	Change
Doctorate graduates	140.1	25.2
Tertiary education	134.8	25.3
International co-publications	394.9	239.9
Most cited publications	135.5	-5.1
R&D expenditure public sector	109.4	-6.0
Government funding business R&D	85.9	-46.0
R&D expenditure business sector	63.5	-21.0
Employment in ICT	104.0	14.6
Product innovators	105.2	-22.8
Business process innovators	123.9	-21.6
Innovation co-operation	140.3	-80.5
Public-private co-publications	219.2	108.4
PCT patent applications	63.1	-13.9
Trademark applications	191.6	2.8
Design applications	78.2	-13.2
Medium & high-tech product exports	12.9	-4.6
Knowledge-intensive services exports	43.9	9.4
Exposure to air pollution	199.7	-1.6
Environment-related technologies	83.2	-1.8

Best three (green) and worst (orange) three indicators highlighted.

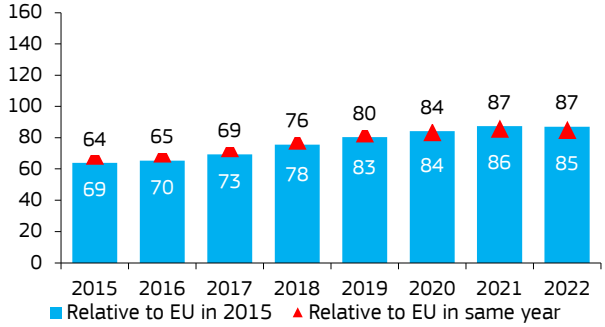
Structural differences	AU	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	53,600	46,400
Change in GDP, %	0.0	-0.4
Employment share in Agriculture	2.6	4.5
Employment share in Industry	19.5	25.0
Employment share in Services	77.9	70.5
Manufacturing - share in total value added	5.6	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	10.5	7.3
FDI net inflows (% GDP)	2.83	1.03
Top R&D spending firms per mln population	4.4	18.3
- average R&D spending, mln Euros	248.3	233.1
Number of Unicorns (July 2021)	8	98
Buyer sophistication 1-7 (best)	3.97	3.73
Governance and policy framework		
Ease of starting a business	80.9	76.5
Basic-school entrepreneurial education and training	4.05	3.47
Government procurement of advanced technology products	3.34	3.50
Rule of law (-2.5 to 2.5 best)	1.70	1.05
Demography		
Population size, mln	25.6	447.2
Change in population, %	0.7	0.0
Share of population aged 15-64	64.5	64.1
Population density (population / km2)	3.3	111.8

The performance of **Japan** is below that of the EU, and the country is a Moderate Innovator. Performance has not increased since 2015. Relative strengths are in Tertiary education, Business R&D expenditures and Patent applications.



Columns show performance relative to EU in 2015. The red triangle and white numbers show performance relative to EU in the same year.

The performance of **China** is above that of the EU, and the country is a Moderate Innovator. Performance has increased strongly since 2015. Relative strengths are in Business R&D expenditures, Trademark applications and Design applications.



Columns show performance relative to EU in 2015. The red triangle and white numbers show performance relative to EU in the same year.

Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

Japan	2022	Change
Doctorate graduates	50.0	17.9
Tertiary education	151.9	9.0
International co-publications	49.8	22.9
Most cited publications	57.8	-5.7
R&D expenditure public sector	88.0	-12.3
Government funding business R&D	69.5	9.6
R&D expenditure business sector	178.4	6.5
Employment in ICT	103.1	19.7
Product innovators	41.6	-13.4
Business process innovators	70.4	-60.0
Innovation co-operation	103.2	-307.0
Public-private co-publications	87.1	16.4
PCT patent applications	379.0	-1.5
Trademark applications	138.6	55.7
Design applications	86.3	-3.1
Medium & high-tech product exports	129.6	-1.9
Knowledge-intensive services exports	95.7	34.0
Exposure to air pollution	98.7	2.1
Environment-related technologies	80.1	-23.7

Best three (green) and worst (orange) three indicators highlighted.

Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

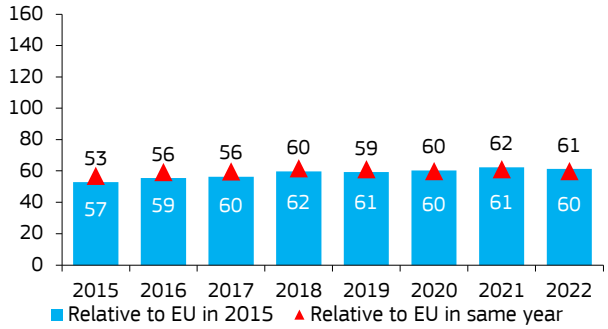
China	2022	Change
Doctorate graduates	N/A	N/A
Tertiary education	34.6	7.7
International co-publications	19.1	15.7
Most cited publications	111.0	36.1
R&D expenditure public sector	75.8	13.4
Government funding business R&D	77.3	7.2
R&D expenditure business sector	127.3	24.7
Employment in ICT	N/A	N/A
Product innovators	N/A	N/A
Business process innovators	N/A	N/A
Innovation co-operation	N/A	N/A
Public-private co-publications	40.1	34.3
PCT patent applications	103.2	40.0
Trademark applications	675.4	392.4
Design applications	461.6	-104.8
Medium & high-tech product exports	106.8	7.4
Knowledge-intensive services exports	70.2	12.1
Exposure to air pollution	28.2	-71.8
Environment-related technologies	70.8	-5.5

Best three (green) and worst (orange) three indicators highlighted.

Structural differences	**JP**	**EU**
Performance and structure of the economy		
GDP per capita, PPP (international $)	42,400	46,400
Change in GDP, %	-1.1	-0.4
Employment share in Agriculture	3.4	4.5
Employment share in Industry	24.4	25.0
Employment share in Services	72.1	70.5
Manufacturing - share in total value added	20.5	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	5.8	7.3
FDI net inflows (% GDP)	0.83	1.03
Top R&D spending firms per mln population	24.3	18.3
- average R&D spending, mln Euros	364.5	233.1
Number of Unicorns (July 2021)	6	98
Buyer sophistication 1-7 (best)	4.91	3.73
Governance and policy framework		
Ease of starting a business	78.0	76.5
Basic-school entrepreneurial education and training	2.80	3.47
Government procurement of advanced technology products	4.06	3.50
Rule of law (-2.5 to 2.5 best)	1.53	1.05
Demography		
Population size, mln	126.2	447.2
Change in population, %	-0.4	0.0
Share of population aged 15-64	59.2	64.1
Population density (population / km2)	346.2	111.8

Structural differences	**CN**	**EU**
Performance and structure of the economy		
GDP per capita, PPP (international $)	17,700	46,400
Change in GDP, %	5.0	-0.4
Employment share in Agriculture	26.1	4.5
Employment share in Industry	28.0	25.0
Employment share in Services	45.9	70.5
Manufacturing - share in total value added	26.9	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	8.7	7.3
FDI net inflows (% GDP)	1.58	1.03
Top R&D spending firms per mln population	3.9	18.3
- average R&D spending, mln Euros	217.2	233.1
Number of Unicorns (July 2021)	173	98
Buyer sophistication 1-7 (best)	4.43	3.73
Governance and policy framework		
Ease of starting a business	72.4	76.5
Basic-school entrepreneurial education and training	4.27	3.47
Government procurement of advanced technology products	4.38	3.50
Rule of law (-2.5 to 2.5 best)	1.72	1.05
Demography		
Population size, mln	1,410.4	447.2
Change in population, %	0.2	0.0
Share of population aged 15-64	70.3	64.1
Population density (population / km2)	149.6	111.8

The performance of **Brazil** is below that of the EU, and the country is an Emerging Innovator. Performance has increased since 2015. Relative strengths are in Business process innovation, Trademarks and Exposure to air pollution applications.



Columns show performance relative to EU in 2015. The red triangle and white numbers show performance relative to EU in the same year.

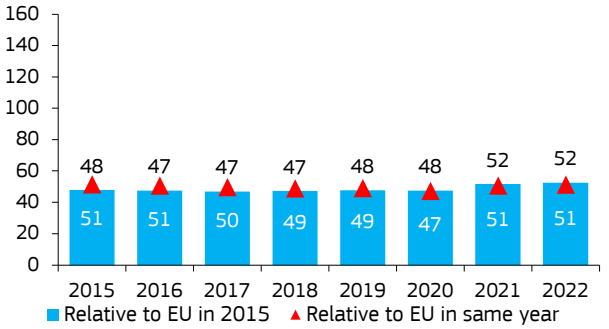
Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

Brazil	2022	Change
Doctorate graduates	29.6	7.4
Tertiary education	58.1	23.5
International co-publications	23.1	16.1
Most cited publications	55.9	3.5
R&D expenditure public sector	N/A	N/A
Government funding business R&D	31.1	19.5
R&D expenditure business sector	N/A	N/A
Employment in ICT	42.7	3.0
Product innovators	62.7	2.7
Business process innovators	197.4	0.0
Innovation co-operation	108.4	-23.1
Public-private co-publications	12.3	6.9
PCT patent applications	10.5	0.7
Trademark applications	165.8	61.8
Design applications	28.9	-2.3
Medium & high-tech product exports	37.5	-12.4
Knowledge-intensive services exports	83.0	-3.0
Exposure to air pollution	115.5	-13.5
Environment-related technologies	87.1	7.1

Best three (green) and worst (orange) three indicators highlighted.

Structural differences	BR	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	15,400	46,400
Change in GDP, %	-0.4	-0.4
Employment share in Agriculture	9.3	4.5
Employment share in Industry	20.2	25.0
Employment share in Services	70.5	70.5
Manufacturing - share in total value added	10.3	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	22.6	7.3
FDI net inflows (% GDP)	3.46	1.03
Top R&D spending firms per mln population	0.3	18.3
- average R&D spending, mln Euros	125.6	233.1
Number of Unicorns (July 2021)	17	98
Buyer sophistication 1-7 (best)	3.51	3.73
Governance and policy framework		
Ease of starting a business	57.8	76.5
Basic-school entrepreneurial education and training	2.58	3.47
Government procurement of advanced technology products	2.96	3.50
Rule of law (-2.5 to 2.5 best)	-0.20	1.05
Demography		
Population size, mln	212.5	447.2
Change in population, %	0.7	0.0
Share of population aged 15-64	69.7	64.1
Population density (population / km2)	25.4	111.8

The performance of **Chile** is below that of the EU, and the country is an Emerging Innovator. Performance has increased since 2015. Relative strengths are in Trademark applications and Environment-related technologies.



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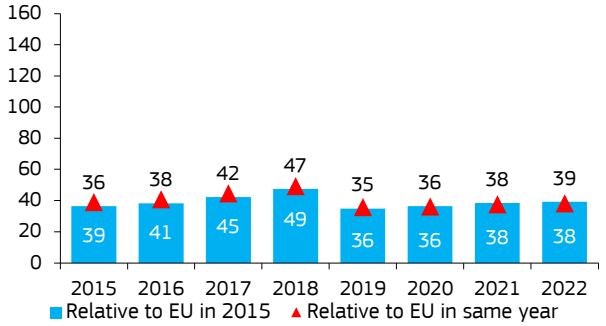
Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

Chile	2022	Change
Doctorate graduates	18.9	3.1
Tertiary education	83.3	18.4
International co-publications	88.8	62.6
Most cited publications	65.9	6.0
R&D expenditure public sector	27.7	2.9
Government funding business R&D	11.4	6.7
R&D expenditure business sector	14.3	1.6
Employment in ICT	57.9	-1.7
Product innovators	28.7	-13.1
Business process innovators	44.0	-51.5
Innovation co-operation	134.1	116.3
Public-private co-publications	29.3	19.1
PCT patent applications	18.8	2.5
Trademark applications	219.1	23.2
Design applications	13.9	-11.3
Medium & high-tech product exports	21.5	-4.6
Knowledge-intensive services exports	51.7	4.0
Exposure to air pollution	83.3	2.9
Environment-related technologies	181.9	27.7

Best three (green) and worst (orange) three indicators highlighted.

Structural differences	CL	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	26,500	46,400
Change in GDP, %	1.8	-0.4
Employment share in Agriculture	9.1	4.5
Employment share in Industry	22.4	25.0
Employment share in Services	68.4	70.5
Manufacturing - share in total value added	10.2	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	31.3	7.3
FDI net inflows (% GDP)	3.51	1.03
Top R&D spending firms per mln population	0.0	18.3
- average R&D spending, mln Euros	N/A	233.1
Number of Unicorns (July 2021)	2	98
Buyer sophistication 1-7 (best)	3.91	3.73
Governance and policy framework		
Ease of starting a business	72.3	76.5
Basic-school entrepreneurial education and training	3.06	3.47
Government procurement of advanced technology products	3.10	3.50
Rule of law (-2.5 to 2.5 best)	1.08	1.05
Demography		
Population size, mln	19.1	447.2
Change in population, %	0.7	0.0
Share of population aged 15-64	68.5	64.1
Population density (population / km2)	25.7	111.8

The performance of **South Africa** is well below that of the EU, and the country is an Emerging Innovator. Performance has increased since 2015. Relative strengths are in Environment-related technologies and Trademarks.



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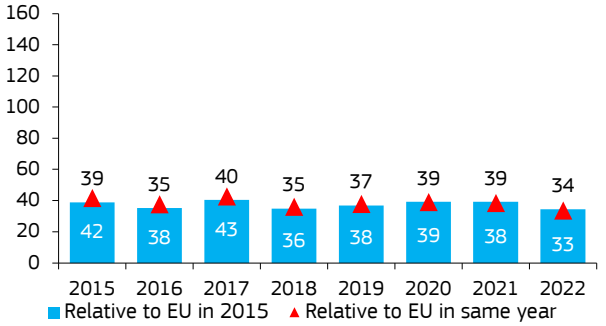
Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

South Africa	2022	Change
Doctorate graduates	N/A	N/A
Tertiary education	36.7	1.0
International co-publications	40.9	30.4
Most cited publications	73.6	2.4
R&D expenditure public sector	62.6	12.6
Government funding business R&D	6.6	-12.7
R&D expenditure business sector	23.6	0.6
Employment in ICT	N/A	N/A
Product innovators	N/A	N/A
Business process innovators	N/A	N/A
Innovation co-operation	N/A	N/A
Public-private co-publications	17.9	9.8
PCT patent applications	16.3	-3.7
Trademark applications	80.4	-5.2
Design applications	31.4	-10.5
Medium & high-tech product exports	61.0	-4.8
Knowledge-intensive services exports	24.2	9.0
Exposure to air pollution	47.6	-4.7
Environment-related technologies	84.9	-3.2

Best three (green) and worst (orange) three indicators highlighted.

Structural differences	ZA	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	14,000	46,400
Change in GDP, %	-2.2	-0.4
Employment share in Agriculture	5.2	4.5
Employment share in Industry	22.9	25.0
Employment share in Services	71.8	70.5
Manufacturing - share in total value added	11.7	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	14.1	7.3
FDI net inflows (% GDP)	0.61	1.03
Top R&D spending firms per mln population	0.2	18.3
- average R&D spending, mln Euros	49.4	233.1
Number of Unicorns (July 2021)	2	98
Buyer sophistication 1-7 (best)	3.96	3.73
Governance and policy framework		
Ease of starting a business	66.3	76.5
Basic-school entrepreneurial education and training	2.76	3.47
Government procurement of advanced technology products	3.02	3.50
Rule of law (-2.5 to 2.5 best)	-0.10	1.05
Demography		
Population size, mln	59.3	447.2
Change in population, %	1.3	0.0
Share of population aged 15-64	65.7	64.1
Population density (population / km2)	48.9	111.8

The performance of **Mexico** is well below that of the EU, and the country is an Emerging Innovator. Performance has decreased since 2015, particularly in 2022. Relative strengths are in Medium and high-tech product exports and Trademarks.



Columns show performance relative to EU in 2015. The red triangle and white numbers show performance relative to EU in the same year.

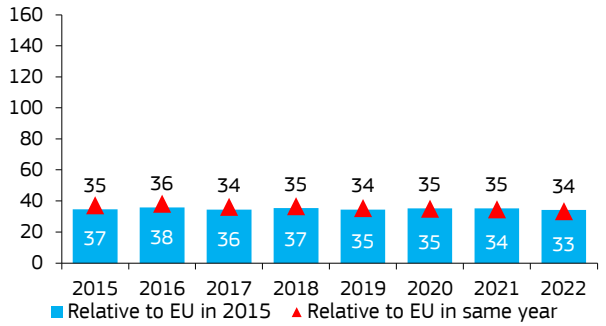
Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

Mexico	2022	Change
Doctorate graduates	12.4	2.6
Tertiary education	58.2	10.1
International co-publications	15.7	10.2
Most cited publications	42.9	-3.6
R&D expenditure public sector	30.9	-11.7
Government funding business R&D	7.7	0.1
R&D expenditure business sector	15.9	-6.7
Employment in ICT	20.7	-4.7
Product innovators	21.6	0.0
Business process innovators	N/A	N/A
Innovation co-operation	N/A	N/A
Public-private co-publications	6.3	3.9
PCT patent applications	4.2	-0.5
Trademark applications	119.9	21.0
Design applications	23.8	-3.6
Medium & high-tech product exports	123.2	1.3
Knowledge-intensive services exports	26.1	-17.7
Exposure to air pollution	103.4	-12.9
Environment-related technologies	75.3	-29.3

Best three (green) and worst (orange) three indicators highlighted.

Structural differences	MX	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	19,500	46,400
Change in GDP, %	-2.9	-0.4
Employment share in Agriculture	12.8	4.5
Employment share in Industry	25.9	25.0
Employment share in Services	61.3	70.5
Manufacturing - share in total value added	17.5	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	13.0	7.3
FDI net inflows (% GDP)	2.77	1.03
Top R&D spending firms per mln population	0.1	18.3
- average R&D spending, mln Euros	110.2	233.1
Number of Unicorns (July 2021)	7	98
Buyer sophistication 1-7 (best)	3.52	3.73
Governance and policy framework		
Ease of starting a business	72.4	76.5
Basic-school entrepreneurial education and training	3.44	3.47
Government procurement of advanced technology products	3.15	3.50
Rule of law (-2.5 to 2.5 best)	-0.65	1.05
Demography		
Population size, mln	128.9	447.2
Change in population, %	1.0	0.0
Share of population aged 15-64	66.5	64.1
Population density (population / km2)	66.3	111.8

The performance of **India** is well below that of the EU, and the country is an Emerging Innovator. Performance has increased marginally since 2015. Relative strengths are in Knowledge-intensive services exports and Trademarks.



Columns show performance relative to EU in 2015. The red triangle and white numbers show performance relative to EU in the same year.

Performance in 2022 relative to the EU in 2022 and change in performance between 2015 and 2022

India	2022	Change
Doctorate graduates	5.2	0.9
Tertiary education	48.1	0.0
International co-publications	5.2	4.8
Most cited publications	68.2	4.1
R&D expenditure public sector	55.5	-3.1
Government funding business R&D	N/A	N/A
R&D expenditure business sector	16.6	-2.5
Employment in ICT	N/A	N/A
Product innovators	N/A	N/A
Business process innovators	N/A	N/A
Innovation co-operation	N/A	N/A
Public-private co-publications	3.6	2.4
PCT patent applications	14.2	-0.6
Trademark applications	83.0	23.9
Design applications	20.7	1.3
Medium & high-tech product exports	61.0	10.6
Knowledge-intensive services exports	98.6	-13.8
Exposure to air pollution	16.2	-24.4
Environment-related technologies	71.1	-15.5

Best three (green) and worst (orange) three indicators highlighted.

Structural differences	**IN**	**EU**
Performance and structure of the economy		
GDP per capita, PPP (international $)	6,900	46,400
Change in GDP, %	-0.1	-0.4
Employment share in Agriculture	43.3	4.5
Employment share in Industry	25.0	25.0
Employment share in Services	31.7	70.5
Manufacturing - share in total value added	14.2	14.9
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	11.5	7.3
FDI net inflows (% GDP)	1.92	1.03
Top R&D spending firms per mln population	0.2	18.3
- average R&D spending, mln Euros	161.4	233.1
Number of Unicorns (July 2021)	68	98
Buyer sophistication 1-7 (best)	4.36	3.73
Governance and policy framework		
Ease of starting a business	66.5	76.5
Basic-school entrepreneurial education and training	4.64	3.47
Government procurement of advanced technology products	4.14	3.50
Rule of law (-2.5 to 2.5 best)	-0.01	1.05
Demography		
Population size, mln	1,379.9	447.2
Change in population, %	1.0	0.0
Share of population aged 15-64	67.2	64.1
Population density (population / km2)	464.1	111.8

6. Country profiles

This section provides individual profiles for the EU Member States and 12 other European and neighbouring countries (Albania, Bosnia and Herzegovina, Iceland, Israel, Montenegro, Norway, North Macedonia, Serbia, Switzerland, Turkey, Ukraine, and United Kingdom). Each profile includes the following information:

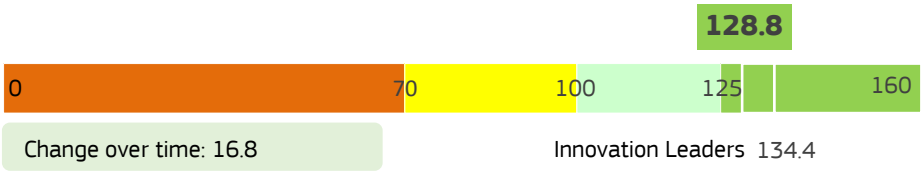
- The country's flag[21].
- A graphical summary of the key performances.
- A table providing a comparison of the respective country's innovation performance in 2022 and performance change between both 2015 and 2022 and between 2021, and 2022 ll relative to the EU score in 2015.
- A short listing of strengths and weaknesses.

Two-page country profiles are available on the EIS website.[22] In addition to the one page included in this report, the second page in the two-page country profile includes the following information:

- A graph showing the development of the country's innovation index over time between 2015 and 2022 as compared to country's initial performance in 2015.
- Graphs for each of the innovation dimensions showing the development over time between 2015 and 2022 as compared to country's initial performance in 2015.
- A table providing data for the contextual indicators, which are used as proxies for structural differences between countries.
- Complementary text highlighting key observations.

The order of countries is first the Member States and then the 12 other European and neighbouring countries. The order of the Member States is based on the alphabetical order of the names in their national language.

[21] https://flagicons.lipis.dev/ for most countries and https://flagpedia.net/organization/un for Switzerland



Belgium	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**128.8**	**16.8**	**4.3**
Human resources	**129.6**	**4.8**	**0.0**
Doctorate graduates	129.7	11.4	0.0
Population with tertiary education	159.3	0.0	0.0
Lifelong learning	93.3	0.0	0.0
Attractive research systems	**157.9**	**-0.8**	**19.0**
International scientific co-publications	180.4	76.3	23.0
Most cited publications	126.2	-18.4	-2.5
Foreign doctorate students	189.7	-34.1	62.3
Digitalisation	**123.2**	**0.0**	**0.0**
Broadband penetration	141.0	0.0	0.0
People with above basic overall digital skills	100.0	0.0	0.0
Finance and support	**129.0**	**44.5**	**24.3**
R&D expenditures in the public sector	121.2	33.9	17.7
Venture capital expenditures	106.6	48.5	23.9
Government support for business R&D	169.5	54.7	33.7
Firm investments	**137.8**	**47.4**	**5.0**
R&D expenditure in the business sector	167.6	70.5	15.5
Non-R&D Innovation expenditures	102.2	21.2	0.0
Innovation expenditures per employee	140.5	51.4	0.0
Use of information technologies	**166.3**	**0.0**	**-9.8**
Enterprises providing ICT training	181.3	0.0	-18.8
Employed ICT specialists	150.0	0.0	0.0
Innovators	**146.5**	**32.7**	**17.8**
Product innovators (SMEs)	134.5	22.0	34.5
Business process innovators (SMEs)	157.0	44.0	0.0
Linkages	**174.0**	**1.9**	**-9.8**
Innovative SMEs collaborating with others	223.6	-40.3	-25.5
Public-private co-publications	271.5	117.4	39.4
Job-to-job mobility of HRST	93.8	-11.8	-17.6
Intellectual assets	**87.1**	**-3.5**	**0.3**
PCT patent applications	95.4	-7.8	-0.2
Trademark applications	95.6	11.8	1.5
Design applications	66.8	-10.0	0.0
Employment impacts	**151.4**	**15.5**	**9.4**
Employment in knowledge-intensive activities	139.0	0.0	0.0
Employment in innovative enterprises	161.4	29.7	18.0
Sales impacts	**101.2**	**28.1**	**-0.5**
Medium and high-tech goods exports	93.2	14.0	-1.2
Knowledge-intensive services exports	97.8	11.8	4.3
Sales of innovative products	115.5	65.5	-5.1
Environmental sustainability	**100.8**	**10.9**	**-4.5**
Resource productivity	128.1	29.2	-2.6
Air emissions by fine particulate matter	103.0	7.6	1.1
Environment-related technologies	70.8	2.2	-12.5

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

BELGIUM is an **Innovation Leader** with performance at 128.8% of the EU average. Performance is below the average of the Innovation Leaders (134.4%). Performance is increasing (16.8%-points) at a rate higher than that of the EU (9.9%-points). The country's performance lead over the EU is becoming larger.

Relative strengths

- Public-private co-publications
- Innovative SMEs collaborating with others
- Foreign doctorate students
- Enterprises providing ICT training
- International scientific co-publications

Relative weaknesses

- Design applications
- Environment-related technologies
- Medium and high-tech goods exports
- Lifelong learning
- Job-to-job mobility of HRST

Strong increases since 2015

- Public-private co-publications
- International scientific co-publications
- R&D expenditure in the business sector

Strong decreases since 2015

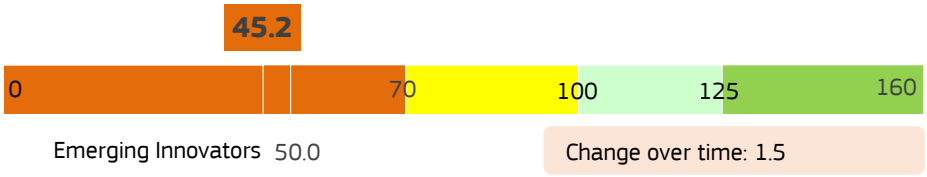
- Innovative SMEs collaborating with others
- Foreign doctorate students
- Most cited publications

Strong increases since 2021

- Foreign doctorate students
- Public-private co-publications
- Product innovators

Strong decreases since 2021

- Innovative SMEs collaborating with others
- Enterprises providing ICT training
- Job-to-job mobility of HRST



Bulgaria	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**45.2**		**1.5**	**3.0**
Human resources	**33.5**		**-4.8**	**-4.8**
Doctorate graduates	40.7		-11.4	-11.4
Population with tertiary education	53.5		0.0	0.0
Lifelong learning	0.0		0.0	0.0
Attractive research systems	**27.6**		**16.7**	**4.2**
International scientific co-publications	28.2		18.0	5.7
Most cited publications	18.6		9.9	2.0
Foreign doctorate students	44.0		30.6	7.4
Digitalisation	**47.0**		**4.8**	**4.8**
Broadband penetration	69.2		9.1	9.1
People with above basic overall digital skills	18.2		0.0	0.0
Finance and support	**22.6**		**-7.0**	**2.0**
R&D expenditures in the public sector	22.7		4.8	0.0
Venture capital expenditures	36.1		-31.3	7.9
Government support for business R&D	4.2		1.9	-1.4
Firm investments	**35.1**		**-6.5**	**-0.1**
R&D expenditure in the business sector	35.8		14.7	1.6
Non-R&D Innovation expenditures	62.5		-34.2	1.1
Innovation expenditures per employee	13.2		1.1	-2.8
Use of information technologies	**35.9**		**-26.1**	**-9.8**
Enterprises providing ICT training	18.8		-50.0	-18.8
Employed ICT specialists	54.5		0.0	0.0
Innovators	**56.0**		**56.7**	**27.8**
Product innovators (SMEs)	78.8		67.4	25.4
Business process innovators (SMEs)	36.0		45.4	30.4
Linkages	**34.4**		**24.2**	**15.8**
Innovative SMEs collaborating with others	56.9		51.8	37.7
Public-private co-publications	34.8		24.4	8.5
Job-to-job mobility of HRST	16.7		0.0	0.0
Intellectual assets	**74.1**		**-27.8**	**-6.2**
PCT patent applications	36.8		-2.0	-1.5
Trademark applications	113.2		25.2	10.0
Design applications	83.9		-98.4	-24.0
Employment impacts	**55.3**		**21.4**	**9.6**
Employment in knowledge-intensive activities	62.3		0.0	0.0
Employment in innovative enterprises	49.8		40.9	18.5
Sales impacts	**60.6**		**31.1**	**11.2**
Medium and high-tech goods exports	54.8		19.3	0.3
Knowledge-intensive services exports	71.3		51.1	24.8
Sales of innovative products	54.1		23.1	9.6
Environmental sustainability	**53.5**		**-26.6**	**-3.5**
Resource productivity	11.4		7.7	-0.3
Air emissions by fine particulate matter	50.7		-27.9	-6.7
Environment-related technologies	99.2		-48.3	-1.9

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

BULGARIA is an **Emerging Innovator** with performance at 45.2% of the EU average. Performance is below the average of the Emerging Innovators (50.0%). Performance is increasing (1.6%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Trademark applications
- Environment-related technologies
- Design applications
- Product innovators
- Knowledge-intensive services exports

Relative weaknesses

- Lifelong learning
- Government support for business R&D
- Resource productivity
- Innovation expenditures per employee
- Enterprises providing ICT training

Strong increases since 2015

- Product innovators
- Innovative SMEs collaborating with others
- Knowledge-intensive services exports

Strong decreases since 2015

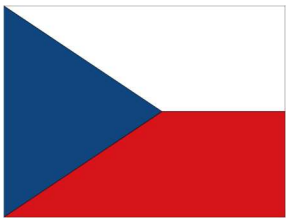
- Design applications
- Enterprises providing ICT training
- Environment-related technologies

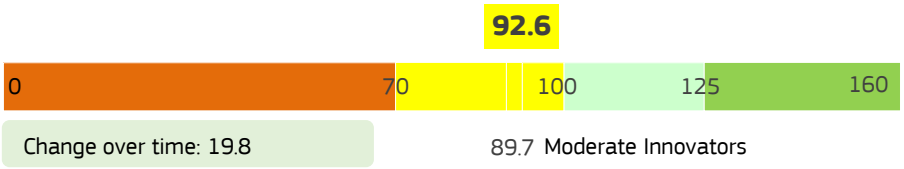
Strong increases since 2021

- Innovative SMEs collaborating with others
- Business process innovators
- Product innovators

Strong decreases since 2021

- Design applications
- Enterprises providing ICT training
- Doctorate graduates





Change over time: 19.8

89.7 Moderate Innovators

Czechia	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**92.6**		**19.8**	**11.7**
Human resources	**75.9**		**0.0**	**0.0**
Doctorate graduates	114.8		0.0	0.0
Population with tertiary education	61.5		0.0	0.0
Lifelong learning	44.4		0.0	0.0
Attractive research systems	**82.2**		**34.6**	**7.7**
International scientific co-publications	103.6		72.5	15.9
Most cited publications	44.6		5.5	1.4
Foreign doctorate students	126.9		63.0	13.8
Digitalisation	**75.8**		**6.3**	**6.3**
Broadband penetration	64.1		12.1	12.1
People with above basic overall digital skills	90.9		0.0	0.0
Finance and support	**86.2**		**12.0**	**21.7**
R&D expenditures in the public sector	98.5		-12.9	6.5
Venture capital expenditures	83.6		82.9	64.0
Government support for business R&D	74.0		-27.3	-1.2
Firm investments	**94.0**		**28.8**	**19.0**
R&D expenditure in the business sector	78.4		14.7	1.6
Non-R&D Innovation expenditures	158.8		49.8	45.0
Innovation expenditures per employee	56.9		21.2	9.8
Use of information technologies	**118.5**		**9.8**	**0.0**
Enterprises providing ICT training	131.3		18.8	0.0
Employed ICT specialists	104.5		0.0	0.0
Innovators	**138.2**		**104.6**	**65.9**
Product innovators (SMEs)	136.3		66.1	55.8
Business process innovators (SMEs)	139.8		145.7	76.8
Linkages	**92.2**		**45.8**	**10.7**
Innovative SMEs collaborating with others	127.8		55.6	34.5
Public-private co-publications	130.8		70.7	14.8
Job-to-job mobility of HRST	47.9		26.5	-11.8
Intellectual assets	**62.9**		**1.7**	**2.9**
PCT patent applications	43.5		-5.8	-3.7
Trademark applications	83.7		20.5	10.7
Design applications	67.3		-3.6	4.8
Employment impacts	**106.1**		**21.1**	**19.7**
Employment in knowledge-intensive activities	96.1		0.0	0.0
Employment in innovative enterprises	114.1		40.5	37.8
Sales impacts	**97.4**		**7.3**	**6.5**
Medium and high-tech goods exports	124.1		4.3	-5.8
Knowledge-intensive services exports	61.7		17.9	13.7
Sales of innovative products	110.4		-1.2	14.3
Environmental sustainability	**98.8**		**15.2**	**1.0**
Resource productivity	78.9		29.0	4.6
Air emissions by fine particulate matter	115.4		15.1	1.9
Environment-related technologies	93.7		6.0	-2.7

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

CZECHIA is a **Moderate Innovator** with performance at 92.6% of the EU average. Performance is above the average of the Moderate Innovators (89.7%). Performance is increasing (19.8%-points) at a rate higher than that of the EU (9.9%-points). The country's performance gap to the EU is becoming smaller.

