European
Innovation
Scoreboard
2020

European
Commission

Innovation

This report was prepared by:
Hugo Hollanders
Maastricht University (Maastricht Economic and Social Research Institute on Innovation and Technology – MERIT)
With contributions from:
Nordine Es-Sadki, Iris Merkelbach, and Aishe Khalilova
Maastricht University (Maastricht Economic and Social Research Institute on Innovation and Technology – MERIT)

as part of the **European Innovation Scoreboards (EIS) project** for the European Commission,
Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

Jointly coordinated and guided by:
Mark Nicklas, Head of Unit, and Marshall Hsia
Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
Directorate F – Industrial Policy and Innovation
Unit F.1 – Industrial Strategy and Value Chains
and
Román Arjona, Head of Unit, Athina Karvounaraki, and Tiago Pereira
Directorate-General for Research and Innovation
Directorate A – Policy & Programming Centre
Unit A.1 – Chief Economist – R&I Strategy & Foresight

Design, typeset and-prepress production: Jacqueline van Kesteren (www.artdustries.com)

The European Innovation Scoreboard report and annexes, and the indicators database are available at:
https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en
The EIS 2020 is accompanied by an Interactive Tool which allows for customized comparisons of the performance scores discussed in the report. The tool contains six modules or screens, with metadata on indicators, definitions of innovation performance groups, etc. The EIS Interactive Tool is available at:
https://interactivetool.eu/EIS/index.html

European **Innovation**
Scoreboard 2020

Foreword

"We must turn the immense challenge we are facing into an opportunity by investing in our common future with the help of the recovery plan. The European Green Deal and our digitisation initiatives will boost jobs and innovative growth, the resilience of our societies and the health of our environment. This is Europe's moment."

Quote from President von der Leyen

The coronavirus pandemic has shaken the world in an unprecedented manner. The resilience of our societies, economies, healthcare and welfare systems has been tested as never before. The European Union has withstood the test, protecting lives and livelihoods whilst preserving the Single Market, and supporting Europe's economy and households.

Research and innovation have proven to be an essential part of the coordinated EU response to the virus outbreak and they will be vital to support Europe's sustainable and inclusive recovery. They boost the resilience of our production sectors, the competitiveness of our economies and the digital and ecological transformation of our societies. Research and innovation ensure preparedness for the future and are critical to deliver on the European Green Deal.

Our renewed commitment to modernise our economies, make them greener, more digital and more resilient, will ensure that we come out stronger from this crisis on all fronts. The Commission's Next Generation EU large-scale recovery package contains a sizeable policy and funding boost to research and innovation, as decisive driver of Europe's future.

Horizon Europe, the next EU research and innovation programme, with a proposed budget of €94.4 billion, will act as accelerator to achieve Europe's environmental and digital transformation. As part of the EU large-scale recovery package, the Commission has proposed additional funding of €13.5 billion for Horizon Europe in order to drive the shift towards a clean, circular, competitive and climate neutral economy. This reinforcement will enable to scale up efforts in support of secure, fast and effective responses to the pandemic and future emergencies, through vaccines, treatments and diagnostics. The programme will strongly support the competitiveness of EU industry, with a focus on breakthrough innovations by small and medium-sized enterprises, start-ups, and midcaps through the European Innovation Council (EIC). Investment in skills and in research and innovation are now more crucial than ever to build up a stronger resilience of our different European ecosystems.

The EU's new Industrial Strategy builds on these key areas by setting out a clear path for the future and identifying a range of actions in support of industry. These actions will reinforce the Single Market, create a global level playing field, and enhance the green transition and circular economy, together with the key issues of innovation, skills and investment. The Strategy enables us to facilitate exchanges with industry and social partners by putting industrial ecosystems at the heart of our actions. It is a new way of working together, which connects key players within specific value chains and allows us to co-create solutions targeted at specific sectoral and competitive challenges. Together with the Recovery Plan for Europe, the new Industrial Strategy will address the key challenges of today and tomorrow by maintaining Europe's global competitiveness and strengthening our industrial and strategic autonomy.

Measuring innovation performance is a key element in achieving these objectives. The 2020 European Innovation Scoreboard shows that our innovation performance continues to increase at a steady pace. Within the EU, the positive convergence in performance between Member States has continued from previous years. The withdrawal of the United Kingdom from the EU earlier this year has had a small impact on the EU's average innovation performance, but has not affected the relative performance of Member States or the EU's global performance. At the international level, the EU maintains a performance lead over the United States and China, but still has a gap with some competitors including Japan and South Korea.

The 2020 European Innovation Scoreboard will support the development of policies to enhance innovation in Europe and inform policy makers in a rapidly evolving global context. We count on you – researchers, innovators, investors, and policy-makers – to accelerate the green and digital transitions in Europe, with innovation leading the way for the future.

Thierry Breton
European Commissioner for Internal Market

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

TABLE OF CONTENTS

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.

This year's EIS reveals that the EU's innovation performance continues to increase at a steady pace. Further overall improvement is expected in the short-term, but progress remains uneven within the EU. The EIS 2020 report is the first edition published since the withdrawal of the United Kingdom from the European Union, and all results for the EU are for the current 27 Member States.

The EU has a performance lead over the United States, but is losing ground vis-à-vis Australia, Japan and South Korea

At the global level, the EU has a performance lead over the United States, China, Brazil, Russia, South Africa, and India, and a performance gap with South Korea, Canada, Australia and Japan (*Figure 1*). Between 2012 and 2019, the EU's performance gap with South Korea, Australia and Japan has increased, and the EU's performance lead over the United States, China, Brazil, Russia and South Africa has become smaller. Between 2012 and 2019, China has been catching up at five times the EU's innovation performance growth rate and predictions show that China will further close this gap and is also likely to overtake the United States if current trends continue. Between 2018 and 2019, performance has decreased for Australia and Japan, and has increased for Canada and for the United States.

Innovation performance has increased for the EU and most Member States

On average, the innovation performance of the EU has now increased by almost nine percentage points since 2012, in particular due to strong performance increases in the following indicators: Broadband penetration, International scientific co-publications, and Non-R&D innovation expenditures. Since 2012, innovation performance increased in 24 EU Member States and decreased in only three. Performance has increased the most in Lithuania, Latvia, Portugal and Greece, and decreased the most in Slovenia and Romania. The process of convergence within the EU, where lower performing countries are growing faster than higher performing countries, has continued in 2019.

Figure 1: Global performance
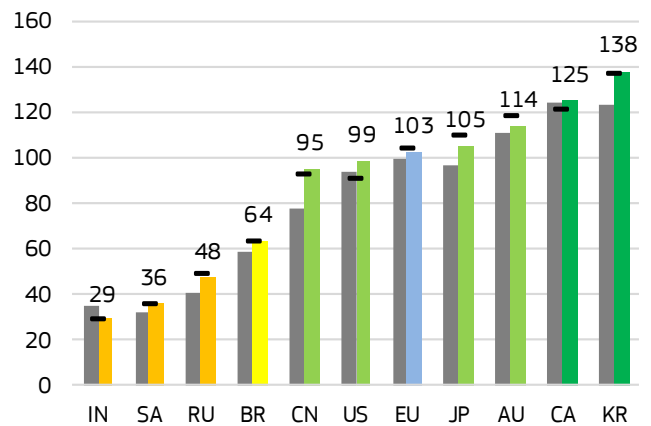
Coloured columns show performance in 2019 relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012. For all years, the same measurement methodology has been used.

Member States are classified into four performance groups based on their average performance scores

Based on their average performance scores as calculated by a composite indicator, the Summary Innovation Index, Member States fall into four different performance groups (*Figure 2*). Denmark, Finland, Luxembourg, the Netherlands, and Sweden are *Innovation Leaders* with innovation performance well above the EU average. Austria, Belgium, Estonia, France, Germany, Ireland, and Portugal are *Strong Innovators* with performance above or close to the EU average. The performance of Croatia, Cyprus, Czechia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, and Spain is below the EU average. These countries are *Moderate Innovators*. Bulgaria and Romania are *Modest Innovators* with performance well below the EU average.

In this year's edition, Luxembourg (previously a Strong Innovator) joins the group of Innovation Leaders, and Portugal (previously a Moderate Innovator) joins the group of Strong Innovators.

Figure 2: Performance of EU Member States' innovation systems
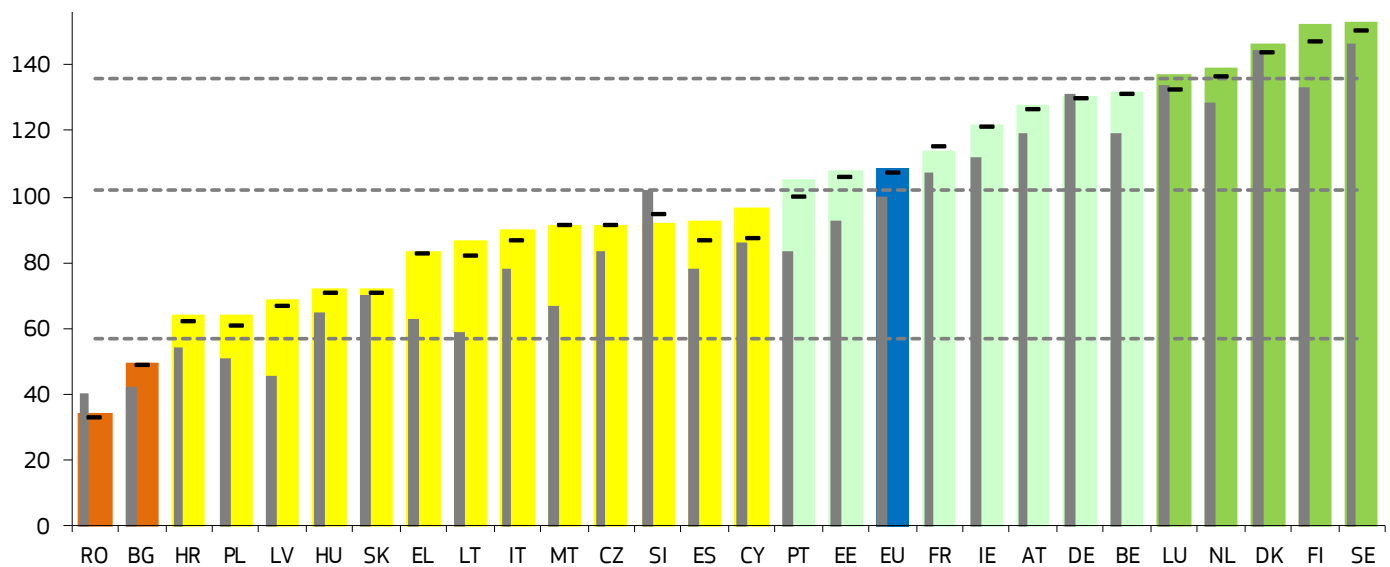
Coloured columns show countries' performance in 2019, using the most recent data for 27 indicators, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data, relative to that of the EU in 2012. Grey columns show countries' performance in 2012 relative to that of the EU in 2012. For all years, the same measurement methodology has been used. The dashed lines show the threshold values between the performance groups..

Performance of innovation systems is measured by average performance on 27 indicators

The EIS measurement framework distinguishes between four main types of activities, capturing ten innovation dimensions and in total 27 different indicators. *Framework conditions* capture the main drivers of innovation performance external to the firm and cover three innovation dimensions: *Human resources, Attractive research systems*, as well as *Innovation-friendly environment*. Investments capture public and private investment in research and innovation and cover two dimensions: *Finance and support* and *Firm investments. Innovation activities* capture the innovation efforts at the level of the firm, grouped in three innovation dimensions: *Innovators, Linkages*, and *Intellectual assets*. Impacts cover the effects of firms' innovation activities in two innovation dimensions: *Employment impacts* and *Sales impacts*.

Since 2012, progress has been strongest in *Innovation-friendly environment* (notably Broadband penetration), *Firm investments* (notably Non-R&D innovation expenditures and Enterprises providing ICT training), *Human resources* (notably Population with completed tertiary education)), and *Attractive research systems* (notably International co-publications). It is also encouraging that Venture capital expenditures have increased significantly. By contrast, Public R&D expenditures as a share of GDP remain below their 2012 level.

Methodological continuity and refinement

The main measurement framework for the European Innovation Scoreboard was significantly modified in 2017. For this year's edition, no changes have been made to the main measurement framework. However, due to data revisions for some indicators, the results for earlier years in this report are not directly comparable to those reported in previous editions of the EIS. Also, with the withdrawal of the UK from the European Union, the EU now represents the average of 27 countries, rather than the 28 countries in previous editions. The UK has consistently performed above the EU28 average, and the absence of the UK from the EU this year has resulted in a small reduction in the EU's average innovation performance. The results for all years for the EU in this year's report relate to the current 27 Member State configuration.

Following a need for additional contextual analyses to better understand performance differences between the innovation indicators used in the main measurement framework, a set of contextual indicators was introduced to the country profiles in the 2017 edition and revised in the 2018 edition. For this year's report, no changes have been made to the contextual indicators used last year.

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.

1.1 Measurement framework

The European Innovation Scoreboard 2020[1] , the 19th edition since the introduction of the EIS in 2001, follows the methodology of the previous EIS 2019 report. Innovation performance is measured using a composite indicator – the Summary Innovation Index – which summarises the performance of a range of different indicators. The EIS distinguishes between four main types of activities – Framework conditions, Investments, Innovation activities, and Impacts – and ten innovation dimensions, capturing in total 27 indicators. The measurement framework is presented in *Table 1*.

Table 1: Measurement framework of the European Innovation Scoreboard

FRAMEWORK CONDITIONS

Human resources

1.1.1	New doctorate graduates
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

Innovation-friendly environment

1.3.1	Broadband penetration
1.3.2	Opportunity-driven entrepreneurship

INVESTMENTS

Finance and support

2.1.1	R&D expenditure in the public sector
2.1.2	Venture capital expenditures

Firm investments

2.2.1	R&D expenditure in the business sector
2.2.2	Non-R&D innovation expenditures
2.2.3	Enterprises providing training to develop or upgrade ICT skills of their personnel

INNOVATION ACTIVITIES

Innovators

3.1.1	SMEs with product or process innovations
3.1.2	SMEs with marketing or organisational innovations
3.1.3	SMEs innovating in-house

Linkages

3.2.1	Innovative SMEs collaborating with others
3.2.2	Public-private co-publications
3.2.3	Private co-funding of public R&D expenditures

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 fast-growing enterprises of innovative sectors

Sales impacts

4.2.1	Medium and high-tech product exports
4.2.2	Knowledge-intensive services exports
4.2.3	Sales of new-to-market and new-to-firm product innovations

---

[1] The EIS reports have been published under the name "European Innovation Scoreboard" until 2009, as "Innovation Union Scoreboard" between 2010 and 2015, and again as "European Innovation Scoreboard" from 2016 onwards.

Framework conditions captures the main drivers of innovation performance external to the firm and differentiates between three innovation dimensions: The *Human resources* dimension includes three indicators and measures the availability of a high-skilled and educated workforce. *Human resources* captures New doctorate graduates, Population aged 25-34 with completed tertiary education, and Population aged 25-64 involved in education and training. *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. *Innovation-friendly environment* captures the environment in which enterprises operate and includes two indicators, Broadband penetration among enterprises and Opportunity-driven entrepreneurship, measuring the degree to which individuals pursue entrepreneurial activities as they see new opportunities.

Investments captures investments made in both the public and business sector and differentiates between two innovation dimensions: *Finance and support* includes two indicators and measures the availability of finance for innovation projects by Venture capital expenditures, and the support of governments for research and innovation activities by R&D expenditures in universities and government research organisations. *Firm investments* includes three indicators of both R&D and Non-R&D investments that firms make to generate innovations and the efforts enterprises make to upgrade the ICT skills of their personnel.

Innovation activities captures different aspects of innovation in the business sector and differentiates between three dimensions: *Innovators* includes three indicators measuring the share of firms that have introduced innovations into the market or within their organisations, covering both product and process innovators, marketing and organisational innovators, and SMEs that innovate in-house. *Linkages* includes three indicators measuring innovation capabilities by looking at collaboration efforts between innovating firms, research collaboration between the private and public sector, and the extent to which the private sector finances public R&D activities. *Intellectual assets* captures different forms of Intellectual Property Rights (IPR) generated in the innovation process, including PCT patent applications, Trademark applications and Design applications.

Impacts captures the effects of firms' innovation activities and differentiates between two innovation dimensions. *Employment impacts* measures the impact on employment and includes two indicators measuring Employment in knowledge-intensive activities and Employment in fast-growing firms in innovative sectors. *Sales impacts* measures the economic impact of innovation and includes three indicators measuring Exports of medium and high-tech products, Exports of knowledge-intensive services and Sales due to innovation activities.

Impact of the withdrawal of the United Kingdom from the European Union

In the EIS 2019, the results for the EU captured average performance of 28 Member States. Due to the withdrawal of the United Kingdom from the European Union, this year's report captures average performance of 27 EU Member States. Compared to the results if the UK would have

been included, the innovation performance of the EU has dropped by almost 3% in 2019. The performance change between 2012 and 2019 is 1.8 percentage points lower. In this report all results for the EU are for the current EU of 27 Member States. In the Annex tables results for the former EU28 are also reported.

In previous EIS reports performance groups were identified based on performance thresholds relative to the EU (cf. ***Section 2.1***), As EU average scores have decreased, keeping the same percentage thresholds might lead to shifts in performance groups for some countries which would not be related to real performance increases. Performance thresholds have therefore been adjusted to compensate for the decrease in EU average scores resulting from the withdrawal of the United Kingdom from the European Union[2].

Data revisions and changes to the normalisation process

The main measurement framework for the European Innovation Scoreboard was significantly modified in 2017. As last year, for this year's edition, no changes have been made to the main measurement framework. However, the results in the 2020 edition are not comparable to the 2019 edition due to data revisions made by the suppliers of the data. Compared to the 2019 edition, the following changes are the most prominent:[3]

Data have been revised for all years, from very small changes to more significant changes, for the three indicators using bibliometric data: International scientific co-publications, Most-cited scientific publications, and Public-private scientific co-publications. For Venture capital expenditures, data for 2018 have been restated by Invest Europe. Restated data for 2018 are, on average, about 12% higher, with large differences between countries ranging from 3% lower restated data to 61% higher restated data. For these four indicators, results in the EIS 2019 are therefore not directly comparable to those in previous EIS reports, and neither are the results for the Summary Innovation Index.

Another change is that the period underlying the time series used in the analysis has changed for most indicators. As explained in ***Chapter 8*** on the methodology of the EIS, the innovation index is the unweighted average of normalised scores for all indicators. For the calculation of normalised scores, first the lowest value of an indicator across all countries and all years is deducted from the value in a particular year for each country. This re-calculated value is then divided by the difference between the highest and lowest value across all countries and all years. Compared to the EIS 2019, for most indicators the time period considered has moved forward at least one year, by adding a more recent value at the end of the time series and by removing the oldest value used in the EIS 2019 from the beginning of the time series. A direct result is that for many indicators, the highest (observed in the newly added most recent year) and lowest observed values (observed in the removed oldest year) have changed compared to the EIS 2019. By changing the highest and/or lowest values, even with no data revisions, the normalised scores will be different compared to those in the EIS 2019. This update in the time period become most visible for the benchmark year relative to the EU which has been 2010 in the EIS 2018 and previous reports, 2011 in the EIS 2019 and which has changed to 2012 in this year's report as 2011 is no longer within the analysed time period 2012-2019.

---

[2]   More details on the adjustments of the threshold values are provided in (the methodology described in) Chapter 8.

[3]   A more detailed explanation of these changes is provided in the EIS 2020 Methodology Report, available at https://ec.europa.eu/docsroom/documents/41462

1.2 Additional 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 was introduced to the country profiles in the 2017 edition and revised in the 2018 edition[4] . For this year's report, no changes have been introduced. The analysis of structural differences by country is performed in the country profiles. 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 particular indicators. Full definitions of all performance indicators and contextual indicators are provided in the EIS 2020 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**.

Performance and structure of the economy

GDP per capita in purchasing power standards[5] 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 2017-2019. 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. In particular, differences in the share of manufacturing industry in GDP, and in the so-called 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,

Table 2: Contextual indicators in the European Innovation Scoreboard

	Period	Source
PERFORMANCE AND STRUCTURE OF THE ECONOMY		
GDP per capita (PPS)	Average 2016-2018	Eurostat
Average annual GDP growth (%)	2017-2019	Eurostat
Employment share Manufacturing (NACE C) (%)	Average 2016-2018	Eurostat
of which High and Medium high-tech (%)	Average 2016-2018	Eurostat
Employment share Services (NACE G-N) (%)	Average 2016-2018	Eurostat
of which Knowledge-intensive services (%)	Average 2016-2018	Eurostat
Turnover share SMEs (%)	Average 2014-2017	Eurostat
Turnover share large enterprises (%)	Average 2014-2017	Eurostat
Foreign-controlled enterprises – share of value added (%)	Average 2015-2017	Eurostat
BUSINESS AND ENTREPRENEURSHIP		
Enterprise births (10+ employees) (%)	Average 2015-2017	Eurostat
Total early-stage Entrepreneurial Activity (TEA) (%)	Average 2017-2019	Global Entrepreneurship Monitor
FDI net inflows (% GDP)	Average 2016-2018	World Bank: World Development Indicators
Top R&D spending enterprises per 10 million population	Average 2017-2019	EU Industrial R&D Investment Scoreboard
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	World Bank: Doing Business
Basic-school entrepreneurial education and training (1 to 5	Average 2017-2019	Global Entrepreneurship Monitor
Government procurement of advanced technology products	Average 2015-2017	World Economic Forum
Rule of law (-2.5 to 2.5 best)	Average 2016-2018	World Bank: World Development Indicators
DEMOGRAPHY		
Population size	Average 2017-2019	Eurostat
Average annual population growth (%)	2017-2019	Eurostat
Population density	Average 2016-2018	Eurostat

---

4   More details on the process of revising the contextual indicators are provided in the EIS Exploratory report "Supplementary analyses and contextualisation of innovation performance data", written by Vladimir Cvijanović, Sirin Elci, Alasdair Reid (EFIS Centre), and Hugo Hollanders (MERIT, Maastricht University). The report is available at https://ec.europa.eu/docsroom/documents/35521

5   The purchasing power standard, abbreviated as 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.

on average, will have higher R&D expenditures, more patent applications, and higher shares of innovating enterprises. Countries with above-average shares of these industries are expected to perform better on several EIS indicators. For example, for the EU27 on average, 85% of R&D expenditures in manufacturing are accounted for by medium-high and high-technology manufacturing industries[6] [7]. Also, the share of enterprises that introduced a product and/or process innovation is higher in medium-high and high-technology manufacturing industries compared to all core industries covered in the Community Innovation Survey[8].