Relative strengths

- Non-R&D Innovation expenditures
- Business process innovators
- Product innovators
- Enterprises providing ICT training
- Public-private co-publications

Relative weaknesses

- PCT patent applications
- Lifelong learning
- Most cited publications
- Job-to-job mobility of HRST
- Innovation expenditures per employee

Strong increases since 2015

- Business process innovators
- Venture capital expenditures
- International scientific co-publications

Strong decreases since 2015

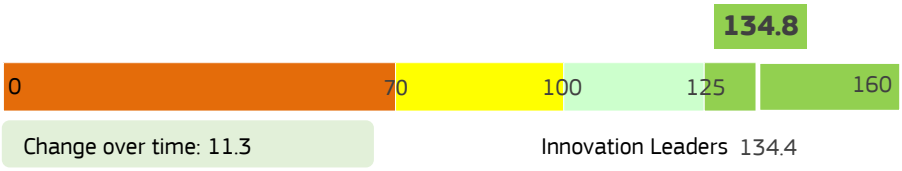
- Government support for business R&D
- R&D expenditures in the public sector
- PCT patent applications

Strong increases since 2021

- Business process innovators
- Venture capital expenditures
- Product innovators

Strong decreases since 2021

- Job-to-job mobility of HRST
- Medium and high-tech goods exports
- PCT patent applications



Denmark	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**134.8**		**11.3**	**0.4**
Human resources	**170.1**		**-14.5**	**-9.7**
Doctorate graduates	144.5		-34.3	-22.9
Population with tertiary education	148.3		0.0	0.0
Lifelong learning	228.9		0.0	0.0
Attractive research systems	**195.6**		**28.3**	**-1.1**
International scientific co-publications	259.6		110.9	0.0
Most cited publications	145.2		-14.1	1.2
Foreign doctorate students	210.8		44.1	-7.3
Digitalisation	**152.2**		**0.0**	**0.0**
Broadband penetration	153.8		0.0	0.0
People with above basic overall digital skills	150.0		0.0	0.0
Finance and support	**111.2**		**39.4**	**16.5**
R&D expenditures in the public sector	143.9		0.0	0.0
Venture capital expenditures	130.3		122.2	50.3
Government support for business R&D	43.6		7.4	3.9
Firm investments	**83.1**		**-21.9**	**-37.4**
R&D expenditure in the business sector	120.9		-3.1	0.0
Non-R&D Innovation expenditures	101.6		47.6	25.3
Innovation expenditures per employee	37.3		-109.1	-135.4
Use of information technologies	**156.5**		**0.0**	**-3.3**
Enterprises providing ICT training	162.5		0.0	-6.3
Employed ICT specialists	150.0		0.0	0.0
Innovators	**117.2**		**63.4**	**-2.0**
Product innovators (SMEs)	120.2		46.2	-0.1
Business process innovators (SMEs)	114.5		81.7	-4.0
Linkages	**218.0**		**21.6**	**2.2**
Innovative SMEs collaborating with others	127.6		15.7	5.9
Public-private co-publications	471.5		143.5	0.0
Job-to-job mobility of HRST	181.3		-26.5	0.0
Intellectual assets	**143.3**		**-0.8**	**-5.1**
PCT patent applications	130.6		-8.3	-2.9
Trademark applications	114.7		13.8	-0.6
Design applications	190.6		-3.1	-11.1
Employment impacts	**108.4**		**6.7**	**-5.5**
Employment in knowledge-intensive activities	122.1		0.0	0.0
Employment in innovative enterprises	97.5		12.8	-10.6
Sales impacts	**104.2**		**26.6**	**37.1**
Medium and high-tech goods exports	89.4		11.8	-5.3
Knowledge-intensive services exports	110.0		5.6	14.2
Sales of innovative products	115.0		70.5	119.0
Environmental sustainability	**127.8**		**5.6**	**1.2**
Resource productivity	66.2		12.3	2.7
Air emissions by fine particulate matter	126.3		6.5	1.4
Environment-related technologies	190.8		0.0	0.0

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

DENMARK is an **Innovation Leader** with performance at 134.8% of the EU average. Performance is just above the average of the Innovation Leaders (134.4%). Performance is increasing (11.3%-points) at a rate higher than that of the EU (9.9%-points). The country's performance lead over the EU is becoming larger.

Relative strengths

- Public-private co-publications
- International scientific co-publications
- Lifelong learning
- Foreign doctorate students
- Environment-related technologies

Relative weaknesses

- Innovation expenditures per employee
- Government support for business R&D
- Resource productivity
- Medium and high-tech goods exports
- Employment in innovative enterprises

Strong increases since 2015

- Public-private co-publications
- Venture capital expenditures
- International scientific co-publications

Strong decreases since 2015

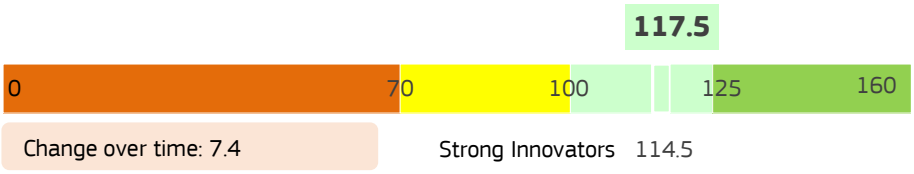
- Innovation expenditures per employee
- Doctorate graduates
- Job-to-job mobility of HRST

Strong increases since 2021

- Sales of innovative products
- Venture capital expenditures
- Non-R&D Innovation expenditures

Strong decreases since 2021

- Innovation expenditures per employee
- Doctorate graduates
- Design applications



Germany	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**117.5**	**7.4**	**-1.7**
Human resources	**99.8**	**-4.8**	**-4.8**
Doctorate graduates	159.3	-11.4	-11.4
Population with tertiary education	66.4	0.0	0.0
Lifelong learning	65.6	0.0	0.0
Attractive research systems	**109.9**	**3.3**	**1.6**
International scientific co-publications	95.5	34.6	7.9
Most cited publications	107.8	-8.6	-0.3
Foreign doctorate students	131.9	0.0	0.0
Digitalisation	**84.7**	**9.5**	**9.5**
Broadband penetration	97.4	18.2	18.2
People with above basic overall digital skills	68.2	0.0	0.0
Finance and support	**93.4**	**19.7**	**10.1**
R&D expenditures in the public sector	137.9	14.5	8.1
Venture capital expenditures	90.8	55.4	20.3
Government support for business R&D	40.1	-10.1	2.2
Firm investments	**138.0**	**18.4**	**-3.9**
R&D expenditure in the business sector	139.2	15.5	-5.4
Non-R&D Innovation expenditures	133.5	4.6	-6.3
Innovation expenditures per employee	140.5	34.9	0.0
Use of information technologies	**121.7**	**-22.8**	**-26.1**
Enterprises providing ICT training	125.0	-43.8	-50.0
Employed ICT specialists	118.2	0.0	0.0
Innovators	**141.1**	**53.4**	**-11.5**
Product innovators (SMEs)	131.4	6.1	-25.9
Business process innovators (SMEs)	149.5	103.7	3.9
Linkages	**141.7**	**27.9**	**-4.0**
Innovative SMEs collaborating with others	117.8	42.1	-19.2
Public-private co-publications	185.8	63.5	17.3
Job-to-job mobility of HRST	141.7	0.0	0.0
Intellectual assets	**124.0**	**-15.5**	**-1.3**
PCT patent applications	132.7	-11.3	-3.0
Trademark applications	107.7	10.2	6.0
Design applications	129.3	-39.9	-4.6
Employment impacts	**128.9**	**4.2**	**-2.6**
Employment in knowledge-intensive activities	101.3	0.0	0.0
Employment in innovative enterprises	150.8	8.1	-5.0
Sales impacts	**112.6**	**3.6**	**-0.8**
Medium and high-tech goods exports	124.9	-0.4	-2.6
Knowledge-intensive services exports	104.8	5.9	6.5
Sales of innovative products	107.3	6.2	-6.9
Environmental sustainability	**122.5**	**9.5**	**0.0**
Resource productivity	133.1	52.4	8.0
Air emissions by fine particulate matter	122.4	3.0	-0.2
Environment-related technologies	112.2	-11.9	-5.2

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

GERMANY is a **Strong Innovator** with performance at 117.5% of the EU average. Performance is above the average of the Strong Innovators (114.5%). Performance is increasing (7.4%-points) at a rate lower than that of the EU (9.9%-points). The country's performance lead over the EU is becoming smaller.

Relative strengths

- Public-private co-publications
- Doctorate graduates
- Employment in innovative enterprises
- Business process innovators
- Job-to-job mobility of HRST

Relative weaknesses

- Government support for business R&D
- Lifelong learning
- Population with tertiary education
- People with above basic overall digital skills
- Venture capital expenditures

Strong increases since 2015

- Business process innovators
- Public-private co-publications
- Venture capital expenditures

Strong decreases since 2015

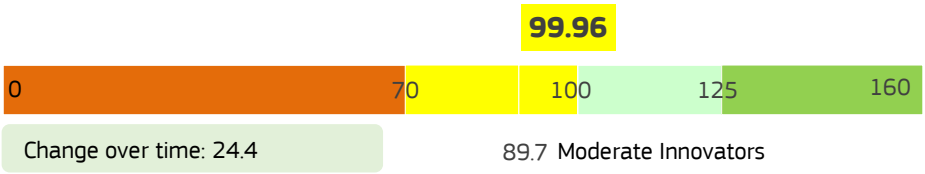
- Enterprises providing ICT training
- Design applications
- Environment-related technologies

Strong increases since 2021

- Venture capital expenditures
- Broadband penetration
- Public-private co-publications

Strong decreases since 2021

- Enterprises providing ICT training
- Product innovators
- Innovative SMEs collaborating with others



Change over time: 24.4

89.7 Moderate Innovators

Estonia	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**99.96**		**24.4**	**-8.9**
Human resources	**123.2**		**-4.8**	**-4.8**
Doctorate graduates	85.2		-11.4	-11.4
Population with tertiary education	112.2		0.0	0.0
Lifelong learning	184.4		0.0	0.0
Attractive research systems	**124.0**		**64.3**	**4.8**
International scientific co-publications	162.7		115.8	7.6
Most cited publications	86.3		15.4	-6.6
Foreign doctorate students	147.2		123.4	27.2
Digitalisation	**86.6**		**6.3**	**6.3**
Broadband penetration	69.2		12.1	12.1
People with above basic overall digital skills	109.1		0.0	0.0
Finance and support	**92.8**		**4.7**	**16.2**
R&D expenditures in the public sector	100.0		-16.1	4.8
Venture capital expenditures	134.5		78.5	39.0
Government support for business R&D	26.9		-43.1	8.1
Firm investments	**93.7**		**25.0**	**-7.6**
R&D expenditure in the business sector	62.8		12.4	8.5
Non-R&D Innovation expenditures	140.3		37.0	-42.0
Innovation expenditures per employee	83.3		25.1	11.5
Use of information technologies	**127.2**		**9.8**	**0.0**
Enterprises providing ICT training	81.3		18.8	0.0
Employed ICT specialists	177.3		0.0	0.0
Innovators	**95.3**		**107.8**	**-88.4**
Product innovators (SMEs)	92.0		83.8	-110.2
Business process innovators (SMEs)	98.3		133.3	-65.2
Linkages	**163.9**		**90.5**	**-57.3**
Innovative SMEs collaborating with others	154.8		80.9	-127.5
Public-private co-publications	198.6		141.8	26.1
Job-to-job mobility of HRST	156.3		76.5	-32.4
Intellectual assets	**120.3**		**24.8**	**4.3**
PCT patent applications	62.4		-5.8	-4.0
Trademark applications	186.7		72.2	11.8
Design applications	129.3		25.2	8.6
Employment impacts	**144.9**		**92.9**	**0.0**
Employment in knowledge-intensive activities	113.0		0.0	0.0
Employment in innovative enterprises	170.2		177.9	0.0
Sales impacts	**67.1**		**3.9**	**-7.4**
Medium and high-tech goods exports	56.5		-8.5	-7.5
Knowledge-intensive services exports	77.6		32.7	18.1
Sales of innovative products	66.5		-13.3	-36.6
Environmental sustainability	**33.5**		**-29.4**	**-17.4**
Resource productivity	16.6		14.3	-2.0
Air emissions by fine particulate matter	35.4		23.1	1.1
Environment-related technologies	47.5		-121.8	-50.1

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ESTONIA is a **Moderate Innovator** with performance at 99.96% of the EU average. Performance is above the average of the Moderate Innovators (89.7%). Performance is increasing (24.4%-points) at a rate higher than that of the EU (9.9%-points). The country's performance gap to the EU has almost disappeared and Estonia is performing only marginally below the EU average despite the decline between 2021 and 2022.

Relative strengths

- Public-private co-publications
- Trademark applications
- Lifelong learning
- Employed ICT specialists
- Employment in innovative enterprises

Relative weaknesses

- Resource productivity
- Government support for business R&D
- Air emissions by fine particulate matter
- Environment-related technologies
- Medium and high-tech goods exports

Strong increases since 2015

- Employment in innovative enterprises
- Public-private co-publications
- Business process innovators

Strong decreases since 2015

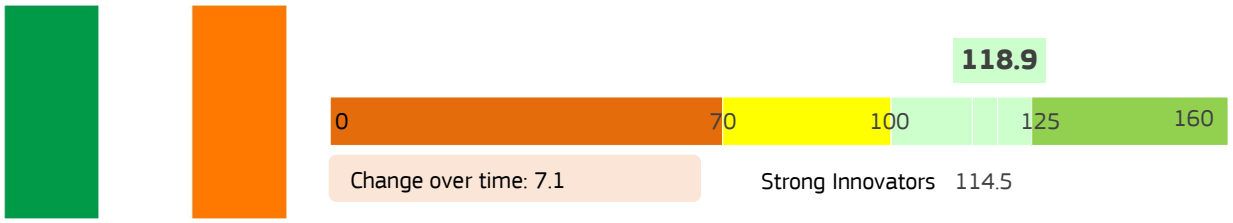
- Environment-related technologies
- Government support for business R&D
- R&D expenditures in the public sector

Strong increases since 2021

- Venture capital expenditures
- Foreign doctorate students
- Public-private co-publications

Strong decreases since 2021

- Innovative SMEs collaborating with others
- Product innovators
- Business process innovators



Ireland	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**118.9**		**7.1**	**7.7**
Human resources	**169.1**		**4.8**	**0.0**
Doctorate graduates	144.5		11.4	0.0
Population with tertiary education	225.4		0.0	0.0
Lifelong learning	131.1		0.0	0.0
Attractive research systems	**158.0**		**33.0**	**7.4**
International scientific co-publications	179.3		100.3	27.4
Most cited publications	118.0		-11.8	-4.7
Foreign doctorate students	207.2		68.4	15.1
Digitalisation	**123.3**		**1.6**	**1.6**
Broadband penetration	92.3		3.0	3.0
People with above basic overall digital skills	163.6		0.0	0.0
Finance and support	**78.9**		**0.0**	**11.1**
R&D expenditures in the public sector	30.3		-19.4	0.0
Venture capital expenditures	94.0		36.9	-1.8
Government support for business R&D	120.4		-12.0	39.4
Firm investments	**73.2**		**-9.0**	**-17.6**
R&D expenditure in the business sector	58.1		-17.1	0.0
Non-R&D Innovation expenditures	12.2		-62.9	-64.7
Innovation expenditures per employee	132.9		52.6	12.7
Use of information technologies	**162.0**		**6.5**	**-13.0**
Enterprises providing ICT training	143.8		12.5	-25.0
Employed ICT specialists	181.8		0.0	0.0
Innovators	**115.8**		**-18.8**	**29.4**
Product innovators (SMEs)	107.8		-30.9	4.2
Business process innovators (SMEs)	122.8		-5.9	56.2
Linkages	**177.1**		**88.8**	**10.8**
Innovative SMEs collaborating with others	201.4		100.5	6.8
Public-private co-publications	242.6		112.4	24.4
Job-to-job mobility of HRST	N/A		N/A	N/A
Intellectual assets	**61.2**		**-15.7**	**-1.5**
PCT patent applications	63.3		-23.5	-7.4
Trademark applications	74.1		-21.9	4.1
Design applications	44.8		-1.7	1.3
Employment impacts	**153.8**		**-13.3**	**29.5**
Employment in knowledge-intensive activities	215.6		0.0	0.0
Employment in innovative enterprises	104.8		-25.4	56.5
Sales impacts	**137.3**		**23.2**	**30.8**
Medium and high-tech goods exports	118.0		35.6	4.9
Knowledge-intensive services exports	131.1		1.6	1.9
Sales of innovative products	169.2		32.2	98.1
Environmental sustainability	**101.7**		**20.0**	**8.2**
Resource productivity	134.5		85.3	28.1
Air emissions by fine particulate matter	123.3		9.4	1.7
Environment-related technologies	37.2		-11.8	2.3

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

IRELAND is a **Strong Innovator** with performance at 118.9% of the EU average. Performance is above the average of the Strong Innovators (114.5%). Performance is increasing (7.1%-points) at a rate lower than that of the EU (9.9%-points). The country's performance lead over the EU is becoming smaller.

Relative strengths

- Public-private co-publications
- Population with tertiary education
- Employment in knowledge-intensive activities
- Foreign doctorate students
- Innovative SMEs collaborating with others

Relative weaknesses

- Non-R&D Innovation expenditures
- R&D expenditures in the public sector
- Environment-related technologies
- Design applications
- R&D expenditure in the business sector

Strong increases since 2015

- Public-private co-publications
- Innovative SMEs collaborating with others
- International scientific co-publications

Strong decreases since 2015

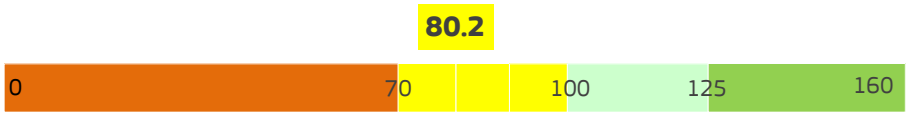
- Non-R&D Innovation expenditures
- Product innovators
- Employment in innovative enterprises

Strong increases since 2021

- Sales of innovative products
- Employment in innovative enterprises
- Business process innovators

Strong decreases since 2021

- Non-R&D Innovation expenditures
- Enterprises providing ICT training
- PCT patent applications



Change over time: 24.1

89.7 Moderate Innovators

Greece	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**80.2**		**24.1**	**3.7**
Human resources	**72.4**		**4.8**	**-4.8**
Doctorate graduates	70.3		11.4	-11.4
Population with tertiary education	118.3		0.0	0.0
Lifelong learning	18.9		0.0	0.0
Attractive research systems	**66.8**		**9.8**	**-1.2**
International scientific co-publications	84.2		42.1	8.3
Most cited publications	89.6		1.5	0.5
Foreign doctorate students	1.4		-2.1	-13.9
Digitalisation	**57.3**		**0.0**	**0.0**
Broadband penetration	38.5		0.0	0.0
People with above basic overall digital skills	81.8		0.0	0.0
Finance and support	**60.7**		**35.2**	**7.9**
R&D expenditures in the public sector	101.5		40.3	17.7
Venture capital expenditures	48.1		49.5	1.5
Government support for business R&D	25.7		13.6	1.0
Firm investments	**71.0**		**24.8**	**5.5**
R&D expenditure in the business sector	43.2		32.6	7.8
Non-R&D Innovation expenditures	106.2		9.0	-6.0
Innovation expenditures per employee	66.8		33.1	15.0
Use of information technologies	**37.0**		**3.3**	**-9.8**
Enterprises providing ICT training	50.0		6.3	-18.8
Employed ICT specialists	22.7		0.0	0.0
Innovators	**167.3**		**106.9**	**15.1**
Product innovators (SMEs)	179.0		123.7	16.6
Business process innovators (SMEs)	157.0		89.0	13.5
Linkages	**114.3**		**59.2**	**-8.8**
Innovative SMEs collaborating with others	174.8		56.6	-16.0
Public-private co-publications	134.4		92.1	19.2
Job-to-job mobility of HRST	58.3		47.1	-14.7
Intellectual assets	**53.8**		**12.8**	**5.1**
PCT patent applications	44.5		8.7	3.1
Trademark applications	91.0		29.9	8.5
Design applications	27.4		4.7	5.0
Employment impacts	**124.2**		**38.1**	**22.6**
Employment in knowledge-intensive activities	80.5		0.0	0.0
Employment in innovative enterprises	158.9		73.0	43.3
Sales impacts	**90.6**		**39.6**	**8.2**
Medium and high-tech goods exports	27.1		14.1	-9.8
Knowledge-intensive services exports	99.3		45.1	46.1
Sales of innovative products	158.0		66.6	-12.2
Environmental sustainability	**71.1**		**-6.3**	**1.1**
Resource productivity	86.3		45.5	17.1
Air emissions by fine particulate matter	71.8		7.4	2.6
Environment-related technologies	55.2		-57.9	-11.7

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GREECE is a **Moderate Innovator** with performance at 80.2% of the EU average. Performance is below the average of the Moderate Innovators (89.7%). Performance is increasing (24.2%-points) at a rate higher than that of the EU (9.9%-points). The country's performance gap to the EU is becoming smaller.

Relative strengths

- Product innovators
- Innovative SMEs collaborating with others
- Employment in innovative enterprises
- Sales of innovative products
- Business process innovators

Relative weaknesses

- Foreign doctorate students
- Lifelong learning
- Employed ICT specialists
- Government support for business R&D
- Medium and high-tech goods exports

Strong increases since 2015

- Product innovators
- Public-private co-publications
- Business process innovators

Strong decreases since 2015

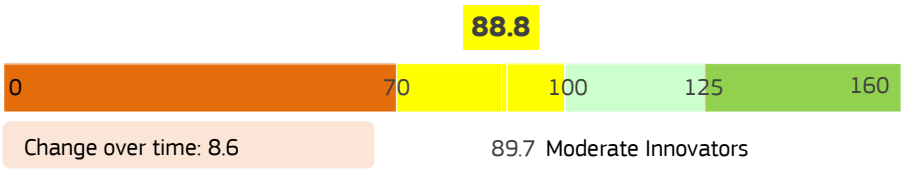
- Environment-related technologies
- Foreign doctorate students

Strong increases since 2021

- Knowledge-intensive services exports
- Employment in innovative enterprises
- Public-private co-publications

Strong decreases since 2021

- Enterprises providing ICT training
- Innovative SMEs collaborating with others
- Job-to-job mobility of HRST



Change over time: 8.6

89.7 Moderate Innovators

Spain	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**88.8**		**8.6**	**5.5**
Human resources	**127.6**		**0.0**	**0.0**
Doctorate graduates	100.0		0.0	0.0
Population with tertiary education	145.9		0.0	0.0
Lifelong learning	140.0		0.0	0.0
Attractive research systems	**96.6**		**15.0**	**5.3**
International scientific co-publications	93.4		50.3	13.8
Most cited publications	92.5		-2.4	1.0
Foreign doctorate students	108.5		20.5	6.9
Digitalisation	**149.8**		**12.7**	**12.7**
Broadband penetration	146.2		24.2	24.2
People with above basic overall digital skills	154.5		0.0	0.0
Finance and support	**74.5**		**7.7**	**6.3**
R&D expenditures in the public sector	75.8		3.2	12.9
Venture capital expenditures	99.6		49.6	18.0
Government support for business R&D	38.8		-29.4	-14.6
Firm investments	**62.4**		**16.5**	**6.0**
R&D expenditure in the business sector	49.3		7.8	6.2
Non-R&D Innovation expenditures	81.3		18.4	-2.6
Innovation expenditures per employee	58.7		22.9	14.5
Use of information technologies	**91.3**		**-6.5**	**-6.5**
Enterprises providing ICT training	100.0		-12.5	-12.5
Employed ICT specialists	81.8		0.0	0.0
Innovators	**50.1**		**19.4**	**20.6**
Product innovators (SMEs)	59.6		42.3	22.9
Business process innovators (SMEs)	41.8		-4.9	18.1
Linkages	**88.5**		**39.8**	**-6.7**
Innovative SMEs collaborating with others	57.0		7.5	3.6
Public-private co-publications	114.7		60.9	18.2
Job-to-job mobility of HRST	102.1		58.8	-26.5
Intellectual assets	**78.1**		**-4.1**	**1.0**
PCT patent applications	64.2		-4.7	2.0
Trademark applications	109.8		7.7	3.0
Design applications	63.8		-12.4	-1.7
Employment impacts	**58.8**		**-5.9**	**5.6**
Employment in knowledge-intensive activities	81.8		0.0	0.0
Employment in innovative enterprises	40.5		-11.3	10.7
Sales impacts	**96.6**		**29.1**	**26.6**
Medium and high-tech goods exports	71.9		-3.3	-5.1
Knowledge-intensive services exports	63.9		46.9	42.8
Sales of innovative products	169.2		50.8	49.3
Environmental sustainability	**102.4**		**-10.6**	**-9.3**
Resource productivity	136.6		0.1	-19.3
Air emissions by fine particulate matter	92.5		5.9	-1.3
Environment-related technologies	83.5		-37.6	-12.2

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

SPAIN is a **Moderate Innovator** with performance at 88.8% of the EU average. Performance is below the average of the Moderate Innovators (89.7%). Performance is increasing (8.6%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Sales of innovative products
- People with above basic overall digital skills
- Broadband penetration
- Population with tertiary education
- Lifelong learning

Relative weaknesses

- Government support for business R&D
- Employment in innovative enterprises
- Business process innovators
- R&D expenditure in the business sector
- Innovative SMEs collaborating with others

Strong increases since 2015

- Public-private co-publications
- Job-to-job mobility of HRST
- Sales of innovative products

Strong decreases since 2015

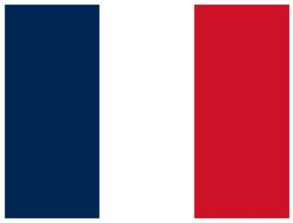
- Environment-related technologies
- Government support for business R&D
- Enterprises providing ICT training

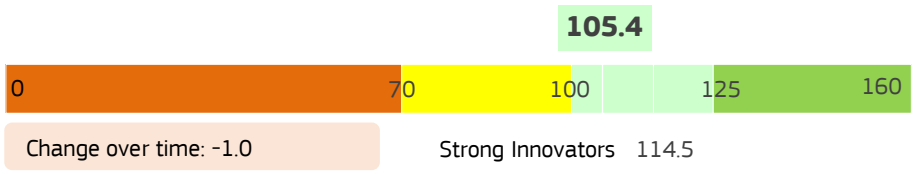
Strong increases since 2021

- Sales of innovative products
- Knowledge-intensive services exports
- Broadband penetration

Strong decreases since 2021

- Job-to-job mobility of HRST
- Resource productivity
- Government support for business R&D





France	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**105.4**		**-1.0**	**-1.0**
Human resources	**125.5**		**-14.5**	**-4.8**
Doctorate graduates	114.8		-34.3	-11.4
Population with tertiary education	155.7		0.0	0.0
Lifelong learning	102.2		0.0	0.0
Attractive research systems	**119.8**		**-2.3**	**1.5**
International scientific co-publications	84.1		25.4	5.3
Most cited publications	90.2		-14.1	0.8
Foreign doctorate students	221.2		-2.4	-0.5
Digitalisation	**112.8**		**7.9**	**7.9**
Broadband penetration	105.1		15.2	15.2
People with above basic overall digital skills	122.7		0.0	0.0
Finance and support	**132.5**		**15.0**	**9.5**
R&D expenditures in the public sector	97.0		0.0	8.1
Venture capital expenditures	128.3		49.3	20.5
Government support for business R&D	183.4		0.0	0.0
Firm investments	**86.7**		**-1.3**	**-7.6**
R&D expenditure in the business sector	102.0		9.3	9.3
Non-R&D Innovation expenditures	47.4		-29.7	-25.9
Innovation expenditures per employee	104.3		17.1	-5.4
Use of information technologies	**83.7**		**-19.6**	**-19.6**
Enterprises providing ICT training	68.8		-37.5	-37.5
Employed ICT specialists	100.0		0.0	0.0
Innovators	**104.5**		**8.4**	**-0.5**
Product innovators (SMEs)	98.9		2.8	-28.5
Business process innovators (SMEs)	109.5		14.5	29.3
Linkages	**121.4**		**43.0**	**-2.7**
Innovative SMEs collaborating with others	137.2		28.2	25.2
Public-private co-publications	113.1		22.9	9.4
Job-to-job mobility of HRST	112.5		64.7	-32.4
Intellectual assets	**80.9**		**-10.0**	**-0.1**
PCT patent applications	103.0		-6.9	-1.5
Trademark applications	69.0		0.8	1.0
Design applications	63.5		-21.8	0.7
Employment impacts	**110.5**		**-5.4**	**3.9**
Employment in knowledge-intensive activities	116.9		0.0	0.0
Employment in innovative enterprises	105.5		-10.3	7.5
Sales impacts	**79.4**		**-21.8**	**-5.4**
Medium and high-tech goods exports	96.9		-7.4	-6.9
Knowledge-intensive services exports	91.7		12.2	13.8
Sales of innovative products	41.8		-79.9	-25.7
Environmental sustainability	**117.4**		**8.9**	**2.8**
Resource productivity	150.7		49.5	10.2
Air emissions by fine particulate matter	107.0		4.5	2.7
Environment-related technologies	100.1		-13.5	-2.1

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

FRANCE is a **Strong Innovator** with performance at 105.4% of the EU average. Performance is below the average of the Strong Innovators (114.5%). Performance is decreasing (-1.0%-points) and is lower than the rate of increase of the EU (9.9%-points). The country's performance lead over the EU is becoming smaller.

Relative strengths

- Foreign doctorate students
- Government support for business R&D
- Population with tertiary education
- Resource productivity
- Innovative SMEs collaborating with others

Relative weaknesses

- Sales of innovative products
- Non-R&D Innovation expenditures
- Design applications
- Enterprises providing ICT training
- Trademark applications

Strong increases since 2015

- Job-to-job mobility of HRST
- Resource productivity
- Venture capital expenditures

Strong decreases since 2015

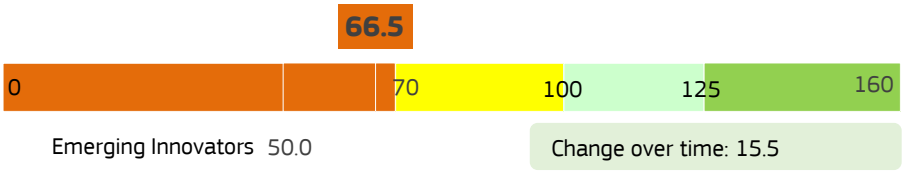
- Sales of innovative products
- Enterprises providing ICT training
- Doctorate graduates

Strong increases since 2021

- Business process innovators
- Innovative SMEs collaborating with others
- Venture capital expenditures

Strong decreases since 2021

- Enterprises providing ICT training
- Job-to-job mobility of HRST
- Product innovators



Croatia	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**66.5**		**15.5**	**2.0**
Human resources	**53.9**		**-4.8**	**0.0**
Doctorate graduates	55.5		-11.4	0.0
Population with tertiary education	66.4		0.0	0.0
Lifelong learning	36.7		0.0	0.0
Attractive research systems	**48.8**		**29.9**	**3.9**
International scientific co-publications	74.3		54.8	11.8
Most cited publications	35.7		16.0	1.2
Foreign doctorate students	41.6		37.2	2.7
Digitalisation	**75.1**		**23.8**	**23.8**
Broadband penetration	38.5		45.5	45.5
People with above basic overall digital skills	122.7		0.0	0.0
Finance and support	**67.2**		**34.1**	**20.6**
R&D expenditures in the public sector	80.3		41.9	16.1
Venture capital expenditures	99.8		52.4	44.6
Government support for business R&D	6.2		4.6	1.8
Firm investments	**40.2**		**-35.9**	**-19.2**
R&D expenditure in the business sector	37.2		15.5	5.4
Non-R&D Innovation expenditures	62.7		-64.3	-50.6
Innovation expenditures per employee	25.3		-56.3	-11.2
Use of information technologies	**90.2**		**0.0**	**0.0**
Enterprises providing ICT training	118.8		0.0	0.0
Employed ICT specialists	59.1		0.0	0.0
Innovators	**126.9**		**87.6**	**-4.0**
Product innovators (SMEs)	133.8		94.7	-17.8
Business process innovators (SMEs)	120.9		79.9	10.7
Linkages	**111.3**		**77.1**	**9.0**
Innovative SMEs collaborating with others	106.3		68.8	-4.1
Public-private co-publications	142.2		115.5	22.2
Job-to-job mobility of HRST	102.1		67.6	14.7
Intellectual assets	**43.1**		**9.2**	**4.8**
PCT patent applications	40.1		-3.0	1.9
Trademark applications	64.7		26.5	7.9
Design applications	24.4		10.6	5.8
Employment impacts	**75.8**		**21.5**	**0.0**
Employment in knowledge-intensive activities	53.2		0.0	0.0
Employment in innovative enterprises	93.6		41.1	0.0
Sales impacts	**56.5**		**29.6**	**6.6**
Medium and high-tech goods exports	52.8		1.6	-9.0
Knowledge-intensive services exports	27.5		26.0	18.6
Sales of innovative products	98.4		70.4	12.9
Environmental sustainability	**56.9**		**-20.5**	**-14.6**
Resource productivity	73.8		15.6	-8.8
Air emissions by fine particulate matter	70.6		14.3	-0.4
Environment-related technologies	19.7		-86.7	-35.4

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CROATIA is an **Emerging Innovator** with performance at 66.5% of the EU average. Performance is above the average of the Emerging Innovators (50.0%). Performance is increasing (15.5%-points) at a rate higher than that of the EU (9.9%-points). The country's performance gap to the EU is becoming smaller.