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[9]. 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

Opportunity-driven entrepreneurship provides a measure of opportunities for engaging in new business. The EIS indicator is complemented 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 four-fifths 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 corporate R&D investors from the EU and abroad [10].

Demand is an important driver of innovation. According to the Oslo Manual (2018[11]) , 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 in order 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.

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

---

[6]   Based on NACE Rev. 2 3-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 2-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).

[7]   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].

[8]   In accordance with Commission Regulation No 995/2012, the following industries and services are included in the Core target population to be 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).

[9]   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.

[10]   https://iri.jrc.ec.europa.eu/rd_monitoring

[11]   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

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. This indicator complements the EIS indicators covering new business activities or perceived possibilities for new business activities: Employment of fast-growing firms in innovative sectors and Opportunity-driven entrepreneurship.

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.

Demography

Structural data also includes population size and the average annual growth rate of population for 2017-2019. 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 MHT exports and the share of employment in knowledge intensive activities.

1.3 Data sources and data availability

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 17 April 2020. International sources have been used wherever possible to improve comparability between countries. The data relates to the actual performance in 2019 for nine indicators, 2018 for six indicators[12], 2017 for six indicators[13], and 2016 for six indicators[14] (these are the most recent years for which data are available, cf. ***Annex E***). Data availability is complete for 26 Member States, with data being available for all 27 indicators. For Malta, data is not available for Opportunity-driven entrepreneurship.

---

[12] For Opportunity-driven entrepreneurship, the same 2018 data were used as in last year's EIS report as GEM no longer updates this indicator as it has replaced this indicator with a new indicator to capture people's motives for starting a business. The 2019/2020 GEM Global Report delivers the first results of this major revision in GEM's approach to motivation: https://www.gemconsortium.org/report

[13] For New doctorate graduates and Foreign doctorate students, the same 2017 data were used as in last year's EIS report as data updates for these indicators were scheduled by Eurostat for May 2020, well after the cut-off date of 17 April 2020. For last year's EIS report, data for these indicators could be updated as Eurostat released more recent data already in April (15 April 2019).

[14] These six indicators all use data from the Community Innovation Survey. The most recent data from the CIS 2016 were released by Eurostat November 2018, data from the CIS 2018 are expected to be released November 2020. For this year's report CIS 2016 data were the most recent data as in last year's EIS report.

2. Innovation performance and trends

2.1 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 27 indicators (cf. *Table 1*)[15] . *Figure 3* shows the scores for the Summary Innovation Index for all EU Member States in 2019, i.e. the most recent year, 2018, and the reference year 2012. Based on this year's results, the Member States fall into four performance groups[16]:

• The first group of **Innovation Leaders** includes 5 Member States where performance is above 125% of the EU average. The Innovation Leaders are Denmark, Finland, Luxembourg, the Netherlands, and Sweden.

• The second group of **Strong Innovators** includes 7 Member States with a performance between 95% and 125% of the EU average. Austria, Belgium, Estonia, France, Germany, Ireland, and Portugal are Strong Innovators.

• The third group of **Moderate Innovators** includes 13 Member States where performance is between 50% and 95% of the EU

average. Croatia, Cyprus, Czechia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, and Spain belong to this group.

• The fourth group of **Modest Innovators** includes two Member States that show a performance level below 50% of the EU average. This group includes Bulgaria and Romania.

Compared to last year's edition, Luxembourg joins the group of Innovation Leaders, and Portugal joins the group of Strong Innovators. *Figure 3* illustrates that performance in 2019, when compared to 2012, is higher for 24 Member States. Compared to 2018, performance in 2019 has improved for 25 Member States. *Section 2.2* discusses the performance changes in more detail. As shown on the map in *Figure 4*, 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 Innovators in Southern and Eastern Europe, and all Modest Innovators in Eastern Europe.

Figure 3: Performance of EU Member States' innovation systems
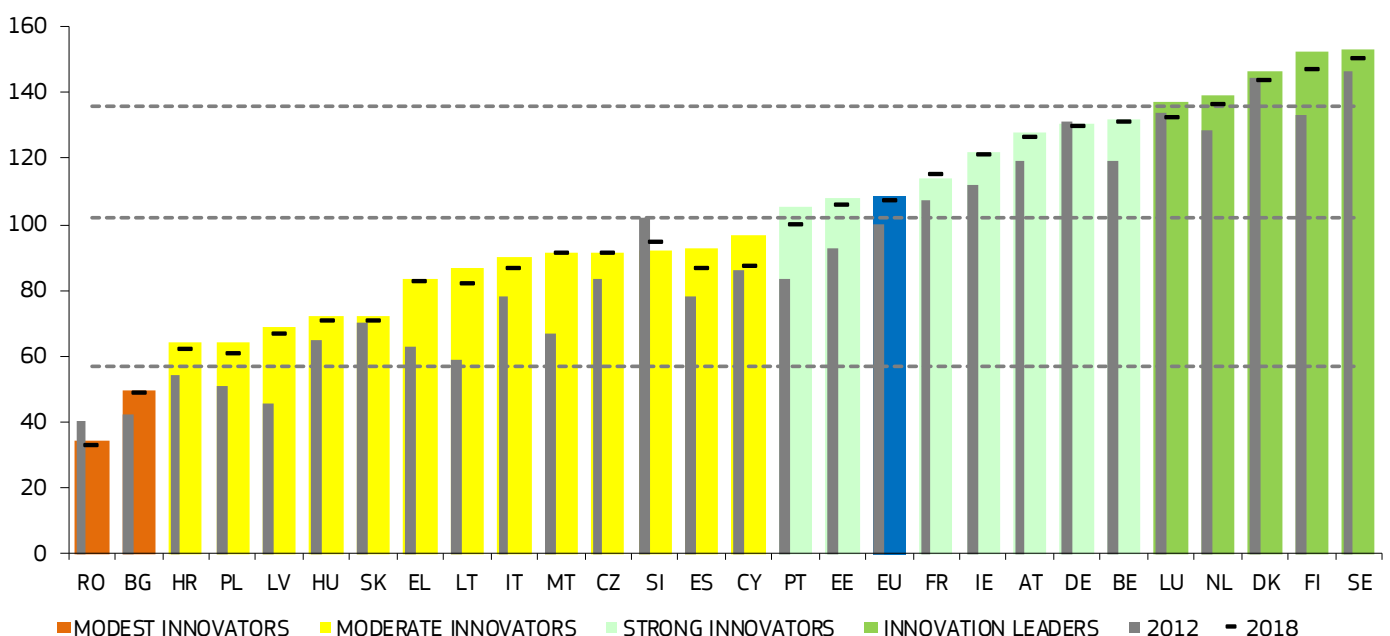
Coloured columns show countries' performance in 2019, using the most recent data for 27 indicators, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data, relative to that of the EU in 2012. Grey columns show countries' performance in 2012 relative to that of the EU 2012. For all years, the same measurement methodology has been used. The dashed lines show the threshold values between the performance groups.

15   Chapter 8 gives a brief explanation of the calculation methodology. The EIS 2020 Methodology Report provides a detailed explanation.

16   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 over time, the absolute thresholds between these groups also increase, explaining why the dashed horizontal lines cross the vertical axis at higher percentage scores. Following the departure of the UK from the EU, EU average scores this year have declined compared to EU average scores in the EIS 2019, which would result in lower threshold values and possible changes in performance group for some countries. For the EIS 2020, thresholds have therefore been adjusted to ensure comparability of performance groups with the EIS 2019. More details are provided in the methodology described in Chapter 8.

Figure 4: Map showing the performance of EU Member States' innovation systems
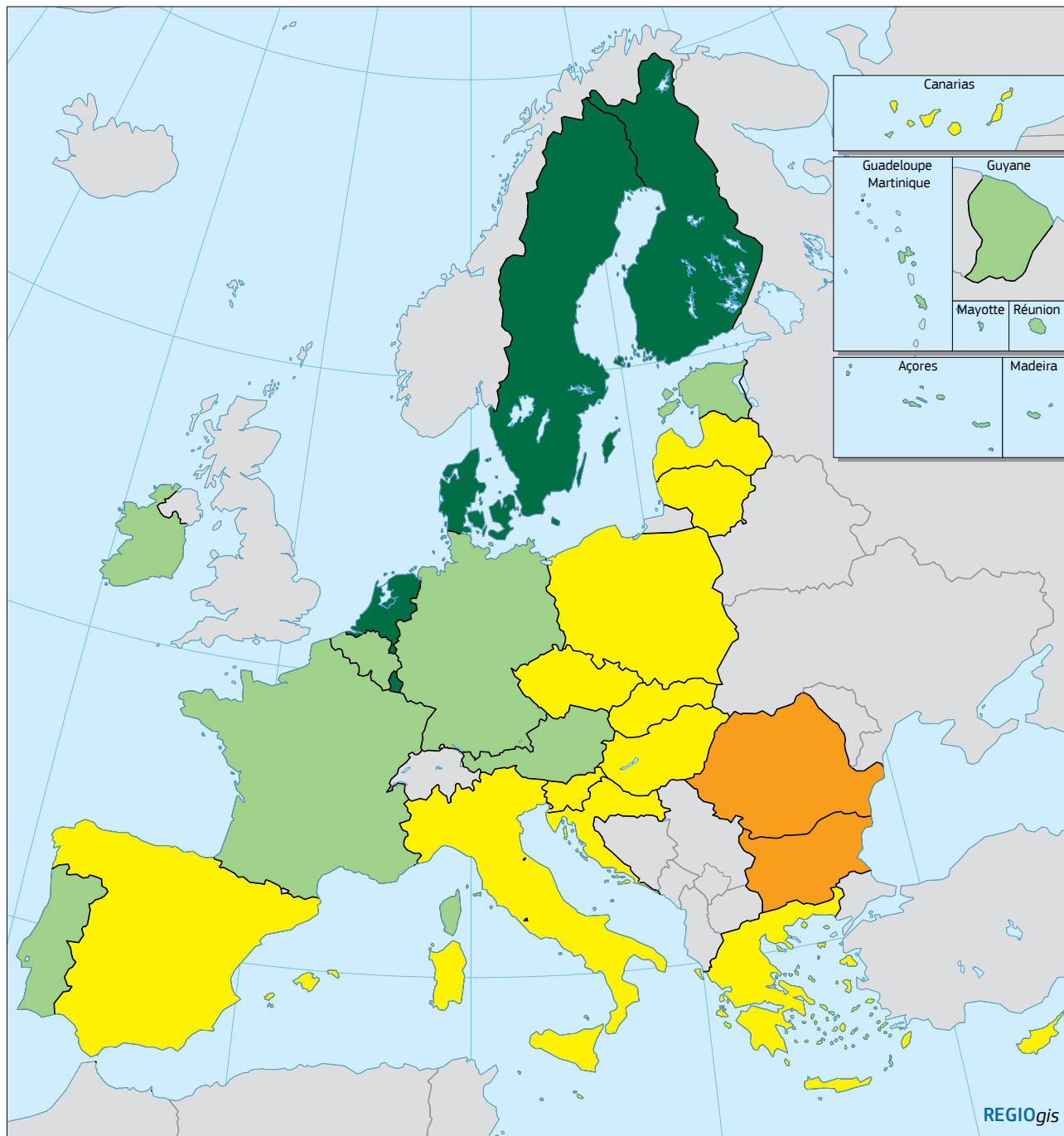
Innovation performance groups

- ▇ Innovation Leader
- ▇ Strong Innovator
- ▇ Moderate Innovator
- ▇ Modest Innovator

Source: European Commission – European Innovation Scoreboard 2020

0   500 km

© EuroGeographics Association for the administrative boundaries

2.2 Performance changes

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 2012 and 2019 improved by 8.9 percentage points. Performance improved for 24 Member States and worsened for three Member States (cf. *Figure 5*):

• For five Member States performance improved by 20 percentage points or more: Lithuania (27.8%-points), Malta (24.7%-points), Latvia (23.3%-points), Portugal (21.5%-points) and Greece (20.7%-points).

• For one Member State performance improved between 15 and 20 percentage points: Finland (19.0%-points).

• For seven Member States performance improved between 10 and 15 percentage points: Estonia (15.0%-points), Spain (14.6%-points), Poland (13.0%)-points), Belgium (12.5%-points), Italy (11.8%-points), Cyprus (11.0%-points) and Netherlands (10.5%-points).

• For eight Member States performance improved between 5 and 10 percentage points: Ireland (9.8%-points), Croatia (9.4%-points), Austria (8.9%-points), Czechia (8.4%-points), Hungary (7.6%-points), Bulgaria (6.9%-points), Sweden (6.9%-points) and France (6.2%-points).

• For three Member States performance improved between 0 and 5 percentage points: Luxembourg (3.6%-points), Slovakia (2.1%-points) and Denmark (1.7%-points).

• For one Member State performance declined between 0 and 5 percentage points: Germany (-0.4%-points).

• For two Member States, performance declined by more 5 percentage points: Romania (-5.7%-points) and Slovenia (-9.9%-points).

In past EIS reports, less innovative countries tended to improve their performance faster than more innovative countries; there was a negative link between the level of and the change in performance. Between 2012 and 2017, there has been a moderate rate of convergence in innovation performance between Member States, with lower performing countries, on average improving their level of innovation performance at a higher rate than higher performing countries. This process of convergence has accelerated in 2018 and 2019[17]. Compared to 2018, performance in 2019 has improved for 25 Member States, most notably for Cyprus, Spain, and Finland, and performance has declined for two Member States, Slovenia, and France (cf. *Figure 3*).

Figure 5: Performance and change of EU Member States' innovation systems
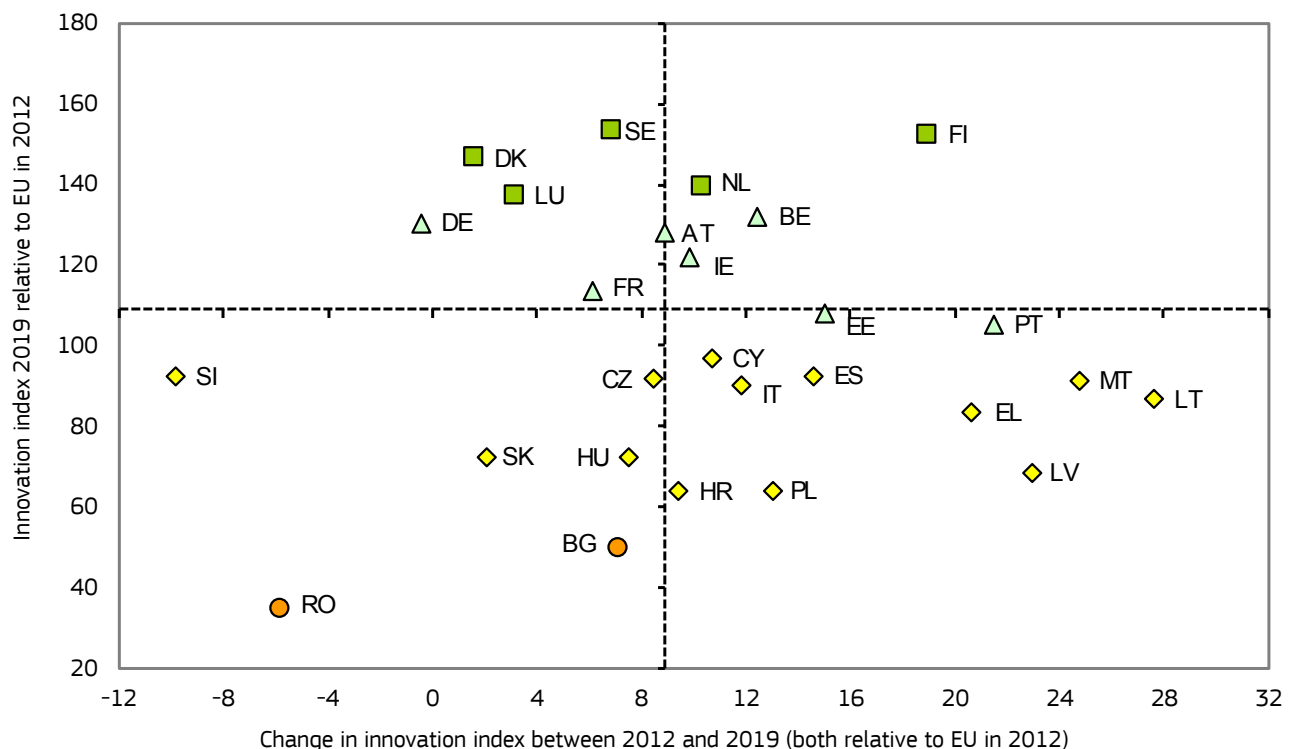
The vertical axis shows Member States' performance in 2019 relative to that of the EU in 2012. The horizontal axis shows the change in performance between 2012 and 2019 relative to that of the EU in 2012. The dashed lines show the respective scores for the EU.

17 The level of sigma-convergence declined from 0.362 in 2012 to 0.342 in 2017 and then to 0.321 in 2018 and 0.315 in 2019.

Innovation Leaders

Performance of the Innovation Leaders improved from 2015 onwards, with an acceleration in 2018 and 2019. Compared to 2012, performance in 2019 has improved by 8.3 percentage points. Performance has improved most in Finland (19.0%-points), most notably in 2018 and 2019, among others due to strong growth in Broadband penetration and Opportunity-driven entrepreneurship. Finland has almost closed the performance gap with Sweden, the best performing EU Member State.

Relatively strong annual increases are also observed for 2018 and 2019 for the Netherlands leading to an overall increase of 10.5%-points. Performance also improved for Sweden (6.9%-points), with relatively strong increases in 2017 and 2019, Luxembourg (3.6%-points), with relatively strong increases in 2015, 2018 and 2019 and Denmark (1.7%-points), where performance declined until 2016 and then started to increase again.

Figure 6: Performance Innovation Leaders
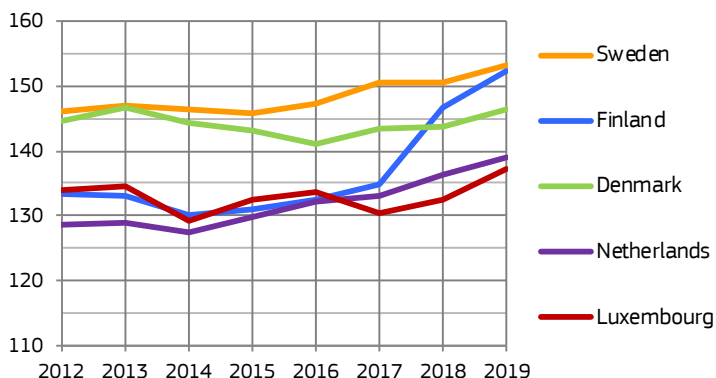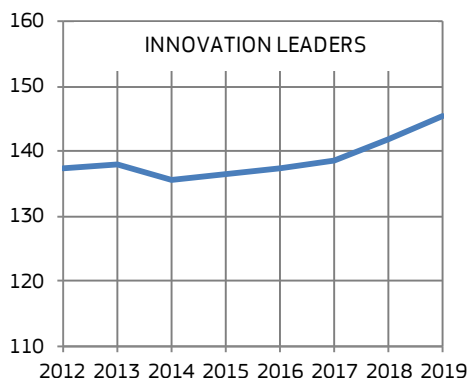
Performance is relative to that of the EU in 2012. The graph on the left shows the average performance of the Innovation Leaders, calculated as the unweighted average of the respective Member States.

Strong Innovators

For the Strong Innovators, performance did not change much between 2012 and 2014, but it started to increase more strongly in 2015 with a very strong increase in 2018 (due to very strong performance increases in Estonia and Portugal), raising average performance by 10.5 percentage points compared to 2012. The performance gap to the Innovation Leaders remained almost the same between 2012 and 2016 and has become smaller in the last three years. Performance has improved for all Strong Innovators between 2012 and 2019, except for Germany. The largest performance improvement occurred in Portugal (21.5%-points), followed by Estonia (15.0%-points) and Belgium (12.5%-points). The strong increases in Portugal and Estonia are entirely

due to increasing performance in 2018, which results from the highly improved performance for the six indicators using CIS data. For Ireland, performance increased strongly in 2016, leading to an overall performance increase compared to 2012 of 9.8%-points. For Austria, performance between 2012 and 2019 increased strongly (8.9%-points), due to a strong performance increase in 2016. For France, performance compared to 2012 increased by 6.2%-points, but in the two most recent years performance has seen moderate declines. For Germany, performance has declined by 0.4%-points, due to declining performance between 2012 and 2016, with increasing performance since 2017.

Figure 7: Performance Strong Innovators

Performance is relative to that of the EU in 2012. 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 2012, with a growth acceleration in 2018. Compared to 2012, average performance has improved by 12.2 percentage points, which is the highest increase of all performance groups. For 12 Moderate Innovators, performance has increased, and it only decreased for Slovenia. For Lithuania, performance improved very strongly by 27.8%-points, with performance improvements in all years except in 2017. Performance increased strongly for Malta (24.7%-points), with a performance increase until 2014 followed by a performance decline in 2016 and a strong performance increase in 2017 and 2018. For Latvia, performance increased by 23.3%-points, with a very strong performance increase in 2014. Performance also increased strongly for Greece (20.7%-points), with annual performance improvements since 2012 and a very strong performance increase in 2018 (10.7%-points). For Spain, performance increased by 14.6%-points, with strong increases in 2016, 2018 and 2019. Poland showed strong increases in 2018 and 2019 which led to an overall performance increase of 13.0%-points compared to 2012. For Italy, performance increased by 11.8%-points, with strong increases in 2018 and 2019. For Cyprus, performance has increased by 11.0%-points, where a 17.6%-point increase in 2017-2019 has more than outweighed a performance decline in 2016. For Croatia, performance has increased by 9.4%-points, with strong increases in 2018 and 2019. For Czechia, relatively strong performance increases in 2017 and 2018 have led to an overall performance increase of 8.4%-points. For Hungary, performance increased by 7.6%-points with annual performance increases since 2013. For Slovakia, performance increased by only 2.1%-points. Only for Slovenia performance has declined at a high rate of 9.9%-points, almost entirely due to declining performance since 2016. Overall, performance for the Moderate Innovators has been converging over time with the performance ratio between the best and worst performer having declined from 2.2 in 2012 to 1.5 in 2019.