Relative strengths

- Public-private co-publications
- Product innovators
- People with above basic overall digital skills
- Business process innovators
- Enterprises providing ICT training

Relative weaknesses

- Government support for business R&D
- Environment-related technologies
- Design applications
- Innovation expenditures per employee
- Knowledge-intensive services exports

Strong increases since 2015

- Public-private co-publications
- Product innovators
- Business process innovators

Strong decreases since 2015

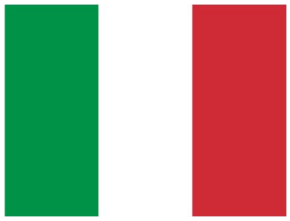
- Environment-related technologies
- Non-R&D Innovation expenditures
- Innovation expenditures per employee

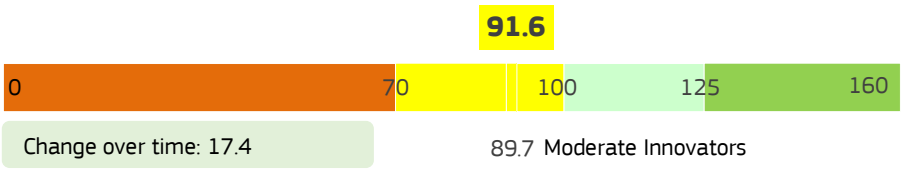
Strong increases since 2021

- Broadband penetration
- Venture capital expenditures
- Public-private co-publications

Strong decreases since 2021

- Non-R&D Innovation expenditures
- Environment-related technologies
- Product innovators





Italy	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**91.6**		**17.4**	**-2.9**
Human resources	**64.1**		**-4.8**	**0.0**
Doctorate graduates	85.2		-11.4	0.0
Population with tertiary education	21.1		0.0	0.0
Lifelong learning	90.0		0.0	0.0
Attractive research systems	**98.6**		**21.2**	**4.7**
International scientific co-publications	87.1		51.5	15.1
Most cited publications	111.8		7.8	1.6
Foreign doctorate students	87.9		22.4	1.5
Digitalisation	**75.2**		**9.5**	**9.5**
Broadband penetration	66.7		18.2	18.2
People with above basic overall digital skills	86.4		0.0	0.0
Finance and support	**79.6**		**30.0**	**-3.6**
R&D expenditures in the public sector	66.7		1.6	8.1
Venture capital expenditures	65.1		7.0	5.2
Government support for business R&D	115.8		91.9	-28.5
Firm investments	**82.1**		**26.2**	**3.9**
R&D expenditure in the business sector	59.5		7.8	0.8
Non-R&D Innovation expenditures	85.9		3.7	-27.0
Innovation expenditures per employee	98.0		66.2	37.8
Use of information technologies	**68.5**		**16.3**	**-13.0**
Enterprises providing ICT training	68.8		31.3	-25.0
Employed ICT specialists	68.2		0.0	0.0
Innovators	**115.2**		**47.2**	**-37.6**
Product innovators (SMEs)	112.3		32.5	-35.0
Business process innovators (SMEs)	117.8		62.8	-40.4
Linkages	**90.6**		**53.2**	**-2.1**
Innovative SMEs collaborating with others	113.9		79.2	-16.2
Public-private co-publications	143.1		82.6	21.5
Job-to-job mobility of HRST	50.0		17.6	0.0
Intellectual assets	**105.4**		**6.0**	**0.4**
PCT patent applications	78.3		2.1	0.4
Trademark applications	107.1		24.0	4.4
Design applications	140.5		-3.0	-2.6
Employment impacts	**107.1**		**10.1**	**-13.3**
Employment in knowledge-intensive activities	101.3		0.0	0.0
Employment in innovative enterprises	111.7		19.4	-25.6
Sales impacts	**88.6**		**14.7**	**-0.8**
Medium and high-tech goods exports	86.7		-3.2	-4.6
Knowledge-intensive services exports	79.5		21.7	28.3
Sales of innovative products	102.8		30.0	-29.6
Environmental sustainability	**117.6**		**5.8**	**-1.0**
Resource productivity	187.9		37.4	0.7
Air emissions by fine particulate matter	104.8		7.7	0.7
Environment-related technologies	67.2		-17.9	-4.4

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

ITALY is a **Moderate Innovator** with performance at 91.6% of the EU average. Performance is above the average of the Moderate Innovators (89.7%). Performance is increasing (17.4%-points) at a rate higher than that of the EU (9.9%-points). The country's performance gap to the EU is becoming smaller.

Relative strengths

- Resource productivity
- Public-private co-publications
- Design applications
- Business process innovators
- Government support for business R&D

Relative weaknesses

- Population with tertiary education
- Job-to-job mobility of HRST
- R&D expenditure in the business sector
- Venture capital expenditures

Strong increases since 2015

- Government support for business R&D
- Public-private co-publications
- Innovative SMEs collaborating with others

Strong decreases since 2015

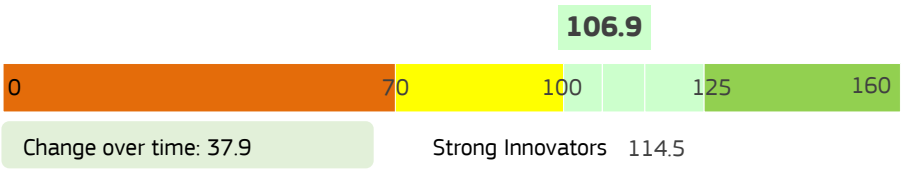
- Environment-related technologies
- Doctorate graduates
- Medium and high-tech goods exports

Strong increases since 2021

- Innovation expenditures per employee
- Knowledge-intensive services exports
- Public-private co-publications

Strong decreases since 2021

- Business process innovators
- Product innovators
- Sales of innovative products



Cyprus	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**106.9**	**37.9**	**5.9**
Human resources	**117.1**	**9.7**	**0.0**
Doctorate graduates	55.5	22.9	0.0
Population with tertiary education	204.6	0.0	0.0
Lifelong learning	87.8	0.0	0.0
Attractive research systems	**147.2**	**70.2**	**15.3**
International scientific co-publications	253.6	211.6	73.7
Most cited publications	82.0	-16.5	-10.6
Foreign doctorate students	137.4	128.2	17.5
Digitalisation	**80.0**	**20.6**	**20.6**
Broadband penetration	82.1	39.4	39.4
People with above basic overall digital skills	77.3	0.0	0.0
Finance and support	**65.9**	**43.1**	**4.5**
R&D expenditures in the public sector	36.4	4.8	6.5
Venture capital expenditures	134.5	129.8	0.0
Government support for business R&D	9.9	5.5	6.5
Firm investments	**48.0**	**32.0**	**-1.6**
R&D expenditure in the business sector	21.6	21.7	4.7
Non-R&D Innovation expenditures	89.2	45.6	-25.7
Innovation expenditures per employee	38.1	28.3	16.6
Use of information technologies	**103.3**	**9.8**	**-19.6**
Enterprises providing ICT training	131.3	18.8	-37.5
Employed ICT specialists	72.7	0.0	0.0
Innovators	**154.8**	**109.0**	**-17.4**
Product innovators (SMEs)	152.4	93.2	-33.7
Business process innovators (SMEs)	157.0	125.9	0.0
Linkages	**228.8**	**177.2**	**18.0**
Innovative SMEs collaborating with others	255.4	197.1	0.0
Public-private co-publications	301.5	314.5	74.9
Job-to-job mobility of HRST	177.1	100.0	8.8
Intellectual assets	**104.0**	**12.4**	**9.7**
PCT patent applications	40.3	1.3	0.5
Trademark applications	195.0	6.1	0.0
Design applications	95.0	30.2	27.8
Employment impacts	**148.8**	**41.9**	**-1.8**
Employment in knowledge-intensive activities	161.0	0.0	0.0
Employment in innovative enterprises	139.2	80.3	-3.4
Sales impacts	**111.4**	**28.8**	**15.1**
Medium and high-tech goods exports	96.7	-28.5	-8.6
Knowledge-intensive services exports	130.2	47.9	37.9
Sales of innovative products	105.4	81.6	19.6
Environmental sustainability	**62.7**	**-1.2**	**13.6**
Resource productivity	49.8	-11.9	-6.2
Air emissions by fine particulate matter	72.6	-9.1	1.6
Environment-related technologies	60.6	15.6	41.3

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CYPRUS is a **Strong Innovator** with performance at 106.9% of the EU average. Performance is below the average of the Strong Innovators (114.5%). Performance is increasing (37.9%-points) at a rate much higher than that of the EU (9.9%-points). The country's performance lead over the EU is becoming larger.

Relative strengths

- Public-private co-publications
- Innovative SMEs collaborating with others
- International scientific co-publications
- Population with tertiary education
- Trademark applications

Relative weaknesses

- Government support for business R&D
- R&D expenditure in the business sector
- R&D expenditures in the public sector
- Innovation expenditures per employee
- PCT patent applications

Strong increases since 2015

- Public-private co-publications
- International scientific co-publications
- Innovative SMEs collaborating with others

Strong decreases since 2015

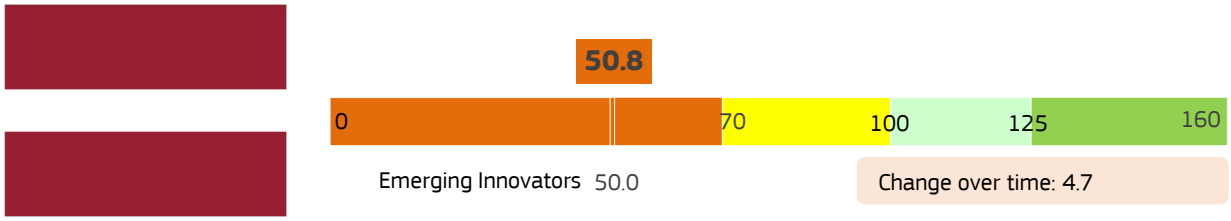
- Medium and high-tech goods exports
- Most cited publications
- Resource productivity

Strong increases since 2021

- Public-private co-publications
- International scientific co-publications
- Environment-related technologies

Strong decreases since 2021

- Enterprises providing ICT training
- Product innovators
- Non-R&D Innovation expenditures



Latvia	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**50.8**		**4.7**	**-0.7**
Human resources	**75.4**		**-9.7**	**-4.8**
Doctorate graduates	25.8		-22.9	-11.4
Population with tertiary education	126.3		0.0	0.0
Lifelong learning	75.6		0.0	0.0
Attractive research systems	**43.1**		**20.5**	**-2.4**
International scientific co-publications	57.9		59.6	17.9
Most cited publications	22.9		-4.6	-15.3
Foreign doctorate students	63.0		38.9	7.1
Digitalisation	**77.2**		**-4.8**	**-4.8**
Broadband penetration	66.7		-9.1	-9.1
People with above basic overall digital skills	90.9		0.0	0.0
Finance and support	**37.6**		**-5.4**	**5.8**
R&D expenditures in the public sector	54.5		6.5	1.6
Venture capital expenditures	45.7		-27.4	16.7
Government support for business R&D	5.2		1.1	0.3
Firm investments	**25.4**		**-14.0**	**-6.5**
R&D expenditure in the business sector	11.5		3.9	3.9
Non-R&D Innovation expenditures	57.3		-26.6	-16.0
Innovation expenditures per employee	12.2		-18.4	-6.9
Use of information technologies	**75.0**		**19.6**	**-3.3**
Enterprises providing ICT training	81.3		37.5	-6.2
Employed ICT specialists	68.2		0.0	0.0
Innovators	**39.3**		**30.0**	**-8.7**
Product innovators (SMEs)	41.3		33.8	-16.2
Business process innovators (SMEs)	37.5		26.0	-0.7
Linkages	**75.3**		**43.7**	**20.9**
Innovative SMEs collaborating with others	45.8		41.6	-1.7
Public-private co-publications	101.1		100.8	39.9
Job-to-job mobility of HRST	87.5		20.6	32.4
Intellectual assets	**67.9**		**14.5**	**3.2**
PCT patent applications	48.8		-0.2	-0.1
Trademark applications	101.4		35.9	4.9
Design applications	58.5		15.9	5.8
Employment impacts	**47.5**		**11.0**	**-4.8**
Employment in knowledge-intensive activities	67.5		0.0	0.0
Employment in innovative enterprises	31.7		21.0	-9.2
Sales impacts	**52.8**		**6.7**	**-5.5**
Medium and high-tech goods exports	42.5		1.4	-6.0
Knowledge-intensive services exports	68.4		10.6	5.6
Sales of innovative products	45.5		9.2	-17.6
Environmental sustainability	**27.3**		**-15.4**	**3.6**
Resource productivity	49.1		7.4	-4.6
Air emissions by fine particulate matter	0.0		0.0	0.0
Environment-related technologies	46.5		-49.4	13.5

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

LATVIA is an **Emerging Innovator** with performance at 50.8% of the EU average. Performance is above the average of the Emerging Innovators (50.0%). Performance is increasing (4.7%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Population with tertiary education
- Trademark applications
- Public-private co-publications
- People with above basic overall digital skills
- Job-to-job mobility of HRST

Relative weaknesses

- Air emissions by fine particulate matter
- Government support for business R&D
- R&D expenditure in the business sector
- Innovation expenditures per employee
- Most cited publications

Strong increases since 2015

- Public-private co-publications
- International scientific co-publications
- Innovative SMEs collaborating with others

Strong decreases since 2015

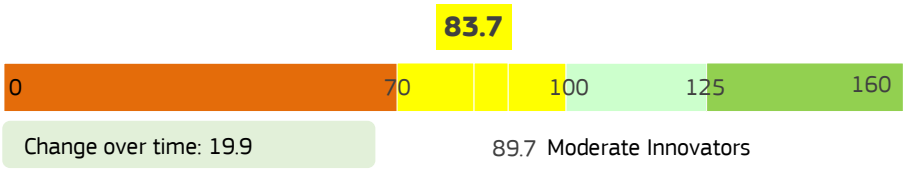
- Environment-related technologies
- Venture capital expenditures
- Non-R&D Innovation expenditures

Strong increases since 2021

- Public-private co-publications
- Job-to-job mobility of HRST
- International scientific co-publications

Strong decreases since 2021

- Sales of innovative products
- Product innovators
- Non-R&D Innovation expenditures



Change over time: 19.9

89.7 Moderate Innovators

Lithuania	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**83.7**	**19.9**	**6.3**
Human resources	**111.6**	**-4.8**	**0.0**
Doctorate graduates	55.5	-11.4	0.0
Population with tertiary education	199.7	0.0	0.0
Lifelong learning	74.4	0.0	0.0
Attractive research systems	**53.1**	**40.0**	**4.6**
International scientific co-publications	72.0	67.8	14.6
Most cited publications	51.5	34.8	13.1
Foreign doctorate students	32.1	25.6	-23.3
Digitalisation	**104.2**	**1.6**	**1.6**
Broadband penetration	117.9	3.0	3.0
People with above basic overall digital skills	86.4	0.0	0.0
Finance and support	**76.0**	**25.7**	**18.6**
R&D expenditures in the public sector	72.7	-17.7	6.5
Venture capital expenditures	121.4	101.4	50.4
Government support for business R&D	18.3	6.3	2.3
Firm investments	**79.6**	**16.7**	**10.3**
R&D expenditure in the business sector	33.8	24.0	9.3
Non-R&D Innovation expenditures	170.9	4.6	30.3
Innovation expenditures per employee	47.1	21.8	-8.9
Use of information technologies	**65.2**	**16.3**	**9.8**
Enterprises providing ICT training	62.5	31.3	18.8
Employed ICT specialists	68.2	0.0	0.0
Innovators	**113.7**	**53.6**	**4.8**
Product innovators (SMEs)	115.5	59.4	0.2
Business process innovators (SMEs)	112.1	47.3	9.7
Linkages	**141.6**	**65.8**	**6.6**
Innovative SMEs collaborating with others	126.3	-10.1	10.7
Public-private co-publications	71.3	51.5	0.3
Job-to-job mobility of HRST	183.3	138.2	5.9
Intellectual assets	**69.1**	**24.6**	**8.9**
PCT patent applications	37.1	4.4	-2.0
Trademark applications	125.3	62.5	21.1
Design applications	53.7	19.8	12.7
Employment impacts	**101.0**	**16.1**	**7.6**
Employment in knowledge-intensive activities	83.1	0.0	0.0
Employment in innovative enterprises	115.2	30.8	14.5
Sales impacts	**51.1**	**14.4**	**6.9**
Medium and high-tech goods exports	60.5	11.5	-2.2
Knowledge-intensive services exports	14.0	7.5	7.6
Sales of innovative products	87.1	26.0	18.0
Environmental sustainability	**80.4**	**2.4**	**-4.8**
Resource productivity	42.1	5.0	-6.6
Air emissions by fine particulate matter	113.2	22.8	4.1
Environment-related technologies	69.4	-23.9	-14.1

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LITHUANIA is a **Moderate Innovator** with performance at 83.7% of the EU average. Performance is below the average of the Moderate Innovators (89.7%). Performance is increasing (19.9%-points) at a rate higher than that of the EU (9.9%-points). The country's performance gap to the EU is becoming smaller.

Relative strengths

- Population with tertiary education
- Job-to-job mobility of HRST
- Non-R&D Innovation expenditures
- Innovative SMEs collaborating with others
- Trademark applications

Relative weaknesses

- Knowledge-intensive services exports
- Government support for business R&D
- Foreign doctorate students
- R&D expenditure in the business sector
- PCT patent applications

Strong increases since 2015

- Job-to-job mobility of HRST
- Venture capital expenditures
- International scientific co-publications

Strong decreases since 2015

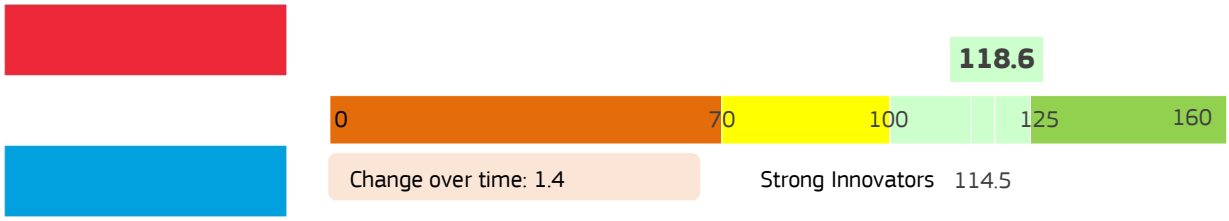
- Environment-related technologies
- R&D expenditures in the public sector
- Doctorate graduates

Strong increases since 2021

- Venture capital expenditures
- Non-R&D Innovation expenditures
- Trademark applications

Strong decreases since 2021

- Foreign doctorate students
- Environment-related technologies
- Innovation expenditures per employee



Luxembourg	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**118.6**		**1.4**	**-0.4**
Human resources	**166.7**		**14.5**	**-4.8**
Doctorate graduates	100.0		34.3	-11.4
Population with tertiary education	225.4		0.0	0.0
Lifelong learning	178.9		0.0	0.0
Attractive research systems	**221.1**		**35.8**	**19.1**
International scientific co-publications	247.8		107.8	18.2
Most cited publications	148.0		21.5	28.3
Foreign doctorate students	326.6		0.0	0.0
Digitalisation	**126.4**		**0.0**	**0.0**
Broadband penetration	125.6		0.0	0.0
People with above basic overall digital skills	127.3		0.0	0.0
Finance and support	**68.1**		**1.0**	**-6.1**
R&D expenditures in the public sector	60.6		-11.3	-3.2
Venture capital expenditures	109.5		23.8	-10.1
Government support for business R&D	20.9		-5.8	-5.7
Firm investments	**52.5**		**16.3**	**0.6**
R&D expenditure in the business sector	37.8		-3.1	-2.3
Non-R&D Innovation expenditures	51.2		18.4	0.0
Innovation expenditures per employee	65.7		32.5	3.8
Use of information technologies	**151.1**		**-3.3**	**-19.6**
Enterprises providing ICT training	106.3		-6.3	-37.5
Employed ICT specialists	200.0		0.0	0.0
Innovators	**99.0**		**-20.9**	**0.0**
Product innovators (SMEs)	107.8		7.4	0.0
Business process innovators (SMEs)	91.3		-51.1	0.0
Linkages	**188.7**		**77.9**	**22.5**
Innovative SMEs collaborating with others	112.2		46.6	0.0
Public-private co-publications	411.1		285.5	159.5
Job-to-job mobility of HRST	154.2		14.7	-17.6
Intellectual assets	**112.0**		**-35.6**	**-14.8**
PCT patent applications	66.6		-7.1	-3.7
Trademark applications	175.1		-22.5	-11.2
Design applications	107.4		-79.2	-30.7
Employment impacts	**135.1**		**-33.6**	**0.0**
Employment in knowledge-intensive activities	215.6		0.0	0.0
Employment in innovative enterprises	71.1		-64.5	0.0
Sales impacts	**83.5**		**-3.0**	**-0.2**
Medium and high-tech goods exports	66.8		-16.0	-2.5
Knowledge-intensive services exports	129.1		10.5	2.3
Sales of innovative products	45.3		-1.7	0.0
Environmental sustainability	**122.4**		**-4.4**	**7.4**
Resource productivity	188.2		15.9	14.2
Air emissions by fine particulate matter	104.6		15.4	1.9
Environment-related technologies	84.1		-42.0	9.3

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

LUXEMBOURG is a **Strong Innovator** with performance at 118.6% of the EU average. Performance is above the average of the Strong Innovators (114.5%). Performance is increasing (1.4%-points) at a rate lower than that of the EU (9.9%-points). The country's performance lead over the EU is becoming smaller.

Relative strengths

- Public-private co-publications
- Foreign doctorate students
- International scientific co-publications
- Population with tertiary education
- Employment in knowledge-intensive activities

Relative weaknesses

- Government support for business R&D
- R&D expenditure in the business sector
- Sales of innovative products
- Non-R&D Innovation expenditures
- R&D expenditures in the public sector

Strong increases since 2015

- Public-private co-publications
- International scientific co-publications
- Innovative SMEs collaborating with others

Strong decreases since 2015

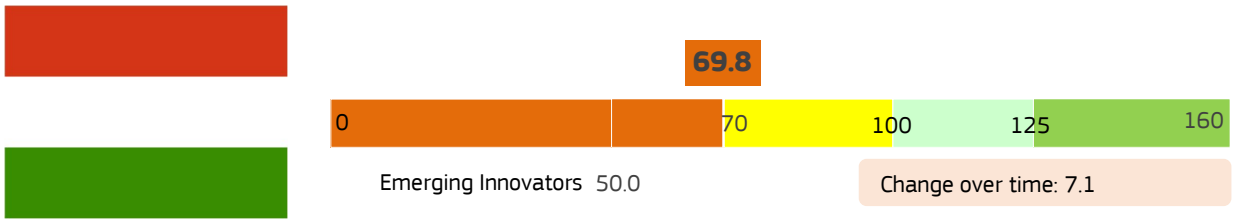
- Design applications
- Employment in innovative enterprises
- Business process innovators

Strong increases since 2021

- Public-private co-publications
- Most cited publications
- International scientific co-publications

Strong decreases since 2021

- Enterprises providing ICT training
- Design applications
- Job-to-job mobility of HRST



Hungary	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**69.8**		**7.1**	**3.0**
Human resources	**45.1**		**0.0**	**0.0**
Doctorate graduates	40.7		0.0	0.0
Population with tertiary education	49.2		0.0	0.0
Lifelong learning	45.6		0.0	0.0
Attractive research systems	**78.8**		**38.3**	**11.5**
International scientific co-publications	53.3		26.5	5.5
Most cited publications	60.1		5.8	12.3
Foreign doctorate students	146.3		120.4	15.2
Digitalisation	**71.8**		**3.2**	**3.2**
Broadband penetration	64.1		6.1	6.1
People with above basic overall digital skills	81.8		0.0	0.0
Finance and support	**79.7**		**9.5**	**1.3**
R&D expenditures in the public sector	37.9		3.2	1.6
Venture capital expenditures	77.6		33.9	7.3
Government support for business R&D	135.7		-7.2	-5.2
Firm investments	**68.3**		**-6.3**	**5.0**
R&D expenditure in the business sector	79.7		7.0	9.3
Non-R&D Innovation expenditures	88.4		-8.0	14.1
Innovation expenditures per employee	43.3		-17.2	-8.3
Use of information technologies	**73.9**		**0.0**	**0.0**
Enterprises providing ICT training	75.0		0.0	0.0
Employed ICT specialists	72.7		0.0	0.0
Innovators	**49.3**		**46.7**	**13.7**
Product innovators (SMEs)	68.8		49.6	2.2
Business process innovators (SMEs)	32.2		43.5	25.9
Linkages	**96.1**		**61.5**	**8.7**
Innovative SMEs collaborating with others	82.9		46.5	-1.6
Public-private co-publications	116.0		70.7	22.0
Job-to-job mobility of HRST	97.9		70.6	11.8
Intellectual assets	**52.3**		**2.5**	**1.6**
PCT patent applications	65.0		-1.6	5.5
Trademark applications	67.2		15.2	2.8
Design applications	19.5		-2.3	-4.0
Employment impacts	**59.4**		**14.0**	**9.3**
Employment in knowledge-intensive activities	92.2		0.0	0.0
Employment in innovative enterprises	33.3		26.8	17.8
Sales impacts	**84.9**		**-7.6**	**-2.6**
Medium and high-tech goods exports	125.7		-1.6	-7.6
Knowledge-intensive services exports	67.7		14.9	8.9
Sales of innovative products	56.6		-41.3	-9.5
Environmental sustainability	**70.4**		**-19.0**	**-3.1**
Resource productivity	57.6		-18.1	11.0
Air emissions by fine particulate matter	94.7		-4.0	0.5
Environment-related technologies	46.9		-37.6	-17.2

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

HUNGARY is an **Emerging Innovator** with performance at 69.8% of the EU average. Performance is above the average of the Emerging Innovators (50.0%). Performance is increasing (7.1%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Foreign doctorate students
- Government support for business R&D
- Medium and high-tech goods exports
- Public-private co-publications
- Job-to-job mobility of HRST

Relative weaknesses

- Design applications
- Business process innovators
- Employment in innovative enterprises
- R&D expenditures in the public sector
- Doctorate graduates

Strong increases since 2015

- Foreign doctorate students
- Public-private co-publications
- Job-to-job mobility of HRST

Strong decreases since 2015

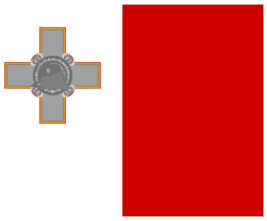
- Sales of innovative products
- Environment-related technologies
- Resource productivity

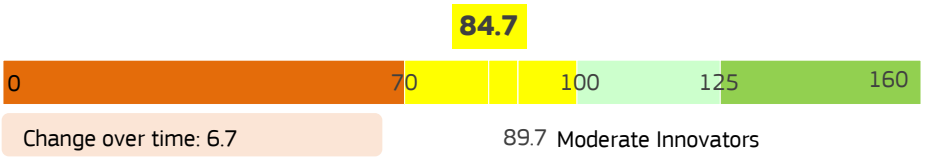
Strong increases since 2021

- Business process innovators
- Public-private co-publications
- Employment in innovative enterprises

Strong decreases since 2021

- Environment-related technologies
- Sales of innovative products
- Innovation expenditures per employee





Malta	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**84.7**	**6.7**	**-4.6**
Human resources	**85.3**	**4.8**	**0.0**
Doctorate graduates	25.8	11.4	0.0
Population with tertiary education	107.3	0.0	0.0
Lifelong learning	133.3	0.0	0.0
Attractive research systems	**99.7**	**64.1**	**12.1**
International scientific co-publications	96.4	73.5	14.0
Most cited publications	46.0	4.9	-16.9
Foreign doctorate students	206.0	184.9	73.9
Digitalisation	**132.3**	**7.9**	**7.9**
Broadband penetration	125.6	15.2	15.2
People with above basic overall digital skills	140.9	0.0	0.0
Finance and support	**17.4**	**-26.8**	**-1.4**
R&D expenditures in the public sector	16.7	-21.0	1.6
Venture capital expenditures	18.3	-40.6	-0.1
Government support for business R&D	17.1	-20.3	-6.9
Firm investments	**42.8**	**-2.0**	**-10.1**
R&D expenditure in the business sector	25.7	3.9	6.2
Non-R&D Innovation expenditures	66.4	4.0	-34.0
Innovation expenditures per employee	38.8	-13.7	-1.7
Use of information technologies	**134.8**	**22.8**	**6.5**
Enterprises providing ICT training	150.0	43.8	12.5
Employed ICT specialists	118.2	0.0	0.0
Innovators	**66.0**	**7.9**	**-52.1**
Product innovators (SMEs)	57.6	-5.9	-72.9
Business process innovators (SMEs)	73.3	22.7	-30.0
Linkages	**97.4**	**50.2**	**-11.1**
Innovative SMEs collaborating with others	65.0	48.6	-1.6
Public-private co-publications	111.9	74.1	38.6
Job-to-job mobility of HRST	116.7	41.2	-41.2
Intellectual assets	**124.5**	**-5.5**	**9.7**
PCT patent applications	59.5	31.4	0.9
Trademark applications	195.0	0.0	0.0
Design applications	138.9	-53.5	27.4
Employment impacts	**111.8**	**-9.1**	**-16.5**
Employment in knowledge-intensive activities	174.0	0.0	0.0
Employment in innovative enterprises	62.4	-17.4	-31.5
Sales impacts	**69.7**	**10.4**	**-11.4**
Medium and high-tech goods exports	98.7	-18.6	-12.3
Knowledge-intensive services exports	62.5	37.1	5.2
Sales of innovative products	43.1	17.1	-29.6
Environmental sustainability	**104.2**	**-3.1**	**-4.6**
Resource productivity	104.1	-28.6	-31.7
Air emissions by fine particulate matter	128.5	5.0	1.1
Environment-related technologies	68.2	4.8	7.2

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MALTA is a **Moderate Innovator** with performance at 84.7% of the EU average. Performance is below the average of the Moderate Innovators (89.7%). Performance is increasing (6.7%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Foreign doctorate students
- Trademark applications
- Employment in knowledge-intensive activities
- Enterprises providing ICT training
- People with above basic overall digital skills

Relative weaknesses

- R&D expenditures in the public sector
- Government support for business R&D
- Venture capital expenditures
- R&D expenditure in the business sector
- Doctorate graduates

Strong increases since 2015

- Foreign doctorate students
- Public-private co-publications
- International scientific co-publications

Strong decreases since 2015

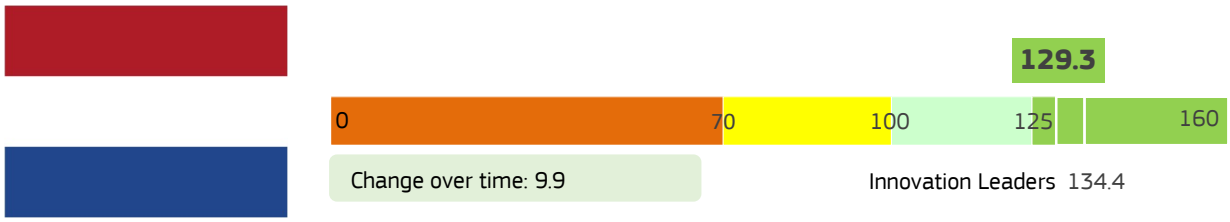
- Design applications
- Venture capital expenditures
- Resource productivity

Strong increases since 2021

- Foreign doctorate students
- Public-private co-publications
- Design applications

Strong decreases since 2021

- Product innovators
- Job-to-job mobility of HRST
- Non-R&D Innovation expenditures



Netherlands	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**129.3**		**9.9**	**2.0**
Human resources	**176.0**		**-4.8**	**-9.7**
Doctorate graduates	85.2		-11.4	-22.9
Population with tertiary education	188.1		0.0	0.0
Lifelong learning	275.6		0.0	0.0
Attractive research systems	**200.5**		**31.5**	**6.5**
International scientific co-publications	199.0		84.7	19.0
Most cited publications	158.9		-12.3	-1.8
Foreign doctorate students	281.7		77.6	13.2
Digitalisation	**165.2**		**7.9**	**7.9**
Broadband penetration	138.5		15.2	15.2
People with above basic overall digital skills	200.0		0.0	0.0
Finance and support	**118.5**		**41.4**	**15.1**
R&D expenditures in the public sector	95.5		0.0	4.8
Venture capital expenditures	127.7		86.6	40.1
Government support for business R&D	135.5		50.9	3.2
Firm investments	**76.9**		**10.8**	**2.0**
R&D expenditure in the business sector	100.7		10.1	6.2
Non-R&D Innovation expenditures	38.3		0.0	0.0
Innovation expenditures per employee	87.0		22.2	0.0
Use of information technologies	**160.9**		**19.6**	**-6.5**
Enterprises providing ICT training	125.0		37.5	-12.5
Employed ICT specialists	200.0		0.0	0.0
Innovators	**104.7**		**9.3**	**13.1**
Product innovators (SMEs)	103.4		-23.0	5.4
Business process innovators (SMEs)	105.8		43.7	21.3
Linkages	**183.4**		**10.4**	**10.5**
Innovative SMEs collaborating with others	161.9		6.8	44.0
Public-private co-publications	326.5		115.7	41.9
Job-to-job mobility of HRST	139.6		-32.4	-32.4
Intellectual assets	**112.1**		**4.3**	**-2.0**
PCT patent applications	119.3		-11.8	-1.1
Trademark applications	105.6		13.7	0.3
Design applications	109.0		16.4	-4.7
Employment impacts	**125.7**		**-15.8**	**0.0**
Employment in knowledge-intensive activities	170.1		0.0	0.0
Employment in innovative enterprises	90.4		-30.2	0.0
Sales impacts	**88.6**		**3.6**	**-2.2**
Medium and high-tech goods exports	89.0		20.1	-8.1
Knowledge-intensive services exports	110.2		7.9	2.6
Sales of innovative products	60.3		-22.8	0.0
Environmental sustainability	**121.9**		**0.5**	**-2.8**
Resource productivity	193.7		16.1	0.0
Air emissions by fine particulate matter	107.9		5.6	0.5

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

The **NETHERLANDS** is an **Innovation Leader** with performance at 129.3% of the EU average. Performance is below the average of the Innovation Leaders (134.4%). Performance is increasing (9.91%-points) at a rate only just above that of the EU (9.89%-points). The country's performance lead over the EU has remained stable.

Relative strengths

- Public-private co-publications
- Foreign doctorate students
- Lifelong learning
- People with above basic overall digital skills
- Employed ICT specialists

Relative weaknesses

- Non-R&D Innovation expenditures
- Sales of innovative products
- Environment-related technologies
- Doctorate graduates
- Innovation expenditures per employee

Strong increases since 2015

- Public-private co-publications
- Venture capital expenditures
- International scientific co-publications

Strong decreases since 2015

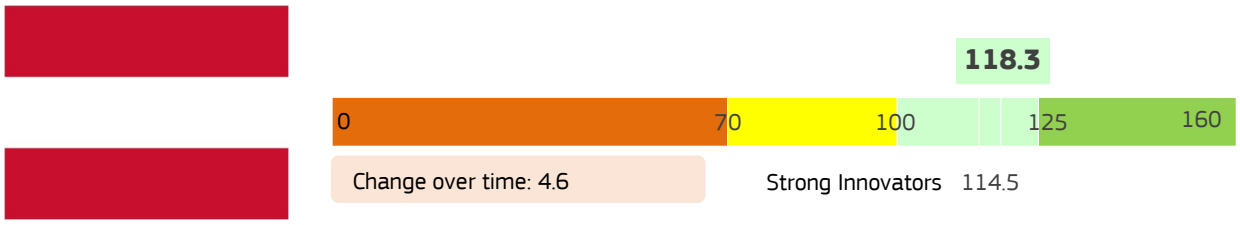
- Job-to-job mobility of HRST
- Employment in innovative enterprises
- Product innovators

Strong increases since 2021

- Innovative SMEs collaborating with others
- Public-private co-publications
- Venture capital expenditures

Strong decreases since 2021

- Job-to-job mobility of HRST
- Doctorate graduates
- Enterprises providing ICT training



Austria	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**118.3**		**4.6**	**1.5**
Human resources	**125.4**		**0.0**	**0.0**
Doctorate graduates	129.7		0.0	0.0
Population with tertiary education	107.3		0.0	0.0
Lifelong learning	142.2		0.0	0.0
Attractive research systems	**156.1**		**31.6**	**5.9**
International scientific co-publications	179.0		80.4	19.8
Most cited publications	110.4		-2.9	-1.2
Foreign doctorate students	214.5		61.8	8.2
Digitalisation	**96.4**		**0.0**	**0.0**
Broadband penetration	69.2		0.0	0.0
People with above basic overall digital skills	131.8		0.0	0.0
Finance and support	**116.0**		**14.6**	**16.1**
R&D expenditures in the public sector	127.3		17.7	8.1
Venture capital expenditures	75.6		53.8	37.1
Government support for business R&D	156.9		-29.9	5.3
Firm investments	**101.5**		**5.9**	**1.4**
R&D expenditure in the business sector	146.6		10.1	1.6
Non-R&D Innovation expenditures	64.5		-9.7	2.8
Innovation expenditures per employee	92.6		17.4	-0.1
Use of information technologies	**93.5**		**-52.2**	**0.0**
Enterprises providing ICT training	87.5		-100.0	0.0
Employed ICT specialists	100.0		0.0	0.0
Innovators	**124.2**		**14.8**	**-17.8**
Product innovators (SMEs)	115.2		8.5	-14.4
Business process innovators (SMEs)	132.0		21.6	-21.4
Linkages	**175.3**		**29.5**	**-1.9**
Innovative SMEs collaborating with others	146.6		-50.0	5.4
Public-private co-publications	381.0		181.9	53.2
Job-to-job mobility of HRST	110.4		32.4	-32.4
Intellectual assets	**143.5**		**0.0**	**7.2**
PCT patent applications	115.1		-6.6	-3.3
Trademark applications	135.2		19.8	8.5
Design applications	190.6		-7.2	18.8
Employment impacts	**122.5**		**1.3**	**0.0**
Employment in knowledge-intensive activities	110.4		0.0	0.0
Employment in innovative enterprises	132.1		2.4	0.0
Sales impacts	**85.7**		**5.8**	**-2.9**
Medium and high-tech goods exports	101.4		-2.2	-3.7
Knowledge-intensive services exports	60.4		12.1	10.1
Sales of innovative products	98.8		8.9	-17.1
Environmental sustainability	**106.5**		**1.2**	**-1.4**
Resource productivity	82.6		11.8	-9.9
Air emissions by fine particulate matter	119.6		8.6	0.1
Environment-related technologies	110.6		-14.9	2.5

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

AUSTRIA is a **Strong Innovator** with performance at 118.3% of the EU average. Performance is above the average of the Strong Innovators (114.5%). Performance is increasing (4.6%-points) at a rate lower than that of the EU (9.9%-points). The country's performance lead over the EU is becoming smaller.

Relative strengths

- Public-private co-publications
- Foreign doctorate students
- Design applications
- International scientific co-publications
- Government support for business R&D

Relative weaknesses

- Knowledge-intensive services exports
- Non-R&D Innovation expenditures
- Broadband penetration
- Venture capital expenditures
- Resource productivity

Strong increases since 2015

- Public-private co-publications
- International scientific co-publications
- Foreign doctorate students

Strong decreases since 2015

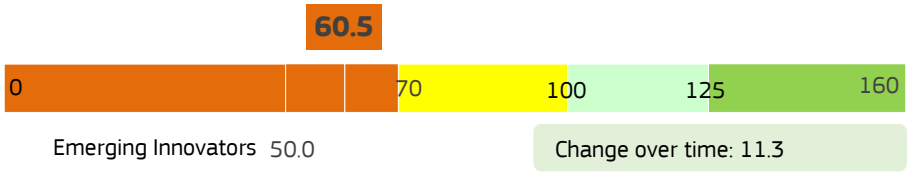
- Enterprises providing ICT training
- Innovative SMEs collaborating with others
- Government support for business R&D

Strong increases since 2021

- Public-private co-publications
- Venture capital expenditures
- International scientific co-publications

Strong decreases since 2021

- Job-to-job mobility of HRST
- Business process innovators
- Sales of innovative products



Emerging Innovators 50.0

Change over time: 11.3

Poland	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**60.5**		**11.3**	**4.3**
Human resources	**54.6**		**0.0**	**-4.8**
Doctorate graduates	25.8		0.0	-11.4
Population with tertiary education	96.3		0.0	0.0
Lifelong learning	40.0		0.0	0.0
Attractive research systems	**42.2**		**26.8**	**11.0**
International scientific co-publications	40.0		31.0	8.9
Most cited publications	44.6		17.9	1.2
Foreign doctorate students	40.3		42.4	34.2
Digitalisation	**84.3**		**7.9**	**7.9**
Broadband penetration	89.7		15.2	15.2
People with above basic overall digital skills	77.3		0.0	0.0
Finance and support	**59.8**		**20.1**	**1.2**
R&D expenditures in the public sector	60.6		3.2	4.8
Venture capital expenditures	48.2		4.4	-6.6
Government support for business R&D	74.7		59.1	4.2
Firm investments	**56.9**		**-6.1**	**-5.2**
R&D expenditure in the business sector	56.1		38.8	3.9
Non-R&D Innovation expenditures	82.6		-45.9	-6.5
Innovation expenditures per employee	37.8		-8.9	-12.7
Use of information technologies	**71.7**		**26.1**	**16.3**
Enterprises providing ICT training	87.5		50.0	31.3
Employed ICT specialists	54.5		0.0	0.0
Innovators	**41.4**		**46.5**	**28.8**
Product innovators (SMEs)	43.5		32.9	11.5
Business process innovators (SMEs)	39.6		60.9	47.3
Linkages	**73.8**		**33.4**	**0.8**
Innovative SMEs collaborating with others	51.1		39.5	29.6
Public-private co-publications	54.1		37.0	5.8
Job-to-job mobility of HRST	100.0		26.5	-26.5
Intellectual assets	**84.0**		**5.9**	**4.2**
PCT patent applications	38.1		1.9	1.1
Trademark applications	89.0		18.5	8.0
Design applications	141.0		1.1	4.9
Employment impacts	**49.2**		**26.5**	**21.7**
Employment in knowledge-intensive activities	55.8		0.0	0.0
Employment in innovative enterprises	44.0		50.8	41.6
Sales impacts	**65.7**		**9.5**	**5.1**
Medium and high-tech goods exports	83.9		-0.4	-1.3
Knowledge-intensive services exports	56.7		20.8	8.7
Sales of innovative products	54.6		9.2	9.4
Environmental sustainability	**44.5**		**-15.7**	**-10.1**
Resource productivity	45.2		20.9	3.6
Air emissions by fine particulate matter	50.8		8.4	1.1
Environment-related technologies	34.3		-69.4	-32.9

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

POLAND is an **Emerging Innovator** with performance at 60.5% of the EU average. Performance is above the average of the Emerging Innovators (50.0%). Performance is increasing (11.3%-points) at a rate higher than that of the EU (9.9%-points). The country's performance gap to the EU is becoming smaller.

Relative strengths

- Design applications
- Job-to-job mobility of HRST
- Population with tertiary education
- Broadband penetration
- Trademark applications

Relative weaknesses

- Doctorate graduates
- Environment-related technologies
- Innovation expenditures per employee
- PCT patent applications
- Business process innovators

Strong increases since 2015

- Business process innovators
- Government support for business R&D
- Enterprises providing ICT training

Strong decreases since 2015

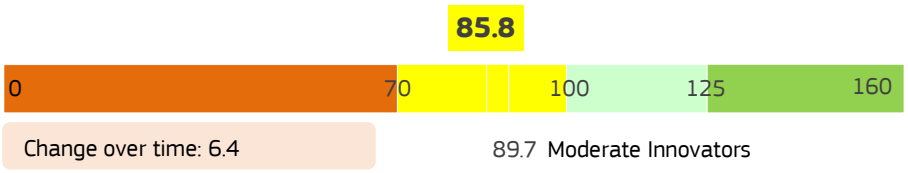
- Environment-related technologies
- Non-R&D Innovation expenditures
- Innovation expenditures per employee

Strong increases since 2021

- Business process innovators
- Employment in innovative enterprises
- Foreign doctorate students

Strong decreases since 2021

- Environment-related technologies
- Job-to-job mobility of HRST
- Innovation expenditures per employee



Change over time: 6.4

89.7 Moderate Innovators

Portugal	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**85.8**		**6.4**	**2.1**
Human resources	**120.2**		**-4.8**	**0.0**
Doctorate graduates	100.0		-11.4	0.0
Population with tertiary education	138.5		0.0	0.0
Lifelong learning	123.3		0.0	0.0
Attractive research systems	**128.9**		**42.6**	**8.0**
International scientific co-publications	132.8		83.0	21.0
Most cited publications	93.0		-10.1	1.1
Foreign doctorate students	192.3		120.2	11.0
Digitalisation	**133.5**		**7.9**	**7.9**
Broadband penetration	148.7		15.2	15.2
People with above basic overall digital skills	113.6		0.0	0.0
Finance and support	**87.6**		**14.5**	**-1.8**
R&D expenditures in the public sector	81.8		-3.2	4.8
Venture capital expenditures	54.4		-16.7	-33.9
Government support for business R&D	140.1		70.5	22.2
Firm investments	**48.0**		**-4.1**	**-4.0**
R&D expenditure in the business sector	58.8		22.5	14.7
Non-R&D Innovation expenditures	64.3		-24.7	3.2
Innovation expenditures per employee	26.5		-8.9	-29.1
Use of information technologies	**114.1**		**-9.8**	**-16.3**
Enterprises providing ICT training	118.8		-18.8	-31.3
Employed ICT specialists	109.1		0.0	0.0
Innovators	**99.3**		**-9.2**	**26.2**
Product innovators (SMEs)	90.6		-15.2	-13.0
Business process innovators (SMEs)	106.9		-2.8	67.9
Linkages	**91.0**		**40.4**	**-27.9**
Innovative SMEs collaborating with others	50.3		-14.3	-14.6
Public-private co-publications	135.3		93.9	23.3
Job-to-job mobility of HRST	104.2		64.7	-61.8
Intellectual assets	**77.6**		**-0.5**	**2.9**
PCT patent applications	53.3		7.7	0.7
Trademark applications	108.0		26.2	6.5
Design applications	78.8		-30.4	2.8
Employment impacts	**95.0**		**-2.9**	**24.2**
Employment in knowledge-intensive activities	88.3		0.0	0.0
Employment in innovative enterprises	100.4		-5.5	46.4
Sales impacts	**74.5**		**28.3**	**11.5**
Medium and high-tech goods exports	65.2		12.4	-4.2
Knowledge-intensive services exports	55.2		8.2	21.8
Sales of innovative products	111.0		72.2	19.9
Environmental sustainability	**27.4**		**-18.4**	**-5.7**
Resource productivity	48.6		-2.7	-6.3
Air emissions by fine particulate matter	0.0		0.0	0.0
Environment-related technologies	47.2		-51.2	-12.0

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PORTUGAL is a **Moderate Innovator** with performance at 85.8% of the EU average. Performance is below the average of the Moderate Innovators (89.7%). Performance is increasing (6.4%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Foreign doctorate students
- Broadband penetration
- Government support for business R&D
- Population with tertiary education
- Public-private co-publications

Relative weaknesses

- Air emissions by fine particulate matter
- Innovation expenditures per employee
- Environment-related technologies
- Resource productivity
- Innovative SMEs collaborating with others

Strong increases since 2015

- Foreign doctorate students
- Public-private co-publications
- International scientific co-publications

Strong decreases since 2015

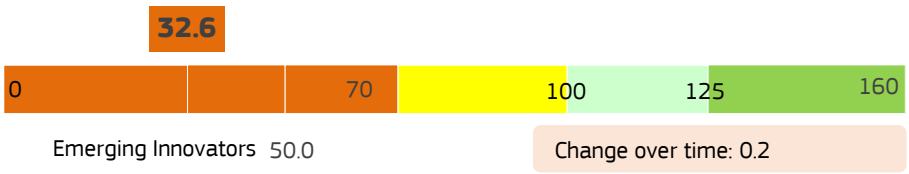
- Environment-related technologies
- Design applications
- Non-R&D Innovation expenditures

Strong increases since 2021

- Business process innovators
- Employment in innovative enterprises
- Public-private co-publications

Strong decreases since 2021

- Job-to-job mobility of HRST
- Venture capital expenditures
- Enterprises providing ICT training



Romania	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**32.6**		**0.2**	**-2.9**
Human resources	**19.2**		**-24.2**	**0.0**
Doctorate graduates	25.8		-57.2	0.0
Population with tertiary education	0.0		0.0	0.0
Lifelong learning	34.4		0.0	0.0
Attractive research systems	**35.5**		**19.0**	**4.2**
International scientific co-publications	23.8		14.6	4.5
Most cited publications	51.4		26.1	6.9
Foreign doctorate students	20.0		7.3	-2.0
Digitalisation	**86.7**		**12.7**	**12.7**
Broadband penetration	135.9		24.2	24.2
People with above basic overall digital skills	22.7		0.0	0.0
Finance and support	**29.5**		**3.7**	**-5.1**
R&D expenditures in the public sector	10.6		-12.9	-1.6
Venture capital expenditures	63.2		47.7	-13.9
Government support for business R&D	7.7		-19.2	-0.7
Firm investments	**12.2**		**-6.5**	**-2.0**
R&D expenditure in the business sector	15.5		12.4	0.0
Non-R&D Innovation expenditures	13.8		-34.6	-14.1
Innovation expenditures per employee	8.2		3.6	8.2
Use of information technologies	**13.0**		**3.3**	**0.0**
Enterprises providing ICT training	12.5		6.3	0.0
Employed ICT specialists	13.6		0.0	0.0
Innovators	**4.6**		**6.5**	**-7.8**
Product innovators (SMEs)	9.9		12.5	-15.1
Business process innovators (SMEs)	0.0		0.0	0.0
Linkages	**7.4**		**-1.4**	**-4.5**
Innovative SMEs collaborating with others	0.0		-4.0	-15.3
Public-private co-publications	38.4		27.5	6.9
Job-to-job mobility of HRST	0.0		-11.8	0.0
Intellectual assets	**32.7**		**5.6**	**0.2**
PCT patent applications	22.8		-1.8	-1.2
Trademark applications	57.5		19.2	5.5
Design applications	20.1		4.0	-2.3
Employment impacts	**8.0**		**0.0**	**0.0**
Employment in knowledge-intensive activities	18.2		0.0	0.0
Employment in innovative enterprises	0.0		0.0	0.0
Sales impacts	**69.3**		**7.7**	**-8.4**
Medium and high-tech goods exports	99.2		12.2	-9.2
Knowledge-intensive services exports	65.9		18.9	12.2
Sales of innovative products	36.4		-11.1	-31.1
Environmental sustainability	**45.6**		**-14.4**	**-14.8**
Resource productivity	7.7		-3.7	-3.1
Air emissions by fine particulate matter	63.3		19.4	-1.2
Environment-related technologies	56.5		-62.0	-39.0

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ROMANIA is an **Emerging Innovator** with performance at 32.6% of the EU average. Performance is below the average of the Emerging Innovators (50.0%). Performance is just increasing (0.2%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Broadband penetration
- Medium and high-tech goods exports
- Knowledge-intensive services exports
- Air emissions by fine particulate matter
- Venture capital expenditures

Relative weaknesses

- Population with tertiary education
- Business process innovators
- Innovative SMEs collaborating with others
- Job-to-job mobility of HRST
- Employment in innovative enterprises

Strong increases since 2015

- Venture capital expenditures
- Public-private co-publications
- Most cited publications

Strong decreases since 2015

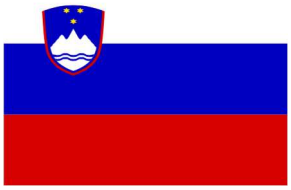
- Environment-related technologies
- Doctorate graduates
- Non-R&D Innovation expenditures

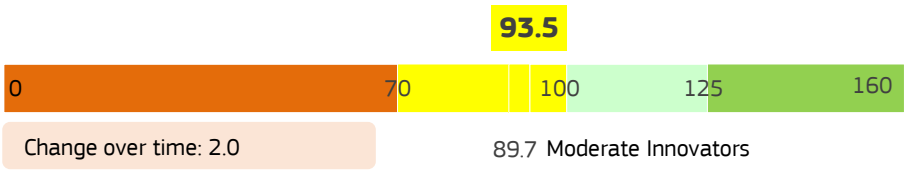
Strong increases since 2021

- Broadband penetration
- Knowledge-intensive services exports
- Innovation expenditures per employee

Strong decreases since 2021

- Environment-related technologies
- Sales of innovative products
- Innovative SMEs collaborating with others





Change over time: 2.0

89.7 Moderate Innovators

Slovenia	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**93.5**	**2.0**	**3.0**
Human resources	**140.2**	**-38.8**	**-4.8**
Doctorate graduates	100.0	-91.5	-11.4
Population with tertiary education	141.0	0.0	0.0
Lifelong learning	190.0	0.0	0.0
Attractive research systems	**108.0**	**41.2**	**5.4**
International scientific co-publications	152.1	74.0	21.9
Most cited publications	75.7	7.7	-2.6
Foreign doctorate students	114.1	83.9	7.6
Digitalisation	**86.7**	**15.9**	**15.9**
Broadband penetration	97.4	30.3	30.3
People with above basic overall digital skills	72.7	0.0	0.0
Finance and support	**65.3**	**-22.1**	**10.8**
R&D expenditures in the public sector	66.7	-6.5	6.5
Venture capital expenditures	20.9	0.6	9.9
Government support for business R&D	124.3	-66.6	17.8
Firm investments	**60.2**	**-29.9**	**0.1**
R&D expenditure in the business sector	102.7	-30.2	4.7
Non-R&D Innovation expenditures	26.9	-75.6	-6.9
Innovation expenditures per employee	50.6	16.1	2.7
Use of information technologies	**126.1**	**19.6**	**-6.5**
Enterprises providing ICT training	137.5	37.5	-12.5
Employed ICT specialists	113.6	0.0	0.0
Innovators	**116.1**	**47.9**	**14.4**
Product innovators (SMEs)	134.6	62.4	-2.6
Business process innovators (SMEs)	99.9	32.4	32.4
Linkages	**142.3**	**54.7**	**15.0**
Innovative SMEs collaborating with others	114.1	-0.3	-4.9
Public-private co-publications	269.6	114.5	42.1
Job-to-job mobility of HRST	110.4	76.5	20.6
Intellectual assets	**77.8**	**-13.9**	**-6.4**
PCT patent applications	67.2	-23.7	-18.0
Trademark applications	113.6	21.5	3.6
Design applications	54.6	-29.0	-0.1
Employment impacts	**107.4**	**-2.9**	**0.0**
Employment in knowledge-intensive activities	135.1	0.0	0.0
Employment in innovative enterprises	85.4	-5.5	0.0
Sales impacts	**82.4**	**10.1**	**2.9**
Medium and high-tech goods exports	112.3	13.0	-5.3
Knowledge-intensive services exports	45.2	16.7	14.8
Sales of innovative products	93.2	-1.2	-0.1
Environmental sustainability	**78.1**	**5.9**	**0.7**
Resource productivity	87.6	19.6	-1.3
Air emissions by fine particulate matter	83.5	2.5	1.4
Environment-related technologies	60.6	0.6	1.1

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

SLOVENIA is a **Moderate Innovator** with performance at 93.5% of the EU average. Performance is above the average of the Moderate Innovators (89.7%). Performance is increasing (2.0%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Public-private co-publications
- Lifelong learning
- International scientific co-publications
- Population with tertiary education
- Enterprises providing ICT training

Relative weaknesses

- Venture capital expenditures
- Non-R&D Innovation expenditures
- Knowledge-intensive services exports
- Innovation expenditures per employee
- Design applications

Strong increases since 2015

- Public-private co-publications
- Foreign doctorate students
- Job-to-job mobility of HRST

Strong decreases since 2015

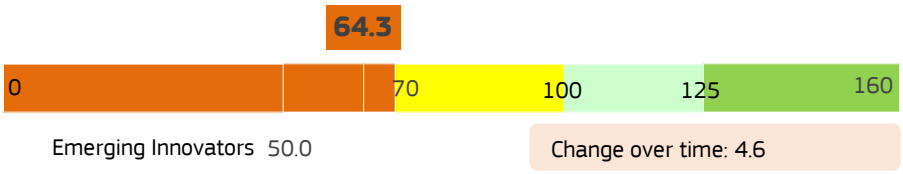
- Doctorate graduates
- Non-R&D Innovation expenditures
- Government support for business R&D

Strong increases since 2021

- Public-private co-publications
- Business process innovators
- Broadband penetration

Strong decreases since 2021

- PCT patent applications
- Enterprises providing ICT training
- Doctorate graduates



Slovakia	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**64.3**		**4.6**	**4.6**
Human resources	**71.8**		**-19.4**	**0.0**
Doctorate graduates	85.2		-45.8	0.0
Population with tertiary education	89.6		0.0	0.0
Lifelong learning	33.3		0.0	0.0
Attractive research systems	**54.2**		**23.9**	**7.9**
International scientific co-publications	70.2		53.9	12.7
Most cited publications	39.4		13.1	5.5
Foreign doctorate students	62.3		19.6	8.5
Digitalisation	**68.4**		**7.9**	**7.9**
Broadband penetration	61.5		15.2	15.2
People with above basic overall digital skills	77.3		0.0	0.0
Finance and support	**38.6**		**12.5**	**7.6**
R&D expenditures in the public sector	45.5		-3.2	8.1
Venture capital expenditures	42.6		32.4	12.3
Government support for business R&D	24.6		13.3	2.2
Firm investments	**55.7**		**10.1**	**4.4**
R&D expenditure in the business sector	29.7		8.5	3.1
Non-R&D Innovation expenditures	99.6		16.7	-1.8
Innovation expenditures per employee	43.2		4.8	11.9
Use of information technologies	**82.6**		**-3.3**	**-6.5**
Enterprises providing ICT training	75.0		-6.3	-12.5
Employed ICT specialists	90.9		0.0	0.0
Innovators	**42.3**		**15.6**	**14.2**
Product innovators (SMEs)	42.9		16.0	0.5
Business process innovators (SMEs)	41.8		15.1	28.8
Linkages	**50.1**		**13.8**	**-0.1**
Innovative SMEs collaborating with others	59.1		-11.3	-8.8
Public-private co-publications	82.7		55.3	10.2
Job-to-job mobility of HRST	29.2		17.6	2.9
Intellectual assets	**52.9**		**5.8**	**4.4**
PCT patent applications	38.5		-0.3	-2.2
Trademark applications	79.1		27.8	10.0
Design applications	45.1		-3.7	7.9
Employment impacts	**54.6**		**11.9**	**9.7**
Employment in knowledge-intensive activities	66.2		0.0	0.0
Employment in innovative enterprises	45.4		22.8	18.6
Sales impacts	**96.9**		**-1.0**	**11.7**
Medium and high-tech goods exports	129.4		6.9	-7.3
Knowledge-intensive services exports	52.0		20.9	15.1
Sales of innovative products	114.5		-36.6	32.7
Environmental sustainability	**93.4**		**-7.8**	**-5.6**
Resource productivity	71.3		0.0	-0.4
Air emissions by fine particulate matter	105.2		19.1	3.7
Environment-related technologies	97.6		-45.4	-20.3

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

SLOVAKIA is an **Emerging Innovator** with performance at 64.3% of the EU average. Performance is above the average of the Emerging Innovators (50.0%). Performance is increasing (4.6%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Medium and high-tech goods exports
- Sales of innovative products
- Air emissions by fine particulate matter
- Non-R&D Innovation expenditures
- Environment-related technologies

Relative weaknesses

- Government support for business R&D
- Job-to-job mobility of HRST
- R&D expenditure in the business sector
- Lifelong learning
- PCT patent applications

Strong increases since 2015

- Public-private co-publications
- International scientific co-publications
- Venture capital expenditures

Strong decreases since 2015

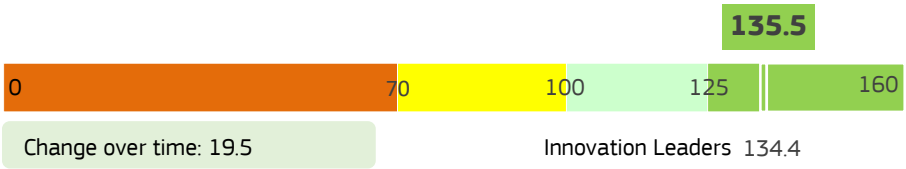
- Doctorate graduates
- Environment-related technologies
- Sales of innovative products

Strong increases since 2021

- Sales of innovative products
- Business process innovators
- Employment in innovative enterprises

Strong decreases since 2021

- Environment-related technologies
- Enterprises providing ICT training
- Innovative SMEs collaborating with others



Finland	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**135.5**	**19.5**	**7.5**
Human resources	**169.5**	**-4.8**	**4.8**
Doctorate graduates	159.3	-11.4	11.4
Population with tertiary education	93.3	0.0	0.0
Lifelong learning	275.6	0.0	0.0
Attractive research systems	**158.7**	**42.9**	**8.5**
International scientific co-publications	218.3	111.6	19.4
Most cited publications	127.1	8.2	3.7
Foreign doctorate students	143.6	55.0	8.8
Digitalisation	**156.5**	**22.2**	**22.2**
Broadband penetration	123.1	42.4	42.4
People with above basic overall digital skills	200.0	0.0	0.0
Finance and support	**101.3**	**17.3**	**6.5**
R&D expenditures in the public sector	124.2	-8.1	0.0
Venture capital expenditures	134.5	87.4	27.0
Government support for business R&D	26.7	-20.6	-5.9
Firm investments	**104.4**	**1.1**	**0.1**
R&D expenditure in the business sector	129.7	-21.7	10.1
Non-R&D Innovation expenditures	72.8	14.4	-9.1
Innovation expenditures per employee	107.7	9.6	-0.3
Use of information technologies	**221.7**	**0.0**	**3.3**
Enterprises providing ICT training	212.5	0.0	6.3
Employed ICT specialists	231.8	0.0	0.0
Innovators	**147.5**	**58.1**	**28.8**
Product innovators (SMEs)	147.9	25.7	14.2
Business process innovators (SMEs)	147.0	92.7	44.2
Linkages	**224.4**	**88.9**	**5.0**
Innovative SMEs collaborating with others	255.4	133.9	0.0
Public-private co-publications	382.0	122.1	39.8
Job-to-job mobility of HRST	133.3	35.3	-5.9
Intellectual assets	**130.8**	**1.2**	**0.2**
PCT patent applications	147.0	-3.4	-3.2
Trademark applications	114.0	26.0	0.9
Design applications	126.3	-12.0	3.8
Employment impacts	**139.1**	**23.0**	**7.1**
Employment in knowledge-intensive activities	129.9	0.0	0.0
Employment in innovative enterprises	146.4	44.1	13.6
Sales impacts	**109.6**	**35.2**	**15.4**
Medium and high-tech goods exports	73.7	10.9	-4.5
Knowledge-intensive services exports	113.1	16.8	12.9
Sales of innovative products	149.8	88.2	44.2
Environmental sustainability	**79.0**	**-0.6**	**0.2**
Resource productivity	25.4	17.4	-4.2
Air emissions by fine particulate matter	99.7	10.8	5.2
Environment-related technologies	101.1	-26.5	-2.7

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FINLAND is an **Innovation Leader** with performance at 135.5% of the EU average. Performance is above the average of the Innovation Leaders (134.4%). Performance is increasing (19.5%-points) at a rate higher than that of the EU (9.9%-points). The country's performance lead over the EU is becoming larger.