Modest Innovators

For the Modest Innovators, overall performance only marginally improved over time (0.6 percentage points), leading to a widening of the performance gap to the Moderate Innovators. Performance for Bulgaria increased by 6.9%-points. For Romania, performance has declined by 5.7%-points, most notable due to a strong decrease in 2014 (minus 9.2%-points), outweighing an increase in performance of 4.1%-points since 2014.

Figure 8: Performance Moderate and Modest Innovators
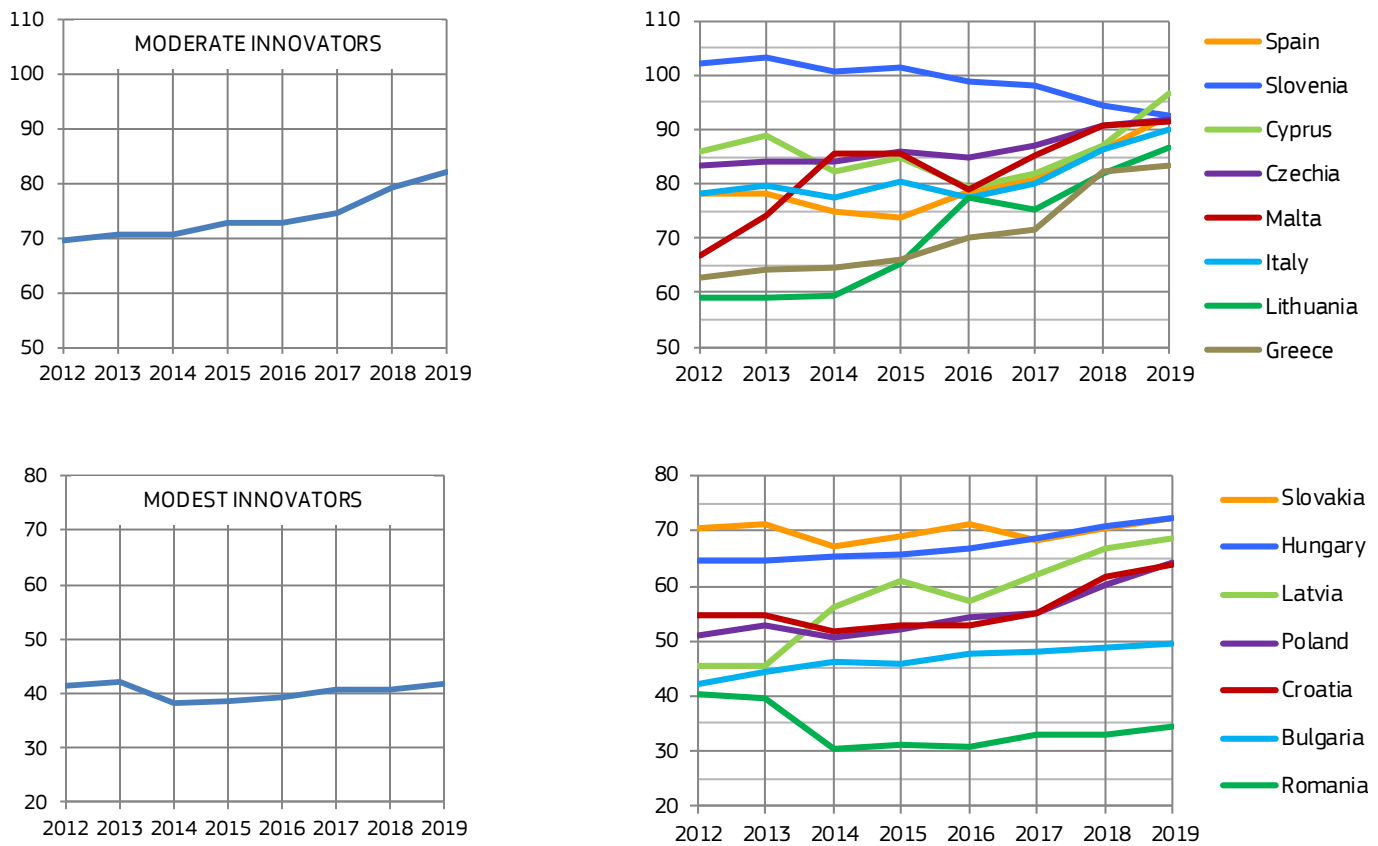
Performance is relative to that of the EU in 2012. The graph on the top left shows the average performance of the Moderate Innovators, calculated as the unweighted average of the respective Member States. The graph on the bottom left shows the average performance of the Modest Innovators, calculated as the unweighted average of the respective Member States.
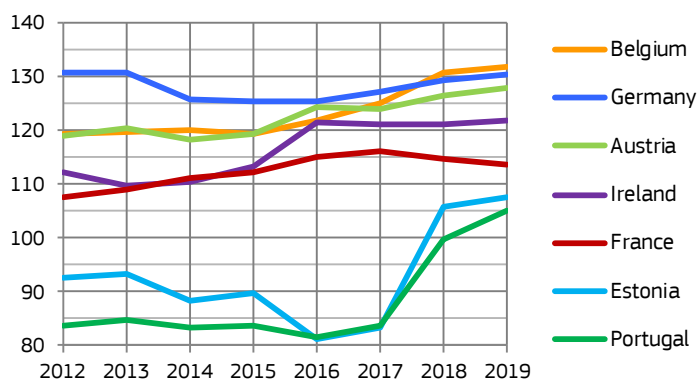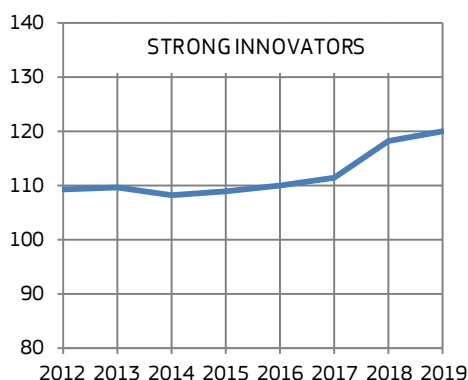
3. Performance of the EU innovation system

Performance of the EU innovation system, measured as the weighted average of the performance of the innovation systems of all 27 Member States, has improved by 8.9 percentage points between 2012 and 2019. However, there are differences in performance changes for the different dimensions and indicators. *Figure 9* shows the performance for each dimension and indicator in 2019 compared to the 2012 performance level (the blue coloured bars) and in 2018 (the black coloured bars). The difference between the respective blue and black coloured bar illustrates the change in the most recent year.

Performance changes are measured as the relative to EU scores shown in *Figure 9* minus 100. Performance has improved the most (74%-points) in Innovation-friendly environment, with strongly increasing performance in Broadband penetration. Performance has also improved strongly in Firm investments (30%-points), with increasing

performance for all three indicators. Performance in Finance and support has increased (15%-points) because of strongly increasing Venture capital expenditures. Performance has increased at an above average rate in Human resources (15%-points), with increasing performance for all three indicators, and Attractive research systems (14%-points), in particular due to a very strong increase in International scientific co-publications. Performance in Employment impacts has increased (8%-points) with both indicators growing at almost equal rates. Performance in Linkages has increased at a lower rate (3%-points), mainly due to a performance increase in Public-private co-publications. Performance has decreased in Intellectual assets (-7%-points), where an increase in Trademark applications has been offset by declining performance in PCT patent applications and Design applications, and Innovators (-11%-points), where performance has decreased strongly for two indicators.

Figure 9: EU Performance change between 2012 and 2019 by dimension and indicator
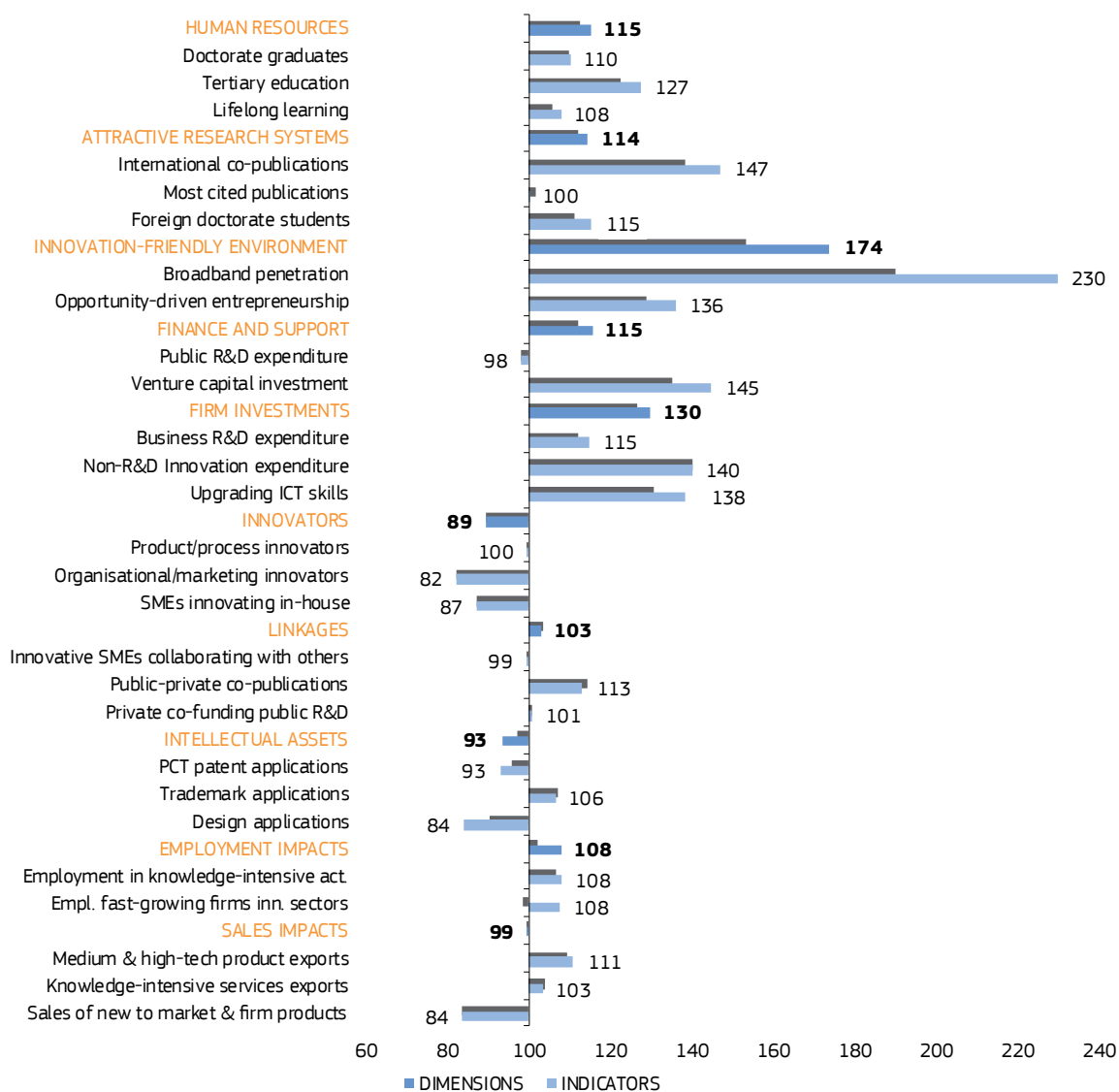
Normalised scores in 2019 (blue coloured bars) and 2018 (black coloured bars) relative to those in 2012 (=100)

4. Innovation dimensions

The order of performance groups observed for the Summary Innovation Index also applies to most dimensions. The *Innovation Leaders* perform best in eight dimensions, with the Strong Innovators showing highest performance in *Innovators* and *Sales Impacts* (**Figure 10**). In several innovation dimensions, performance differences vary considerably between the performance groups. The performance difference between the Innovation Leaders and the Strong Innovators in *Innovation-Friendly Environment* is almost 79%-points; in *Attractive Research Systems* and Human Resources it is close to 50%-points. Performance differences between the Innovation Leaders and the Strong Innovators are relatively small in *Firm investments*, *Sales Impacts* and *Innovators*. Between the Strong and Moderate Innovators, performance differences are high (more than 50%-points) for *Innovators*, *Linkages* and *Finance and Support*, and performance differences are relatively small for *Innovation-friendly Environment* and *Employment impacts*. Between the Moderate and Modest Innovators, performance differences are relatively high (more than 50%-points) for *Firm Investments*, *Innovators* and *Human*

resources, and performance differences are relatively small for *Intellectual assets* and *Employment impacts*.

Country rankings in *Human Resources* and *Attractive Research Systems* come close to the overall classification of performance groups. This also holds, although to a lesser extent, for *Innovation-Friendly Environment* and *Linkages*. The dimensions *Finance and Support*, *Innovators*, *Firm Investments*, and *Sales Impacts* deviate the most from the overall classification. The dimensions *Intellectual assets* and *Employment Impacts* also deviate from the overall classification, but to a lesser extent. These deviations demonstrate that countries can perform well in particular dimensions, while their overall performance is lower, resulting in becoming a member of a lower innovation performance group. Analogously, a Leading Innovator can perform poorly in a particular dimension but can compensate such relative weaknesses with stronger performance in other dimensions.

Figure 10: Performance groups: innovation performance per dimension
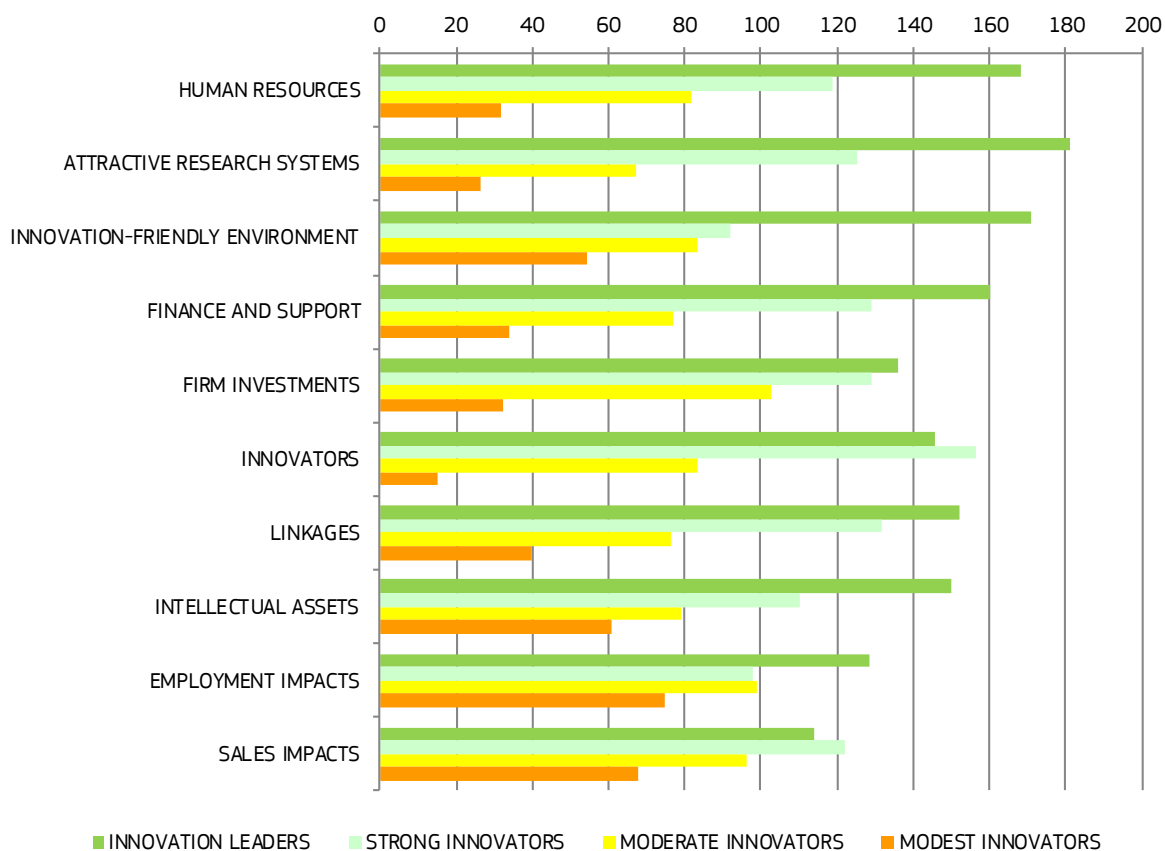
Average scores for each performance group equal the unweighted average of the relative-to-EU scores of the Member States within that group. As these unweighted averages do not consider differences in country size, results are not directly comparable. Average scores for the performance groups have been adjusted such that their average equals 100 for each dimension.

Human resources
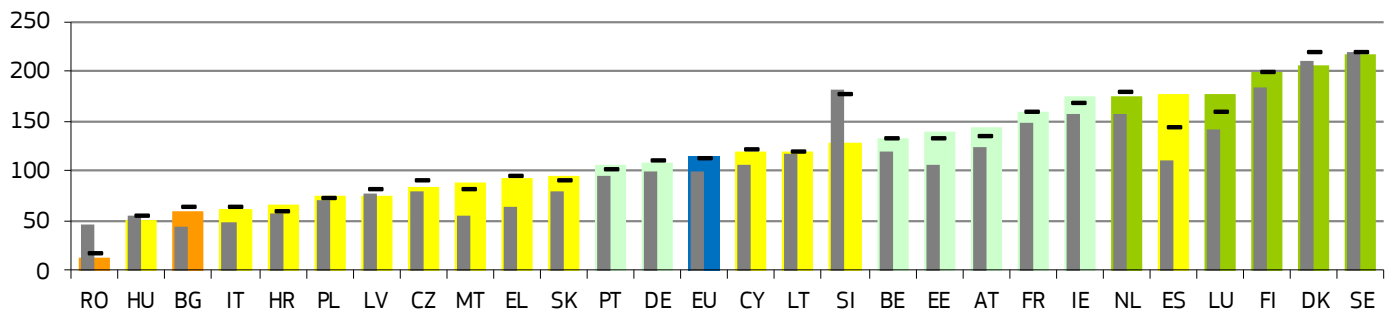
Coloured columns show Member States' performance in 2019, using the most recent data for the indicators in this dimension, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012.

Performance in *Human Resources* largely reflects the overall classification into four performance groups. All Innovation Leaders are included in the top 6. All Strong Innovators, except Germany and Portugal, perform above the EU average. Most of the Moderate Innovators perform below the EU average, with Spain performing well above this average. The Modest Innovators perform below the EU average, with Romania being the worst performer and Bulgaria performing better than Moderate Innovator Hungary.

For 21 Member States, performance has improved between 2012 and 2019. The highest rate of performance increase is for Spain (66.7%), followed by Luxembourg (36.2%), Estonia (34.9%), and Malta (34.7%).

For Slovenia (-53.6%), Romania (-33.0%), Hungary (-3.7%), Denmark (-3.1%), Sweden (-2.3%), and Latvia (-1.6%) performance has decreased. The EU average increased by 15.2% between 2012 and 2019.

Compared to 2018, performance has improved for 14 Member States, with the highest rate of performance increase for Spain (34.3%), and Luxembourg (18.6%). Performance declined for 13 Member States, with the strongest declines for Slovenia (-47.8%, due to a strong decline in Doctorate graduates), and Denmark (-10.6%). The EU average increased by 2.5% between 2018 and 2019.

Attractive research systems
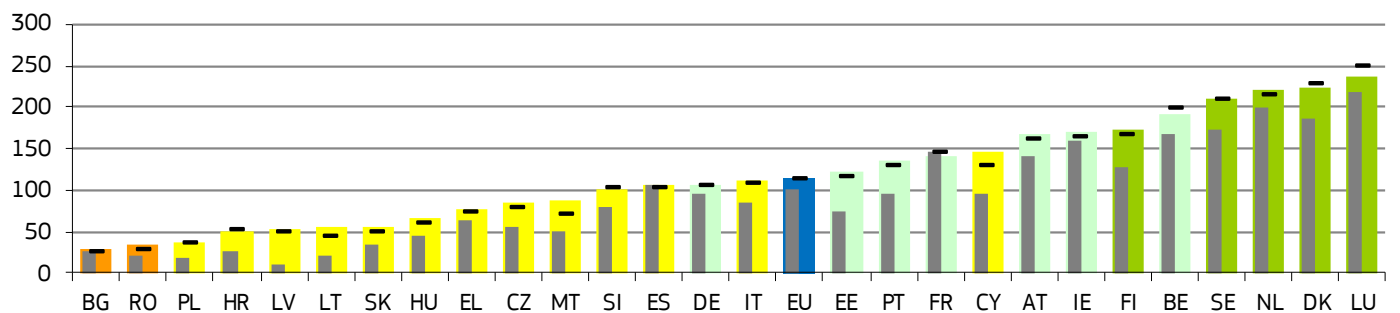
Coloured columns show Member States' performance in 2019, using the most recent data for the indicators in this dimension, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012.

Performance in *Attractive Research Systems* largely reflects the overall classification into four performance groups. The Innovation Leaders all perform well above the EU average. All Strong Innovators perform above the EU average, except for Germany. Most of the Moderate Innovators perform below the EU average, where only Cyprus performs above the EU average. The Modest Innovators perform least well, taking the last two positions in the performance ranking.