Relative strengths

- Public-private co-publications
- Lifelong learning
- Innovative SMEs collaborating with others
- Employed ICT specialists
- Enterprises providing ICT training

Relative weaknesses

- Resource productivity
- Government support for business R&D
- Non-R&D Innovation expenditures
- Medium and high-tech goods exports
- Population with tertiary education

Strong increases since 2015

- Innovative SMEs collaborating with others
- Public-private co-publications
- International scientific co-publications

Strong decreases since 2015

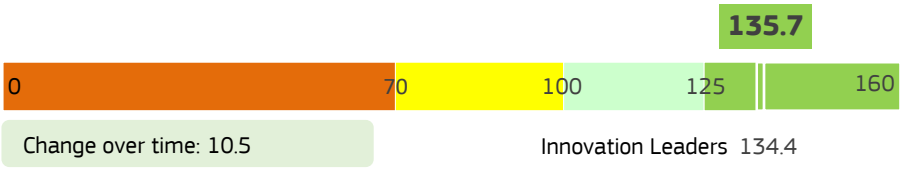
- Environment-related technologies
- R&D expenditure in the business sector
- Government support for business R&D

Strong increases since 2021

- Business process innovators
- Sales of innovative products
- Broadband penetration

Strong decreases since 2021

- Non-R&D Innovation expenditures
- Job-to-job mobility of HRST
- Government support for business R&D



Sweden	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**135.7**		**10.5**	**1.7**
Human resources	**183.9**		**-19.4**	**-9.7**
Doctorate graduates	144.5		-45.8	-22.9
Population with tertiary education	149.5		0.0	0.0
Lifelong learning	275.6		0.0	0.0
Attractive research systems	**183.2**		**26.8**	**4.5**
International scientific co-publications	241.1		106.0	16.0
Most cited publications	132.2		-7.1	-0.1
Foreign doctorate students	207.6		27.2	3.8
Digitalisation	**150.2**		**6.3**	**6.3**
Broadband penetration	153.8		12.1	12.1
People with above basic overall digital skills	145.5		0.0	0.0
Finance and support	**112.6**		**29.4**	**32.8**
R&D expenditures in the public sector	130.3		4.8	4.8
Venture capital expenditures	127.7		90.5	33.6
Government support for business R&D	69.3		-0.3	69.9
Firm investments	**129.6**		**-9.0**	**0.4**
R&D expenditure in the business sector	168.9		23.3	9.3
Non-R&D Innovation expenditures	73.1		-48.7	-7.5
Innovation expenditures per employee	140.5		0.0	0.0
Use of information technologies	**202.2**		**0.0**	**0.0**
Enterprises providing ICT training	175.0		0.0	0.0
Employed ICT specialists	231.8		0.0	0.0
Innovators	**142.6**		**75.0**	**0.8**
Product innovators (SMEs)	149.5		53.5	-20.5
Business process innovators (SMEs)	136.5		97.9	23.5
Linkages	**139.6**		**5.1**	**-24.1**
Innovative SMEs collaborating with others	133.7		20.0	-2.9
Public-private co-publications	381.4		128.8	39.9
Job-to-job mobility of HRST	41.7		-61.8	-70.6
Intellectual assets	**124.6**		**-8.9**	**-2.2**
PCT patent applications	150.6		0.0	0.0
Trademark applications	119.2		17.9	4.1
Design applications	94.8		-39.8	-9.6
Employment impacts	**156.9**		**18.8**	**3.0**
Employment in knowledge-intensive activities	181.8		0.0	0.0
Employment in innovative enterprises	137.1		36.0	5.7
Sales impacts	**102.8**		**21.7**	**-1.1**
Medium and high-tech goods exports	94.2		2.1	-7.9
Knowledge-intensive services exports	114.9		17.1	11.7
Sales of innovative products	97.9		52.5	-7.0
Environmental sustainability	**86.9**		**6.3**	**-1.8**
Resource productivity	54.3		3.9	3.5
Air emissions by fine particulate matter	103.5		9.3	0.1
Environment-related technologies	94.3		4.4	-7.7

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SWEDEN is an **Innovation Leader** with performance at 135.7% of the EU average. Performance is above the average of the Innovation Leaders (134.4%). Performance is increasing (10.5%-points) at a rate higher than that of the EU (9.9%-points). The country's performance lead over the EU is becoming larger.

Relative strengths

- Public-private co-publications
- Lifelong learning
- International scientific co-publications
- Employed ICT specialists
- Foreign doctorate students

Relative weaknesses

- Job-to-job mobility of HRST
- Resource productivity
- Government support for business R&D
- Non-R&D Innovation expenditures
- Medium and high-tech goods exports

Strong increases since 2015

- Public-private co-publications
- International scientific co-publications
- Business process innovators

Strong decreases since 2015

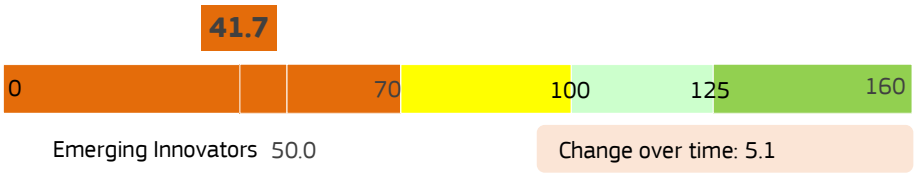
- Job-to-job mobility of HRST
- Non-R&D Innovation expenditures
- Doctorate graduates

Strong increases since 2021

- Government support for business R&D
- Public-private co-publications
- Venture capital expenditures

Strong decreases since 2021

- Job-to-job mobility of HRST
- Doctorate graduates
- Product innovators



Albania *	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**41.7**		**5.0**	**-0.1**
Human resources	**56.8**		**-0.2**	**0.0**
Doctorate graduates	10.0		-0.5	0.0
Population with tertiary education	78.8		0.0	0.0
Lifelong learning	88.9		0.0	0.0
Attractive research systems	**39.1**		**14.7**	**6.2**
International scientific co-publications	6.8		10.2	3.8
Most cited publications	50.3		48.4	10.4
Foreign doctorate students	58.6		-54.8	-0.8
Digitalisation	**5.0**		**1.1**	**1.1**
Broadband penetration	8.9		2.2	2.2
People with above basic overall digital skills	0.0		0.0	0.0
Finance and support	**0.0**		**0.0**	**0.0**
R&D expenditures in the public sector	0.0		0.0	0.0
Venture capital expenditures	N/A		N/A	N/A
Government support for business R&D	N/A		N/A	N/A
Firm investments	**0.0**		**0.0**	**0.0**
R&D expenditure in the business sector	0.0		0.0	0.0
Non-R&D Innovation expenditures	N/A		N/A	N/A
Innovation expenditures per employee	N/A		N/A	N/A
Use of information technologies	**N/A**		**N/A**	**N/A**
Enterprises providing ICT training	N/A		N/A	N/A
Employed ICT specialists	N/A		N/A	N/A
Innovators	**70.4**		**-8.6**	**-8.6**
Product innovators (SMEs)	81.4		-9.4	-9.4
Business process innovators (SMEs)	60.7		-7.7	-7.7
Linkages	**40.8**		**-13.3**	**-14.4**
Innovative SMEs collaborating with others	73.1		-27.9	-27.9
Public-private co-publications	6.3		8.7	4.9
Job-to-job mobility of HRST	N/A		N/A	N/A
Intellectual assets	**5.7**		**5.2**	**-1.3**
PCT patent applications	N/A		N/A	N/A
Trademark applications	12.3		13.4	-3.0
Design applications	0.0		0.0	-0.4
Employment impacts	**35.2**		**-2.5**	**-2.5**
Employment in knowledge-intensive activities	25.5		0.0	0.0
Employment in innovative enterprises	43.0		-4.8	-4.8
Sales impacts	**55.6**		**3.3**	**5.1**
Medium and high-tech goods exports	0.0		0.0	0.0
Knowledge-intensive services exports	20.9		10.0	15.2
Sales of innovative products	169.2		0.0	0.0
Environmental sustainability	**98.2**		**37.3**	**0.0**
Resource productivity	36.8		19.5	0.0
Air emissions by fine particulate matter	N/A		N/A	N/A
Environment-related technologies	190.8		58.2	0.0

ALBANIA is an **Emerging Innovator** with performance at 41.7% of the EU average. Performance is below the average of the Emerging Innovators (50.0%). Performance is increasing (5.1%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Environment-related technologies
- Sales of innovative products
- Lifelong learning
- Product innovators
- Population with tertiary education

Relative weaknesses

- People with above basic overall digital skills
- R&D expenditures in the public sector
- R&D expenditure in the business sector
- Design applications
- Medium and high-tech goods exports

Strong increases since 2015

- Environment-related technologies
- Most cited publications
- Resource productivity

Strong decreases since 2015

- Foreign doctorate students
- Innovative SMEs collaborating with others
- Product innovators

Strong increases since 2021

- Knowledge-intensive services exports
- Most cited publications
- Public-private co-publications

Strong decreases since 2021

- Innovative SMEs collaborating with others
- Product innovators
- Business process innovators

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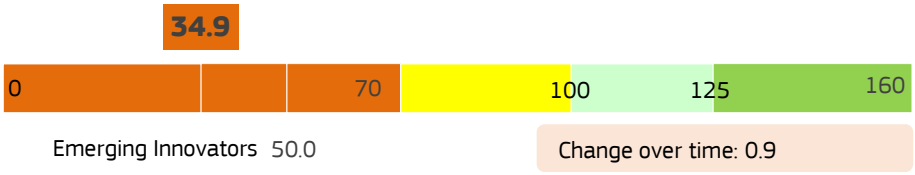
* Results for Albania (AL) are less reliable due to limited data availability. ** Data are not available, and it has been assumed that the normalised and relative to EU values equal 0, the same as the worst performing country. This assumption has been made to maximize data availability to allow to include Albania in the EIS and is in line with the latest known low R&D intensity of 0.15 in 2008.



Bosnia and Herzegovina	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**34.9**		**0.9**	**-0.9**
Human resources	**10.9**		**3.4**	**0.0**
Doctorate graduates	16.8		8.0	0.0
Population with tertiary education	0.0		0.0	0.0
Lifelong learning	16.7		0.0	0.0
Attractive research systems	**24.1**		**10.1**	**-10.0**
International scientific co-publications	17.2		19.4	3.1
Most cited publications	23.8		4.5	-13.9
Foreign doctorate students	N/A		N/A	N/A
Digitalisation	**31.0**		**0.0**	**0.0**
Broadband penetration	51.3		0.0	0.0
People with above basic overall digital skills	4.5		0.0	0.0
Finance and support	**0.7**		**-1.8**	**-0.3**
R&D expenditures in the public sector	0.0		-1.6	0.0
Venture capital expenditures	N/A		N/A	N/A
Government support for business R&D	1.7		-1.8	-0.6
Firm investments	**0.4**		**-3.0**	**0.0**
R&D expenditure in the business sector	1.4		-9.3	0.0
Non-R&D Innovation expenditures	0.0		0.0	0.0
Innovation expenditures per employee	0.0		0.0	0.0
Use of information technologies	**71.7**		**-6.5**	**-6.5**
Enterprises providing ICT training	68.8		-6.3	-6.3
Employed ICT specialists	N/A		N/A	N/A
Innovators	**110.5**		**0.0**	**0.0**
Product innovators (SMEs)	151.7		0.0	0.0
Business process innovators (SMEs)	74.5		0.0	0.0
Linkages	**15.2**		**13.1**	**5.8**
Innovative SMEs collaborating with others	N/A		N/A	N/A
Public-private co-publications	26.3		23.1	10.2
Job-to-job mobility of HRST	N/A		N/A	N/A
Intellectual assets	**8.9**		**-5.8**	**-0.5**
PCT patent applications	14.5		-18.6	-2.2
Trademark applications	9.9		6.7	1.6
Design applications	0.4		-0.1	0.0
Employment impacts	**79.8**		**0.0**	**0.0**
Employment in knowledge-intensive activities	N/A		N/A	N/A
Employment in innovative enterprises	71.5		0.0	0.0
Sales impacts	**31.9**		**7.0**	**0.0**
Medium and high-tech goods exports	29.0		14.1	0.0
Knowledge-intensive services exports	7.3		5.1	0.0
Sales of innovative products	67.2		0.0	0.0
Environmental sustainability	**88.8**		**1.1**	**-1.1**
Resource productivity	14.7		3.0	-3.2
Air emissions by fine particulate matter	N/A		N/A	N/A
Environment-related technologies	190.8		0.0	0.0

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

BOSNIA AND HERZEGOVINA is an **Emerging Innovator** with performance at 34.9% of the EU average. Performance is below the average of the Emerging Innovators (50.0%). Performance is increasing (0.9%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Environment-related technologies
- Product innovators
- Business process innovators
- Employment in innovative enterprises
- Enterprises providing ICT training

Relative weaknesses

- Population with tertiary education
- R&D expenditures in the public sector
- Non-R&D Innovation expenditures
- Innovation expenditures per employee
- Design applications

Strong increases since 2015

- Public-private co-publications
- International scientific co-publications
- Medium and high-tech goods exports

Strong decreases since 2015

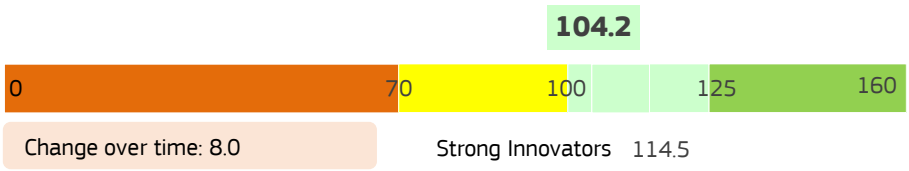
- PCT patent applications
- R&D expenditure in the business sector
- Enterprises providing ICT training

Strong increases since 2021

- Public-private co-publications
- International scientific co-publications
- Trademark applications

Strong decreases since 2021

- Most cited publications
- Enterprises providing ICT training
- Resource productivity



Iceland	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**104.2**		**8.0**	**2.2**
Human resources	**137.1**		**4.8**	**0.0**
Doctorate graduates	85.2		11.4	0.0
Population with tertiary education	101.8		0.0	0.0
Lifelong learning	245.6		0.0	0.0
Attractive research systems	**178.7**		**29.6**	**2.4**
International scientific co-publications	259.6		11.2	0.0
Most cited publications	90.7		-16.2	-8.0
Foreign doctorate students	244.6		146.7	27.5
Digitalisation	**162.1**		**0.0**	**0.0**
Broadband penetration	N/A		N/A	N/A
People with above basic overall digital skills	186.4		0.0	0.0
Finance and support	**111.0**		**32.2**	**3.5**
R&D expenditures in the public sector	101.5		6.5	11.3
Venture capital expenditures	N/A		N/A	N/A
Government support for business R&D	139.9		63.8	-7.4
Firm investments	**78.1**		**18.2**	**2.0**
R&D expenditure in the business sector	110.1		56.6	6.2
Non-R&D Innovation expenditures	81.5		0.0	0.0
Innovation expenditures per employee	48.7		0.0	0.0
Use of information technologies	**105.4**		**0.0**	**0.0**
Enterprises providing ICT training	131.3		0.0	0.0
Employed ICT specialists	77.3		0.0	0.0
Innovators	**102.2**		**-18.0**	**0.0**
Product innovators (SMEs)	103.5		-41.6	0.0
Business process innovators (SMEs)	101.1		7.1	0.0
Linkages	**228.7**		**25.6**	**0.0**
Innovative SMEs collaborating with others	205.6		23.2	0.0
Public-private co-publications	471.5		89.3	0.0
Job-to-job mobility of HRST	143.8		0.0	0.0
Intellectual assets	**56.7**		**-35.1**	**-4.4**
PCT patent applications	87.2		-9.4	-11.5
Trademark applications	70.4		-99.8	4.5
Design applications	0.9		-16.7	-2.8
Employment impacts	**127.8**		**-9.0**	**0.0**
Employment in knowledge-intensive activities	131.2		0.0	0.0
Employment in innovative enterprises	125.0		-17.3	0.0
Sales impacts	**45.7**		**8.4**	**14.7**
Medium and high-tech goods exports	0.0		0.0	0.0
Knowledge-intensive services exports	94.9		25.0	44.1
Sales of innovative products	39.0		0.0	0.0
Environmental sustainability	**63.6**		**35.6**	**1.9**
Resource productivity	109.3		100.8	30.4
Air emissions by fine particulate matter	46.9		15.0	-13.5
Environment-related technologies	43.4		15.8	0.9

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ICELAND is a **Strong Innovator** with performance at 104.2% of the EU average. Performance is below the average of the Strong Innovators (114.5%). Performance is increasing (8.0%-points) at a rate lower than that of the EU (9.9%-points). The country's performance lead over the EU is becoming smaller.

Relative strengths

- Public-private co-publications
- International scientific co-publications
- Lifelong learning
- Foreign doctorate students
- Innovative SMEs collaborating with others

Relative weaknesses

- Medium and high-tech goods exports
- Design applications
- Sales of innovative products
- Environment-related technologies
- Air emissions by fine particulate matter

Strong increases since 2015

- Foreign doctorate students
- Resource productivity
- Public-private co-publications

Strong decreases since 2015

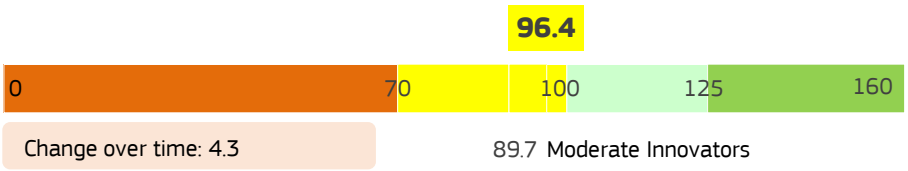
- Trademark applications
- Product innovators
- Employment in innovative enterprises

Strong increases since 2021

- Knowledge-intensive services exports
- Resource productivity
- Foreign doctorate students

Strong decreases since 2021

- Air emissions by fine particulate matter
- PCT patent applications
- Most cited publications



Change over time: 4.3

89.7 Moderate Innovators

Israel *	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**96.4**		**4.3**	**-0.7**
Human resources	**121.0**		**-5.7**	**0.0**
Doctorate graduates	89.9		-9.0	0.0
Population with tertiary education	137.0		0.0	0.0
Lifelong learning	N/A		N/A	N/A
Attractive research systems	**108.3**		**-0.6**	**-3.7**
International scientific co-publications	106.3		36.4	9.7
Most cited publications	87.5		-16.2	-8.8
Foreign doctorate students	N/A		N/A	N/A
Digitalisation	**41.5**		**0.0**	**0.0**
Broadband penetration	36.7		0.0	0.0
People with above basic overall digital skills	N/A		N/A	N/A
Finance and support	**50.4**		**-18.4**	**-3.7**
R&D expenditures in the public sector	55.7		-17.7	-0.2
Venture capital expenditures	N/A		N/A	N/A
Government support for business R&D	51.3		-17.6	-8.0
Firm investments	**161.8**		**0.0**	**0.0**
R&D expenditure in the business sector	168.9		0.0	0.0
Non-R&D Innovation expenditures	N/A		N/A	N/A
Innovation expenditures per employee	N/A		N/A	N/A
Use of information technologies	**122.9**		**42.3**	**11.0**
Enterprises providing ICT training	23.0		0.0	0.0
Employed ICT specialists	231.8		88.3	22.9
Innovators	**N/A**		**N/A**	**N/A**
Product innovators (SMEs)	N/A		N/A	N/A
Business process innovators (SMEs)	N/A		N/A	N/A
Linkages	**72.0**		**17.3**	**2.9**
Innovative SMEs collaborating with others	N/A		N/A	N/A
Public-private co-publications	124.9		30.4	5.1
Job-to-job mobility of HRST	N/A		N/A	N/A
Intellectual assets	**81.4**		**0.5**	**-2.6**
PCT patent applications	150.6		0.0	0.0
Trademark applications	48.6		10.9	-2.5
Design applications	21.7		-6.9	-5.8
Employment impacts	**190.8**		**0.0**	**0.0**
Employment in knowledge-intensive activities	215.6		0.0	0.0
Employment in innovative enterprises	N/A		N/A	N/A
Sales impacts	**121.1**		**31.7**	**1.4**
Medium and high-tech goods exports	119.0		24.9	2.5
Knowledge-intensive services exports	106.7		35.1	0.0
Sales of innovative products	N/A		N/A	N/A
Environmental sustainability	**25.2**		**-32.8**	**-11.8**
Resource productivity	N/A		N/A	N/A
Air emissions by fine particulate matter	N/A		N/A	N/A
Environment-related technologies	29.1		-31.4	-11.3

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

* Results for Israel are less reliable due to limited data availability.

ISRAEL is a **Moderate Innovator** with performance at 96.4% of the EU average. Performance is above the average of the Moderate Innovators (89.7%). Performance is increasing (4.3%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Employed ICT specialists
- Employment in knowledge-intensive activities
- R&D expenditure in the business sector
- PCT patent applications
- Population with tertiary education

Relative weaknesses

- Design applications
- Enterprises providing ICT training
- Environment-related technologies
- Broadband penetration
- Trademark applications

Strong increases since 2015

- Employed ICT specialists
- International scientific co-publications
- Knowledge-intensive services exports

Strong decreases since 2015

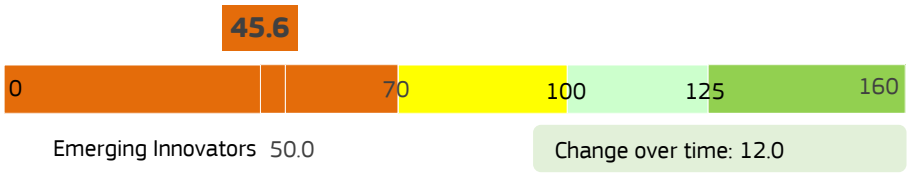
- Environment-related technologies
- R&D expenditures in the public sector
- Government support for business R&D

Strong increases since 2021

- Employed ICT specialists
- International scientific co-publications
- Public-private co-publications

Strong decreases since 2021

- Environment-related technologies
- Most cited publications
- Government support for business R&D



North Macedonia	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**45.6**		**12.0**	**3.1**
Human resources	**34.1**		**-6.6**	**0.0**
Doctorate graduates	11.0		-11.4	0.0
Population with tertiary education	78.6		0.0	0.0
Lifelong learning	8.9		-6.7	0.0
Attractive research systems	**76.6**		**73.2**	**7.7**
International scientific co-publications	19.7		16.4	2.5
Most cited publications	34.4		23.4	2.2
Foreign doctorate students	228.7		234.8	24.3
Digitalisation	**47.0**		**1.6**	**1.6**
Broadband penetration	69.2		3.0	3.0
People with above basic overall digital skills	18.2		0.0	0.0
Finance and support	**15.5**		**-4.3**	**3.8**
R&D expenditures in the public sector	24.2		-12.9	3.2
Venture capital expenditures	N/A		N/A	N/A
Government support for business R&D	6.8		7.7	4.2
Firm investments	**40.6**		**0.5**	**0.0**
R&D expenditure in the business sector	3.4		1.6	0.0
Non-R&D Innovation expenditures	114.5		0.0	0.0
Innovation expenditures per employee	14.4		0.0	0.0
Use of information technologies	**26.1**		**-6.5**	**-16.3**
Enterprises providing ICT training	50.0		-12.5	-31.3
Employed ICT specialists	0.0		0.0	0.0
Innovators	**60.0**		**5.3**	**0.0**
Product innovators (SMEs)	49.2		-4.8	0.0
Business process innovators (SMEs)	69.5		16.0	0.0
Linkages	**49.5**		**34.7**	**-16.3**
Innovative SMEs collaborating with others	46.0		-11.4	0.0
Public-private co-publications	25.5		17.4	8.3
Job-to-job mobility of HRST	62.5		82.4	-41.2
Intellectual assets	**19.1**		**6.5**	**2.5**
PCT patent applications	30.0		11.3	2.1
Trademark applications	22.7		7.1	6.6
Design applications	0.5		0.4	0.0
Employment impacts	**28.0**		**0.0**	**0.0**
Employment in knowledge-intensive activities	11.7		0.0	0.0
Employment in innovative enterprises	41.0		0.0	0.0
Sales impacts	**64.2**		**17.1**	**2.9**
Medium and high-tech goods exports	122.2		23.8	0.0
Knowledge-intensive services exports	40.6		24.4	8.6
Sales of innovative products	22.6		0.0	0.0
Environmental sustainability	**86.8**		**30.1**	**41.8**
Resource productivity	39.6		19.0	-3.0
Air emissions by fine particulate matter	N/A		N/A	N/A
Environment-related technologies	161.8		44.8	82.1

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NORTH MACEDONIA is an **Emerging Innovator** with performance at 45.6% of the EU average. Performance is below the average of the Emerging Innovators (50.0%). Performance is increasing (12.0%-points) at a rate higher than that of the EU (9.9%-points). The country's performance gap to the EU is becoming smaller.

Relative strengths

- Foreign doctorate students
- Environment-related technologies
- Medium and high-tech goods exports
- Non-R&D Innovation expenditures
- Population with tertiary education

Relative weaknesses

- Employed ICT specialists
- Design applications
- R&D expenditure in the business sector
- Government support for business R&D
- Lifelong learning

Strong increases since 2015

- Foreign doctorate students
- Job-to-job mobility of HRST
- Environment-related technologies

Strong decreases since 2015

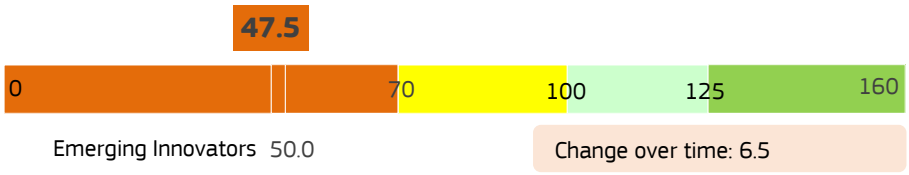
- R&D expenditures in the public sector
- Enterprises providing ICT training
- Doctorate graduates

Strong increases since 2021

- Environment-related technologies
- Foreign doctorate students
- Knowledge-intensive services exports

Strong decreases since 2021

- Job-to-job mobility of HRST
- Enterprises providing ICT training
- Resource productivity



Emerging Innovators 50.0

Change over time: 6.5

Montenegro	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**47.5**		**6.5**	**1.4**
Human resources	**38.2**		**1.0**	**0.0**
Doctorate graduates	5.3		3.7	0.0
Population with tertiary education	95.1		0.0	0.0
Lifelong learning	10.0		-2.2	0.0
Attractive research systems	**44.9**		**-20.8**	**-14.7**
International scientific co-publications	64.1		60.9	23.7
Most cited publications	23.8		-41.8	-37.8
Foreign doctorate students	60.9		-51.2	0.0
Digitalisation	**38.9**		**14.3**	**14.3**
Broadband penetration	51.3		27.3	27.3
People with above basic overall digital skills	22.7		0.0	0.0
Finance and support	**14.5**		**11.5**	**0.0**
R&D expenditures in the public sector	27.3		19.4	0.0
Venture capital expenditures	N/A		N/A	N/A
Government support for business R&D	0.4		-0.2	0.0
Firm investments	**23.7**		**0.2**	**0.0**
R&D expenditure in the business sector	9.5		0.8	0.0
Non-R&D Innovation expenditures	34.7		0.0	0.0
Innovation expenditures per employee	27.1		0.0	0.0
Use of information technologies	**76.1**		**16.3**	**6.5**
Enterprises providing ICT training	137.5		31.3	12.5
Employed ICT specialists	9.1		0.0	0.0
Innovators	**132.5**		**0.0**	**0.0**
Product innovators (SMEs)	170.6		0.0	0.0
Business process innovators (SMEs)	99.0		0.0	0.0
Linkages	**49.0**		**-11.4**	**3.3**
Innovative SMEs collaborating with others	76.4		0.0	0.0
Public-private co-publications	45.3		40.9	30.8
Job-to-job mobility of HRST	29.2		-44.1	-5.9
Intellectual assets	**20.3**		**11.4**	**-5.2**
PCT patent applications	41.5		38.7	-6.0
Trademark applications	12.2		-16.3	-10.7
Design applications	0.0		0.0	0.0
Employment impacts	**105.3**		**0.0**	**0.0**
Employment in knowledge-intensive activities	67.5		0.0	0.0
Employment in innovative enterprises	135.3		0.0	0.0
Sales impacts	**35.4**		**18.4**	**12.2**
Medium and high-tech goods exports	16.6		15.0	-2.9
Knowledge-intensive services exports	40.8		38.2	39.8
Sales of innovative products	51.9		0.0	0.0
Environmental sustainability	**55.4**		**47.0**	**0.0**
Resource productivity	N/A		N/A	N/A
Air emissions by fine particulate matter	N/A		N/A	N/A
Environment-related technologies	64.0		45.1	0.0

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MONTENEGRO is an **Emerging Innovator** with performance at 47.5% of the EU average. Performance is below the average of the Emerging Innovators (50.0%). Performance is increasing (6.5%-points) at a rate lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Product innovators
- Enterprises providing ICT training
- Employment in innovative enterprises
- Business process innovators
- Population with tertiary education

Relative weaknesses

- Design applications
- Government support for business R&D
- Doctorate graduates
- Employed ICT specialists
- R&D expenditure in the business sector

Strong increases since 2015

- International scientific co-publications
- Environment-related technologies
- Public-private co-publications

Strong decreases since 2015

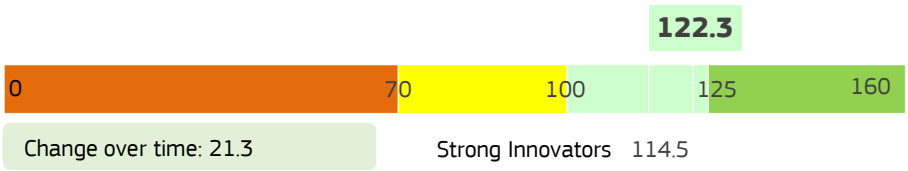
- Foreign doctorate students
- Job-to-job mobility of HRST
- Most cited publications

Strong increases since 2021

- Knowledge-intensive services exports
- Public-private co-publications
- Broadband penetration

Strong decreases since 2021

- Most cited publications
- Trademark applications
- PCT patent applications



Norway	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**122.3**	**21.3**	**4.4**
Human resources	**163.3**	**-9.7**	**-4.8**
Doctorate graduates	114.8	-22.9	-11.4
Population with tertiary education	185.0	0.0	0.0
Lifelong learning	197.8	0.0	0.0
Attractive research systems	**164.1**	**31.6**	**11.2**
International scientific co-publications	259.6	155.7	41.5
Most cited publications	119.1	-11.8	0.0
Foreign doctorate students	129.8	11.1	7.3
Digitalisation	**143.7**	**4.8**	**4.8**
Broadband penetration	117.9	9.1	9.1
People with above basic overall digital skills	177.3	0.0	0.0
Finance and support	**134.7**	**66.8**	**32.7**
R&D expenditures in the public sector	139.4	41.9	4.8
Venture capital expenditures	132.0	103.6	96.2
Government support for business R&D	132.4	62.3	4.8
Firm investments	**82.9**	**23.4**	**4.6**
R&D expenditure in the business sector	80.4	28.7	7.8
Non-R&D Innovation expenditures	89.4	2.2	7.4
Innovation expenditures per employee	79.9	39.5	-1.1
Use of information technologies	**162.0**	**-16.3**	**-16.3**
Enterprises providing ICT training	181.3	-31.3	-31.3
Employed ICT specialists	140.9	0.0	0.0
Innovators	**155.6**	**73.7**	**-1.7**
Product innovators (SMEs)	176.8	67.5	-2.7
Business process innovators (SMEs)	136.9	80.4	-0.5
Linkages	**249.2**	**80.6**	**2.6**
Innovative SMEs collaborating with others	255.4	105.8	0.0
Public-private co-publications	471.5	188.0	47.6
Job-to-job mobility of HRST	150.0	11.8	-14.7
Intellectual assets	**60.6**	**9.1**	**0.2**
PCT patent applications	94.0	0.6	-2.1
Trademark applications	59.1	27.7	5.8
Design applications	16.9	5.2	-1.3
Employment impacts	**134.4**	**20.8**	**1.6**
Employment in knowledge-intensive activities	122.1	0.0	0.0
Employment in innovative enterprises	144.2	39.9	3.1
Sales impacts	**56.0**	**5.3**	**-0.4**
Medium and high-tech goods exports	6.0	6.2	0.0
Knowledge-intensive services exports	114.4	9.8	14.0
Sales of innovative products	42.8	-1.2	-17.7
Environmental sustainability	**84.9**	**0.9**	**6.0**
Resource productivity	71.3	-1.3	0.8
Air emissions by fine particulate matter	80.1	8.6	3.1
Environment-related technologies	105.3	-6.7	13.1

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NORWAY is a **Strong Innovator** with performance at 122.3% of the EU average. Performance is above the average of the Strong Innovators (114.5%). Performance is increasing (21.3%-points) at a rate higher than that of the EU (9.9%-points). The country's performance lead over the EU is becoming larger.