For 26 Member States, performance has improved between 2012 and 2019. The highest rate of performance increase is for Cyprus (50.4%), followed by Finland (47.4%), Estonia (46.5%), and Latvia (43.4%). Only for France (-3.8%), performance has decreased. The EU average increased by 14.2% between 2012 and 2019.

Compared to 2018, performance has improved for 21 Member States, with the highest rate of performance increase for Malta (18.2%), Cyprus (16.2%), and Lithuania (10.2%). Performance declined for six Member States, in particular for Luxembourg (-11.3%) and Belgium (-7.5%). The EU average increased by 2.2% between 2018 and 2019.

Innovation-friendly environment

Coloured columns show Member States' performance in 2019, using the most recent data for the indicators in this dimension, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012.

Performance in *Innovation-Friendly Environment* deviates from the overall classification into four performance groups. The Innovation Leaders are the best performing countries taking all the top 5 positions. Most Strong Innovators perform below the EU average, with Portugal being the only Strong Innovator to perform above the EU average. The Moderate Innovators show a strong performance on this dimension, in particular Malta, Poland, Spain, and Lithuania, who all perform above the EU average. For the Modest Innovators, this is a relatively strong innovation dimension, with Romania outperforming three Moderate Innovators.

For 25 Member States, performance has improved between 2012 and 2019. The highest rate of performance increase is observed in Poland

(182.7%), Finland (162.3%), Malta (128.6%), Spain (127.6%), and Portugal (109.2%). Performance decreased for Belgium (-21.9%) and Slovenia (-24.5%). The EU average increased by 73.9% between 2012 and 2019.

Compared to 2018, performance has improved for 23 Member States, with the highest rate of performance increase for Cyprus (60.5%), Finland (53.9%), Malta (48.2%), Spain (45.6%), and Poland (42.1%). Performance declined for three Member States, which are France (-7.1%), Sweden (-6.1%) and Estonia (-4.3%). The EU average increased by 20.4% between 2018 and 2019.

Finance and support
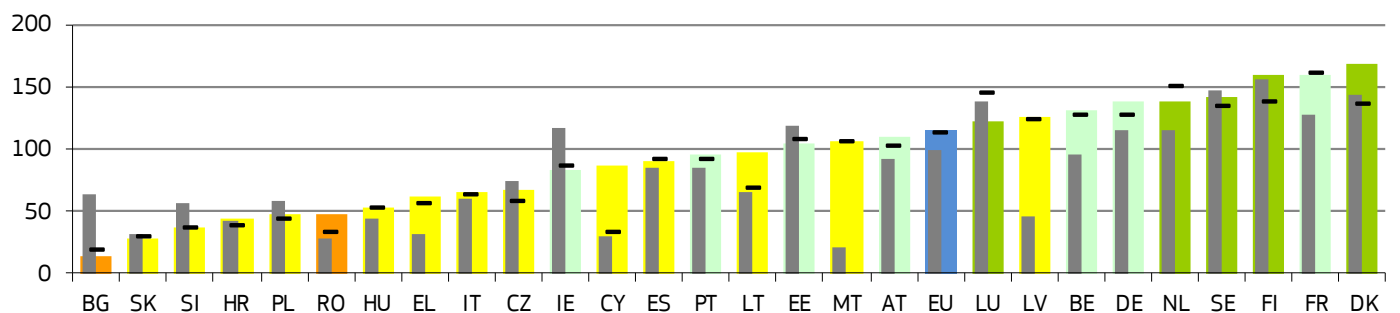
Coloured columns show Member States' performance in 2019, using the most recent data for the indicators in this dimension, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012.

Performance in *Finance and Support* reflects to some extent the overall classification into four performance groups. The Innovation Leaders all perform above the EU average but are not all the top performing countries on this indicator. Three Strong Innovators perform above the EU average, with France being the overall second-best performing country. Four Strong Innovators perform below the EU average, which include Austria, Estonia, Portugal, and Ireland. All Moderate Innovators, except Latvia, perform below the EU average. The Modest Innovators perform relatively well below the EU average, with Romania performing better than five Moderate Innovators.

Performance has increased for 18 Member States. The highest rate of performance increase between 2012 and 2019 is observed in Malta

(85.8%), Latvia (81.2%), and Cyprus (57.4%). For nine Member States, performance has decreased, in particular for Bulgaria (-49.4%), Ireland (-34.1%) and Slovenia (-19.4%). The EU average increased by 15.5% between 2012 and 2019.

Compared to 2018, performance has improved for 19 Member States, with the highest rate of performance increase for Cyprus (55.3%), Denmark (33.0%) and Lithuania (29.3%). Performance declined for 8 Member States, with the strongest declines for Luxembourg (-22.2%) and the Netherlands (-10.8%). The EU average increased by 3.5% between 2018 and 2019.

Firm investments
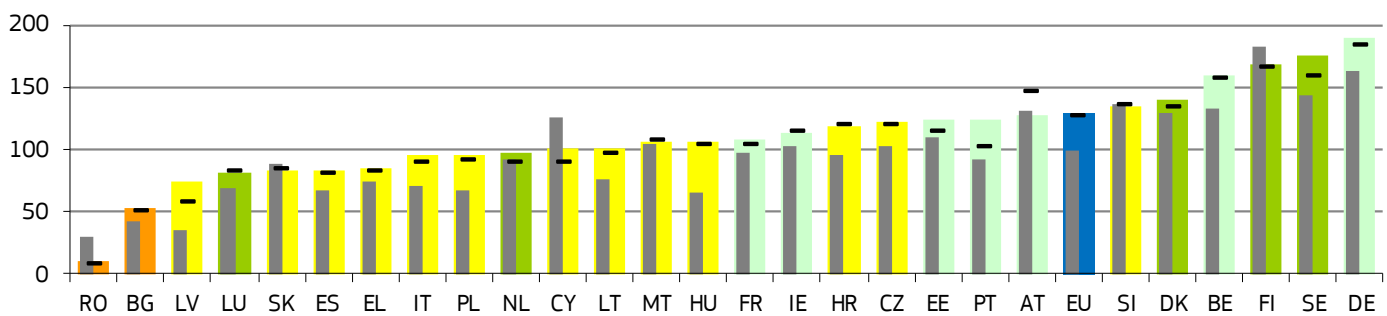
Coloured columns show Member States' performance in 2019, using the most recent data for the indicators in this dimension, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012.

Performance in *Firm Investments* deviates to some extent from the overall classification into four performance groups with three Innovation Leaders in the top 5, with Sweden and Finland ranking second and third and Denmark ranking fifth. Most Strong Innovators, except Germany and Belgium, perform below the EU average[18]. Germany is the overall leader and the Modest Innovators perform the worst in this dimension.

For 21 Member States, performance increased between 2012 and 2019. The highest rate of performance increase is observed in Hungary (41.9%) and Latvia (38.0%). The EU average increased by 29.9% between 2012 and 2019. For six Member States, performance decreased, in particular for Cyprus (-25.0%), Romania (-19.0%) and Finland (-14.6%).

Compared to 2018, performance has improved for 21 Member States, with the highest rate of performance increase for Portugal (21.8%), followed by Sweden (17.3%) and Latvia (17.1%). Performance declined for six Member States, with the strongest decline for Austria (-18.4%). The EU average increased by 3.3% between 2018 and 2019.

Innovators

Coloured columns show Member States' performance in 2019, using the most recent data for the indicators in this dimension, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012.

Performance in the *Innovators* dimension deviates from the overall classification into four performance groups. Portugal, a Strong Innovator, is the overall best performing country. All other Strong Innovators perform above the EU average as well. Finland is the only Innovation Leader in the top 5, and Denmark performs below the EU average. Three Moderate Innovators, Greece, Italy, and Latvia perform above the EU average.

For only 12 Member States, performance increased between 2012 and 2019. The highest rate of performance increase is observed in Lithuania (54.5%), followed by Finland (41.5%) and Greece (37.6%). For 15 Member States performance declined, in particular for Germany (-36.1%), Romania (-26.7%) and Slovenia (-25.6%). The EU average decreased by 10.6% between 2012 and 2019.

Compared to 2018, performance has remained the same for the EU and all 27 Member States as there has been no update of the CIS data with the same CIS 2016 data used for both 2018 and 2019.

---

[18] Compared to the other dimensions, the EU's rank position is relatively high with only six countries performing above the EU. The top 5 countries – Belgium, Denmark, Finland, Germany and Sweden - account for more than 50% of the EU's business R&D expenditures and almost 60% of the EU's Non-R&D innovation expenditures.
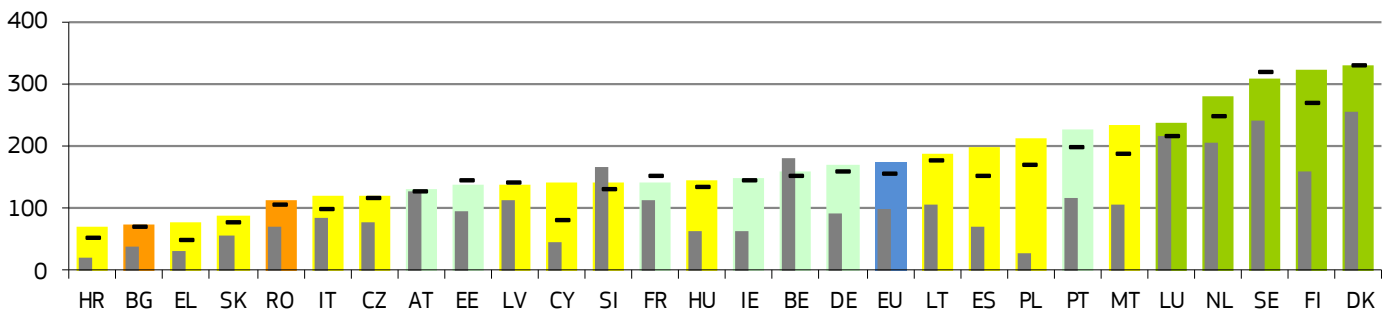
Linkages

Coloured columns show Member States' performance in 2019, using the most recent data for the indicators in this dimension, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012.

Performance in *Linkages* reflects to some extent the overall classification into four performance groups. The Innovation Leaders are represented amongst the top group of countries, together with Strong Innovator countries Austria and Belgium who rank first and second. Luxembourg, an Innovation Leader, and two Strong Innovators – Ireland, and Portugal – perform below the EU average. Three Moderate Innovators – Greece, Slovenia, and Lithuania - perform above the EU average.

For 12 Member States, performance increased between 2012 and 2019. The highest rate of performance increase is observed in Greece (43.4%), Austria and Estonia (for both a 25.8% increase). For 15 Member States, performance declined, in particular for Cyprus (-34.4%), Hungary

(-23.0%) and Slovenia (-22.2%). The EU average increased by 3.0 % between 2012 and 2019.

Compared to 2018, performance has improved for 14 Member States, with the highest rate of performance increase for Italy (14.2%), followed by Luxembourg (9.0%) and Austria (8.0%). Performance declined for 13 Member States, with the strongest declines for Lithuania (-9.0%), Croatia (-7.5%) and Sweden (-6.0%). The EU average declined by 0.2% between 2018 and 2019.

Intellectual assets

Coloured columns show Member States' performance in 2019, using the most recent data for the indicators in this dimension, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012.

Performance in *Intellectual Assets* deviates to some extent from the overall classification into four performance groups. Luxembourg, an Innovation Leader, is the overall best performing country, and all Innovation Leaders perform above the EU average. Malta, a Moderate Innovator, and Austria, a Strong Innovator, take up the other top 5 positions. Ireland, one of the Strong Innovators, performs well below the EU average. Three other Strong Innovators perform below the EU average, which are Belgium, France, and Portugal. Bulgaria, a Modest Innovator, is performing at a level close to that of the EU average.

For 17 Member States, performance has increased between 2012 and 2019. The highest rate of performance increase is observed in Malta (36.0%) and Estonia (20.0%). Performance has declined for 10 Member

States, in particular for Germany (-19.5%), Austria (-16.6%), and Luxembourg (-13.2%). The EU average has decreased by 6.6 % between 2012 and 2019.

Compared to 2018, performance has improved for only 6 Member States, with the highest rate of performance increase for Latvia (4.3%), Luxembourg (3.8%) and Cyprus (3.0%). Performance has declined for 21 Member States, in particular due to decreasing performance for Design applications, with the strongest declines for Malta (-24.9%) and Czechia (-12.9%). The EU average decreased by 3.4 % between 2018 and 2019.

Employment impacts
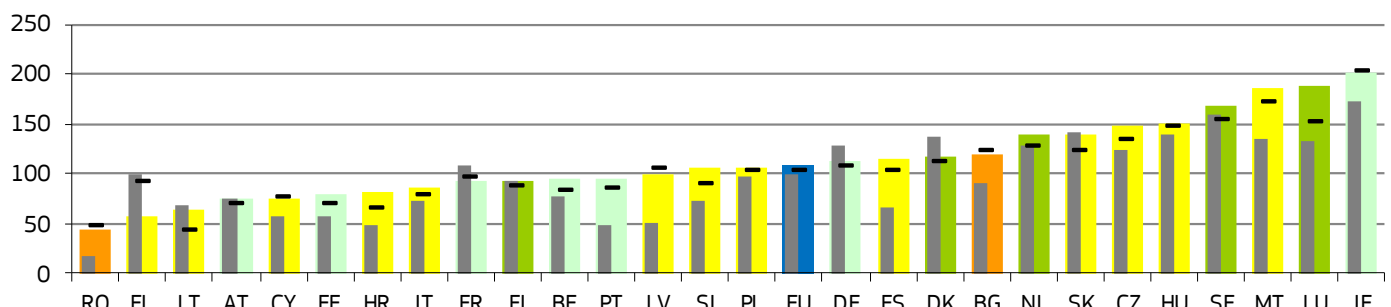
Coloured columns show Member States' performance in 2019, using the most recent data for the indicators in this dimension, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012.

Performance in *Employment Impacts* deviates from the overall classification into four performance groups with only two Innovation Leaders, Luxembourg, and Sweden, in the top 5 performing countries. Ireland, a Strong Innovator, is the best performing country. Most of the Innovation Leaders, except Finland, perform above the EU average. Bulgaria, a Modest Innovator, shows a strong performance above the EU average. Five Strong Innovators – Portugal, Belgium, France, Estonia, and Austria – all perform below the EU average.

For 21 Member States, performance has increased between 2012 and 2019. The highest rate of performance increase is observed in Luxembourg (57.3%), followed by Malta (53.0%), Latvia (50.1%) and

Spain and Portugal (both experiencing an increase of 48.1%). Performance decreased for 6 Member States, in particular for Greece (-42.7%) and Denmark (-20.0%). The EU average has increased by 7.9% between 2012 and 2019.

Compared to 2018, performance has improved for 20 Member States, with the highest rate of performance increase for Luxembourg (37.6%) and Latvia (22.1%). Performance declined for seven Member States, with the strongest declines for Greece (-35.3%), Latvia (-4.8%) and France (-4.4%). The EU average increased by 5.8% between 2018 and 2019.

Sales impacts
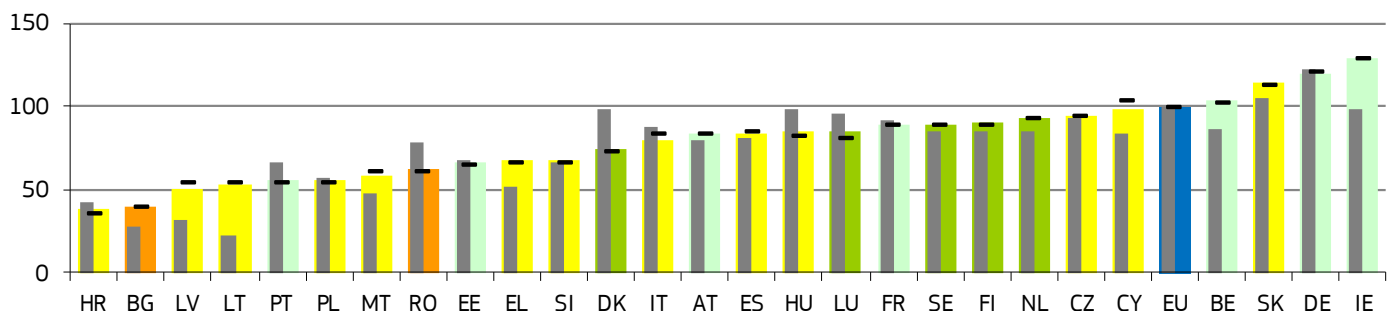
Coloured columns show Member States' performance in 2019, using the most recent data for the indicators in this dimension, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012.
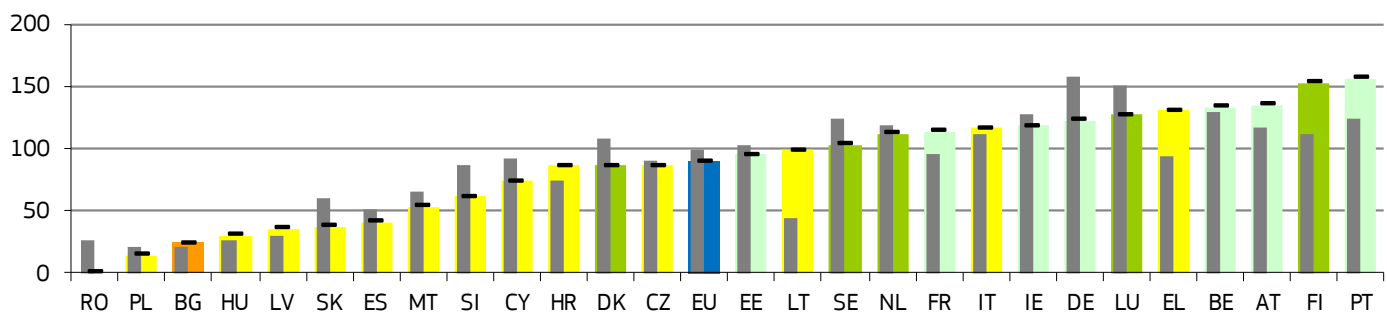
Performance in *Sales Impacts* deviates from the overall classification of performance groups into four performance groups. All Innovation Leaders perform below the EU average. The top-3 best performing countries include two Strong Innovators: Ireland, and Germany, followed by a Moderate Innovator: Slovakia. The Strong Innovators are also dispersed, as France and Austria perform relatively close to the EU average while Estonia and Portugal are ranked well below the EU average[19]. The Modest Innovators perform below the EU average, but Romania notes a relatively high position, leaving five Moderate Innovators and one Strong Innovator behind. Performance between 2012 and 2019 has increased for 16 Member States. The highest rate

of performance increase is observed in Lithuania (30.5%) and Ireland (30.4%). For 11 Member States, performance has declined, in particular for Denmark (-25.0%), Romania (-16.9%) and Hungary (-13.6%). The EU average has decreased by 0.5% between 2012 and 2019.

Compared to 2018, performance has improved for 20 Member States, with the highest rate of performance increase for Luxembourg (4.2%), Croatia (2.9%) and Belgium (2.7%). Performance declined for 7 Member States, with the strongest declines for Cyprus (-5.0%), Latvia (-3.2%) and the Italy (-2.2%). The EU average increased by 0.3% between 2018 and 2019.

---

[19] Compared to the other dimensions, the EU's rank position is relatively high. This can among others be explained by the strong performance of Germany, one of the top performers for Medium and high-tech product exports, accounting for 30% of EU MHT exports.

5. Benchmarking innovation performance with non-EU countries

5.1 Benchmarking against other European countries and regional neighbours

This section discusses the results for 10 more European countries or regional neighbours using the same methodology as used for the EU Member States[20]. Switzerland is the overall Innovation Leader in Europe, outperforming all EU Member States (**Figure 11**). Switzerland's strong performance results from being the best performer on eight indicators. Switzerland's performance relative to the EU in 2012 has improved strongly by 22.6%-points.

Iceland, Israel, Norway, and the United Kingdom are Strong Innovators. The performance of both Norway and the United Kingdom relative to the EU in 2012 has increased strongly by 26.6%[21] and 17.3%[22] respectively. The relative performance of Israel (1.2%) and that of Iceland (-1.5%) have remained close to that of the EU in 2012. Israel is the overall leader on four indicators, and Iceland, Norway, and the United Kingdom on three indicators each.

Serbia and Turkey are Moderate Innovators, and for both countries performance relative to the EU has increased strongly by 13.2% (in particular due to a strong performance increase in Broadband penetration) and 12.5% (due to strong performance increases in 2018 for the indicators using CIS data), respectively. Montenegro, included for the first time in the EIS, North Macedonia and Ukraine are Modest Innovators. Performance relative to the EU has increased strongly for North Macedonia (14.8%, in particular due to a strong performance increase for Foreign doctorate students), more moderately for Montenegro (5.0%), and decreased for Ukraine (-1.0%). The performance groups for all countries are shown on a map in **Figure 12**.

Figure 11: Performance of European and neighbouring countries' systems of innovation
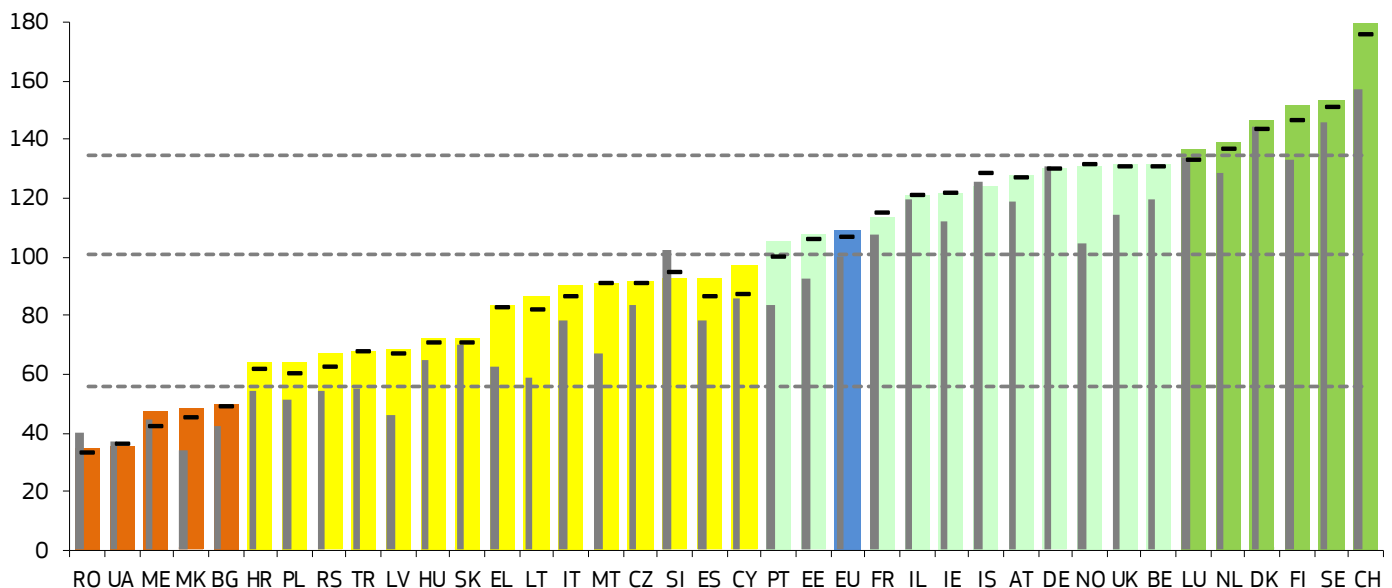
Coloured columns show countries' performance in 2019, using the most recent data for 27 indicators, relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, using the next most recent data, relative to that of the EU in 2012. Grey columns show countries' performance in 2012 relative to that of the EU 2012. For all years, the same measurement methodology has been used. The dashed lines show the threshold values between the performance groups. European and neighbouring countries include Iceland (IS), Israel (IL), Norway (NO), North Macedonia (MK), Montenegro (ME), Serbia (RS), Switzerland (CH), Turkey (TR), Ukraine (UA), and United Kingdom (UK).

---

[20] Average data availability for this year's report is good with data available for 27 indicators for Norway and the United Kingdom, 26 indicators for Switzerland, 25 indicators for Serbia and Turkey, 23 indicators for Iceland, North Macedonia, Montenegro and Ukraine, and 21 indicators for Israel.

[21] For Norway, the sharp increase can largely be explained by a change in the collection of Community Innovation Survey (CIS). The strong increase in the results for the six indicators using CIS data is caused by the fact that for the CIS 2014 and CIS 2016 data were collected in a separate innovation survey, whereas CIS data up until the CIS 2012 were collected in a combined innovation and R&D survey.

[22] For the United Kingdom, the strongest increase in performance was in 2016 due to high performance increases in two indicators using CIS data: Non-R&D innovation expenditures and Sales due to product innovations.

Figure 12: Map showing the performance of European and neighbouring countries' innovation systems
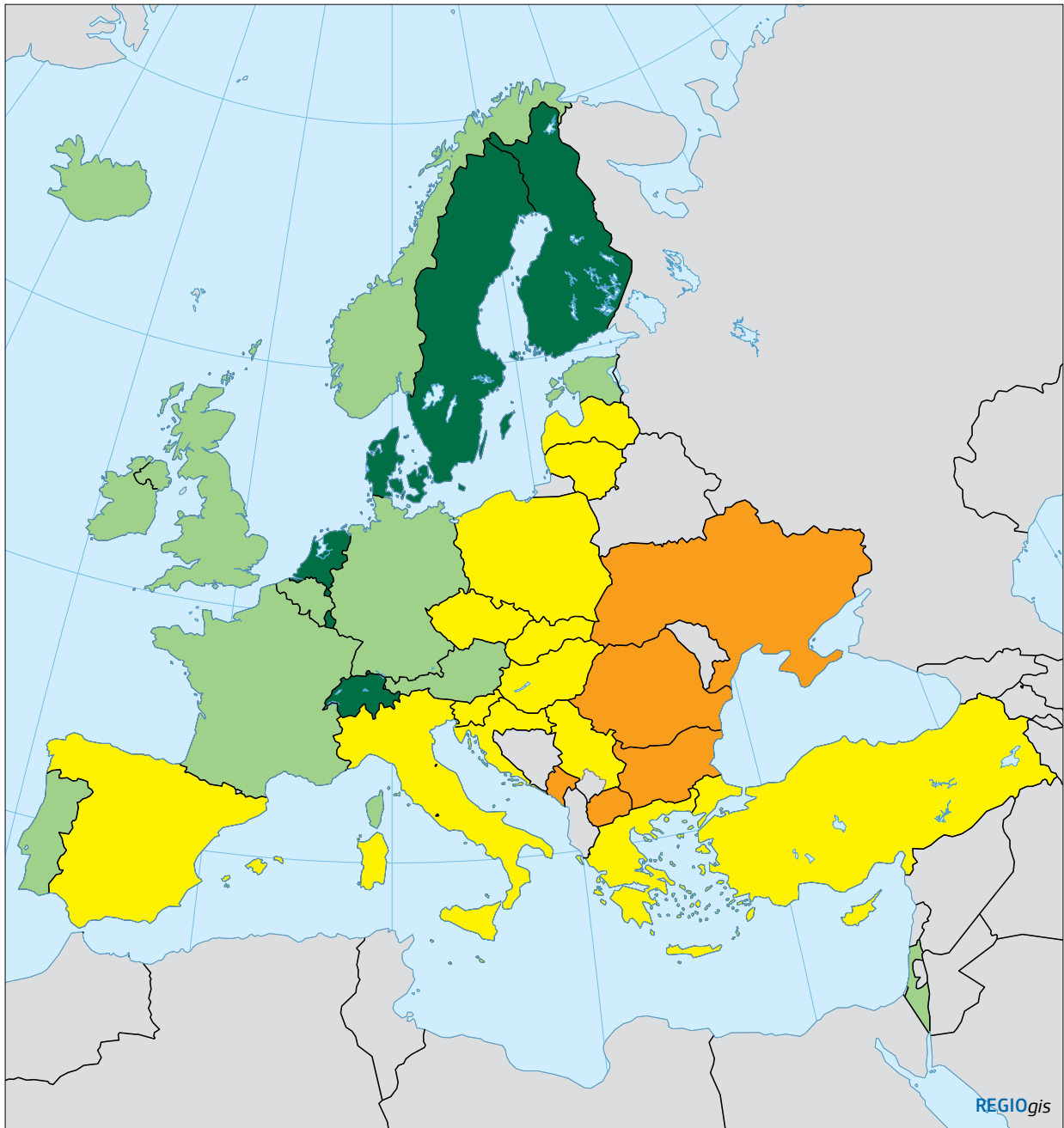
Innovation performance groups

- Innovation Leader
- Strong Innovator
- Moderate Innovator
- Modest Innovator

Source: European Commission - European Innovation Scoreboard 2020

0   500 km

© EuroGeographics Association for the administrative boundaries

5.2 Benchmarking against global competitors

This section provides a comparison of the EU to some of its main global economic competitors including Australia, the BRICS countries (Brazil, Russia, India, China, and South Africa), Canada, Japan, South Korea, and the United States. South Korea is the most innovative country performing 38 per cent above the performance score of the EU in 2012 (**Figure 13**). Canada, Australia, and Japan also have a performance lead over the EU, while the EU has a performance lead over the United States, China, Brazil, South Africa, Russia, and India.

Based on relative-to-EU performance in 2019, South Korea and Canada would be Innovation Leaders. Australia, China, Japan, and the United States would be Strong Innovators, Brazil would be a Moderate Innovator, and Russia, India, and South Africa would be Modest Innovators.

Performance has increased most in China and South Korea, at a rate more than five times that of the EU since 2012 (**Figure 14**). For Australia, Brazil, Japan, Russia, South Africa, and the United States, performance has also increased at a higher rate compared to the EU. For Canada and India, performance has decreased compared to the EU. For India performance has also decreased in absolute terms. Combining current performance and growth rate shows that Australia, Japan, and South Korea have an increasing performance lead over the EU, while Canada has a decreasing performance lead. The EU has an increasing performance lead over India, and a decreasing performance lead over Brazil, China, Russia, South Africa, and the United States.

Between 2018 and 2019, performance has decreased relatively strongly for Australia (due to declining performance on SMEs with product and/or process innovations, Innovative SMEs cooperating with others, and PCT patent applications) and Japan (due to declining performance on SMEs with marketing and/or organisational innovations, Innovative SMEs cooperating with others, and Trademark applications), and has increased relatively strongly for Canada (due to increasing performance on SMEs with product and/or process innovations and SMEs with marketing and/or organisational innovations), China (due to increasing performance on Most-cited scientific publications and Public-private scientific co-pubications), and very strongly for the United States (almost entirely due to a quadrupling of the share of SMEs with product and/or process innovations). Between 2018 and 2019, the EU has closed part of its performance gap with Australia and Japan, but Canada and South Korea managed to increase their performance lead. Brazil, China, India, South Africa and in particular the United States decreased their performance gap to the EU, with the EU increasing its performance lead over Russia.

Figure 13: Global performance

Coloured columns show performance in 2019 relative to that of the EU in 2012. The horizontal hyphens show performance in 2018, relative to that of the EU in 2012. Grey columns show performance in 2012 relative to that of the EU in 2012. For all years, the same measurement methodology has been used.

Figure 14: Change in global performance

The vertical axis shows countries' performance in 2019 relative to that of the EU in 2012. The horizontal axis shows the change in performance between 2012 and 2019 relative to that of the EU in 2012. The dashed lines show the respective scores for the EU.

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 16 indicators (**Table 3**) has been used for the international comparison of the EU with its global competitors. For some indicators, different definitions have been used as compared to the previous chapters[23]:

- 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 an older EBOPS classification.

For each of the international 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. For each country, a table with structural data is included, similar to the contextual indicators used for the European and neighbouring countries in **Chapter 7**. The countries are ordered according to their performance rank order (cf. **Figure 13**).

Data have been extracted from various sources including Eurostat, OECD (MSTI, Education at a Glance), 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 this international comparison.

Table 3: Indicators used in the international comparison

	DATA SOURCE	YEAR
FRAMEWORK CONDITIONS		
HUMAN RESOURCES		
1.1.1 New doctorate graduates (per 1000 population aged 25-34)	OECD – Education at a Glance	2017
1.1.2 Population aged 25-64 having completed tertiary education	OECD – Education at a Glance	2018
ATTRACTIVE RESEARCH SYSTEMS		
1.2.1 International scientific co-publications (per million population)	Scopus*	2019
1.2.2 Scientific publications among the top 10% most cited publications worldwide (share of total scientific publications of the country)	Scopus*	2017
INNOVATION-FRIENDLY ENVIRONMENT		
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	2018
FIRM INVESTMENTS		
2.2.1 R&D expenditure in the business sector (percentage of GDP)	OECD, UIS	2018
INNOVATION ACTIVITIES		
INNOVATORS		
3.1.1 SMEs introducing product or process innovations (%-share)	OECD	2016
3.1.2 SMEs introducing marketing or organisational innovations (%-share)	OECD	2016
LINKAGES		
3.2.1 Innovative SMEs collaborating with others (%-share)	OECD	2016
3.2.2 Public-private co-publications (per million population)	Scopus*	2019
3.2.3 Private co-funding of public R&D expenditures (percentage of GDP)	OECD	2018
INTELLECTUAL ASSETS		
3.3.1 PCT patent applications	Patents: OECD GDP World Bank	2017
3.3.2 Trademark applications (per billion GDP)	World Bank – WDI**	2018
3.3.3 Design applications (per billion GDP)	World Bank – WDI**	2018
IMPACTS		
EMPLOYMENT IMPACTS		
No indicator included in international comparison		
SALES IMPACTS		
4.2.1 Medium and high-tech product exports (share of total product exports)	United Nations	2018
4.2.2 Knowledge-intensive services exports (share of total service exports)	United Nations, OECD, JRC	2018

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

[23] 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 so-called Unicorns is included in the Business and Entrepreneurship category. Unicorns are start-ups with a value of more than US$1 billion.

The contextual indicators on the following pages show the following differences with the EU: The relative size of South Korea's manufacturing industry is almost twice that of the EU. Top R&D spending firms in South Korea spend more on R&D, and 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. The relative size of Australia's manufacturing industry is less than half that of the EU, however entrepreneurial activities are at a higher level. Japan's top R&D spending firms spend more on R&D as compared to EU top R&D spending firms.

FDI net inflows as a percentage of GDP are much lower, and Japan is also facing a declining population size. For the United States, entrepreneurial activities are at a higher level, and top R&D spending firms spend 60% more on R&D. The number of Unicorns is more than eight times that of the EU. China's agricultural sector accounts for almost 30% of total employment, while also the relative size of the manufacturing industry is twice that of the EU. Entrepreneurial activities in China are at a higher level, and the number of Unicorns is more than three times that of the EU. 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. The structure of Russia's economy is comparable to that of the EU. Top R&D spending firms in Russia spend less on R&D compared to those in the EU. India's agricultural sector accounts for almost 45% of total employment, 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.

Table 4: Contextual indicators in the international comparison

	Period	Source
PERFORMANCE AND STRUCTURE OF THE ECONOMY		
GDP per capita, PPP (international dollars)	Average 2016-2018	World Development Indicators*
Average annual GDP growth (%)	2016-2018	World Development Indicators*
Employment share in Agriculture (%)	Average 2016-2018	World Development Indicators*
Employment share in Industry (%)	Average 2016-2018	World Development Indicators*
Employment share in Services (%)	Average 2016-2018	World Development Indicators*
Manufacturing – share in total value added **	Average 2016-2018	UNIDO
BUSINESS AND ENTREPRENEURSHIP		
Total early-stage Entrepreneurial Activity (TEA) (%)	Average 2017-2019	Global Entrepreneurship Monitor
FDI net inflows (% GDP)	Average 2016-2018	World Development Indicators*
Top R&D spending enterprises per 10 million population	Average 2017-2019	EU Industrial R&D Investment Scoreboard
Top R&D spending enterprises, average R&D spending, million Euros	Average 2017-2019	EU Industrial R&D Investment Scoreboard
Number of Unicorns	All active enterprises April 2020	CB Insights***
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 2016-2018	World Development Indicators*
Average annual population growth (%)	2016-2018	World Development Indicators*
Population density (inhabitants / km2)	Average 2016-2018	World Development Indicators*

*Database from the World Bank ** Value added data are used in the international comparison as employment data are not available.*
**** https://www.cbinsights.com/research-unicorn-companies*

The performance of **South Korea** is well above that of the EU, and the country is an Innovation Leader. Performance has increased since 2012, in particular in 2018. South Korea's relative strengths are in Intellectual Property applications.
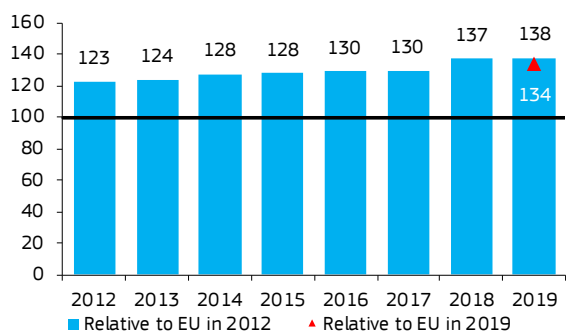
The performance of **Canada** is well above that of the EU, and the country is an Innovation Leader. Performance has remained the same compared to 2012. Canada's relative strengths are in Patent and Trademark applications.
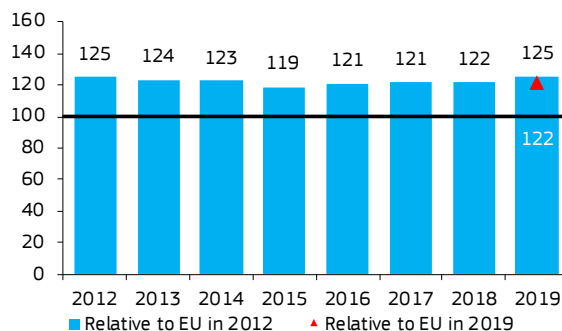
Columns show performance relative to EU27 in 2012. The red triangle shows performance relative to EU27 in 2019.

Columns show performance relative to EU27 in 2012. The red triangle shows performance relative to EU27 in 2019

Performance in 2012 and 2019 relative to the EU in 2012

South Korea	2012	2019	2012-2019
Doctorate graduates	73.0	95.6	22.6
Tertiary education	177.5	180.2	2.7
International co-publications	93.9	91.4	-2.6
Most cited publications	81.1	76.5	-4.6
R&D expenditure public sector	107.4	115.1	7.7
R&D expenditure business sector	216.5	219.8	3.4
Product and/or process innovators	51.6	76.6	25.1
Marketing and/or organisational innovators	49.5	106.8	57.3
Innovation collaboration	57.5	51.3	-6.3
Public-private co-publications	116.6	111.8	-4.8
Private co-funding public R&D expenditures	98.3	122.1	23.8
PCT patent applications	392.4	502.8	110.4
Trademark applications	249.9	252.7	2.8
Design applications	200.1	228.8	28.7
Medium & high-tech product exports	128.2	117.1	-11.1
Knowledge-intensive services exports	91.7	85.7	-6.0

Best three and worst three indicators highlighted.

Performance in 2012 and 2019 relative to the EU in 2012

Canada	2012	2019	2012-2019
Doctorate graduates	74.9	82.3	7.4
Tertiary education	157.1	160.0	2.9
International co-publications	168.9	164.3	-4.6
Most cited publications	130.6	116.9	-13.7
R&D expenditure public sector	113.4	105.6	-7.8
R&D expenditure business sector	75.0	54.9	-20.1
Product and/or process innovators	169.4	194.2	24.8
Marketing and/or organisational innovators	154.9	200.0	45.1
Innovation collaboration	n/a	n/a	n/a
Public-private co-publications	119.2	107.7	-11.5
Private co-funding public R&D expenditures	108.7	95.4	-13.2
PCT patent applications	276.9	270.7	-6.1
Trademark applications	212.9	208.6	-4.3
Design applications	64.9	78.0	13.1
Medium & high-tech product exports	64.2	58.4	-5.8
Knowledge-intensive services exports	102.6	95.3	-7.3

Best three and worst three indicators highlighted.

Structural differences	KR	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	38,700	41,800
Change in GDP, %	2.5	2.2
Employment share in Agriculture	4.9	4.7
Employment share in Industry	25.1	25.0
Employment share in Services	70.0	70.3
Manufacturing - share in total value added	28.6	15.8
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	7.4	6.7
FDI net inflows (% GDP)	0.97	2.63
Top R&D spending firms per million population	13.6	16.2
- average R&D spending, million Euros	350.3	223.6
Number of Unicorns	10	27
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	2.05	1.93
Government procurement of advanced technology products	3.88	3.50
Rule of law (-2.5 to 2.5 best)	1.19	1.06
Demography		
Population size, million	51.4	446.1
Change in population, %	0.3	0.2
Share of population aged 15-64	72.9	65.0
Population density (population / km2)	527.7	105.3

Structural differences	CA	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	46,600	41,800
Change in GDP, %	0.9	2.2
Employment share in Agriculture	1.5	4.7
Employment share in Industry	19.6	25.0
Employment share in Services	78.9	70.3
Manufacturing - share in total value added	10.0	15.8
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	18.5	6.7
FDI net inflows (% GDP)	2.24	2.63
Top R&D spending firms per million population	7.6	16.2
- average R&D spending, million Euros	164.6	223.6
Number of Unicorns	2	27
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	2.52	1.93
Government procurement of advanced technology products	3.45	3.50
Rule of law (-2.5 to 2.5 best)	1.80	1.06
Demography		
Population size, million	36.6	446.1
Change in population, %	1.2	0.2
Share of population aged 15-64	67.3	65.0
Population density (population / km2)	4.0	105.3

The performance of **Australia** is above that of the EU, and the country is a Strong Innovator. Performance has remained the same compared to 2012. Australia's strengths are in International co-publications, and Patent and Trademark applications.
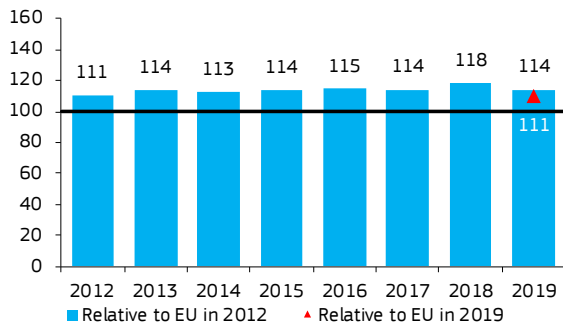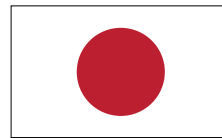
The performance of **Japan** is slightly above that of the EU, and the country is a Strong Innovator. Performance has increased since 2012. Japan's relative strengths are in Business R&D expenditures and Patent and Trademark applications.
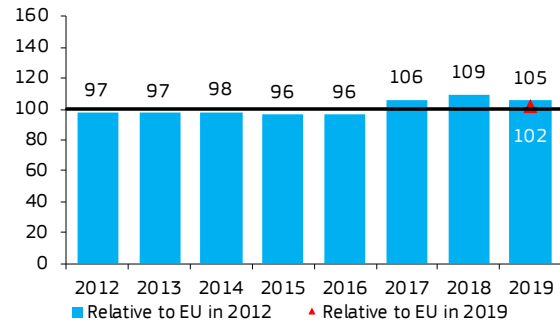
■ Relative to EU in 2012   ▲ Relative to EU in 2019

Columns show performance relative to EU27 in 2012. The red triangle shows performance relative to EU27 in 2019

■ Relative to EU in 2012   ▲ Relative to EU in 2019

Columns show performance relative to EU27 in 2012. The red triangle shows performance relative to EU27 in 2019

Performance in 2012 and 2019 relative to the EU in 2012

Australia	2012	2019	2012-2019
Doctorate graduates	114.6	135.9	21.3
Tertiary education	127.4	133.1	5.7
International co-publications	185.0	166.0	-19.0
Most cited publications	130.3	131.9	1.7
R&D expenditure public sector	113.6	109.5	-4.1
R&D expenditure business sector	96.2	65.1	-31.1
Product and/or process innovators	159.7	154.2	-5.5
Marketing and/or organisational innovators	125.3	117.8	-7.5
Innovation collaboration	75.2	119.6	44.4
Public-private co-publications	90.2	94.0	3.9
Private co-funding public R&D expenditures	88.9	92.5	3.7
PCT patent applications	309.3	299.5	-9.9
Trademark applications	268.2	226.4	-41.7
Design applications	85.6	99.5	13.9
Medium & high-tech product exports	15.5	13.3	-2.1
Knowledge-intensive services exports	52.8	51.6	-1.2

Best three and worst three indicators highlighted.