Relative strengths

- Public-private co-publications
- International scientific co-publications
- Innovative SMEs collaborating with others
- Lifelong learning
- Population with tertiary education

Relative weaknesses

- Medium and high-tech goods exports
- Design applications
- Sales of innovative products
- Trademark applications
- Resource productivity

Strong increases since 2015

- Public-private co-publications
- International scientific co-publications
- Innovative SMEs collaborating with others

Strong decreases since 2015

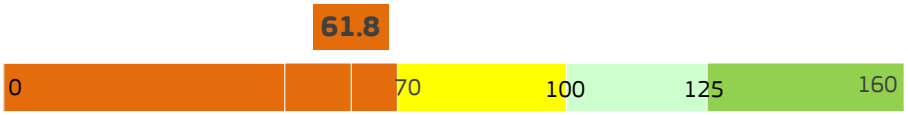
- Enterprises providing ICT training
- Doctorate graduates
- Most cited publications

Strong increases since 2021

- Venture capital expenditures
- Public-private co-publications
- International scientific co-publications

Strong decreases since 2021

- Enterprises providing ICT training
- Sales of innovative products
- Job-to-job mobility of HRST



Emerging Innovators 50.0

Change over time: 15.6

Serbia	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**61.8**	**15.6**	**-3.6**
Human resources	**49.1**	**4.8**	**-4.8**
Doctorate graduates	55.5	11.4	-11.4
Population with tertiary education	55.3	0.0	0.0
Lifelong learning	33.3	0.0	0.0
Attractive research systems	**42.7**	**18.5**	**2.5**
International scientific co-publications	46.6	30.7	1.8
Most cited publications	43.6	14.6	4.8
Foreign doctorate students	36.3	15.7	-2.2
Digitalisation	**47.7**	**22.2**	**22.2**
Broadband penetration	56.4	42.4	42.4
People with above basic overall digital skills	36.4	0.0	0.0
Finance and support	**38.7**	**20.9**	**5.1**
R&D expenditures in the public sector	66.7	8.1	3.2
Venture capital expenditures	29.8	44.6	10.5
Government support for business R&D	15.3	13.7	2.0
Firm investments	**102.2**	**12.2**	**0.0**
R&D expenditure in the business sector	20.3	10.9	0.0
Non-R&D Innovation expenditures	181.5	25.6	0.0
Innovation expenditures per employee	108.9	0.0	0.0
Use of information technologies	**60.9**	**-19.6**	**-42.4**
Enterprises providing ICT training	75.0	-37.5	-81.3
Employed ICT specialists	45.5	0.0	0.0
Innovators	**132.2**	**85.0**	**-2.3**
Product innovators (SMEs)	157.2	101.1	-15.1
Business process innovators (SMEs)	110.2	67.8	11.3
Linkages	**66.0**	**41.7**	**-22.1**
Innovative SMEs collaborating with others	58.3	31.0	-55.8
Public-private co-publications	54.1	43.8	21.6
Job-to-job mobility of HRST	77.1	50.0	-11.8
Intellectual assets	**20.4**	**5.6**	**-0.4**
PCT patent applications	29.3	5.0	0.0
Trademark applications	27.8	13.5	3.9
Design applications	0.7	0.4	-4.1
Employment impacts	**98.7**	**37.3**	**0.0**
Employment in knowledge-intensive activities	51.9	0.0	0.0
Employment in innovative enterprises	135.8	71.6	0.0
Sales impacts	**77.5**	**18.5**	**1.7**
Medium and high-tech goods exports	70.3	-4.5	-3.6
Knowledge-intensive services exports	75.1	30.8	9.0
Sales of innovative products	89.5	34.1	0.0
Environmental sustainability	**27.3**	**-16.0**	**-16.6**
Resource productivity	3.1	-2.0	-2.8
Air emissions by fine particulate matter	0.0	-11.8	0.0
Environment-related technologies	91.6	-30.6	-45.7

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

SERBIA is an **Emerging Innovator** with performance at 61.8% of the EU average. Performance is above the average of the Emerging Innovators (50.0%). Performance is increasing (15.6%-points) at a rate higher than that of the EU (9.9%-points). The country's performance gap to the EU is becoming smaller.

Relative strengths

- Non-R&D Innovation expenditures
- Product innovators
- Employment in innovative enterprises
- Business process innovators
- Innovation expenditures per employee

Relative weaknesses

- Air emissions by fine particulate matter
- Design applications
- Resource productivity
- Government support for business R&D
- R&D expenditure in the business sector

Strong increases since 2015

- Product innovators
- Employment in innovative enterprises
- Business process innovators

Strong decreases since 2015

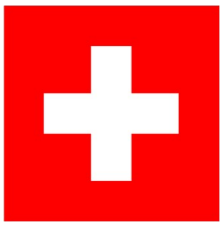
- Enterprises providing ICT training
- Environment-related technologies
- Air emissions by fine particulate matter

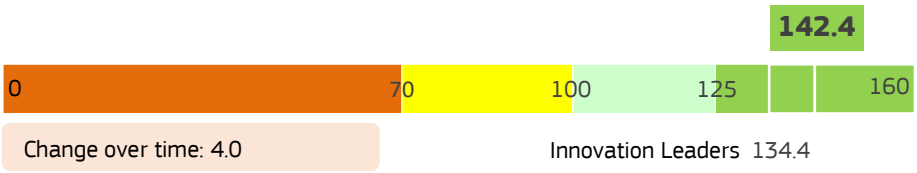
Strong increases since 2021

- Broadband penetration
- Public-private co-publications
- Business process innovators

Strong decreases since 2021

- Enterprises providing ICT training
- Innovative SMEs collaborating with others
- Environment-related technologies





Switzerland	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**142.4**		**4.0**	**1.7**
Human resources	**204.7**		**4.8**	**0.0**
Doctorate graduates	218.7		11.4	0.0
Population with tertiary education	167.9		0.0	0.0
Lifelong learning	232.2		0.0	0.0
Attractive research systems	**226.7**		**1.9**	**-1.3**
International scientific co-publications	259.6		0.0	0.0
Most cited publications	152.5		-6.1	-2.5
Foreign doctorate students	326.6		21.0	0.0
Digitalisation	**115.5**		**0.0**	**0.0**
Broadband penetration	78.4		0.0	0.0
People with above basic overall digital skills	163.6		0.0	0.0
Finance and support	**87.0**		**27.2**	**-1.2**
R&D expenditures in the public sector	124.2		11.3	0.0
Venture capital expenditures	102.1		63.9	-10.6
Government support for business R&D	18.9		10.9	6.9
Firm investments	**134.6**		**4.5**	**0.0**
R&D expenditure in the business sector	140.5		4.7	0.0
Non-R&D Innovation expenditures	N/A		N/A	N/A
Innovation expenditures per employee	N/A		N/A	N/A
Use of information technologies	**139.1**		**0.0**	**0.0**
Enterprises providing ICT training	N/A		N/A	N/A
Employed ICT specialists	145.5		0.0	0.0
Innovators	**131.3**		**-13.7**	**0.0**
Product innovators (SMEs)	128.9		-40.6	0.0
Business process innovators (SMEs)	133.4		14.9	0.0
Linkages	**196.5**		**20.8**	**2.5**
Innovative SMEs collaborating with others	80.4		11.5	0.0
Public-private co-publications	471.5		26.4	0.0
Job-to-job mobility of HRST	170.8		26.5	5.9
Intellectual assets	**138.9**		**-4.5**	**-5.2**
PCT patent applications	141.5		-3.3	0.9
Trademark applications	124.2		-4.1	0.1
Design applications	150.8		-6.3	-16.3
Employment impacts	**168.1**		**-5.2**	**0.0**
Employment in knowledge-intensive activities	175.3		0.0	0.0
Employment in innovative enterprises	162.4		-10.1	0.0
Sales impacts	**112.5**		**7.4**	**17.6**
Medium and high-tech goods exports	132.3		44.9	38.1
Knowledge-intensive services exports	95.6		11.6	9.8
Sales of innovative products	109.6		-46.4	0.0
Environmental sustainability	**123.3**		**-2.2**	**0.6**
Resource productivity	193.7		7.4	0.0
Air emissions by fine particulate matter	127.6		4.8	0.4

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

SWITZERLAND is an **Innovation Leader** with performance at 142.4% of the EU average. Performance is above the average of the Innovation Leaders (134.4%). Performance is increasing (4.0%-points) at a rate lower than that of the EU (9.9%-points). The country's performance lead over the EU is becoming smaller.

Relative strengths

- Public-private co-publications
- Foreign doctorate students
- International scientific co-publications
- Lifelong learning
- Doctorate graduates

Relative weaknesses

- Government support for business R&D
- Environment-related technologies
- Broadband penetration
- Innovative SMEs collaborating with others
- Knowledge-intensive services exports

Strong increases since 2015

- Venture capital expenditures
- Medium and high-tech goods exports
- Job-to-job mobility of HRST

Strong decreases since 2015

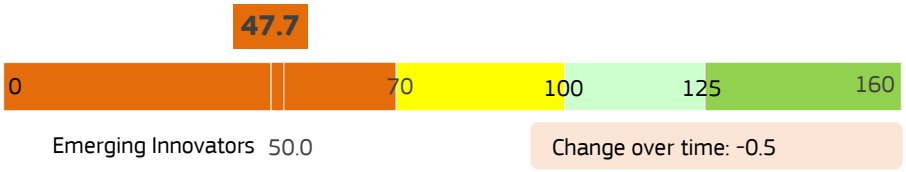
- Sales of innovative products
- Product innovators
- Environment-related technologies

Strong increases since 2021

- Medium and high-tech goods exports
- Knowledge-intensive services exports
- Government support for business R&D

Strong decreases since 2021

- Design applications
- Venture capital expenditures
- Most cited publications



Emerging Innovators 50.0

Change over time: -0.5

Turkey	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**47.7**		**-0.5**	**1.5**
Human resources	**46.5**		**5.1**	**0.0**
Doctorate graduates	25.8		11.4	0.0
Population with tertiary education	69.4		0.0	0.0
Lifelong learning	44.4		1.1	0.0
Attractive research systems	**39.2**		**13.8**	**3.5**
International scientific co-publications	10.3		10.2	4.0
Most cited publications	61.5		14.8	3.9
Foreign doctorate students	33.0		15.0	2.2
Digitalisation	**30.7**		**0.0**	**0.0**
Broadband penetration	33.3		0.0	0.0
People with above basic overall digital skills	27.3		0.0	0.0
Finance and support	**66.1**		**28.9**	**10.7**
R&D expenditures in the public sector	39.4		-6.5	0.0
Venture capital expenditures	N/A		N/A	N/A
Government support for business R&D	110.0		73.9	24.1
Firm investments	**47.8**		**-33.3**	**0.7**
R&D expenditure in the business sector	44.6		24.8	2.3
Non-R&D Innovation expenditures	61.5		-122.0	0.0
Innovation expenditures per employee	39.8		0.0	0.0
Use of information technologies	**22.8**		**-13.0**	**-9.8**
Enterprises providing ICT training	43.8		-25.0	-18.8
Employed ICT specialists	0.0		0.0	0.0
Innovators	**58.4**		**-38.3**	**-1.9**
Product innovators (SMEs)	64.1		-18.2	-8.2
Business process innovators (SMEs)	53.5		-59.6	4.8
Linkages	**65.5**		**-18.4**	**-15.7**
Innovative SMEs collaborating with others	42.1		-6.7	0.0
Public-private co-publications	12.7		10.2	4.4
Job-to-job mobility of HRST	106.3		-41.2	-38.2
Intellectual assets	**27.5**		**6.6**	**1.8**
PCT patent applications	53.0		15.6	3.7
Trademark applications	18.2		6.5	1.1
Design applications	2.5		-3.8	0.1
Employment impacts	**20.1**		**-29.0**	**0.0**
Employment in knowledge-intensive activities	0.0		0.0	0.0
Employment in innovative enterprises	36.1		-55.7	0.0
Sales impacts	**82.5**		**31.9**	**17.6**
Medium and high-tech goods exports	112.8		49.1	29.0
Knowledge-intensive services exports	59.3		39.9	20.0
Sales of innovative products	74.8		0.0	0.0
Environmental sustainability	**44.6**		**5.9**	**-6.7**
Resource productivity	69.4		27.9	0.0
Air emissions by fine particulate matter	N/A		N/A	N/A
Environment-related technologies	34.8		-7.7	-12.8

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022, with scores relative to those of the EU in 2015. Positive performance changes are shown in green, negative performance changes in red.

TURKEY is an **Emerging Innovator** with performance at 47.7% of the EU average. Performance is below the average of the Emerging Innovators (50.0%). Performance is decreasing (-0.5%-points) and is lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Medium and high-tech goods exports
- Government support for business R&D
- Job-to-job mobility of HRST
- Sales of innovative products
- Resource productivity

Relative weaknesses

- Employed ICT specialists
- Design applications
- International scientific co-publications
- Public-private co-publications
- Trademark applications

Strong increases since 2015

- Government support for business R&D
- Medium and high-tech goods exports
- Knowledge-intensive services exports

Strong decreases since 2015

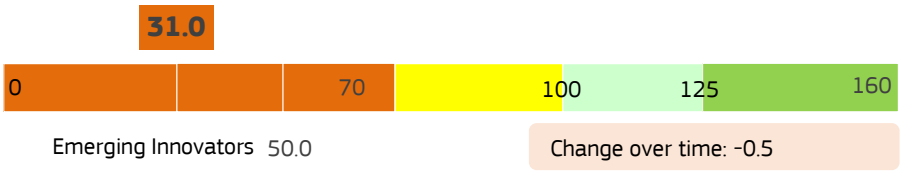
- Non-R&D Innovation expenditures
- Business process innovators
- Employment in innovative enterprises

Strong increases since 2021

- Medium and high-tech goods exports
- Government support for business R&D
- Knowledge-intensive services exports

Strong decreases since 2021

- Job-to-job mobility of HRST
- Enterprises providing ICT training
- Environment-related technologies



Emerging Innovators 50.0

Change over time: -0.5

Ukraine *	Performance relative to EU in 2022		Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**31.0**		**-0.5**	**1.6**
Human resources	**36.0**		**-10.8**	**0.0**
Doctorate graduates	33.1		-8.5	0.0
Population with tertiary education	N/A		N/A	N/A
Lifelong learning	N/A		N/A	N/A
Attractive research systems	**14.8**		**3.6**	**1.5**
International scientific co-publications	7.9		8.9	1.3
Most cited publications	9.0		5.1	2.3
Foreign doctorate students	34.8		-4.6	0.0
Digitalisation	**N/A**		**N/A**	**N/A**
Broadband penetration	N/A		N/A	N/A
People with above basic overall digital skills	N/A		N/A	N/A
Finance and support	**33.2**		**1.6**	**9.2**
R&D expenditures in the public sector	11.5		-23.4	0.0
Venture capital expenditures	58.6		43.9	30.1
Government support for business R&D	26.1		-8.3	0.0
Firm investments	**31.2**		**-5.3**	**0.1**
R&D expenditure in the business sector	15.2		-11.3	0.0
Non-R&D Innovation expenditures	53.6		0.2	0.2
Innovation expenditures per employee	N/A		N/A	N/A
Use of information technologies	**31.3**		**-3.9**	**0.0**
Enterprises providing ICT training	30.0		-3.8	0.0
Employed ICT specialists	N/A		N/A	N/A
Innovators	**0.0**		**-7.1**	**-7.1**
Product innovators (SMEs)	0.0		-6.9	-6.9
Business process innovators (SMEs)	N/A		N/A	N/A
Linkages	**21.1**		**5.1**	**0.4**
Innovative SMEs collaborating with others	31.3		0.0	0.0
Public-private co-publications	15.4		17.9	1.5
Job-to-job mobility of HRST	N/A		N/A	N/A
Intellectual assets	**20.8**		**6.3**	**1.9**
PCT patent applications	39.8		4.4	3.6
Trademark applications	15.0		17.0	2.1
Design applications	1.2		0.5	-0.3
Employment impacts	**70.1**		**0.0**	**0.0**
Employment in knowledge-intensive activities	79.2		0.0	0.0
Employment in innovative enterprises	N/A		N/A	N/A
Sales impacts	**32.3**		**-2.0**	**0.3**
Medium and high-tech goods exports	27.3		-19.1	-1.7
Knowledge-intensive services exports	59.7		12.7	0.0
Sales of innovative products	3.1		3.4	3.4
Environmental sustainability	**75.9**		**-10.4**	**-3.0**
Resource productivity	N/A		N/A	N/A
Air emissions by fine particulate matter	N/A		N/A	N/A
Environment-related technologies	87.8		-10.0	-2.9

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* Results for Ukraine are less reliable due to limited data availability.

UKRAINE is an **Emerging Innovator** with performance at 31.0% of the EU average. Performance is below the average of the Emerging Innovators (50.0%). Performance is decreasing (-0.5%-points) and is lower than that of the EU (9.9%-points). The country's performance gap to the EU is becoming larger.

Relative strengths

- Environment-related technologies
- Employment in knowledge-intensive activities
- Knowledge-intensive services exports
- Venture capital expenditures
- Non-R&D Innovation expenditures

Relative weaknesses

- Product innovators
- Design applications
- Sales of innovative products
- International scientific co-publications
- Most cited publications

Strong increases since 2015

- Venture capital expenditures
- Public-private co-publications
- Trademark applications

Strong decreases since 2015

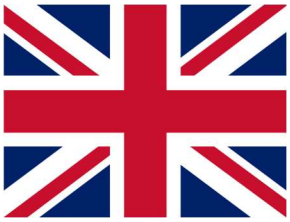
- R&D expenditures in the public sector
- Medium and high-tech goods exports
- R&D expenditure in the business sector

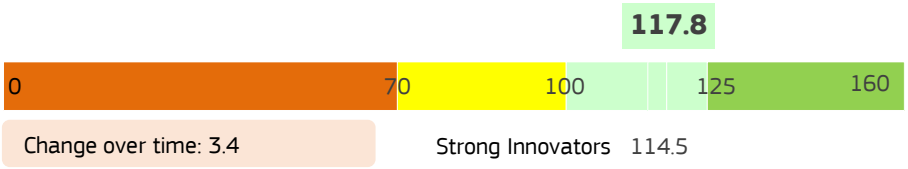
Strong increases since 2021

- Venture capital expenditures
- PCT patent applications
- Sales of innovative products

Strong decreases since 2021

- Product innovators
- Environment-related technologies
- Medium and high-tech goods exports





United Kingdom	Performance relative to EU in 2022	Performance change 2015-2022	Performance change 2021-2022
SUMMARY INNOVATION INDEX	**117.8**	**3.4**	**-0.2**
Human resources	**173.3**	**0.5**	**0.0**
Doctorate graduates	218.7	11.4	0.0
Population with tertiary education	150.2	0.0	0.0
Lifelong learning	144.4	-16.7	0.0
Attractive research systems	**171.7**	**19.1**	**2.5**
International scientific co-publications	155.8	80.9	17.8
Most cited publications	145.8	2.3	-2.8
Foreign doctorate students	241.1	-1.4	0.0
Digitalisation	**43.5**	**0.0**	**0.0**
Broadband penetration	38.5	0.0	0.0
People with above basic overall digital skills	N/A	N/A	N/A
Finance and support	**122.6**	**51.9**	**1.8**
R&D expenditures in the public sector	62.1	-4.8	0.0
Venture capital expenditures	134.5	76.1	5.7
Government support for business R&D	183.4	103.5	0.0
Firm investments	**73.9**	**6.3**	**0.0**
R&D expenditure in the business sector	77.0	11.6	0.0
Non-R&D Innovation expenditures	70.6	-20.7	0.0
Innovation expenditures per employee	73.8	28.3	0.0
Use of information technologies	**137.0**	**0.0**	**-16.3**
Enterprises providing ICT training	125.0	0.0	-31.3
Employed ICT specialists	150.0	0.0	0.0
Innovators	**48.1**	**-58.2**	**0.0**
Product innovators (SMEs)	91.0	-8.4	0.0
Business process innovators (SMEs)	10.5	-111.2	0.0
Linkages	**205.5**	**22.4**	**4.9**
Innovative SMEs collaborating with others	216.6	-13.6	0.0
Public-private co-publications	212.7	91.9	25.9
Job-to-job mobility of HRST	193.8	23.5	0.0
Intellectual assets	**76.9**	**-11.7**	**-5.1**
PCT patent applications	93.2	-3.8	-0.1
Trademark applications	78.5	-11.3	-4.2
Design applications	53.0	-21.3	-11.7
Employment impacts	**149.5**	**-1.2**	**0.0**
Employment in knowledge-intensive activities	181.8	0.0	0.0
Employment in innovative enterprises	123.8	-2.3	0.0
Sales impacts	**110.8**	**-10.2**	**5.1**
Medium and high-tech goods exports	91.8	-2.0	0.0
Knowledge-intensive services exports	122.5	11.6	15.4
Sales of innovative products	119.2	-46.3	0.0
Environmental sustainability	**117.3**	**4.3**	**0.6**
Resource productivity	193.7	40.0	0.0
Air emissions by fine particulate matter	87.8	-0.3	0.9
Environment-related technologies	85.9	-14.6	0.5

The second column shows performance relative to that of the EU in 2022. Colours next to the column show matching colour codes: dark green: above 125% of the performance of the EU in 2022; light green: between 100% and 125%; yellow: between 70% and 100%; orange: below 70%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data. The next columns show performance change over time between 2015 and 2022 and between 2021 and 2022. Positive performance changes are shown in green, negative performance changes in red.

The **UNITED KINGDOM** is a **Strong Innovator** with performance at 117.8% of the EU average. Performance is above the average of the Strong Innovators (114.5%). Performance is increasing (3.4%-points) at a rate lower than that of the EU (9.9%-points). The country's performance lead over the EU is becoming smaller.

Relative strengths

- Foreign doctorate students
- Doctorate graduates
- Innovative SMEs collaborating with others
- Public-private co-publications
- Job-to-job mobility of HRST

Relative weaknesses

- Business process innovators
- Broadband penetration
- Design applications
- R&D expenditures in the public sector
- Non-R&D Innovation expenditures

Strong increases since 2015

- Government support for business R&D
- Public-private co-publications
- International scientific co-publications

Strong decreases since 2015

- Business process innovators
- Sales of innovative products
- Design applications

Strong increases since 2021

- Public-private co-publications
- International scientific co-publications
- Knowledge-intensive services exports

Strong decreases since 2021

- Enterprises providing ICT training
- Design applications
- Trademark applications

7. European Innovation Scoreboard methodology

The overall performance of each country's innovation system has been summarised in a composite indicator, the Summary Innovation Index. Full details on the EIS methodology are available in the EIS 2022 Methodology Report . The methodology used for calculating the Summary Innovation Index is outlined below. "All countries" include all Member States and other European and neighbouring countries included in Section 5.1.

European benchmark

Step 1: Setting reference years

For each indicator, a reference year is identified based on data availability for all countries for which data availability is at least 75%. For most indicators, this reference year will be lagging one or two years behind the year to which the EIS refers (cf. Annex E).

Step 2: Imputing for missing values

Reference year data are then used for "2022", etc. If data for a year-in-between are not available, missing values are replaced with the value for the previous year. If data are not available at the beginning of the time series, missing values are replaced with the next available year. The following examples clarify this step and show how 'missing' data are imputed. If data are missing for all years, no data will be imputed (the indicator will not contribute to the Summary Innovation Index).

Latest year missing	"2022"	"2021"	"2020"	"2019"	"2018"
Available data	N/A	45	40	35	30
Use most recent year	**45**	45	40	35	30
Year-in-between missing	"2022"	"2021"	"2020"	"2019"	"2018"
Available data	50	N/A	40	35	30
Substitute with previous year	50	**40**	40	35	30
Beginning-of-period missing	"2022"	"2021"	"2020"	"2019"	"2018"
Available data	50	45	40	35	N/A
Substitute with next available year	50	45	40	35	**35**

Step 3: Identifying and replacing outliers

Positive outliers are identified as those country scores which are higher than the mean across all countries plus twice the standard deviation. Negative outliers are identified as those country scores which are smaller than the mean across all countries minus twice the standard deviation. These outliers are replaced by the respective maximum and minimum values observed over all the years and all countries.

Step 4: Transforming data if data are highly skewed

Most of the indicators are fractional indicators with values between 0% and 100%. Some indicators are unbound indicators, where values are not limited to an upper threshold. These indicators can be highly volatile and can have skewed data distributions (where most countries show low performance levels, and a few countries show exceptionally high levels of performance). For these indicators where the degree of skewness across the full eight-year period is above one, data have been transformed using a square root transformation. For the following indicators data have been transformed: Air emissions in fine particulates in industry, Non-R&D innovation expenditures, PCT patent applications, Trademark applications, and Venture capital expenditures. A square root transformation uses the square root of the indicator value instead of the original value.

Step 5: Determining Maximum and Minimum scores

The Maximum score is the highest score found for the eight-year period within all countries excluding positive outliers. Similarly, the Minimum score is the lowest score found for the eight-year period within all countries excluding negative outliers.

Step 6: Calculating re-scaled scores

Re-scaled scores of the country scores (after correcting for outliers and a possible transformation of the data) for all years are calculated by first subtracting the Minimum score and then dividing by the difference between the Maximum and Minimum score. The maximum re-scaled score is thus equal to 1, and the minimum re-scaled score is equal to 0. For positive and negative outliers, the re-scaled score is equal to 1 or 0, respectively.

Step 7: Calculating composite innovation indexes

For each year, a composite Summary Innovation Index is calculated as the unweighted average of the re-scaled scores for all indicators where all indicators receive the same weight (1/32 if data are available for all 32 indicators).

Step 8: Calculating relative to EU performance scores

Performance scores relative to the EU are then calculated as the SII of the respective country divided by the SII of the EU multiplied by 100. Relative performance scores are calculated for the full eight-year period compared to the performance of the EU in 2015 and for the latest year also to that of the EU in 2022. For the definition of the performance groups, only the performance scores relative to the EU in 2022 have been used.

International benchmark

The methodology for calculating average innovation performance for the EU and its major global competitors is similar to that used for calculating average innovation performance for the EU Member States but using a smaller set of countries and a smaller set of indicators.

Performance group membership

For determining performance group membership, the EIS uses the following classification scheme:

- Innovation Leaders are all countries with a relative performance in 2022 above 125% of the EU average in 2022.
- Strong Innovators are all countries with a relative performance in 2022 between 100% and 125% of the EU average in 2022.
- Moderate Innovators are all countries with a relative performance in 2022 between 70% and 100% of the EU average in 2022.
- Emerging Innovators are all countries with a relative performance in 2022 below 70% of the EU average in 2022.

[22] https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en

Annex A: Country abbreviations

AL	Albania	IS	Iceland
AT	Austria	IT	Italy
AU	Australia	JP	Japan
BA	Bosnia and Herzegovina	KR	South Korea
BE	Belgium	LT	Lithuania
BG	Bulgaria	LU	Luxembourg
BR	Brazil	LV	Latvia
CA	Canada	ME	Montenegro
CH	Switzerland	MK	North Macedonia
CL	Chile	MT	Malta
CN	China	MX	Mexico
CY	Cyprus	NL	Netherlands
CZ	Czechia	NO	Norway
DE	Germany	PL	Poland
DK	Denmark	PT	Portugal
EL	Greece	RO	Romania
EE	Estonia	RS	Serbia
ES	Spain	SE	Sweden
FI	Finland	SI	Slovenia
FR	France	SK	Slovakia
HR	Croatia	TR	Turkey
HU	Hungary	UA	Ukraine
IE	Ireland	UK	United Kingdom
IL	Israel	US	United States
IN	India	ZA	South Africa

Annex B: Performance per indicator

Available on the EIS website: https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en

Annex C: Indicator values by country in 2022

	EU	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL
FRAMEWORK CONDITIONS																				
Human resources																				
1.1.1 New doctorate graduates	0.7	0.9	0.3	0.8	1.0	1.1	0.6	1.0	0.5	0.7	0.8	0.4	0.6	0.4	0.2	0.4	0.7	0.3	0.2	0.6
1.1.2 Population completed tertiary education	41.2	50.9	33.6	34.9	49.1	35.7	43.2	61.7	44.2	48.7	50.3	35.7	28.3	58.3	45.5	57.5	62.6	32.9	42.4	55.6
1.1.3 Lifelong learning	10.8	10.2	1.8	5.8	22.4	7.7	18.4	13.6	3.5	14.4	11.0	5.1	9.9	9.7	8.6	8.5	17.9	5.9	13.8	26.6
Attractive research systems																				
1.2.1 International scientific co-publications	1181	2088	372	1222	3455	1131	1889	2075	1003	1107	1002	891	1036	2913	707	865	2848	655	1141	2297
1.2.2 Scientific publications among top 10% most cited	979.1	1207.7	270.1	496.2	1373.0	1047.1	859.5	1135.8	888.3	914.2	893.5	419.3	1081.8	822.1	307.6	557.1	1397.5	631.5	508.5	1491.8
1.2.3 Foreign doctorate students	17.8	32.6	8.6	22.3	36.1	23.1	25.6	35.5	1.5	19.2	37.9	8.2	15.8	24.0	11.7	6.6	89.0	25.5	35.3	47.9
Digitalisation																				
1.3.1 Broadband penetration	52.0	68.0	40.0	38.0	80.0	51.0	40.0	49.0	28.0	70.0	54.0	28.0	39.0	45.0	39.0	59.0	62.0	38.0	62.0	67.0
1.3.2 Individuals with above basic overall digital skills	26.0	26.0	8.0	24.0	37.0	19.0	28.0	40.0	22.0	38.0	31.0	31.0	23.0	21.0	24.0	23.0	32.0	22.0	35.0	52.0
INVESTMENTS																				
Finance and support																				
2.1.1 R&D expenditure in the public sector	0.78	0.92	0.27	0.77	1.18	1.03	0.78	0.32	0.79	0.62	0.76	0.65	0.56	0.36	0.48	0.60	0.52	0.37	0.23	0.75
2.1.2 Venture capital investments	0.190	0.216	0.025	0.132	0.322	0.156	0.689	0.167	0.044	0.188	0.312	0.189	0.080	0.401	0.040	0.279	0.227	0.114	0.006	0.309
2.1.3 Direct and indirect government support for business R&D	0.17	0.29	0.01	0.13	0.08	0.07	0.05	0.21	0.04	0.07	0.39	0.01	0.20	0.02	0.01	0.03	0.04	0.23	0.03	0.23
Firm investments																				
2.2.1 R&D expenditure in the business sector	1.53	2.53	0.58	1.21	1.84	2.11	0.98	0.91	0.69	0.78	1.56	0.60	0.93	0.37	0.22	0.55	0.61	1.23	0.43	1.54
2.2.2 Non-R&D innovation expenditure	0.80	0.83	0.36	1.84	0.82	1.34	1.47	0.04	0.89	0.56	0.23	0.36	0.61	0.65	0.31	2.11	0.26	0.64	0.39	0.16
2.2.3 Innovation expenditures per person employed	7484	11806	1197	4357	2938	11819	6275	9872	5077	4488	7798	2072	7338	2997	1120	3649	4995	3374	3050	6540
Use of information technologies																				
2.3.1 Enterprises providing ICT training	20.0	33.0	7.0	25.0	30.0	24.0	17.0	27.0	12.0	20.0	15.0	23.0	15.0	25.0	17.0	14.0	21.0	16.0	28.0	24.0
2.3.2 Employed ICT specialists	4.5	5.6	3.5	4.6	5.6	4.9	6.2	6.3	2.8	4.1	4.5	3.6	3.8	3.9	3.8	3.8	6.7	3.9	4.9	6.7
INNOVATION ACTIVITIES																				
Innovators																				
3.1.1 SMEs with product innovations	27.0	34.7	22.2	35.2	31.5	34.1	25.2	28.7	48.0	17.9	26.7	34.6	29.7	38.8	13.7	30.5	28.7	19.9	17.4	27.7
3.1.2 SMEs with business process innovations	41.6	63.4	24.5	52.2	45.5	54.8	41.1	47.7	66.3	26.1	44.1	47.2	46.4	64.9	24.9	44.8	39.3	23.5	34.5	43.1
Linkages																				
3.2.1 Innovative SMEs collaborating with others	11.7	24.3	7.3	14.5	14.5	13.5	17.3	22.0	19.3	7.3	15.5	12.3	13.1	27.8	6.1	14.4	12.9	9.9	8.1	18.0
3.2.2 Public-private co-publications	133.8	356.2	49.3	173.8	699.0	245.0	261.6	318.8	178.5	152.9	150.8	188.5	189.7	395.1	135.2	96.6	537.2	154.6	149.2	427.5
3.2.3 Job-to-job mobility of Human Resources in S&T	6.8	6.5	2.8	4.3	10.7	8.8	9.5	N/A	4.8	6.9	7.4	6.9	4.4	10.5	6.2	10.8	9.4	6.7	7.6	8.7
Intellectual assets																				
3.3.1 PCT patent applications	3.49	3.17	0.47	0.66	5.95	6.14	1.36	1.40	0.69	1.44	3.70	0.56	2.14	0.57	0.83	0.48	1.55	1.47	1.23	4.97
3.3.2 Trademark applications	7.39	6.85	9.15	5.49	9.35	8.39	22.33	4.49	6.30	8.68	4.00	3.62	8.32	41.87	7.58	10.91	19.86	3.84	49.87	8.11
3.3.3 Design applications	3.99	2.67	3.35	2.69	7.61	5.16	5.16	1.79	1.09	2.55	2.54	0.98	5.61	3.79	2.34	2.14	4.29	0.78	5.55	4.35
IMPACTS																				
Employment impacts																				
4.1.1 Employment in knowledge-intensive activities	14.5	17.5	11.6	14.2	16.2	14.6	15.5	23.4	13.0	13.1	15.8	10.9	14.6	19.2	12.0	13.2	26.4	13.9	20.2	19.9
4.1.2 Employment in innovative enterprises	59.0	77.3	44.1	63.2	58.3	74.1	79.9	60.4	76.5	41.3	60.6	57.1	62.5	70.7	38.7	63.5	50.4	39.2	47.8	56.1
Economic effects																				
4.2.1 Medium & high-tech product exports	55.5	52.7	36.6	65.6	51.1	66.0	37.3	63.1	24.9	43.7	54.2	35.7	49.9	54.1	31.4	39.0	41.6	66.3	55.0	50.9
4.2.2 Knowledge-intensive services exports	75.0	73.6	57.5	51.7	81.0	77.9	61.4	93.8	74.5	53.1	69.9	31.0	62.5	93.3	55.8	22.8	92.6	55.3	52.2	81.2
4.2.3 Sales of new-to-market and new-to-enterprise	13.14	15.07	7.44	14.43	15.00	14.05	8.98	36.94	20.35	21.74	5.91	12.94	13.48	13.80	6.36	11.54	6.35	7.75	6.08	8.21
Environmental sustainability																				
4.3.1 Resource productivity	2.23	2.68	0.80	1.89	1.68	2.76	0.89	2.78	2.01	2.81	3.04	1.80	3.64	1.42	1.41	1.30	3.64	1.54	2.29	4.96
4.3.2 Air emissions in fine particulates (PM2.5) in Industry	0.073	0.064	0.315	0.032	0.013	0.019	0.425	0.017	0.191	0.099	0.052	0.197	0.058	0.186	0.844	0.037	0.059	0.091	0.010	0.050
4.3.3 Development of environment-related technologies	12.92	10.05	12.84	12.30	23.12	14.12	7.76	6.74	8.52	11.30	12.93	5.03	9.69	9.05	7.66	9.91	11.36	7.70	9.79	10.15