Performance in 2012 and 2019 relative to the EU in 2012

Japan	2012	2019	2012-2019
Doctorate graduates	67.6	65.1	-2.5
Tertiary education	162.6	157.3	-5.3
International co-publications	76.5	71.9	-4.6
Most cited publications	62.8	56.9	-5.9
R&D expenditure public sector	95.9	87.6	-8.4
R&D expenditure business sector	196.6	178.8	-17.8
Product and/or process innovators	78.0	117.4	39.4
Marketing and/or organisational innovators	93.4	49.5	-43.9
Innovation collaboration	29.6	119.7	90.1
Public-private co-publications	115.3	98.7	-16.6
Private co-funding public R&D expenditures	31.1	35.0	3.9
PCT patent applications	301.5	356.8	55.2
Trademark applications	93.6	187.5	93.9
Design applications	88.0	96.2	8.2
Medium & high-tech product exports	122.1	118.7	-3.3
Knowledge-intensive services exports	122.5	106.1	-16.4

Best three and worst three indicators highlighted.

Structural differences	AU	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	49,500	41,800
Change in GDP, %	0.9	2.2
Employment share in Agriculture	2.6	4.7
Employment share in Industry	19.6	25.0
Employment share in Services	77.8	70.3
Manufacturing - share in total value added	6.1	15.8
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	11.4	6.7
FDI net inflows (% GDP)	3.78	2.63
Top R&D spending firms per million population	5.6	16.2
– average R&D spending, million Euros	217.6	223.6
Number of Unicorns	3	27
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	2.16	1.93
Government procurement of advanced technology products	3.34	3.50
Rule of law (-2.5 to 2.5 best)	1.72	1.06
Demography		
Population size, million	24.6	446.1
Change in population, %	1.6	0.2
Share of population aged 15-64	65.5	65.0
Population density (population / km2)	3.2	105.3

Structural differences	JP	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	42,000	41,800
Change in GDP, %	1.4	2.2
Employment share in Agriculture	3.5	4.7
Employment share in Industry	24.6	25.0
Employment share in Services	71.9	70.3
Manufacturing - share in total value added	21.1	15.8
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	5.1	6.7
FDI net inflows (% GDP)	0.59	2.63
Top R&D spending firms per million population	26.9	16.2
– average R&D spending, million Euros	306.3	223.6
Number of Unicorns	3	27
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	1.66	1.93
Government procurement of advanced technology products	4.06	3.50
Rule of law (-2.5 to 2.5 best)	1.51	1.06
Demography		
Population size, million	126.8	446.1
Change in population, %	-0.1	0.2
Share of population aged 15-64	60.1	65.0
Population density (population / km2)	347.7	105.3

The performance of the **United States**, a Strong Innovator, is below that of the EU. Performance has decreased until 2018 and then increased strongly in 2019 due to a very strong increase in the share of SMEs that introduced a product or process innovation.
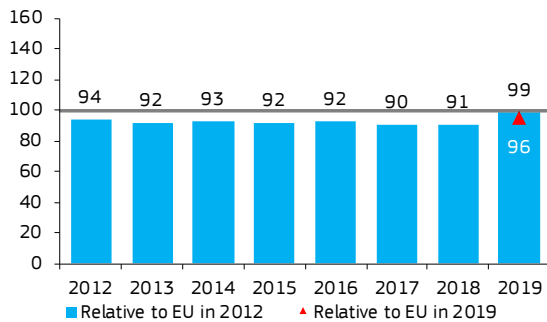
The performance of **China** is below that of the EU, and the country is a Strong Innovator. Performance has increased strongly since 2012. Relative strengths are in Business R&D expenditures and Trademark and Design applications.
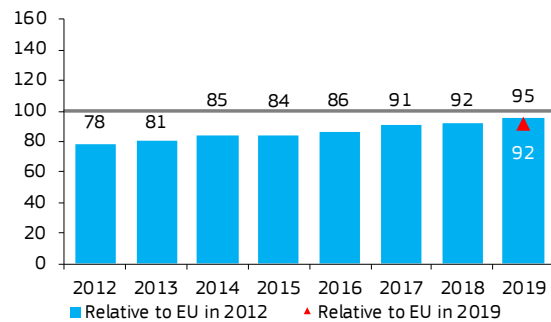
Columns show performance relative to EU27 in 2012. The red triangle shows performance relative to EU27 in 2019.

Columns show performance relative to EU27 in 2012. The red triangle shows performance relative to EU27 in 2019.

Performance in 2012 and 2019 relative to the EU in 2012

United States	2012	2019	2012-2019
Doctorate graduates	77.9	81.5	3.6
Tertiary education	120.1	127.9	7.8
International co-publications	114.4	110.6	-3.9
Most cited publications	153.3	133.8	-19.5
R&D expenditure public sector	103.5	91.1	-12.4
R&D expenditure business sector	149.0	141.4	-7.6
Product and/or process innovators	67.5	150.3	82.8
Marketing and/or organisational innovators	n/a	n/a	n/a
Innovation collaboration	n/a	n/a	n/a
Public-private co-publications	169.1	138.9	-30.2
Private co-funding public R&D expenditures	35.5	37.7	2.2
PCT patent applications	98.7	105.2	6.4
Trademark applications	60.0	61.8	1.8
Design applications	47.5	60.5	13.0
Medium & high-tech product exports	87.3	78.1	-9.2
Knowledge-intensive services exports	102.1	97.2	-4.9

Best three and worst three indicators highlighted.

Performance in 2012 and 2019 relative to the EU in 2012

China	2012	2019	2012-2019
Doctorate graduates	12.8	11.1	-1.6
Tertiary education	n/a	n/a	n/a
International co-publications	34.7	43.9	9.2
Most cited publications	68.4	101.9	33.5
R&D expenditure public sector	59.2	68.6	9.4
R&D expenditure business sector	106.2	114.8	8.6
Product and/or process innovators	n/a	n/a	n/a
Marketing and/or organisational innovators	n/a	n/a	n/a
Innovation collaboration	n/a	n/a	n/a
Public-private co-publications	17.5	35.5	18.0
Private co-funding public R&D expenditures	114.3	107.3	-7.0
PCT patent applications	67.4	86.0	18.6
Trademark applications	230.6	331.5	100.9
Design applications	200.1	210.8	10.8
Medium & high-tech product exports	97.7	93.2	-4.5
Knowledge-intensive services exports	91.9	96.4	4.5

Best three and worst three indicators highlighted.

Structural differences	US	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	60,200	41,800
Change in GDP, %	1.2	2.2
Employment share in Agriculture	1.4	4.7
Employment share in Industry	19.8	25.0
Employment share in Services	78.8	70.3
Manufacturing - share in total value added	11.4	15.8
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	15.6	6.7
FDI net inflows (% GDP)	1.91	2.63
Top R&D spending firms per million population	24.3	16.2
– average R&D spending, million Euros	359.3	223.6
Number of Unicorns	222	27
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	2.37	1.93
Government procurement of advanced technology products	4.52	3.50
Rule of law (-2.5 to 2.5 best)	1.57	1.06
Demography		
Population size, million	324.9	446.1
Change in population, %	0.7	0.2
Share of population aged 15-64	65.7	65.0
Population density (population / km2)	35.5	105.3

Structural differences	CN	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	16,800	41,800
Change in GDP, %	6.2	2.2
Employment share in Agriculture	26.9	4.7
Employment share in Industry	28.4	25.0
Employment share in Services	44.7	70.3
Manufacturing - share in total value added	31.3	15.8
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	9.6	6.7
FDI net inflows (% GDP)	1.48	2.63
Top R&D spending firms per million population	3.2	16.2
– average R&D spending, million Euros	173.7	223.6
Number of Unicorns	119	27
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	2.17	1.93
Government procurement of advanced technology products	4.38	3.50
Rule of law (-2.5 to 2.5 best)	-0.27	1.06
Demography		
Population size, million	1385.9	446.1
Change in population, %	0.6	0.2
Share of population aged 15-64	71.7	65.0
Population density (population / km2)	147.6	105.3

The performance of **Brazil** is below that of the EU, and the country is a Moderate Innovator. Performance has increased since 2012. Brazil's relative strengths are in Marketing and organisational innovation and Trademark applications.
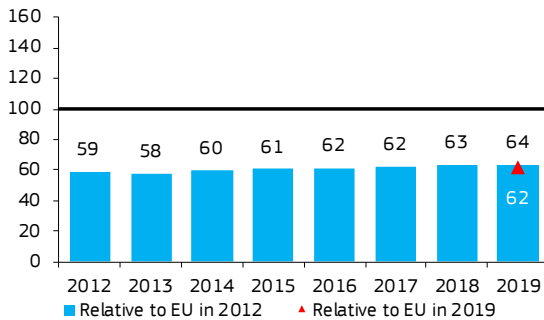
The performance of **Russia** is well below that of the EU, and the country is a Modest Innovator. Performance has increased since 2012. Russia's relative strengths are in Tertiary education, Private co-funding of public R&D, and Trademark applications.
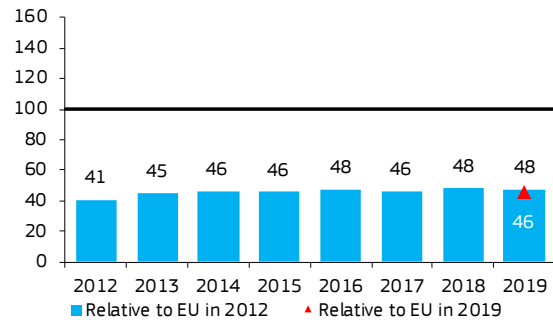
Columns show performance relative to EU27 in 2012. The red triangle shows performance relative to EU27 in 2019.

Columns show performance relative to EU27 in 2012. The red triangle shows performance relative to EU27 in 2019.

Performance in 2012 and 2019 relative to the EU in 2012

Brazil	2012	2019	2012-2019
Doctorate graduates	n/a	n/a	n/a
Tertiary education	35.5	50.8	15.3
International co-publications	41.6	47.0	5.4
Most cited publications	51.4	52.5	1.1
R&D expenditure public sector	n/a	n/a	n/a
R&D expenditure business sector	n/a	n/a	n/a
Product and/or process innovators	103.4	103.8	0.5
Marketing and/or organisational innovators	164.3	187.9	23.6
Innovation collaboration	57.9	52.3	-5.6
Public-private co-publications	8.4	7.6	-0.7
Private co-funding public R&D expenditures	n/a	n/a	n/a
PCT patent applications	71.9	84.1	12.2
Trademark applications	116.5	120.2	3.7
Design applications	51.4	53.7	2.3
Medium & high-tech product exports	45.7	40.4	-5.3
Knowledge-intensive services exports	105.7	114.2	8.5

Best three and worst three indicators highlighted.

Performance in 2012 and 2019 relative to the EU in 2012

Russia	2012	2019	2012-2019
Doctorate graduates	78.0	62.5	-15.5
Tertiary education	148.4	162.3	13.9
International co-publications	46.2	52.7	6.5
Most cited publications	15.1	22.8	7.7
R&D expenditure public sector	54.0	60.6	6.6
R&D expenditure business sector	48.7	38.0	-10.7
Product and/or process innovators	11.4	12.0	0.5
Marketing and/or organisational innovators	2.5	2.9	0.4
Innovation collaboration	7.5	17.0	9.6
Public-private co-publications	8.4	19.1	10.8
Private co-funding public R&D expenditures	106.5	110.5	4.1
PCT patent applications	69.8	79.0	9.2
Trademark applications	135.3	129.0	-6.3
Design applications	44.9	59.3	14.4
Medium & high-tech product exports	18.4	18.1	-0.3
Knowledge-intensive services exports	94.2	93.7	-0.5

Best three and worst three indicators highlighted.

Structural differences	BR	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	15,700	41,800
Change in GDP, %	-1.9	2.2
Employment share in Agriculture	9.6	4.7
Employment share in Industry	20.5	25.0
Employment share in Services	69.9	70.3
Manufacturing - share in total value added	11.0	15.8
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	20.5	6.7
FDI net inflows (% GDP)	3.89	2.63
Top R&D spending firms per million population	0.4	16.2
– average R&D spending, million Euros	177.1	223.6
Number of Unicorns	7	27
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	1.59	1.93
Government procurement of advanced technology products	2.96	3.50
Rule of law (-2.5 to 2.5 best)	-0.24	1.06
Demography		
Population size, million	207.8	446.1
Change in population, %	0.8	0.2
Share of population aged 15-64	69.7	65.0
Population density (population / km2)	24.9	105.3

Structural differences	RU	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	25,800	41,800
Change in GDP, %	0.8	2.2
Employment share in Agriculture	6.2	4.7
Employment share in Industry	26.9	25.0
Employment share in Services	66.9	70.3
Manufacturing - share in total value added	13.6	15.8
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	14.2	6.7
FDI net inflows (% GDP)	1.63	2.63
Top R&D spending firms per million population	0.1	16.2
– average R&D spending, million Euros	48.7	223.6
Number of Unicorns	0	27
Buyer sophistication 1-7 (best)	3.56	3.73
Governance and policy framework		
Ease of starting a business	77.4	76.5
Basic-school entrepreneurial education and training	1.95	1.93
Government procurement of advanced technology products	3.33	3.50
Rule of law (-2.5 to 2.5 best)	-0.80	1.06
Demography		
Population size, million	144.4	446.1
Change in population, %	0.1	0.2
Share of population aged 15-64	68.1	65.0
Population density (population / km2)	8.8	105.3

The performance of **India** is well below that of the EU, and the country is a Modest Innovator. Performance has decreased since 2012. Relative strengths are in Exports of knowledge-intensive services.
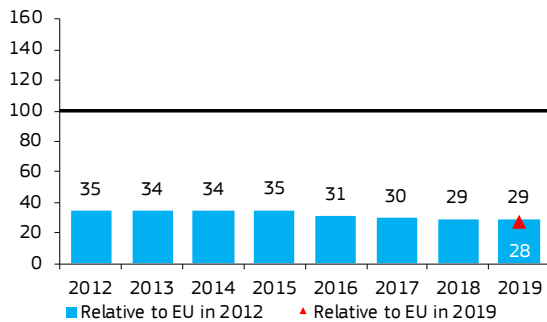
The performance of **South Africa** is well below that of the EU, and the country is a Modest Innovator. Performance has increased since 2012. Relative strengths are in Patent and Trademark applications.

Columns show performance relative to EU27 in 2012. The red triangle shows performance relative to EU27 in 2019.
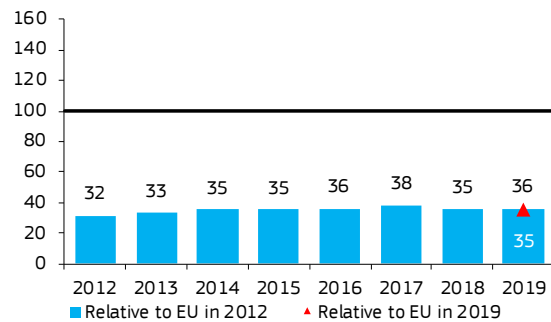
Columns show performance relative to EU27 in 2012. The red triangle shows performance relative to EU27 in 2019.

Performance in 2012 and 2019 relative to the EU in 2012

India	2012	2019	2012-2019
Doctorate graduates	6.0	6.6	0.6
Tertiary education	38.7	36.0	-2.7
International co-publications	17.5	19.8	2.3
Most cited publications	59.3	57.9	-1.4
R&D expenditure public sector	72.7	56.1	-16.6
R&D expenditure business sector	23.0	13.3	-9.6
Product and/or process innovators	n/a	n/a	n/a
Marketing and/or organisational innovators	n/a	n/a	n/a
Innovation collaboration	n/a	n/a	n/a
Public-private co-publications	2.4	2.9	0.5
Private co-funding public R&D expenditures	n/a	n/a	n/a
PCT patent applications	66.6	54.1	-12.5
Trademark applications	77.9	64.7	-13.2
Design applications	40.4	43.8	3.3
Medium & high-tech product exports	44.9	50.0	5.0
Knowledge-intensive services exports	119.6	109.7	-9.9

Best three and worst three indicators highlighted.

Performance in 2012 and 2019 relative to the EU in 2012

South Africa	2012	2019	2012-2019
Doctorate graduates	11.4	14.1	2.8
Tertiary education	10.5	14.4	4.0
International co-publications	54.1	62.3	8.2
Most cited publications	74.2	68.4	-5.8
R&D expenditure public sector	52.4	63.4	10.9
R&D expenditure business sector	27.2	23.4	-3.9
Product/process innovators	n/a	n/a	n/a
Product and/or process innovators	n/a	n/a	n/a
Marketing and/or organisational innovators	n/a	n/a	n/a
Public-private co-publications	5.7	5.7	-0.1
Private co-funding public R&D expenditures	35.0	58.2	23.2
PCT patent applications	213.5	186.7	-26.8
Trademark applications	120.0	96.6	-23.3
Design applications	60.9	62.6	1.6
Medium & high-tech product exports	49.5	50.1	0.5
Knowledge-intensive services exports	n/a	n/a	n/a

Best three and worst three indicators highlighted.

Structural differences	IN	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	7,200	41,800
Change in GDP, %	6.5	2.2
Employment share in Agriculture	44.2	4.7
Employment share in Industry	24.5	25.0
Employment share in Services	31.3	70.3
Manufacturing - share in total value added	16.9	15.8
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	11.9	6.7
FDI net inflows (% GDP)	1.67	2.63
Top R&D spending firms per million population	0.2	16.2
– average R&D spending, million Euros	156.7	223.6
Number of Unicorns	21	27
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	2.66	1.93
Government procurement of advanced technology products	4.14	3.50
Rule of law (-2.5 to 2.5 best)	0.00	1.06
Demography		
Population size, million	1338.6	446.1
Change in population, %	1.1	0.2
Share of population aged 15-64	66.5	65.0
Population density (population / km2)	450.2	105.3

Structural differences	SA	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	13,400	41,800
Change in GDP, %	-0.5	2.2
Employment share in Agriculture	5.3	4.7
Employment share in Industry	23.3	25.0
Employment share in Services	71.4	70.3
Manufacturing - share in total value added	12.4	15.8
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	10.9	6.7
FDI net inflows (% GDP)	0.94	2.63
Top R&D spending firms per million population	0.3	16.2
– average R&D spending, million Euros	54.2	223.6
Number of Unicorns	2	27
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	1.74	1.93
Government procurement of advanced technology products	3.02	3.50
Rule of law (-2.5 to 2.5 best)	-0.01	1.06
Demography		
Population size, million	57.0	446.1
Change in population, %	1.4	0.2
Share of population aged 15-64	65.6	65.0
Population density (population / km2)	47.0	105.3

6. Expected short-term changes in EU innovation performance

This chapter includes a forward-looking analysis of EU innovation performance discussing more recent developments, trends, and expected changes. The aim is to address the need for more recent information, since available statistical data for the indicators used for constructing the innovation index are, on average, two to three years old.

Where previous EIS reports provided forecasts for EU innovation performance for two years from now, this report takes a more conservative approach due to the Covid-19 crisis. As it is unclear how economies will react to the economic crisis, the forecast will be limited to only one year. For most indicators, the forecast is using the results of a linear regression extending 'business as usual' to the near future. As business is clearly being affected by the Covid-19 crisis, with an expected decline in consumer and business demand, with business investments being postponed or reduced to lower levels, and with both formal and informal restrictions on the mobility of trade and people between European countries, for the forecast only half of the expected increase from the linear regression analysis will be used. For the indicators using CIS data, provisional CIS 2018 data have been used to forecast EU performance. For the estimates using provisional CIS 2018 data, a more conservative approach has been used as the results between the CIS 2016 and CIS 2018 are not directly comparable due to differences in the collection of these data (cf. ***section 6.2*** for more details).

In summary, the analysis suggests that EU innovation performance will continue to increase for most indicators, leading to an increase in overall EU innovation performance, compared to 2012, from 109 in 2019 to 112 in one year from now or a 3.2 percentage point increase. Almost 70% of the expected increase can be explained by the expected increase in only a few indicators: Broadband penetration (30%), SMEs with product or process innovations, SMEs with marketing or organisational innovators, Innovative SMEs collaborating with others, and Sales of new-to-market and new-to-firm product innovations.

EU innovation performance is expected to increase strongly by at least 10 percent for two indicators, by between five and 10 percent for one indicator, by between one and five percent for 14 indicators, neither to increase or decrease for two indicators, and to decrease for two indicators (***Table 5***). For six indicators no forecast is available, for different reasons such as the linear regressions provided no reliable forecast, the indicator is no longer updated (Opportunity-driven entrepreneurship), or because no provisional CIS 2018 data are available (SMEs innovating in-house).

Section 6.1 explores EU trend performance for those indicators for which results are based on linear regressions. ***Section 6.2*** discusses the provisional CIS 2018 data and how these were used to forecast CIS 2016 data. ***Section 6.3*** examines a more limited trend performance of the EU compared to four of its main international competitors.