	AT	PL	PT	RO	SI	SK	FI	SE	AL*	BA*	IS	IL*	MK	ME	NO	RS	CH	TR	UA*	UK
FRAMEWORK CONDITIONS																				
Human resources																				
1.1.1 New doctorate graduates	0.9	0.2	0.7	0.2	0.7	0.6	1.1	1.0	0.1	0.1	0.6	0.6	0.1	0.1	0.8	0.4	1.7	0.2	0.2	1.6
1.1.2 Population completed tertiary education	42.4	40.6	47.5	23.3	47.9	39.5	40.1	49.3	37.7	24.9	41.5	47.3	37.7	40.4	55.1	33.9	52.3	36.2	N/A	49.4
1.1.3 Lifelong learning	14.6	5.4	12.9	4.9	18.9	4.8	30.5	34.7	9.8	3.3	23.9	N/A	2.6	2.7	19.6	4.8	22.7	5.8	N/A	14.8
Attractive research systems																				
1.2.1 International scientific co-publications	2072	505	1551	322	1769	845	2515	2772	131	248	3743	1253	275	777	2980	580	3961	170	143	1811
1.2.2 Scientific publications among top 10% most cited	1069.3	497.0	918.0	555.9	767.5	451.4	1215.3	1259.7	545.9	315.4	898.3	870.2	407.7	315.7	1145.7	487.4	1436.1	643.8	186.0	1378.4
1.2.3 Foreign doctorate students	36.8	7.9	33.1	4.6	20.1	11.6	25.0	35.6	11.0	N/A	41.7	N/A	39.1	11.3	22.7	7.3	56.6	6.7	7.0	41.1
Digitalisation																				
1.3.1 Broadband penetration	40.0	48.0	71.0	66.0	51.0	37.0	61.0	73.0	16.5	33.0	N/A	27.3	40.0	33.0	59.0	35.0	43.6	26.0	N/A	28.0
1.3.2 Individuals with above basic overall digital skills	33.0	21.0	29.0	9.0	20.0	21.0	48.0	36.0	4.0	5.0	45.0	N/A	8.0	9.0	43.0	12.0	40.0	10.0	N/A	N/A
INVESTMENTS																				
Finance and support																				
2.1.1 R&D expenditure in the public sector	0.96	0.52	0.66	0.19	0.56	0.42	0.94	0.98	N/A	0.12	0.79	0.49	0.28	0.30	1.04	0.56	0.94	0.38	0.20	0.53
2.1.2 Venture capital investments	0.108	0.044	0.056	0.076	0.008	0.034	0.343	0.309	N/A	N/A	N/A	N/A	N/A	N/A	0.330	0.017	0.198	N/A	0.065	0.458
2.1.3 Direct and indirect government support for business R&D	0.27	0.13	0.24	0.01	0.22	0.04	0.05	0.12	N/A	0.00	0.24	0.09	0.01	0.00	0.23	0.03	0.03	0.19	0.05	0.41
Firm investments																				
2.2.1 R&D expenditure in the business sector	2.22	0.88	0.92	0.28	1.57	0.49	1.97	2.55	N/A	0.07	1.68	4.91	0.10	0.19	1.24	0.35	2.13	0.71	0.28	1.19
2.2.2 Non-R&D innovation expenditure	0.38	0.57	0.37	0.05	0.10	0.79	0.46	0.46	N/A	0.01	0.56	N/A	1.01	0.14	0.65	3.57	N/A	0.35	0.28	0.44
2.2.3 Innovation expenditures per person employed	6952	2974	2155	829	3905	3371	8040	11955	N/A	237	3767	N/A	1282	2205	6026	8129	N/A	3120	N/A	5583
Use of information technologies																				
2.3.1 Enterprises providing ICT training	18.0	18.0	23.0	6.0	26.0	16.0	38.0	32.0	N/A	15.0	25.0	N/A	12.0	26.0	33.0	16.0	N/A	11.0	8.8	24.0
2.3.2 Employed ICT specialists	4.5	3.5	4.7	2.6	4.8	4.3	7.4	8.0	N/A	N/A	4.0	N/A	2.3	2.5	5.4	3.3	5.5	1.3	N/A	5.6
INNOVATION ACTIVITIES																				
Innovators																				
3.1.1 SMEs with product innovations	30.4	14.2	24.9	6.7	34.8	14.1	37.8	38.1	22.8	38.6	27.8	N/A	15.5	42.9	44.3	39.9	33.5	18.9	4.4	24.9
3.1.2 SMEs with business process innovations	50.2	25.5	43.4	5.3	41.6	26.1	54.2	51.4	31.1	34.8	41.9	N/A	33.5	41.3	51.5	44.3	50.5	29.2	N/A	17.7
Linkages																				
3.2.1 Innovative SMEs collaborating with others	16.4	6.7	6.6	1.5	13.1	7.5	27.6	15.1	8.9	N/A	22.5	N/A	6.2	9.3	37.4	7.4	9.7	5.8	4.7	23.6
3.2.2 Public-private co-publications	498.3	74.4	179.6	53.9	353.7	111.4	499.5	498.8	12.4	38.3	705.0	166.1	37.2	62.8	615.6	74.4	812.9	20.6	24.1	280.0
3.2.3 Job-to-job mobility of Human Resources in S&T	7.3	6.8	7.0	1.4	7.3	3.4	8.4	4.0	N/A	N/A	8.9	N/A	5.0	3.4	9.2	5.7	10.2	7.1	N/A	11.3
Intellectual assets																				
3.3.1 PCT patent applications	4.62	0.51	0.99	0.18	1.58	0.52	7.54	9.31	N/A	0.07	2.65	9.16	0.31	0.60	3.08	0.30	6.98	0.98	0.55	3.03
3.3.2 Trademark applications	12.49	6.07	8.43	3.01	9.20	5.00	9.26	10.01	0.48	0.40	4.13	2.34	0.87	0.47	3.14	1.10	10.75	0.68	0.57	4.94
3.3.3 Design applications	7.61	5.63	3.15	0.80	2.18	1.80	5.04	3.78	0.00	0.01	0.04	0.87	0.02	0.00	0.67	0.03	6.02	0.10	0.05	2.11
IMPACTS																				
Employment impacts																				
4.1.1 Employment in knowledge-intensive activities	15.3	11.1	13.6	8.2	17.2	11.9	16.8	20.8	8.8	N/A	16.9	34.1	7.7	12.0	16.2	10.8	20.3	6.8	12.9	20.8
4.1.2 Employment in innovative enterprises	68.6	42.3	59.1	12.3	54.7	42.8	72.8	70.0	42.0	50.5	66.5	N/A	41.5	69.5	72.2	69.6	77.6	40.0	N/A	66.1
Economic effects																				
4.2.1 Medium & high-tech product exports	56.1	48.8	40.9	55.2	60.7	67.8	44.5	53.1	11.5	25.8	8.7	63.5	64.9	20.5	16.1	43.1	69.1	60.9	25.0	52.1
4.2.2 Knowledge-intensive services exports	50.9	48.7	47.8	54.3	41.7	45.8	82.9	84.0	27.0	18.7	71.8	79.0	38.9	39.0	83.7	59.8	72.3	50.3	50.5	88.6
4.2.3 Sales of new-to-market and new-to-enterprise	12.99	7.50	14.50	5.24	12.29	14.94	19.33	12.87	40.10	9.06	5.56	N/A	3.52	7.16	6.03	11.83	14.33	10.00	1.10	15.53
Environmental sustainability																				
4.3.1 Resource productivity	1.95	1.35	1.40	0.74	2.03	1.77	1.03	1.49	1.21	0.86	2.38	N/A	1.26	N/A	1.76	0.67	4.57	1.74	N/A	3.84
4.3.2 Air emissions in fine particulates (PM2.5) in Industry	0.024	0.314	0.824	0.237	0.135	0.057	0.074	0.062	N/A	N/A	0.341	N/A	N/A	N/A	0.150	0.794	0.011	N/A	N/A	0.117
4.3.3 Development of environment-related technologies	13.96	6.46	7.73	8.64	9.05	12.68	13.03	12.36	28.63	37.27	7.36	5.95	18.99	9.38	13.44	12.09	7.77	6.51	11.72	11.53

Annex D: Performance change by country and indicator in relative to EU scores between 2015 and 2022

Performance change is measured as the difference between performance in 2022 relative to the EU in 2015 and performance in 2015 relative to the EU in 2015.

	EU	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL
FRAMEWORK CONDITIONS																				
Human resources																				
1.1.1 New doctorate graduates	-22.9	11.4	-11.4	0.0	-34.3	-11.4	-11.4	11.4	11.4	0.0	-34.3	-11.4	-11.4	22.9	-22.9	-11.4	34.3	0.0	11.4	-11.4
1.1.2 Population completed tertiary education	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.1.3 Lifelong learning	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Attractive research systems																				
1.2.1 International scientific co-publications	49.6	76.3	18.0	72.5	110.9	34.6	115.8	100.3	42.1	50.3	25.4	54.8	51.5	211.6	59.6	67.8	107.8	26.5	73.5	84.7
1.2.2 Scientific publications among top 10% most cited	-3.8	-18.4	9.9	5.5	-14.1	-8.6	15.4	-11.8	1.5	-2.4	-14.1	16.0	7.8	-16.5	-4.6	34.8	21.5	5.8	4.9	-12.3
1.2.3 Foreign doctorate students	10.6	-34.1	30.6	63.0	44.1	0.0	123.4	68.4	-2.1	20.5	-2.4	37.2	22.4	128.2	38.9	25.6	0.0	120.4	184.9	77.6
Digitalisation																				
1.3.1 Broadband penetration	18.2	0.0	9.1	12.1	0.0	18.2	12.1	3.0	0.0	24.2	15.2	45.5	18.2	39.4	-9.1	3.0	0.0	6.1	15.2	15.2
1.3.2 Individuals with above basic overall digital skills	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INVESTMENTS																				
Finance and support																				
2.1.1 R&D expenditure in the public sector	6.5	33.9	4.8	-12.9	0.0	14.5	-16.1	-19.4	40.3	3.2	0.0	41.9	1.6	4.8	6.5	-17.7	-11.3	3.2	-21.0	0.0
2.1.2 Venture capital investments	49.5	48.5	-31.3	82.9	122.2	55.4	78.5	36.9	49.5	49.6	49.3	52.4	7.0	129.8	-27.4	101.4	23.8	33.9	-40.6	86.6
2.1.3 Direct and indirect government support for business R&D	12.9	54.7	1.9	-27.3	7.4	-10.1	-43.1	-12.0	13.6	-29.4	0.0	4.6	91.9	5.5	1.1	6.3	-5.8	-7.2	-20.3	50.9
Firm investments																				
2.2.1 R&D expenditure in the business sector	14.7	70.5	14.7	14.7	-3.1	15.5	12.4	-17.1	32.6	7.8	9.3	15.5	7.8	21.7	3.9	24.0	-3.1	7.0	3.9	10.1
2.2.2 Non-R&D innovation expenditure	1.7	21.2	-34.2	49.8	47.6	4.6	37.0	-62.9	9.0	18.4	-29.7	-64.3	3.7	45.6	-26.6	4.6	18.4	-8.0	4.0	0.0
2.2.3 Innovation expenditures per person employed	31.2	51.4	1.1	21.2	-109.1	34.9	25.1	52.6	33.1	22.9	17.1	-56.3	66.2	28.3	-18.4	21.8	32.5	-17.2	-13.7	22.2
Use of information technologies																				
2.3.1 Enterprises providing ICT training	0.0	0.0	-50.0	18.8	0.0	-43.8	18.8	12.5	6.3	-12.5	-37.5	0.0	31.3	18.8	37.5	31.3	-6.3	0.0	43.8	37.5
2.3.2 Employed ICT specialists	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INNOVATION ACTIVITIES																				
Innovators																				
3.1.1 SMEs with product innovations	26.7	22.0	67.4	66.1	46.2	6.1	83.8	-30.9	123.7	42.3	2.8	94.7	32.5	93.2	33.8	59.4	7.4	49.6	-5.9	-23.0
3.1.2 SMEs with business process innovations	53.8	44.0	45.4	145.7	81.7	103.7	133.3	-5.9	89.0	-4.9	14.5	79.9	62.8	125.9	26.0	47.3	-51.1	43.5	22.7	43.7
Linkages																				
3.2.1 Innovative SMEs collaborating with others	26.8	-40.3	51.8	55.6	15.7	42.1	80.9	100.5	56.6	7.5	28.2	68.8	79.2	197.1	41.6	-10.1	46.6	46.5	48.6	6.8
3.2.2 Public-private co-publications	37.2	117.4	24.4	70.7	143.5	63.5	141.8	112.4	92.1	60.9	22.9	115.5	82.6	314.5	100.8	51.5	285.5	70.7	74.1	115.7
3.2.3 Job-to-job mobility of Human Resources in S&T	41.2	-11.8	0.0	26.5	-26.5	0.0	76.5	N/A	47.1	58.8	64.7	67.6	17.6	100.0	20.6	138.2	14.7	70.6	41.2	-32.4
Intellectual assets																				
3.3.1 PCT patent applications	-6.6	-7.8	-2.0	-5.8	-8.3	-11.3	-5.8	-23.5	8.7	-4.7	-6.9	-3.0	2.1	1.3	-0.2	4.4	-7.1	-1.6	31.4	-11.8
3.3.2 Trademark applications	13.1	11.8	25.2	20.5	13.8	10.2	72.2	-21.9	29.9	7.7	0.8	26.5	24.0	6.1	35.9	62.5	-22.5	15.2	0.0	13.7
3.3.3 Design applications	-18.5	-10.0	-98.4	-3.6	-3.1	-39.9	25.2	-1.7	4.7	-12.4	-21.8	10.6	-3.0	30.2	15.9	19.8	-79.2	-2.3	-53.5	16.4
IMPACTS																				
Employment impacts																				
4.1.1 Employment in knowledge-intensive activities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.1.2 Employment in innovative enterprises	15.5	29.7	40.9	40.5	12.8	8.1	177.9	-25.4	73.0	-11.3	-10.3	41.1	19.4	80.3	21.0	30.8	-64.5	26.8	-17.4	-30.2
Economic effects																				
4.2.1 Medium & high-tech product exports	3.5	14.0	19.3	4.3	11.8	-0.4	-8.5	35.6	14.1	-3.3	-7.4	1.6	-3.2	-28.5	1.4	11.5	-16.0	-1.6	-18.6	20.1
4.2.2 Knowledge-intensive services exports	21.1	11.8	51.1	17.9	5.6	5.9	32.7	1.6	45.1	46.9	12.2	26.0	21.7	47.9	10.6	7.5	10.5	14.9	37.1	7.9
4.2.3 Sales of new-to-market and new-to-enterprise innovations	8.9	65.5	23.1	-1.2	70.5	6.2	-13.3	32.2	66.6	50.8	-79.9	70.4	30.0	81.6	9.2	26.0	-1.7	-41.3	17.1	-22.8
Environmental sustainability																				
4.3.1 Resource productivity	22.7	29.2	7.7	29.0	12.3	52.4	14.3	85.3	45.5	0.1	49.5	15.6	37.4	-11.9	7.4	5.0	15.9	-18.1	-28.6	16.1
4.3.2 Air emissions in fine particulates (PM2.5) in Industry	5.8	7.6	-27.9	15.1	6.5	3.0	23.1	9.4	7.4	5.9	4.5	14.3	7.7	-9.1	0.0	22.8	15.4	-4.0	5.0	5.6
4.3.3 Development of environment-related technologies	-15.0	2.2	-48.3	6.0	0.0	-11.9	-121.8	-11.8	-57.9	-37.6	-13.5	-86.7	-17.9	15.6	-49.4	-23.9	-42.0	-37.6	4.8	-16.4

Performance change is measured as the difference between performance in 2022 relative to the EU in 2015 and performance in 2015 relative to the EU in 2015.

	AT	PL	PT	RO	SI	SK	FI	SE	AL*	BA	IS	IL*	MK	ME	NO	RS	CH	TR	UA*	UK
FRAMEWORK CONDITIONS																				
Human resources																				
1.1.1 New doctorate graduates	0.0	0.0	-11.4	-57.2	-91.5	-45.8	-11.4	-45.8	-0.5	8.0	11.4	-9.0	-11.4	3.7	-22.9	11.4	11.4	11.4	-8.5	11.4
1.1.2 Population completed tertiary education	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0
1.1.3 Lifelong learning	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	-6.7	-2.2	0.0	0.0	0.0	1.1	N/A	-16.7
Attractive research systems																				
1.2.1 International scientific co-publications	80.4	31.0	83.0	14.6	74.0	53.9	111.6	106.0	10.2	19.4	11.2	36.4	16.4	60.9	155.7	30.7	0.0	10.2	8.9	80.9
1.2.2 Scientific publications among top 10% most cited	-2.9	17.9	-10.1	26.1	7.7	13.1	8.2	-7.1	48.4	4.5	-16.2	-16.2	23.4	-41.8	-11.8	14.6	-6.1	14.8	5.1	2.3
1.2.3 Foreign doctorate students	61.8	42.4	120.2	7.3	83.9	19.6	55.0	27.2	-54.8	N/A	146.7	N/A	234.8	-51.2	11.1	15.7	21.0	15.0	-4.6	-1.4
Digitalisation																				
1.3.1 Broadband penetration	0.0	15.2	15.2	24.2	30.3	15.2	42.4	12.1	2.2	0.0	N/A	0.0	3.0	27.3	9.1	42.4	0.0	0.0	N/A	0.0
1.3.2 Individuals with above basic overall digital skills	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.0	N/A	N/A
INVESTMENTS																				
Finance and support																				
2.1.1 R&D expenditure in the public sector	17.7	3.2	-3.2	-12.9	-6.5	-3.2	-8.1	4.8	0.0	-1.6	6.5	-17.7	-12.9	19.4	41.9	8.1	11.3	-6.5	-23.4	-4.8
2.1.2 Venture capital investments	53.8	4.4	-16.7	47.7	0.6	32.4	87.4	90.5	N/A	N/A	N/A	N/A	N/A	N/A	103.6	44.6	63.9	N/A	43.9	76.1
2.1.3 Direct and indirect government support for business R&D	-29.9	59.1	70.5	-19.2	-66.6	13.3	-20.6	-0.3	N/A	-1.8	63.8	-17.6	7.7	-0.2	62.3	13.7	10.9	73.9	-8.3	103.5
Firm investments																				
2.2.1 R&D expenditure in the business sector	10.1	38.8	22.5	12.4	-30.2	8.5	-21.7	23.3	0.0	-9.3	56.6	0.0	1.6	0.8	28.7	10.9	4.7	24.8	-11.3	11.6
2.2.2 Non-R&D innovation expenditure	-9.7	-45.9	-24.7	-34.6	-75.6	16.7	14.4	-48.7	N/A	0.0	0.0	N/A	0.0	0.0	2.2	25.6	N/A	-122.0	0.2	-20.7
2.2.3 Innovation expenditures per person employed	17.4	-8.9	-8.9	3.6	16.1	4.8	9.6	0.0	N/A	0.0	0.0	N/A	0.0	0.0	39.5	0.0	N/A	0.0	N/A	28.3
Use of information technologies																				
2.3.1 Enterprises providing ICT training	-100.0	50.0	-18.8	6.3	37.5	-6.3	0.0	0.0	N/A	-6.3	0.0	0.0	-12.5	31.3	-31.3	-37.5	N/A	-25.0	-3.8	0.0
2.3.2 Employed ICT specialists	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	N/A	0.0	88.3	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0
INNOVATION ACTIVITIES																				
Innovators																				
3.1.1 SMEs with product innovations	8.5	32.9	-15.2	12.5	62.4	16.0	25.7	53.5	-9.4	0.0	-41.6	N/A	-4.8	0.0	67.5	101.1	-40.6	-18.2	-6.9	-8.4
3.1.2 SMEs with business process innovations	21.6	60.9	-2.8	0.0	32.4	15.1	92.7	97.9	-7.7	0.0	7.1	N/A	16.0	0.0	80.4	67.8	14.9	-59.6	N/A	-111.2
Linkages																				
3.2.1 Innovative SMEs collaborating with others	-50.0	39.5	-14.3	-4.0	-0.3	-11.3	133.9	20.0	-27.9	N/A	23.2	N/A	-11.4	0.0	105.8	31.0	11.5	-6.7	0.0	-13.6
3.2.2 Public-private co-publications	181.9	37.0	93.9	27.5	114.5	55.3	122.1	128.8	8.7	23.1	89.3	30.4	17.4	40.9	188.0	43.8	26.4	10.2	17.9	91.9
3.2.3 Job-to-job mobility of Human Resources in S&T	32.4	26.5	64.7	-11.8	76.5	17.6	35.3	-61.8	N/A	N/A	0.0	N/A	82.4	-44.1	11.8	50.0	26.5	-41.2	N/A	23.5
Intellectual assets																				
3.3.1 PCT patent applications	-6.6	1.9	7.7	-1.8	-23.7	-0.3	-3.4	0.0	N/A	-18.6	-9.4	0.0	11.3	38.7	0.6	5.0	-3.3	15.6	4.4	-3.8
3.3.2 Trademark applications	19.8	18.5	26.2	19.2	21.5	27.8	26.0	17.9	13.4	6.7	-99.8	10.9	7.1	-16.3	27.7	13.5	-4.1	6.5	17.0	-11.3
3.3.3 Design applications	-7.2	1.1	-30.4	4.0	-29.0	-3.7	-12.0	-39.8	0.0	-0.1	-16.7	-6.9	0.4	0.0	5.2	0.4	-6.3	-3.8	0.5	-21.3
IMPACTS																				
Employment impacts																				
4.1.1 Employment in knowledge-intensive activities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.1.2 Employment in innovative enterprises	2.4	50.8	-5.5	0.0	-5.5	22.8	44.1	36.0	-4.8	0.0	-17.3	N/A	0.0	0.0	39.9	71.6	-10.1	-55.7	N/A	-2.3
Economic effects																				
4.2.1 Medium & high-tech product exports	-2.2	-0.4	12.4	12.2	13.0	6.9	10.9	2.1	0.0	14.1	0.0	24.9	23.8	15.0	6.2	-4.5	44.9	49.1	-19.1	-2.0
4.2.2 Knowledge-intensive services exports	12.1	20.8	8.2	18.9	16.7	20.9	16.8	17.1	10.0	5.1	25.0	35.1	24.4	38.2	9.8	30.8	11.6	39.9	12.7	11.6
4.2.3 Sales of new-to-market and new-to-enterprise innovations	8.9	9.2	72.2	-11.1	-1.2	-36.6	88.2	52.5	0.0	0.0	0.0	N/A	0.0	0.0	-1.2	34.1	-46.4	0.0	3.4	-46.3
Environmental sustainability																				
4.3.1 Resource productivity	11.8	20.9	-2.7	-3.7	19.6	0.0	17.4	3.9	19.5	3.0	100.8	N/A	19.0	N/A	-1.3	-2.0	7.4	27.9	N/A	40.0
4.3.2 Air emissions in fine particulates (PM2.5) in Industry	8.6	8.4	0.0	19.4	2.5	19.1	10.8	9.3	N/A	N/A	15.0	N/A	N/A	N/A	8.6	-11.8	4.8	N/A	N/A	-0.3
4.3.3 Development of environment-related technologies	-14.9	-69.4	-51.2	-62.0	0.6	-45.4	-26.5	4.4	58.2	0.0	15.8	-31.4	44.8	45.1	-6.7	-30.6	-17.3	-7.7	-10.0	-14.6

Annex E: Indicators: definitions, data sources and interpretation

More details including Eurostat series code are available in the Methodology Report.

INDICATOR	DEFINITION NUMERATOR SOURCE	DEFINITION DENOMINATOR SOURCE	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
1.1.1 New doctorate graduates in science, technology, engineering, and mathematics (STEM) per 1000 population aged 25-34	Number of doctorate graduates in science, technology, engineering, and mathematics (STEM) Eurostat	Population between and including 25 and 34 years Eurostat	2020 The indicator is a measure of the supply of new second-stage tertiary graduates in all fields of training (ISCED 8). For most countries, ISCED 8 captures PhD graduates There is a complex relation between STEM-graduates and innovation in the private sector. STEM-graduates do well as an employee within firms with many of them taking up managerial positions. However, non-STEM graduates are more likely to be involved in entrepreneurial activities. Graduates with a STEM-background who have completed a non-STEM study next to their core curriculum, show as much entrepreneurial activity as non-STEM graduates
1.1.2 Percentage population aged 25-34 having completed tertiary education	Number of persons in age class with some form of post-secondary education Eurostat	Population between and including 25 and 34 years Eurostat	2021 This is a general indicator of the supply of advanced skills. It is not limited to science and technical fields, because the adoption of innovations in many areas depends on a wide range of skills. The indicator focuses on a younger age cohort of the population, aged 25 to 34, and will therefore easily and quickly reflect changes in educational policies leading to more tertiary graduates
1.1.3. Lifelong learning	The target population for lifelong learning statistics refers to all persons in private households aged between 25 and 64 years. The information collected relates to all education or training, whether or not relevant to the respondent's current or possible future job. Data are collected through the EU Labour Force Survey Eurostat	Total population of the same age group, excluding those who did not answer the question concerning participation in (formal and non-formal) education and training Eurostat	2021 Lifelong learning encompasses all purposeful learning activity, whether formal, non-formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills and competence. The intention or aim to learn is the critical point that distinguishes these activities from non-learning activities, such as cultural or sporting activities
1.2.1 International scientific co-publications per million population	Number of scientific publications with at least one co-author based abroad (where abroad is non-EU for the EU) Scopus *	Total population Eurostat	2021 International scientific co-publications are a proxy for the quality of scientific research as collaboration increases scientific productivity
1.2.2 Scientific publications among the top-10% most cited publications worldwide as percentage of total scientific publications of the country	Number of scientific publications among the top-10% most cited publications worldwide Scopus *	Total number of scientific publications Scopus *	2019 The indicator is a measure for the efficiency of the research system, as highly cited publications are assumed to be of higher quality. There could be a bias towards small or English-speaking countries given the coverage of Scopus' publication data
1.2.3 Foreign doctorate students as a percentage of all doctorate students	Number of doctorate students from foreign countries Eurostat	Total number of doctorate students Eurostat	2020 The share of foreign doctorate students reflects the mobility of students as an effective way of diffusing knowledge. Attracting high-skilled foreign doctorate students will secure a continuous supply of researchers

INDICATOR	DEFINITION NUMERATOR SOURCE	DEFINITION DENOMINATOR SOURCE	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
1.3.1 Broadband penetration	Number of enterprises with a maximum contracted download speed of the fastest fixed internet connection of at least 100 Mb/s Eurostat, Community Survey of ICT Usage and E-commerce in Enterprises	All enterprises Eurostat, Community Survey of ICT Usage and E-commerce in Enterprises	2021 Realising Europe's full e-potential depends on creating the conditions for electronic commerce and the Internet to flourish. This indicator captures the relative use of this e-potential by the share of enterprises that have access to fast broadband
1.3.2 Individuals who have above basic overall digital skills (% share)	Number of individuals with above basic overall digital skills Eurostat: EU survey on the ICT usage in households and by individuals	Total number of individuals aged 16 to 74 Eurostat	2021 Above basic overall digital skills represent the highest level of the overall digital skills indicator, which is a composite indicator based on selected activities performed by individuals aged 16-74 on the internet in four specific areas (information, communication, problem solving, content creation) during the previous 3 months
2.1.1 R&D expenditure in the public sector (percentage of GDP)	All R&D expenditures in the government sector (GOVERD) and the higher education sector (HERD) Eurostat	Gross Domestic Product Eurostat	2020 Research and development (R&D) expenditure represents one of the major drivers of economic growth in a knowledge-based economy. As such, trends in the R&D expenditure indicator provide key indications of the future competitiveness and wealth of the EU. R&D spending is essential for making the transition to a knowledge-based economy as well as for improving production technologies and stimulating growth
2.1.2 Venture capital (percentage of GDP)	Venture capital expenditures is defined as private equity being raised for investment in companies. Management buyouts, management buy-ins, and venture purchase of quoted shares are excluded. Venture capital includes early stage (seed + start-up) and expansion and replacement capital Invest Europe Comment: Three-year averages have been used	Gross Domestic Product Eurostat	2021 The amount of venture capital is a proxy for the relative dynamism of new business creation. For enterprises using or developing new (risky) technologies, venture capital is often the only available means of financing their (expanding) business
2.1.3 Direct government funding and government tax support for business R&D (percentage of GDP)	Sum of GTARD as a percentage of GDO and Direct funding of BERD as a percentage of GDP OECD R&D Tax Incentive Database, http://oe.cd/rdtax, December 2020		2019 Public financing of R&D can take two forms: Direct funding for R&D through instruments such as grants and public procurement, and Indirect support through the tax system Direct funding is well captured in the official data on R&D expenditure by source of fund, differentiating between Business enterprise sector, Government sector, Higher education sector, Private non-profit sector, and Abroad. Data on R&D funded by the Government sector are available from Eurostat (EU Member States and other European countries), OECD (OECD member states) and UIS (global coverage). Over time, more and more countries have introduced R&D tax incentives. In the EU, 21 countries were offering R&D tax relief in 2018, a significant increase compared to only 12 countries offering R&D tax relief in 2000
2.2.1 R&D expenditure in the business sector (percentage of GDP)	All R&D expenditures in the business sector (BERD) Eurostat	Gross Domestic Product Eurostat	2020 The indicator captures the formal creation of new knowledge within firms. It is particularly important in the science-based sectors (pharmaceuticals, chemicals and some areas of electronics) where most new knowledge is created in or near R&D laboratories

INDICATOR	DEFINITION NUMERATOR SOURCE	DEFINITION DENOMINATOR SOURCE	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
2.2.2 Non-R&D innovation expenditures (percentage of turnover)	Sum of total innovation expenditure by enterprises in all size classes, excluding intramural and extramural R&D expenditures Eurostat (Community Innovation Survey)	Total turnover for all enterprises Eurostat (Community Innovation Survey)	2020 This indicator measures non-R&D innovation expenditure as a percentage of total turnover. Several of the components of innovation expenditure, such as investment in equipment and machinery and the acquisition of patents and licenses, measure the diffusion of new production technology and ideas
2.2.3 Innovation expenditures per person employed	Sum of total innovation expenditure by enterprises in all size classes in Purchasing Power Standards (PPS) Eurostat (Community Innovation Survey)	Total employment in innovative enterprises in all size classes Eurostat (Community Innovation Survey)	2018 The indicator measures the monetary input directly related to innovation activities
2.3.1 Enterprises providing training to develop or upgrade ICT skills of their personnel	Number of enterprises that provided any type of training to develop ICT related skills of their personnel Eurostat, Community Survey of ICT Usage and E-commerce in Enterprises	All enterprises Eurostat, Community Survey of ICT Usage and E-commerce in Enterprises	2020 ICT skills are particularly important for innovation in an increasingly digital economy. The share of enterprises providing training in that respect is a proxy for the overall skills development of employees
2.3.2 ICT specialists (as a percentage of total employment)	Number of employed ICT specialists Eurostat	Total employment Eurostat	2021 Eurostat defines ICT specialists as "workers who have the ability to develop, operate and maintain ICT systems, and for whom ICT constitute the main part of their job". Operationalised in terms of ISCO codes, this definition converts into a statistical definition of ICT specialists as follow: from 2011 onwards - corresponding to the application of the ISCO-08, Eurostat and OECD adopted a joint approach to define the occupations to be treated as ICT specialists (OECD, 2015[23])
3.1.1 SMEs introducing product innovations (percentage of SMEs)	Number of Small and medium-sized enterprises (SMEs) who introduced at least one product innovation. A product innovation is the market introduction of a new or significantly improved good or service with respect to its capabilities, user friendliness, components, or sub-systems Eurostat (Community Innovation Survey)	Total number of Small and medium-sized enterprises Eurostat (Community Innovation Survey)	2020 Product innovation is a key ingredient to innovation as they can create new markers and improve competitiveness. Higher shares of product innovators reflect a higher level of innovation activities
3.1.2 SMEs introducing business process innovations (percentage of SMEs)	Number of Small and medium-sized enterprises (SMEs) who introduced at least one business process innovation either new to the enterprise or new to their market Eurostat (Community Innovation Survey)	Total number of Small and medium-sized enterprises Eurostat (Community Innovation Survey)	2020 Many firms innovate not by improving new products but by improving their business processes. Business process innovations include process, marketing and organisational innovations
3.2.1 Innovative SMEs collaborating with others (percentage of SMEs)	Number of Small and medium-sized enterprises with innovation co-operation activities, i.e. those firms that had any co-operation agreements on innovation activities with other enterprises or institutions in the three years of the survey period Eurostat (Community Innovation Survey)	Total number of Small and medium-sized enterprises Eurostat (Community Innovation Survey)	2020 This indicator measures the degree to which SMEs are involved in innovation co-operation. Complex innovations often depend on the ability to draw on diverse sources of information and knowledge, or to collaborate in the development of an innovation. This indicator measures the flow of knowledge between public research institutions and firms, and between firms and other firms. The indicator is limited to SMEs, because almost all large firms are involved in innovation co-operation

[23] https://ec.europa.eu/eurostat/cache/metadata/Annexes/isoc_skslf_esms_an1.pdf

INDICATOR	DEFINITION NUMERATOR SOURCE	DEFINITION DENOMINATOR SOURCE	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
3.2.2 Public-private co-publications per million population	Number of public-private co-authored research publications. The definition of the "private sector" excludes the private medical and health sector. Publications are assigned to the country in which the business companies or other private sector organisations are located Scopus *	Total population Eurostat	2021 This indicator captures public-private research linkages and active collaboration activities between business sector researchers and public sector researchers resulting in academic publications
3.2.3 Job-to-job mobility of Human Resources in Science & Technology	Job-to-job mobility of Human Resources in Science & Technology Eurostat: Job-to-job mobility of HRST by sex [hrst_fl_mobsex]	Working age population aged 25-64 Eurostat	2020 Human Resources in Science & Technology (HRST) are people who fulfil one or other of the following conditions: 1) have successfully completed a tertiary level education; 2) not formally qualified as above but employed in a S&T occupation where the above qualifications are normally required. Job-to-job mobility in this context is defined as the movement of individuals between one job and another from one year to the next. It does not include inflows into the labour market from a situation of unemployment or inactivity
3.3.1 PCT patent applications per billion GDP (in PPS)	Number of patent applications filed under the PCT, at international phase, designating the European Patent Office (EPO). Patent counts are based on the priority date, the inventor's country of residence and fractional counts OECD	Gross Domestic Product in Purchasing Power Standard Eurostat	2018 The capacity of firms to develop new products will determine their competitive advantage. One measure of the rate of new product innovation is the number of patents. This indicator measures the number of PCT patent applications
3.3.2 Trademark applications per billion GDP (in PPS)	Number of trademark applications applied for at EUIPO European Union Intellectual Property Office (EUIPO) Comment: Two-year averages have been used	Gross Domestic Product in Purchasing Power Standard Eurostat	2021 Trademarks are an important innovation indicator, especially for the service sector. The Community trademark gives its proprietor a uniform right applicable in all Member States of the European Union through a single procedure which simplifies trademark policies at European level. It fulfils the three essential functions of a trademark: it identifies the origin of goods and services, guarantees consistent quality through evidence of the company's commitment vis-à-vis the consumer, and it is a form of communication, a basis for publicity and advertising
3.3.3 Design applications per billion GDP (in PPS)	Number of individual designs applied for at EUIPO European Union Intellectual Property Office (EUIPO) Comment: Two-year averages have been used	Gross Domestic Product in Purchasing Power Standard Eurostat	2021 A design is the outward appearance of a product or part of it resulting from the lines, contours, colours, shape, texture, materials and/or its ornamentation. A product can be any industrial or handicraft item including packaging, graphic symbols and typographic typefaces but excluding computer programmes. It also includes products that are composed of multiple components, which may be disassembled and reassembled. Community design protection is directly enforceable in each Member State, and it provides both the option of an unregistered and a registered Community design right for one area encompassing all Member States
4.1.1 Employment in knowledge-intensive activities (percentage of total employment)	Number of employed persons in knowledge-intensive activities in business industries. Knowledge-intensive activities are defined, based on EU Labour Force Survey data, as all NACE Rev.2 industries at 2-digit level where at least 33% of employment has a higher education degree (ISCED 5-8) Eurostat	Total employment Eurostat	2021 Knowledge-intensive activities provide services directly to consumers, such as telecommunications, and provide inputs to the innovative activities of other firms in all sectors of the economy

INDICATOR	DEFINITION NUMERATOR SOURCE	DEFINITION DENOMINATOR SOURCE	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
4.1.2 Employment in innovative enterprises	Number of employed persons in innovative enterprises ('Enterprises that have either introduced an innovation or have any kind of innovation activity (including enterprises with abandoned/suspended or on-going innovation activities) Eurostat (Community Innovation Survey)	Total employment for enterprises with 10 or more employees Eurostat (Community Innovation Survey)	2020 Innovation in enterprises has a profound impact on the employability of workers, but its effect in product- and process-innovation oriented firms varies across countries. Firm innovation proves to be specifically important during a time of economic recession. Although high-skilled employees are less affected by a recession than low-skilled employees, a notable positive effect is observed for low-skilled employees in innovative firms as well
4.2.1 Exports of medium and high technology products as a share of total product exports	Value of medium and high-tech exports, in national currency and current prices, including exports of the following SITC Rev.3 products: 266, 267, 512, 513, 525, 533, 54, 553, 554, 562, 57, 58, 591, 593, 597, 598, 629, 653, 671, 672, 679, 71, 72, 731, 733, 737, 74, 751, 752, 759, 76, 77, 78, 79, 812, 87, 88 and 891 Eurostat (ComExt) for Member States, UN ComTrade for non-EU countries	Value of total product exports Eurostat (ComExt) for Member States, UN ComTrade for non-EU countries	2021 The indicator measures the technological competitiveness of the EU, i.e. the ability to commercialise the results of research and development (R&D) and innovation in international markets. It also reflects product specialisation by country. Creating, exploiting and commercialising new technologies are vital for the competitiveness of a country in the modern economy. Medium and high technology products are key drivers for economic growth, productivity and welfare, and are generally a source of high value added and well-paid employment
4.2.2 Knowledge-intensive services exports as percentage of total services exports	Exports of knowledge-intensive services is defined as the sum of credits in EBOPS 2010 (Extended Balance of Payments Services Classification) items SC1, SC2, SC3A, SF, SG, SH, SI, SJ and SK1[24] Eurostat	Total value of services exports Eurostat	2020 The indicator measures the competitiveness of the knowledge-intensive services sector. Competitiveness-enhancing measures and innovation strategies can be mutually reinforcing for the growth of employment, export shares and turnover at the firm level. It reflects the ability of an economy, notably resulting from innovation, to export services with high levels of value added, and successfully take part in knowledge-intensive global value chains
4.2.3 Sales of new-to-market and new-to-firm innovations as percentage of turnover	Sum of total turnover of new or significantly improved products, either new-to-the-firm or new-to-the-market, for all enterprises Eurostat (Community Innovation Survey)	Total turnover for all enterprises Eurostat (Community Innovation Survey)	2020 This indicator measures the turnover of new or significantly improved products and includes both products which are only new to the firm and products which are also new to the market. The indicator thus captures both the creation of state-of-the-art technologies (new-to-market products) and the diffusion of these technologies (new-to-firm products)
4.3.1 Resource productivity	Resource productivity is expressed by the amount of GDP generated per unit of direct material consumed, i.e. GDP / DMC in euros per kg Eurostat: Resource productivity [env_ac_rp]		2020 Resource productivity is a measure of the total amount of materials directly used by an economy (measured as domestic material consumption (DMC)) in relation to GDP. It provides insights into whether decoupling between the use of natural resources and economic growth is taking place. Resource productivity (GDP/DMC) is the EU sustainable development indicator for policy evaluation Domestic material consumption (DMC) measures the total amount of materials directly used by an economy and is defined as the annual quantity of raw materials extracted from the domestic territory, plus all physical imports minus all physical exports

[24] SC1 (Sea transport), SC2 (Air transport), SC3A (Space transport), SF (Insurance and pension services), SG (Financial services), SH (Charges for the use of intellectual property), SI (Telecommunications, computer, and information services), SJ (Other business services) and SK1 (Audio-visual and related services)

INDICATOR	DEFINITION NUMERATOR SOURCE	DEFINITION DENOMINATOR SOURCE	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
4.3.2 Air emissions by fine particulate matter (PM2.5) in Industry	Air emissions by fine particulate matter (PM2.5) in the Manufacturing sector in Tonnes Eurostat, Air emissions accounts by NACE Rev. 2 activity [env_ac_ainah_r2]	Value added in the Manufacturing sector - Chain linked volumes (2010), million euro Eurostat	2019 Air pollution may be anthropogenic (human-induced) or of natural origin. Air pollution has the potential to harm both human health and the environment: particulate matter (PM), nitrogen dioxide and ground-level ozone are known to pose particular health risks. Long-term and peak exposures to these pollutants may be associated, among other impacts, with cardiovascular and respiratory diseases or an increased incidence of cancer. This indicator captures average concentration levels of fine particulate matter (PM2.5 — particles with a diameter of 2.5 micrometres or less) to which the population is exposed. The EU set an annual limit of 25 µg/m³ for fine particulate matter in Directive 2008/50/EC[25] on ambient air quality and cleaner air, while the World Health Organisation (WHO[26]) set a more stringent, but non-binding guideline value, whereby annual mean concentrations should not exceed 10 µg/m³ in order to protect human health. PM2.5 is considered by the WHO as the pollutant with the highest impact on human health
4.3.3 Development of environment-related technologies, percentage of all technologies	Number of environment-related inventions OECD Green Growth database	Total number of patents	2019 The number of environment-related inventions is expressed as a percentage of all domestic inventions (in all technologies). Indicators of technology development are constructed by measuring inventive activity using patent data across a wide range of environment-related technological domains (ENVTECH[27]), including environmental management, water-related adaptation, and climate change mitigation technologies. The counts used include only higher-value inventions (with patent family size ≥ 2). Data are obtained from the Patents: Technology development dataset of the OECD Environment Database[28]

* Data provided by Science-Metrix as part of a contract to European Commission (DG Research and Innovation).

[25] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0050

[26] https://www.who.int/en/

[27] www.oecd.org/environment/consumption-innovation/ENV-tech%20search%20strategies,%20version%20for%20OECDstat%20(2016).pdf

[28] https://www.oecd-ilibrary.org/environment/data/oecd-environment-statistics_env-data-en

Annex F: Summary Innovation Index (SII) time series: normalised scores, relative to EU scores, and change over time

	SUMMARY INNOVATION INDEX								RELATIVE TO EU IN 2015								... IN 2022	CHANGE BETWEEN 2015 AND 2022
	2015	2016	2017	2018	2019	2020	2021	2022	2015	2016	2017	2018	2019	2020	2021	2022	2022	
EU	0.493	0.495	0.501	0.512	0.514	0.533	0.539	0.542	100.0	100.4	101.5	103.7	104.3	108.0	109.3	109.9	100.0	9.9
BE	0.615	0.620	0.632	0.641	0.627	0.680	0.676	0.698	124.7	125.8	128.0	129.9	127.2	137.9	137.2	141.5	128.8	16.8
BG	0.238	0.244	0.239	0.241	0.239	0.229	0.230	0.245	48.2	49.5	48.4	48.8	48.5	46.5	46.7	49.7	45.2	1.5
CZ	0.404	0.409	0.412	0.416	0.428	0.443	0.444	0.502	82.0	82.9	83.5	84.3	86.8	89.8	90.0	101.7	92.6	19.8
DK	0.675	0.678	0.687	0.679	0.683	0.718	0.728	0.731	136.8	137.4	139.3	137.6	138.5	145.5	147.7	148.1	134.8	11.3
DE	0.601	0.597	0.601	0.607	0.608	0.641	0.646	0.637	121.8	121.0	121.9	123.0	123.2	130.0	130.9	129.2	117.5	7.4
EE	0.422	0.391	0.405	0.474	0.488	0.553	0.585	0.542	85.5	79.3	82.2	96.2	99.0	112.1	118.7	109.8	100.0	24.4
IE	0.610	0.619	0.627	0.622	0.620	0.602	0.607	0.645	123.6	125.5	127.2	126.1	125.6	122.0	123.0	130.7	118.9	7.1
EL	0.316	0.319	0.333	0.363	0.368	0.399	0.417	0.435	64.1	64.6	67.6	73.5	74.7	81.0	84.5	88.2	80.2	24.1
ES	0.439	0.443	0.452	0.464	0.471	0.460	0.454	0.481	88.9	89.9	91.6	94.0	95.5	93.2	92.1	97.5	88.8	8.6
FR	0.576	0.577	0.583	0.580	0.578	0.571	0.576	0.571	116.8	117.1	118.2	117.5	117.1	115.8	116.8	115.9	105.4	-1.0
HR	0.284	0.291	0.291	0.300	0.306	0.340	0.350	0.360	57.5	58.9	58.9	60.8	62.1	69.0	71.1	73.0	66.5	15.5
IT	0.411	0.413	0.420	0.443	0.448	0.504	0.511	0.497	83.2	83.7	85.1	89.7	90.9	102.1	103.6	100.7	91.6	17.4
CY	0.392	0.395	0.411	0.430	0.415	0.537	0.550	0.579	79.5	80.0	83.4	87.2	84.1	108.8	111.5	117.4	106.9	37.9
LV	0.252	0.268	0.272	0.275	0.267	0.279	0.279	0.275	51.1	54.4	55.2	55.7	54.2	56.6	56.6	55.8	50.8	4.7
LT	0.356	0.370	0.376	0.415	0.414	0.413	0.422	0.454	72.1	75.0	76.2	84.1	84.0	83.6	85.6	92.0	83.7	19.9
LU	0.636	0.643	0.655	0.654	0.656	0.654	0.645	0.643	128.9	130.3	132.7	132.6	133.0	132.6	130.8	130.4	118.6	1.4
HU	0.343	0.345	0.344	0.354	0.340	0.352	0.364	0.378	69.6	69.9	69.8	71.7	68.9	71.3	73.8	76.7	69.8	7.1
MT	0.426	0.434	0.447	0.471	0.487	0.534	0.482	0.459	86.4	87.9	90.6	95.4	98.7	108.2	97.6	93.0	84.7	6.7
NL	0.652	0.663	0.667	0.682	0.693	0.685	0.691	0.701	132.2	134.4	135.2	138.3	140.4	138.9	140.1	142.1	129.3	9.9
AT	0.619	0.614	0.619	0.636	0.632	0.629	0.634	0.641	125.4	124.5	125.4	128.9	128.2	127.6	128.6	130.1	118.3	4.6
PL	0.272	0.280	0.290	0.288	0.294	0.296	0.307	0.328	55.2	56.8	58.9	58.5	59.5	59.9	62.2	66.5	60.5	11.3
PT	0.434	0.433	0.432	0.470	0.479	0.439	0.455	0.465	88.0	87.9	87.6	95.2	97.2	89.0	92.2	94.3	85.8	6.4
RO	0.176	0.175	0.170	0.159	0.166	0.189	0.191	0.177	35.7	35.5	34.4	32.2	33.6	38.4	38.7	35.9	32.6	0.2
SI	0.497	0.492	0.495	0.476	0.461	0.473	0.492	0.507	100.8	99.8	100.3	96.6	93.4	96.0	99.7	102.7	93.5	2.0
SK	0.326	0.319	0.336	0.332	0.333	0.326	0.326	0.349	66.1	64.6	68.1	67.3	67.6	66.0	66.1	70.7	64.3	4.6
FI	0.638	0.644	0.640	0.667	0.672	0.683	0.697	0.735	129.4	130.6	129.8	135.3	136.2	138.6	141.4	148.9	135.5	19.5
SE	0.683	0.690	0.699	0.699	0.700	0.728	0.727	0.735	138.6	139.9	141.7	141.7	141.9	147.6	147.4	149.1	135.7	10.5
AL*	0.201	0.214	0.194	0.200	0.237	0.224	0.227	0.226	40.8	43.4	39.4	40.5	48.0	45.4	45.9	45.8	41.7	5.0
BA	0.185	0.185	0.181	0.158	0.155	0.181	0.194	0.189	37.5	37.4	36.7	32.0	31.5	36.6	39.2	38.3	34.9	0.9
IS	0.525	0.540	0.534	0.526	0.537	0.547	0.554	0.565	106.5	109.6	108.2	106.7	108.9	110.8	112.3	114.5	104.2	8.0
IL*	0.501	0.505	0.514	0.515	0.519	0.522	0.526	0.523	101.7	102.4	104.1	104.3	105.3	105.8	106.6	106.0	96.4	4.3
MK	0.188	0.185	0.191	0.209	0.209	0.210	0.232	0.247	38.0	37.4	38.7	42.4	42.5	42.6	47.0	50.1	45.6	12.0
ME	0.225	0.242	0.246	0.219	0.234	0.232	0.250	0.257	45.6	49.0	49.8	44.5	47.4	47.1	50.7	52.2	47.5	6.5
NO	0.558	0.558	0.564	0.611	0.617	0.635	0.641	0.663	113.1	113.1	114.3	123.9	125.1	128.6	130.0	134.4	122.3	21.3
RS	0.258	0.251	0.271	0.291	0.311	0.344	0.353	0.335	52.3	50.8	55.0	58.9	63.1	69.7	71.6	67.9	61.8	15.6
CH	0.752	0.756	0.755	0.747	0.756	0.760	0.764	0.772	152.5	153.4	153.2	151.5	153.2	154.1	154.9	156.5	142.4	4.0
TR	0.261	0.262	0.270	0.299	0.302	0.250	0.251	0.259	53.0	53.1	54.8	60.7	61.3	50.7	50.9	52.4	47.7	-0.5
UA*	0.170	0.164	0.155	0.152	0.148	0.153	0.160	0.168	34.5	33.2	31.4	30.7	30.1	31.0	32.5	34.1	31.0	-0.5
UK	0.622	0.624	0.644	0.655	0.655	0.636	0.640	0.639	126.0	126.6	130.6	132.8	132.9	129.0	129.7	129.5	117.8	3.4

* Results for Albania (AL), Israel (IL) and Ukraine (UA) are less reliable due to limited data availability.

Annex G: Performance scores by country per dimension in 2022

Performance is measured relative to that of the EU in 2022.

	HUMAN RESOURCES	ATTRACTIVE RESEARCH SYSTEMS	DIGITALISATION	FINANCE AND SUPPORT	FIRM INVESTMENTS	INFORMATION TECHNOLOGIES	INNOVATORS	LINKAGES	INTELLECTUAL ASSETS	EMPLOYMENT IMPACTS	SALES IMPACTS	ENVIRONMENTAL SUSTAINABILITY
	2022	2022	2022	2022	2022	2022	2022	2022	2022	2022	2022	2022
EU	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BE	129.6	157.9	123.2	129.0	137.8	166.3	146.5	174.0	87.1	151.4	101.2	100.8
BG	33.5	27.6	47.0	22.6	35.1	35.9	56.0	34.4	74.1	55.3	60.6	53.5
CZ	75.9	82.2	75.8	86.2	94.0	118.5	138.2	92.2	62.9	106.1	97.4	98.8
DK	170.1	195.6	152.2	111.2	83.1	156.5	117.2	218.0	143.3	108.4	104.2	127.8
DE	99.8	109.9	84.7	93.4	138.0	121.7	141.1	141.7	124.0	128.9	112.6	122.5
EE	123.2	124.0	86.6	92.8	93.7	127.2	95.3	163.9	120.3	144.9	67.1	33.5
IE	169.1	158.0	123.3	78.9	73.2	162.0	115.8	177.1	61.2	153.8	137.3	101.7
EL	72.4	66.8	57.3	60.7	71.0	37.0	167.3	114.3	53.8	124.2	90.6	71.1
ES	127.6	96.6	149.8	74.5	62.4	91.3	50.1	88.5	78.1	58.8	96.6	102.4
FR	125.5	119.8	112.8	132.5	86.7	83.7	104.5	121.4	80.9	110.5	79.4	117.4
HR	53.9	48.8	75.1	67.2	40.2	90.2	126.9	111.3	43.1	75.8	56.5	56.9
IT	64.1	98.6	75.2	79.6	82.1	68.5	115.2	90.6	105.4	107.1	88.6	117.6
CY	117.1	147.2	80.0	65.9	48.0	103.3	154.8	228.8	104.0	148.8	111.4	62.7
LV	75.4	43.1	77.2	37.6	25.4	75.0	39.3	75.3	67.9	47.5	52.8	27.3
LT	111.6	53.1	104.2	76.0	79.6	65.2	113.7	141.6	69.1	101.0	51.1	80.4
LU	166.7	221.1	126.4	68.1	52.5	151.1	99.0	188.7	112.0	135.1	83.5	122.4
HU	45.1	78.8	71.8	79.7	68.3	73.9	49.3	96.1	52.3	59.4	84.9	70.4
MT	85.3	99.7	132.3	17.4	42.8	134.8	66.0	97.4	124.5	111.8	69.7	104.2
NL	176.0	200.5	165.2	118.5	76.9	160.9	104.7	183.4	112.1	125.7	88.6	121.9
AT	125.4	156.1	96.4	116.0	101.5	93.5	124.2	175.3	143.5	122.5	85.7	106.5
PL	54.6	42.2	84.3	59.8	56.9	71.7	41.4	73.8	84.0	49.2	65.7	44.5
PT	120.2	128.9	133.5	87.6	48.0	114.1	99.3	91.0	77.6	95.0	74.5	27.4
RO	19.2	35.5	86.7	29.5	12.2	13.0	4.6	7.4	32.7	8.0	69.3	45.6
SI	140.2	108.0	86.7	65.3	60.2	126.1	116.1	142.3	77.8	107.4	82.4	78.1
SK	71.8	54.2	68.4	38.6	55.7	82.6	42.3	50.1	52.9	54.6	96.9	93.4
FI	169.5	158.7	156.5	101.3	104.4	221.7	147.5	224.4	130.8	139.1	109.6	79.0
SE	183.9	183.2	150.2	112.6	129.6	202.2	142.6	139.6	124.6	156.9	102.8	86.9
AL*	56.8	39.1	5.0	0.0	0.0	N/A	70.4	40.8	31.0	35.2	55.6	98.2
BA	10.9	24.1	31.0	0.7	0.4	71.7	110.5	15.2	8.9	79.8	31.9	88.8
IS	137.1	178.7	162.1	111.0	78.1	105.4	102.2	228.7	56.7	127.8	45.7	63.6
IL*	121.0	108.3	41.5	50.4	161.8	122.9	N/A	72.0	81.4	190.8	121.1	25.2
RS	34.1	76.6	47.0	15.5	40.6	26.1	60.0	49.5	19.1	28.0	64.2	86.8
NO	38.2	44.9	38.9	14.5	23.7	76.1	132.5	49.0	20.3	105.3	35.4	55.4
MK	163.3	164.1	143.7	134.7	82.9	162.0	155.6	249.2	60.6	134.4	56.0	84.9
ME	49.1	42.7	47.7	38.7	102.2	60.9	132.2	66.0	20.4	98.7	77.5	27.3
CH	204.7	226.7	115.5	87.0	134.6	139.1	131.3	196.5	138.9	168.1	112.5	123.3
TR	46.5	39.2	30.7	66.1	47.8	22.8	58.4	65.5	27.5	20.1	82.5	44.6
UA*	36.0	14.8	N/A	33.2	31.2	31.3	0.0	21.1	20.8	70.1	32.3	75.9
UK	173.3	171.7	43.5	122.6	73.9	137.0	48.1	205.5	76.9	149.5	110.8	117.3

* Results for Albania (AL), Israel (IL) and Ukraine (UA) are less reliable due to limited data availability.

N/A = not available

Annex H: Performance data global competitors

Performance in 2022 (relative to EU in 2022)

	AU	BR	CA	CL	CN	IN	JP	KR	MX	US	ZA
Summary Innovation Index	105.9	59.8	114.6	51.3	85.0	33.4	95.2	116.4	33.5	108.3	38.2
1.1.1 New doctorate graduates	140.1	29.6	93.7	18.9	N/A	5.2	50.0	115.5	12.4	83.4	N/A
1.1.2 Population completed tertiary education	134.8	58.1	159.0	83.3	34.6	48.1	151.9	172.4	58.2	128.0	36.7
1.2.1 International scientific co-publications	394.9	23.1	259.6	88.8	19.1	5.2	49.8	87.3	15.7	112.7	40.9
1.2.2 Scientific publications among top 10% most cited	135.5	55.9	115.5	65.9	111.0	68.2	57.8	82.8	42.9	136.8	73.6
2.1.1 R&D expenditure in the public sector	109.4	N/A	111.1	27.7	75.8	55.5	88.0	123.6	30.9	96.1	62.6
2.1.2 Direct & indirect government funding business R&D	85.9	31.1	93.5	11.4	77.3	N/A	69.5	165.9	7.7	127.3	6.6
2.2.1 R&D expenditure in the business sector	63.5	N/A	59.9	14.3	127.3	16.6	178.4	263.8	15.9	180.0	23.6
2.3.2 Employment in ICT	104.0	42.7	N/A	57.9	N/A	N/A	103.1	90.3	20.7	109.0	N/A
3.1.1 SMEs with product innovations	105.2	62.7	181.9	28.7	N/A	N/A	41.6	39.0	21.6	77.5	N/A
3.1.2 SMEs with business process innovations	123.9	197.4	180.9	44.0	N/A	N/A	70.4	40.1	N/A	74.3	N/A
3.2.1 Innovative SMEs collaborating with others	140.3	108.4	181.4	134.1	N/A	N/A	103.2	111.3	N/A	591.5	N/A
3.2.2 Public-private co-publications	219.2	12.3	179.3	29.3	40.1	3.6	87.1	114.4	6.3	116.6	17.9
3.3.1 PCT patent applications	63.1	10.5	73.0	18.8	103.2	14.2	379.0	330.1	4.2	112.9	16.3
3.3.2 Trademark applications	191.6	165.8	145.9	219.1	675.4	83.0	138.6	239.5	119.9	72.9	80.4
3.3.3 Design applications	78.2	28.9	61.9	13.9	461.6	20.7	86.3	439.6	23.8	35.2	31.4
4.2.1 Medium & high-tech product exports	12.9	37.5	58.6	21.5	106.8	61.0	129.6	136.4	123.2	93.6	61.0
4.2.2 Knowledge-intensive services exports	43.9	83.0	94.6	51.7	70.2	98.6	95.7	53.0	26.1	100.8	24.2
4.3.2 Air pollution in PM 2.5	199.7	115.5	190.1	83.3	28.2	16.2	98.7	49.1	103.4	175.6	47.6
4.3.3 Environment-related technologies	83.2	87.1	91.8	181.9	70.8	71.1	80.1	97.0	75.3	71.7	84.9

Change in performance (2015-2022)

Performance change is measured as the difference between performance in 2022 relative to the EU in 2015 and performance in 2015 relative to the EU in 2015 (the results are the same as those shown in the final column in the performance tables in the country profiles in Section 5.2).

	AU	BR	CA	CL	CN	IN	JP	KR	MX	US	ZA
Summary Innovation Index	1.2	9.0	6.8	5.0	24.9	-0.4	-0.3	5.0	-4.8	7.4	3.0
1.1.1 New doctorate graduates	25.2	7.4	-0.6	3.1	N/A	0.9	17.9	30.6	2.6	5.0	N/A
1.1.2 Population completed tertiary education	25.3	23.5	19.3	18.4	7.7	0.0	9.0	7.8	10.1	20.2	1.0
1.2.1 International scientific co-publications	239.9	16.1	121.2	62.6	15.7	4.8	22.9	48.9	10.2	43.9	30.4
1.2.2 Scientific publications among top 10% most cited	-5.1	3.5	-16.5	6.0	36.1	4.1	-5.7	0.5	-3.6	-15.9	2.4
2.1.1 R&D expenditure in the public sector	-6.0	N/A	0.1	2.9	13.4	-3.1	-12.3	17.1	-11.7	5.3	12.6
2.1.2 Direct & indirect government funding business R&D	-46.0	19.5	-39.0	6.7	7.2	N/A	9.6	-52.8	0.1	-23.2	-12.7
2.2.1 R&D expenditure in the business sector	-21.0	N/A	-0.6	1.6	24.7	-2.5	6.5	56.6	-6.7	54.8	0.6
2.3.2 Employment in ICT	14.6	3.0	N/A	-1.7	N/A	N/A	19.7	14.0	-4.7	7.1	N/A
3.1.1 SMEs with product innovations	-22.8	2.7	54.2	-13.1	N/A	N/A	-13.4	5.2	0.0	64.4	N/A
3.1.2 SMEs with business process innovations	-21.6	0.0	42.2	-51.5	N/A	N/A	-60.0	-56.0	N/A	-58.5	N/A
3.2.1 Innovative SMEs collaborating with others	-80.5	-23.1	0.0	116.3	N/A	N/A	-307.0	-146.3	N/A	0.0	N/A
3.2.2 Public-private co-publications	108.4	6.9	58.4	19.1	34.3	2.4	16.4	38.0	3.9	17.1	9.8
3.3.1 PCT patent applications	-13.9	0.7	-11.0	2.5	40.0	-0.6	-1.5	38.5	-0.5	-16.8	-3.7
3.3.2 Trademark applications	2.8	61.8	-12.9	23.2	392.4	23.9	55.7	30.1	21.0	22.3	-5.2
3.3.3 Design applications	-13.2	-2.3	9.4	-11.3	-104.8	1.3	-3.1	-120.3	-3.6	3.2	-10.5
4.2.1 Medium & high-tech product exports	-4.6	-12.4	-5.0	-4.6	7.4	10.6	-1.9	8.5	1.3	1.4	-4.8
4.2.2 Knowledge-intensive services exports	9.4	-3.0	19.3	4.0	12.1	-13.8	34.0	10.1	-17.7	27.6	9.0
4.3.2 Air pollution in PM 2.5	-1.6	-13.5	-3.3	2.9	-71.8	-24.4	2.1	10.3	-12.9	-7.7	-4.7
4.3.3 Environment-related technologies	-1.8	7.1	-8.0	27.7	-5.5	-15.5	-23.7	-18.8	-29.3	-27.0	-3.2

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