Figure 15: Increase in expected EU innovation performance
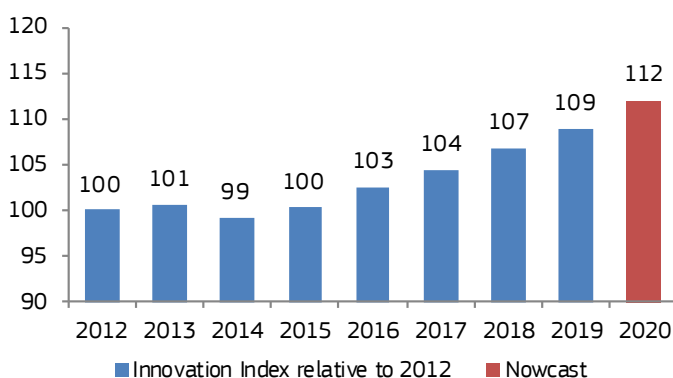
Table 5: Changes in two years' time in EU innovation performance

	CURRENT SCORE	EXPECTED CHANGE IN ONE YEAR	METHODOLOGY
HUMAN RESOURCES			
1.1.1 Doctorate graduates	1.94	1-5% increase	Linear regression
1.1.2 Population with tertiary education	39.2	1-5% increase	Linear regression
1.1.3 Population involved in lifelong learning	10.6	1-5% increase	Linear regression
ATTRACTIVE RESEARCH SYSTEMS			
1.2.1 International scientific co-publications	1092.5	1-5% increase	Linear regression
1.2.2 Scientific publications among the top 10% most cited	10.0	*No reliable forecast*	*Linear regression*
1.2.3 Foreign doctorate students	17.8	1-5%increase	Linear regression
INNOVATION-FRIENDLY ENVIRONMENT			
1.3.1 Broadband penetration	23.0	More than 10% increase	Linear regression
1.3.2 Opportunity-driven entrepreneurship	3.60	*Data for indicator no longer collected by Global Entrepreneurship Monitor*	
FINANCE AND SUPPORT			
2.1.1 R&D expenditure in the public sector (% of GDP)	0.72	*No reliable forecast*	*Linear regression*
2.1.2 Venture capital (% of GDP)	0.124	1-5% increase	Linear regression
FIRM INVESTMENTS			
2.2.1 R&D expenditure in the business sector	1.45	1-5% increase	Linear regression
2.2.2 Non-R&D innovation expenditures	0.86	1-5% increase	Fast-track data
2.2.3 Enterprises providing training to develop or upgrade ICT skills	23.0	1-5% increase	Linear regression
INNOVATORS			
3.1.1. SMEs introducing product or process innovations	33.8	5-10% increase	Fast-track data
3.1.2 SMEs introducing marketing or organisational innovations	35.0	1-5% increase	Fast-track data
3.1.3 SMEs innovating in-house	28.6	*No fast-track data*	
LINKAGES			
3.2.1 Innovative SMEs collaborating with others	9.3	More than 10% increase	Fast-track data
3.2.2 Public-private co-publications	91.4	1-5% increase	Linear regression
3.2.3 Private co-funding of public R&D expenditures	0.055	*No reliable forecast*	*Linear regression*
INTELLECTUAL ASSETS			
3.3.1 PCT patent applications	3.39	1-5% decrease	Linear regression
3.3.2 Trademark applications	8.21	1-5% increase	Linear regression
3.33. Design applications	4.05	1-5% decrease	Linear regression
EMPLOYMENT IMPACT			
4.1.1 Employment in knowledge-intensive activities	13.7	No notable change	Linear regression
4.1.2 Employment in fast-growing enterprises	5.15	*No reliable forecast*	*Linear regression*
SALES IMPACTS			
4.2.1 Exports of medium and high technology products	57.1	1-5% increase	Linear regression
4.2.2 Knowledge-intensive services exports	68.4	No notable change	Linear regression
4.2.3 Sales of new-to-market and new-to-firm innovations	12.5	1-5% increase	Fast-track data

6.1 EU trend performance compared to China, Japan, South Korea, and the United States

This section discusses expected short-term changes for 20 indicators. Expected changes have been calculated applying a simple linear regression using the time series data for the 2012-2019 period covered in this EIS report (see the EIS 2020 Methodology Report for more details). For those indicators for which no reliable forecast could be estimated, it is assumed that performance will not change.

Human resources

New doctorate graduates has been increasing from 2012 onwards. A linear regression using data for the latest eight years has been used to estimate an increase from 1.94 to 1.96 in one year from now. For *Population aged 25-34 having completed tertiary education*, there was a break in series in 2014. A linear regression using data for 2014-2019 has been used to estimate an increase from 39.2 to 39.9 in one year from now. For *Lifelong learning*, there was a break in series in 2013. The regression results using a linear regression for 2013-2018 has been used to estimate an increase from 10.6 to 10.7 in one year from now.

Attractive research systems

International scientific co-publications has shown a steady increase over time. A linear regression for the latest eight years has been used to estimate an increase from 1092.5 to 1137.7 in one year from now. For the share of *Most-cited scientific publications* no reliable forecast could be made due to the volatile behaviour of the indicator with a strong increase in 2012 followed by yearly declining performance in 2015 and another strong increase in 2016 followed by a strong decline the year after. For the share of *Foreign doctorate students*, a linear regression using data for the latest eight years has been used to estimate an increase from 17.8 to 18.1 in one year from now.

Innovation-friendly environment

For *Broadband penetration*, data are available for six years only. A linear regression has been used for the years 2014-2019 and the results show an expected increase from 23.0 to 25.6 in one year from now. For *Opportunity-driven entrepreneurship* no forecast has been made as GEM has decided no longer collect data for this indicator.

Finance and support

For *R&D expenditure in the public sector*, performance was at a stable level until 2015. Performance dropped in 2016 after which it stayed at the same lower level. The linear regression analysis resulted in low predictive power, and it has therefore been assumed that the indicator will hold its value. *Venture capital expenditures* shows a stable performance from 2011 to 2013 and an increasing performance from 2013 onwards. A linear regression using data for the latest eight years has been used to estimate an increase from 0.124 to 0.131 in one year from now.

Firm investments

R&D expenditures in the business sector has been increasing over time. A linear regression using data for the latest eight years has been used to estimate an increase from 1.45 to 1.47 in one year from now. For *Non-*

R&D innovation expenditures **section 6.2** discusses the results using preliminary CIS 2018 data. For *Enterprises providing training to develop or upgrade ICT skills of their personnel*, a linear regression using data for the latest eight years has been used to estimate an increase from 23.0 to 23.7 in one year from now.

Innovators

Section 6.2 discusses the results for the three indicators included in this dimension using preliminary CIS 2018 data.

Linkages

For *Innovative SMEs collaborating with others* **section 6.2** discusses the results using preliminary CIS 2018 data. Public-private co-publications has been increasing steadily over time. A linear regression using data for the latest eight years has been used to estimate an increase from 91.4 to 93.1 in one year from now. For *Private co-funding of public R&D expenditures* no reliable forecast could be made as performance first slowly increased during the first four years and then slowly decreases using the second four years.

Intellectual assets

PCT patent applications per billion GDP has been steadily decreasing over time. A linear regression using data for the latest eight years estimates a further decrease from 3.39 to 3.31 in one year from now. *Trademark applications per billion GDP* has been increasing between 2012 and 2014 and, after a decline in 2015, has been increasing again. A linear regression using data for the latest eight years estimates a further increase from 8.21 to 8.31 in one year from now. *Design applications per billion GDP* has been decreasing between 2012 and 2016, followed by a temporary increase in 2017 and a further, relatively strong, decline in 2018 and 2019. A linear regression using data for the latest eight years estimates a further decrease from 4.05 to 3.95 in one year from now.

Employment impacts

The *Employment share in knowledge-intensive activities* has been increasing continuously over time. A linear regression using data for the latest eight years has been used to estimate a further increase from 13.7 to 13.8 in one year from now. For *Employment in fast-growing enterprises of innovative sectors*, a linear regression has only low predictive power, and it has therefore been assumed that the indicator will hold its value.

Sales impacts

For *Medium and high-tech products exports* performance has been increasing until 2016 and then remained almost stable. A linear regression using data for the latest eight years has been used to estimate an increase from 57.1 to 57.7 in one year from now. For *Knowledge-intensive services exports*, performance has been slowly increasing over time. A linear regression using data for the latest eight years has been used to estimate a further increase from 68.4 to 68.7 in one year from now. For *Sales of innovative products* **section 6.2** discusses the results using preliminary CIS 2018 data.

6.2 Forecasts using provisional CIS 2018 data[24]

The Community Innovation Survey (CIS) is a survey of innovation activity in enterprises. For the CIS 2016, the latest innovation survey for which final results are available, most questions cover the reference period 2014-2014, i.e. the three-year period from the beginning of 2014 to the end of 2016. According to Commission Regulation No 995/2012, national CIS statistics must be delivered to Eurostat within 18 months of the end of the reference year, i.e. June in even-numbered years (e.g., June 2018 for the CIS 2016). Data are then checked and corrected for detected inconsistencies by Eurostat. Final CIS 2016 data were made available by Eurostat in November 2018. Final CIS 2018 data are expected to be made available by Eurostat in the last quarter of 2020.

Eurostat has made a request to national data providers to share provisional CIS 2018 data including the following indicators 'comparable' to those used in the EIS:

- Enterprises introducing product innovations as percentage of total enterprises

- Enterprises introducing business process innovations as percentage of total enterprises

- Innovative enterprises cooperating with others as percentage of total enterprises

- Non-R&D innovation expenditures as percentage of total turnover

- Sales from product innovations new to market and new to enterprise as percentage of total turnover

Provisional CIS 2018 data were received from 27 countries, including 22 Member States[25], Iceland, Montenegro[26], Serbia, Turkey, and United Kingdom[27].

The CIS follows the recommendations for measuring innovation as laid out in the Oslo Manual. With the introduction of the fourth edition of the Oslo Manual in 2018, the CIS questionnaire was significantly revised for the CIS 2018 and later editions. For the EIS the following changes have a direct impact on the comparability of the EIS results over time:

- The types of innovations have been reduced from four to two: where the CIS 2016 and earlier editions differentiate between product, process, organisational and marketing innovation, the CIS 2018 and future editions differentiate between product and business process innovations, the latter comprising the previous three types process, organisational and marketing innovation.

- The definition of innovation was changed to "new or improved products or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been

made available to potential users or brought into use by the unit (process)" (OECD/EUROSTAT, 2018:32). The definition of innovation was changed to "new or improved products or processes (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users or brought into use by the unit (process)" (OECD/EUROSTAT, 2018:32). The change from 'significant improved' to 'differs significantly from previous products or processes' could introduce a discontinuity in the results.

Annex I shows the differences between the questions used for constructing the EIS indicators in the CIS 2016 and CIS 2018 and the expected impact on the EIS. The introduction of the CIS 2018 is expected to lead to a break in series for several indicators using CIS data.

Table 6 provides a comparison of the provisional CIS 2018 data with those from the CIS 2016. For the share of SMEs that introduced a product innovation, results suggest a 23% increase for the EU based on CIS 2018 compared to CIS 2016. Results also show that for most countries the share of SMEs that introduced a product is expected to increase, with very high rates of increase for Romania (three times as high), Estonia (more than twice as high) and Croatia, Malta and Slovenia (close to twice as high).

For the share of SMEs that introduced a business process innovation, a proxy using CIS 2016 data has been calculated using tabulated data from Eurostat's online database as the difference between "Product and/or process innovative SMEs only (including enterprises with abandoned/suspended or on-going innovation activities)" and "Product innovative SMEs only". Results seem to suggest an increase in the share of SMEs that introduced a business process innovation for the EU, but results are more mixed across the different countries, with eight countries showing a decrease in the share of SMEs that introduced a business process innovation.

For the share of Innovative SMEs that collaborated with others, results suggest a 41% increase for the EU based on CIS 2018 compared to CIS 2016. This higher rate might be partly due to the CIS 2018 results also including SMEs with only marketing or organisational innovations as these enterprises were not asked to report on their collaboration activities in previous CIS versions. For some countries, the indicator seems to decline, which therefore hides an even stronger decline for those SMEs that did not introduce a marketing or organisational innovation.

For Non-R&D innovation expenditures, results show a small increase for the EU as CIS 2018 results are 3% higher than CIS 2016 results. At the country level, results are mixed, with relatively strong increases for some countries, e.g. Denmark, Italy and Spain, and very strong decreases for other countries, e.g. Croatia, Portugal, Slovenia, and Turkey.

For the Sales of new-to-market and new-to-firm product innovations, results show an increase for the EU as CIS 2018 results are 9% higher

---

than CIS 2016 results. At the country level, results seem to increase for most countries.

For the forecast exercise, the following more conservative results have been used:

• For SMEs that introduced a product and/or process innovation, an increase of 16.1% is expected by taking the average of the 23.0% increase for product innovators and 9.1% increase for business process innovators. The conservative estimate used for the forecast is half of this estimate or 8.1% showing an increase in the value of the indicator from 33.8 for the CIS 2016 to 35.2.

• For SMEs that introduced a marketing and/or organisational innovation, half of the 9.1% increase for business process innovators

has been used showing an increase in the value of the indicator from 35.0 for the CIS 2016 to 35.8.

• For Innovative SMEs collaborating with others, half of the 41.2% increase has been used showing an increase in the value of the indicator from 9.32 for the CIS 2016 to 10.28.

• For Non-R&D innovation expenditures, half of the 3.1% increase has been used showing an increase in the value of the indicator from 0.857 for the CIS 2016 to 0.863.

• For Sales due to new-to-market and new-to-firm innovations, half of the 9.2% increase has been used showing an increase in the value of the indicator from 12.51 for the CIS 2016 to 12.80.

Table 6: Relative performance of provisional CIS 2018 data compared to CIS 2016 data for EU, EU Member States, and other European countries

		SMES THAT INTRODUCED A PRODUCT INNOVATION	SMES THAT INTRODUCED A BUSINESS PROCESS INNOVATION	INNOVATIVE SMES COLLABORATING WITH OTHERS	NON-R&D INNOVATION EXPENDITURES	SALES OF NEW-TO-MARKET OR NEW-TO-FIRM PRODUCT INNOVATIONS
EU	European Union	123	109	141	103	109
BG	Bulgaria	148	107	116	74	106
CZ	Czechia	105	108	93	137	86
DK	Denmark	132	--	104	142	--
DE	Germany	128	123	173	110	106
EE	Estonia	248	141	112	67	118
IE	Ireland	102	82	188	100	174
EL	Greece	139	106	88	105	142
ES	Spain	133	78	109	140	83
FR	France	121	85	99	85	90
HR	Croatia	194	109	128	47	143
IT	Italy	117	134	251	139	136
LV	Latvia	134	106	112	61	105
LT	Lithuania	119	101	81	74	66
HU	Hungary	146	104	161	53	115
MT	Malta	197	150	250	51	91
PL	Poland	139	107	96	58	102
PT	Portugal	69	57	73	34	122
RO	Romania	308	95	106	--	185
SI	Slovenia	187	133	104	20	142
SK	Slovakia	112	100	100	109	150
FI	Finland	85	98	283	76	126
SE	Sweden	146	131	108	77	148
IS	Iceland	85	104	98	--	--
RS	Serbia	148	139	137	--	--
TR	Turkey	65	56	55	44	64
UK	United Kingdom	83	48	77	--	--

Relative performance for provisional CIS 2018 indicator scores has been calculated relative to the CIS 2016 indicator scores (where the relative score is 100 if the provisional CIS 2018 score equals the CIS 2016 score).

6.3 EU trend performance compared to China, Japan, South Korea, and the United States

Nowcasts for 2018 have been calculated for the EU, China, Japan, South Korea, and the United States, using estimates based on nowcasting three-year averages for the innovation index scores. Details are explained in the EIS 2020 Methodology Report. The results confirm that stronger growth performance of South Korea between 2012 and 2019 (cf. *Section 5.2*) is expected to continue. South Korea's performance relative to the EU in 2012 would increase from 138 this year to 140 next year (*Figure 16*), and the EU performance gap towards South Korea is expected to further increase. Japan's performance relative to the EU in 2012 would increase from 105 this year to 107 next year, and the EU

performance gap towards Japan is also expected to further increase. The performance of the United States is expected not to change, and the performance gap of the EU over the United States is expected to increase. China's performance relative to the EU in 2012 would increase from 95 this year to 97 next year, and the EU performance lead over china is expected to further decrease. A longer-term perspective would also suggest, if current trends would continue, that China would overtake the United States two years from now, and that China would overtake the EU in three years from now.

Figure 16: Expected short-term changes in innovation performance for main competitors
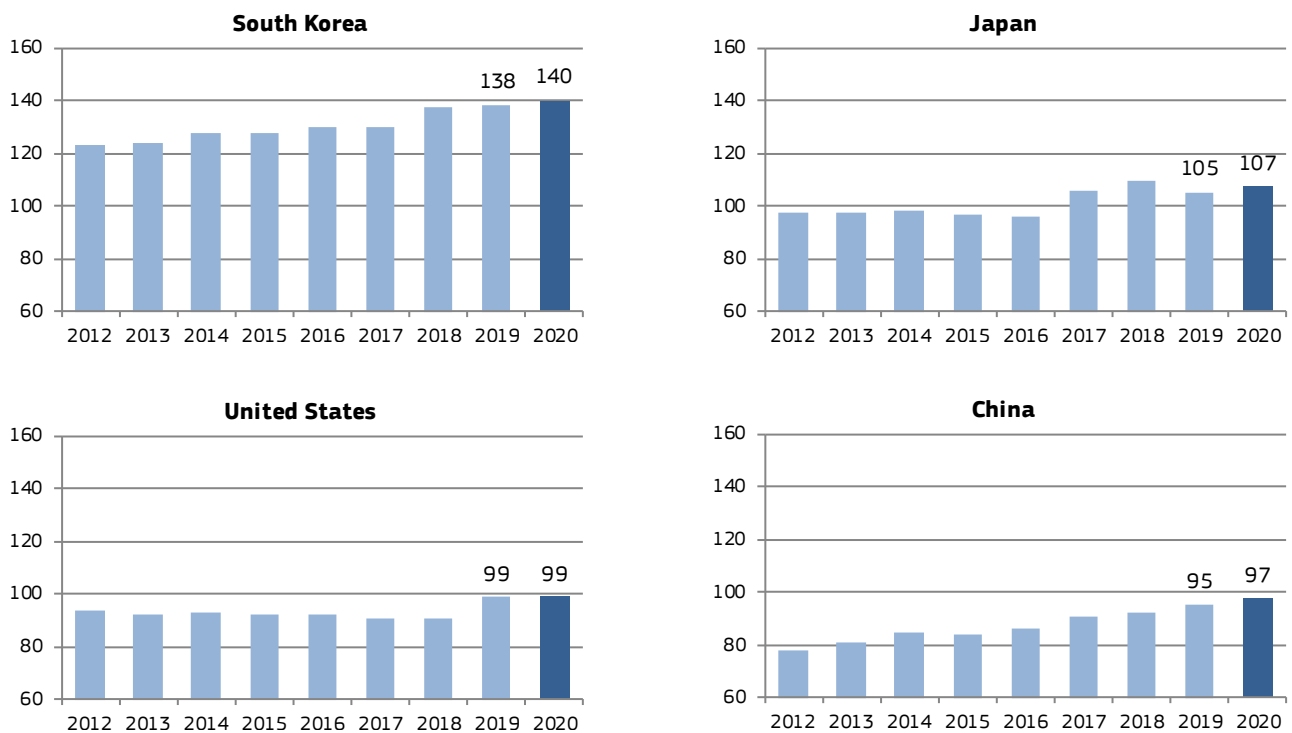
Light blue colums show real performance relative to the EU in 2012, the dark blue column shows the nowcast one year from now relative to the EU in 2012.

7. Country profiles

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

- A graph showing the development of the country's innovation index over time between 2012 and 2019 as compared to the EU performance score in 2012 (blue bars) and relative performance to the EU in 2019 (red dot). For all indicators underlying the innovation index, "2019" refers to the most recent data available; depending on data update schedules, the most recent actual performance year by indicator is 2016, 2017, 2018 or 2019; "2012" refers to data seven years older than the most recent available results.

- A table providing a comparison of the respective country's innovation performance in 2012 and 2019 by indicator and dimension relative to that of the EU in 2012 and 2019 (Annex D shows the difference between both relative scores for all countries and all indicators). Different colour codes highlight strengths and weaknesses in 2012 and 2019[28]. For allocating color codes the precise thresholds in Chapter 8 have been used, but for ease of understanding rounded thresholds are given in the text below the table.

- A table providing data for the contextual indicators, which are used as proxies for structural differences between countries. The EIS 2020 Methodology Report provides detailed definitions for these indicators. Significant differences for those indicators measuring percentage shares or levels, with the indicator value being more than 20% above or below the EU average, are mentioned in the text for the set of structural indicators.

- A table reporting on progress towards the EU targets for 2020 for R&D expenditures and Tertiary educational attainment (targets are provided in http://ec.europa.eu/eurostat/web/europe-2020-indicators/europe-2020-strategy/headline-indicators-scoreboard).

- A box showing links to the Research and Innovation Observatory (RIO) and European Semester country reports. The annual RIO Country Reports analyse and assess the development and performance of national research and innovation systems and related policies in the perspective of EU strategy and goals. The reports also assess the match between national policy priorities and the structural challenges of the respective research and innovation system (https://rio.jrc.ec.europa.eu/). The European Semester provides a framework for the coordination of economic policies across the European Union. It allows EU countries to discuss their economic and budget plans and monitor progress at specific times throughout the year (https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester_en). The European Semester country reports include quantitative and qualitative analyses on framework conditions for innovation.

---

[28] For those dimensions where data are missing for at least one indicator, relative scores for the dimension have been calculated compared to the EU dimension score using all indicators. This can result in relative dimension scores which do not match the relative performance scores for the indicators belonging to that dimension, as the dimension score for the country has been calculated using data for less indicators than the dimension score for the EU. These potential cases are highlighted in the performance tables with an §.

Belgium is a **Strong Innovator**.
Over time, performance has increased relative to that of the EU in 2012.

- Relative to EU in 2012 ◆ Relative to EU in 2019
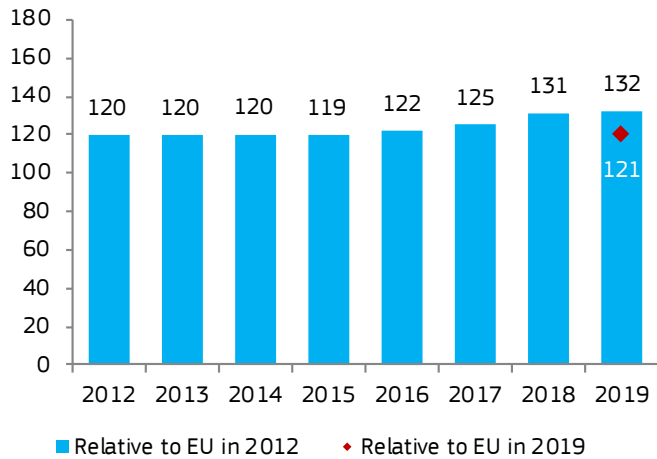
Attractive research systems, *Linkages* and *Innovators* are the strongest innovation dimensions. Belgium scores particularly well on Innovative SMEs collaborating with others, Foreign doctorate students, International scientific co-publications, and Enterprises providing ICT training. *Intellectual assets*, *Employment impacts* and *Innovation-friendly environment* are the weakest innovation dimensions. Low-scoring indicators include Opportunity-driven entrepreneurship, Employment in fast-growing enterprises of innovative sectors, Non-R&D innovation expenditures, and Design applications.

Structural differences with the EU are shown in the table below. Belgium shows the highest positive difference to the EU in Top R&D spending enterprises, GDP per capita and Buyer sophistication, and the biggest negative difference in FDI net inflows, Enterprise births and Employment share in manufacturing.

Belgium	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**121.2**	**119.5**	**132.0**
Human resources	**116.0**	**120.3**	**133.5**
New doctorate graduates	103.3	94.3	113.8
Population with tertiary education	156.5	181.0	199.2
Lifelong learning	78.4	84.4	84.4
Attractive research systems	**167.0**	**166.7**	**190.7**
International scientific co-publications	183.3	196.8	269.2
Most cited publications	131.4	133.6	131.5
Foreign doctorate students	213.7	209.8	246.4
Innovation-friendly environment	**90.9**	**180.0**	**158.1**
Broadband penetration	134.8	170.0	310.0
Opportunity-driven entrepreneurship	41.2	186.8	56.1
Finance and support	**113.5**	**96.3**	**131.1**
R&D expenditure in the public sector	114.9	90.8	112.8
Venture capital expenditures	111.9	105.4	161.7
Firm investments	**122.4**	**132.6**	**159.0**
R&D expenditure in the business sector	135.3	117.8	155.0
Non-R&D innovation expenditures	60.9	92.1	85.4
Enterprises providing ICT training	172.2	192.3	238.5
Innovators	**149.5**	**128.6**	**133.6**
SMEs product/process innovations	151.0	152.4	150.4
SMEs marketing/organizational innovations	142.2	105.2	116.7
SMEs innovating in-house	155.0	130.1	135.0
Linkages	**163.7**	**153.1**	**168.5**
Innovative SMEs collaborating with others	257.6	231.7	255.8
Public-private co-publications	144.9	146.0	163.8
Private co-funding of public R&D exp.	118.9	110.4	119.9
Intellectual assets	**87.5**	**93.4**	**81.7**
PCT patent applications	93.9	98.1	87.1
Trademark applications	97.4	95.1	103.7
Design applications	67.6	85.5	56.7
Employment impacts	**88.5**	**76.6**	**95.5**
Employment in knowledge-intensive activities	125.0	133.8	135.1
Employment fast-growing enterprises	58.9	30.5	63.5
Sales impacts	**104.5**	**86.7**	**103.9**
Medium and high-tech product exports	83.7	80.2	92.7
Knowledge-intensive services exports	104.8	97.5	108.2
Sales of new-to-market/firm innovations	133.1	82.2	111.2

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	BE	EU
Performance and structure of the economy		
GDP per capita (PPS)	35,500	29,100
Average annual GDP growth (%)	1.44	1.84
Employment share manufacturing (NACE C) (%)	12.6	16.6
of which High and medium high-tech (%)	35.8	37.5
Employment share services (NACE G-N) (%)	40.3	41.4
of which Knowledge-intensive services (%)	36.7	34.3
Turnover share SMEs (%)	40.0	38.3
Turnover share large enterprises (%)	35.4	43.2
Foreign-controlled enterprises – share of value added (%)	12.2	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.6	1.1
Total Entrepreneurial Activity (TEA) (%)	6.2	6.7
FDI net inflows (% GDP)	-2.2	2.6
Top R&D spending enterprises per 10 million population	29.9	16.2
Buyer sophistication (1 to 7 best)	4.4	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	74.0	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.0	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.5	3.5
Rule of law (-2.5 to 2.5 best)	1.4	1.1
Demography		
Population size (millions)	11.4	446.2
Average annual population growth (%)	0.46	0.14
Population density (inhabitants/km^2)	374.2	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	2.43	2.76	3.00
Tertiary educational attainment (% of population aged 30-34)	42.7	47.5	47.0

1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/country-analysis/Belgium

Bulgaria is a **Modest Innovator**.
Over time, performance has increased relative to that of the EU in 2012.

■ Relative to EU in 2012   ◆ Relative to EU in 2019

Employment impacts and *Intellectual assets* are the strongest innovation dimensions. Employment in fast-growing enterprises of innovative sectors, Design applications, and Trademark applications, score relatively high above the EU average. *Finance and support, Attractive research systems* and *Innovators* are the weakest innovation dimensions. Bulgaria's lowest indicator scores are on R&D expenditures in the public sector, Public-private co-publications, Most cited publications, and Lifelong learning.

Structural differences with the EU are shown in the table below. Bulgaria shows the highest positive difference to the EU in Average annual change in GDP, Enterprise births and Value-added share foreign-controlled enterprises, and the biggest negative difference in Top R&D spending enterprises, GDP per capita and Employment share high and medium high-tech manufacturing.

Bulgaria	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**45.4**	**42.3**	**49.5**
Human resources	**52.2**	**44.9**	**60.1**
New doctorate graduates	72.6	59.6	80.0
Population with tertiary education	59.7	62.0	76.0
Lifelong learning	16.5	7.8	17.8
Attractive research systems	**25.8**	**25.2**	**29.4**
International scientific co-publications	24.4	24.0	35.8
Most cited publications	20.8	20.1	20.9
Foreign doctorate students	36.3	36.9	41.9
Innovation-friendly environment	**42.9**	**39.7**	**74.6**
Broadband penetration	65.2	80.0	150.0
Opportunity-driven entrepreneurship	17.5	12.7	23.9
Finance and support	**11.6**	**62.8**	**13.5**
R&D expenditure in the public sector	4.8	10.2	4.7
Venture capital expenditures	19.5	151.2	28.2
Firm investments	**40.7**	**42.9**	**52.9**
R&D expenditure in the business sector	35.7	19.9	40.9
Non-R&D innovation expenditures	58.4	45.2	81.9
Enterprises providing ICT training	27.8	69.2	38.5
Innovators	**26.8**	**21.0**	**24.0**
SMEs product/process innovations	33.5	28.6	33.4
SMEs marketing/organizational innovations	19.2	17.8	15.8
SMEs innovating in-house	26.9	17.1	23.4
Linkages	**34.6**	**35.3**	**35.6**
Innovative SMEs collaborating with others	30.1	26.1	29.9
Public-private co-publications	15.4	10.4	17.4
Private co-funding of public R&D exp.	46.1	51.2	46.5
Intellectual assets	**83.4**	**60.5**	**77.9**
PCT patent applications	38.5	29.9	35.7
Trademark applications	107.6	107.4	114.6
Design applications	127.6	65.6	107.0
Employment impacts	**111.3**	**91.9**	**120.1**
Employment in knowledge-intensive activities	56.3	37.8	60.8
Employment fast-growing enterprises	155.9	135.5	167.9
Sales impacts	**40.5**	**27.5**	**40.3**
Medium and high-tech product exports	43.2	18.4	47.9
Knowledge-intensive services exports	45.4	25.1	46.9
Sales of new-to-market/firm innovations	30.3	39.5	25.3

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	BG	EU
Performance and structure of the economy		
GDP per capita (PPS)	15,000	29,100
Average annual GDP growth (%)	3.23	1.84
Employment share manufacturing (NACE C) (%)	19.2	16.6
of which High and medium high-tech (%)	20.4	37.5
Employment share services (NACE G-N) (%)	41.9	41.4
of which Knowledge-intensive services (%)	27.8	34.3
Turnover share SMEs (%)	47.4	38.3
Turnover share large enterprises (%)	30.3	43.2
Foreign-controlled enterprises – share of value added (%)	15.6	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	2.0	1.1
Total Entrepreneurial Activity (TEA) (%)	4.9	6.7
FDI net inflows (% GDP)	2.7	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	3.4	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	71.8	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.9	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.3	3.5
Rule of law (-2.5 to 2.5 best)	0.0	1.1
Demography		
Population size (millions)	7.1	446.2
Average annual population growth (%)	-0.72	0.14
Population density (inhabitants/km²)	64.3	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.95	0.76	1.50
Tertiary educational attainment (% of population aged 30-34)	32.1	32.7	36.0

1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/country-analysis/Bulgaria

Czechia is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2012.

■ Relative to EU in 2012   ◆ Relative to EU in 2019

Employment impacts, *Innovators* and *Sales impacts* are the strongest innovation dimensions. Czechia scores high on Employment in fast-growing enterprises of innovative sectors, Innovative SMEs collaborating with others, Medium and high-tech product exports and Enterprises providing ICT training. *Intellectual assets*, *Finance and support* and *Innovation-friendly environment* are the weakest innovation dimensions. Low-scoring indicators include Venture capital expenditures, Most cited publications, PCT patent applications, and Exports of knowledge intensive services.

Structural differences with the EU are shown in the table below. Czechia shows the highest positive difference to the EU in Value-added share foreign-controlled enterprises, FDI net inflows and Employment share in manufacturing, and the biggest negative difference in Top R&D spending enterprises, Enterprise births and Buyer sophistication.

Czechia	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**84.3**	**83.2**	**91.7**
Human resources	**73.3**	**78.8**	**84.4**
New doctorate graduates	86.3	86.5	95.0
Population with tertiary education	57.1	50.4	72.7
Lifelong learning	78.4	101.1	84.4
Attractive research systems	**73.3**	**55.8**	**83.7**
International scientific co-publications	99.2	80.5	145.7
Most cited publications	45.3	39.1	45.4
Foreign doctorate students	95.3	69.1	109.9
Innovation-friendly environment	**69.9**	**78.8**	**121.5**
Broadband penetration	65.2	80.0	150.0
Opportunity-driven entrepreneurship	75.2	78.0	102.4
Finance and support	**57.8**	**74.7**	**57.8**
R&D expenditure in the public sector	101.9	92.7	100.0
Venture capital expenditures	7.6	44.6	11.0
Firm investments	**93.7**	**102.0**	**121.7**
R&D expenditure in the business sector	81.6	66.8	93.5
Non-R&D innovation expenditures	89.0	116.9	124.7
Enterprises providing ICT training	111.1	130.8	153.8
Innovators	**97.0**	**90.7**	**86.7**
SMEs product/process innovations	96.7	87.4	96.4
SMEs marketing/organizational innovations	84.6	103.1	69.4
SMEs innovating in-house	109.6	81.1	95.4
Linkages	**90.0**	**73.8**	**92.7**
Innovative SMEs collaborating with others	140.4	110.7	139.5
Public-private co-publications	71.5	76.7	80.9
Private co-funding of public R&D exp.	69.9	51.2	70.5
Intellectual assets	**55.3**	**61.9**	**51.7**
PCT patent applications	45.5	41.9	42.2
Trademark applications	68.6	74.6	73.1
Design applications	56.9	79.3	47.8
Employment impacts	**137.9**	**123.6**	**148.8**
Employment in knowledge-intensive activities	93.8	89.2	101.4
Employment fast-growing enterprises	173.6	151.3	187.0
Sales impacts	**95.2**	**93.3**	**94.7**
Medium and high-tech product exports	129.0	126.7	143.0
Knowledge-intensive services exports	50.7	45.1	52.4
Sales of new-to-market/firm innovations	104.8	108.0	87.5

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	CZ	EU
Performance and structure of the economy		
GDP per capita (PPS)	26,800	29,100
Average annual GDP growth (%)	2.72	1.84
Employment share manufacturing (NACE C) (%)	27.8	16.6
of which High and medium high-tech (%)	41.1	37.5
Employment share services (NACE G-N) (%)	35.6	41.4
of which Knowledge-intensive services (%)	35.4	34.3
Turnover share SMEs (%)	39.0	38.3
Turnover share large enterprises (%)	43.5	43.2
Foreign-controlled enterprises – share of value added (%)	21.3	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.6	1.1
Total Entrepreneurial Activity (TEA) (%)	7.3	6.7
FDI net inflows (% GDP)	4.7	2.6
Top R&D spending enterprises per 10 million population	1.9	16.2
Buyer sophistication (1 to 7 best)	3.0	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	76.4	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.6	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.1	3.5
Rule of law (-2.5 to 2.5 best)	1.1	1.1
Demography		
Population size (millions)	10.6	446.2
Average annual population growth (%)	0.33	0.14
Population density (inhabitants/km^2)	137.2	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.93	1.93	1.00
Tertiary educational attainment (% of population aged 30-34)	30.1	34.9	32.0

1 Sources are provided in the introduction to the country profiles.

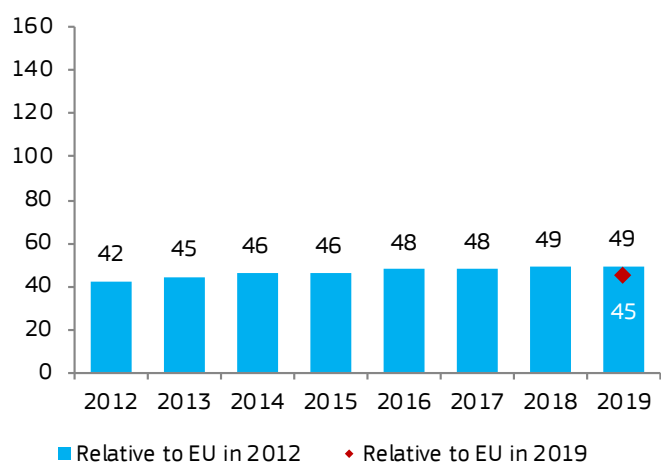**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/country-analysis/Czech-Republic

Denmark is an **Innovation Leader**.
Over time, performance has remained the same relative to that of the EU in 2012.

■ Relative to EU in 2012   ◆ Relative to EU in 2019
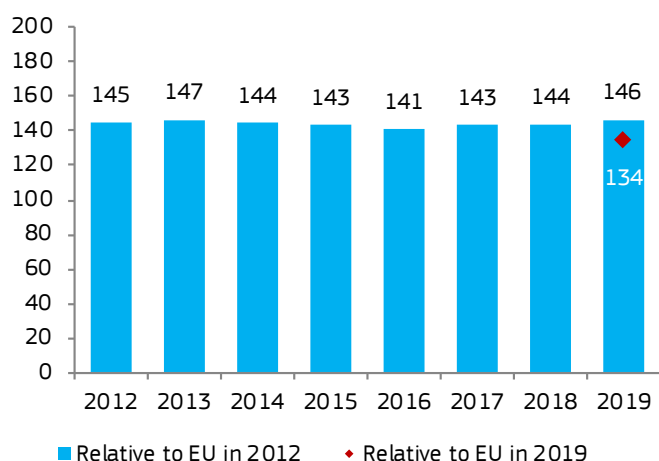
Attractive research systems, Innovation-friendly environment and *Human resources* are the strongest innovation dimensions. Denmark scores particularly well on Public-private co-publications, International scientific co-publications, Lifelong learning, and Opportunity-driven entrepreneurship. *Sales impacts* and *Innovators* are the weakest innovation dimensions. Low-scoring indicators include Sales of new-to-market and new-to-firm product innovations, Non-R&D innovation expenditures, Private co-funding of public R&D expenditures, and SMEs innovating in-house.

Structural differences with the EU are shown in the table below. Denmark shows the highest positive difference to the EU in Top R&D spending enterprises, Basic-school entrepreneurial education and training and GDP per capita, and the biggest negative difference in Enterprise births, FDI net inflows and Employment share in manufacturing.

Denmark	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**134.5**	**144.7**	**146.4**
Human resources	**179.7**	**210.0**	**206.9**
New doctorate graduates	177.3	176.9	195.2
Population with tertiary education	141.6	176.9	180.2
Lifelong learning	233.0	287.8	251.1
Attractive research systems	**196.6**	**184.9**	**224.6**
International scientific co-publications	277.1	278.8	406.9
Most cited publications	146.2	155.1	146.3
Foreign doctorate students	198.5	165.2	228.8
Innovation–friendly environment	**189.5**	**256.1**	**329.6**
Broadband penetration	178.3	250.0	410.0
Opportunity-driven entrepreneurship	202.3	260.2	275.6
Finance and support	**145.4**	**142.9**	**167.9**
R&D expenditure in the public sector	165.3	144.0	162.3
Venture capital expenditures	122.6	141.2	177.3
Firm investments	**107.5**	**130.1**	**139.6**
R&D expenditure in the business sector	135.3	155.9	155.0
Non-R&D innovation expenditures	43.6	52.4	61.0
Enterprises providing ICT training	144.4	176.9	200.0
Innovators	**96.9**	**107.9**	**86.6**
SMEs product/process innovations	98.0	121.0	97.6
SMEs marketing/organizational innovations	117.6	108.3	96.5
SMEs innovating in-house	75.4	94.9	65.7
Linkages	**149.7**	**152.9**	**154.1**
Innovative SMEs collaborating with others	144.0	174.4	142.9
Public-private co-publications	324.9	322.6	367.3
Private co-funding of public R&D exp.	70.8	69.5	71.5
Intellectual assets	**147.1**	**136.6**	**137.4**
PCT patent applications	132.7	126.2	123.2
Trademark applications	132.9	125.5	141.4
Design applications	183.5	160.0	153.9
Employment impacts	**109.7**	**138.3**	**118.3**
Employment in knowledge-intensive activities	121.3	128.4	131.1
Employment fast-growing enterprises	100.3	146.3	108.1
Sales impacts	**74.3**	**98.8**	**73.8**
Medium and high-tech product exports	85.6	69.1	94.9
Knowledge-intensive services exports	100.5	122.7	103.8
Sales of new-to-market/firm innovations	24.8	105.3	20.7

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	DK	EU
Performance and structure of the economy		
GDP per capita (PPS)	38,400	29,100
Average annual GDP growth (%)	2.38	1.84
Employment share manufacturing (NACE C) (%)	11.7	16.6
of which High and medium high-tech (%)	43.2	37.5
Employment share services (NACE G-N) (%)	41.1	41.4
of which Knowledge-intensive services (%)	35.1	34.3
Turnover share SMEs (%)	42.8	38.3
Turnover share large enterprises (%)	39.2	43.2
Foreign-controlled enterprises – share of value added (%)	10.6	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.4	1.1
Total Entrepreneurial Activity (TEA) (%)	5.5	6.7
FDI net inflows (% GDP)	1.3	2.6
Top R&D spending enterprises per 10 million population	68.5	16.2
Buyer sophistication (1 to 7 best)	3.9	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	85.0	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	3.1	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.5	3.5
Rule of law (-2.5 to 2.5 best)	1.9	1.1
Demography		
Population size (millions)	5.8	446.2
Average annual population growth (%)	0.50	0.14
Population density (inhabitants/km^2)	137.2	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	3.06	3.03	3.00
Tertiary educational attainment (% of population aged 30-34)	45.7	49.1	40.0

1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:
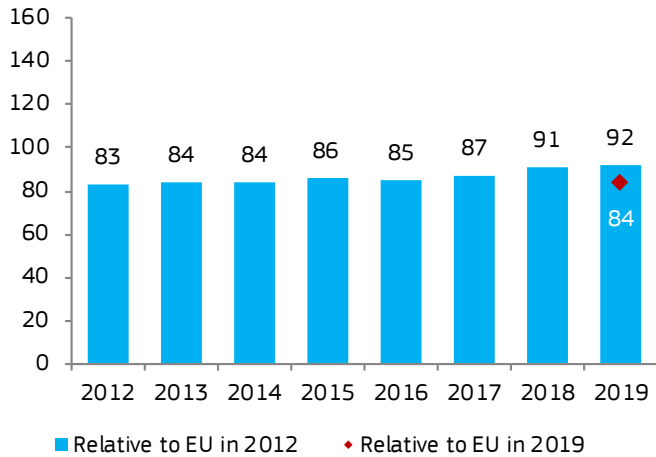
https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Denmark

Germany is a **Strong Innovator**.
Over time, performance has remained the same compared to that of the EU in 2012.

■ Relative to EU in 2012   ◆ Relative to EU in 2019
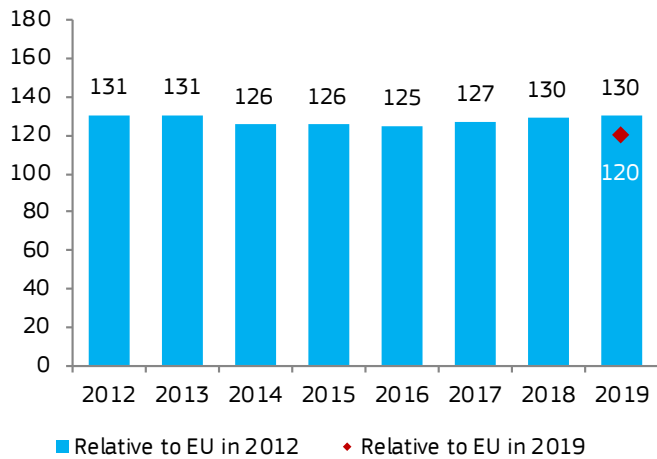
Firm investments, Innovators and *Linkages* are the strongest innovation dimensions. Germany performs particularly well on Public-private co-publications, R&D expenditure in the business sector, Enterprises providing ICT training, and Public R&D expenditures. *Attractive research systems*, *Human resources* and *Innovation-friendly environment* are the weakest innovation dimensions. Germany's lowest indicator scores are on Foreign doctorate students, Population with tertiary education, Lifelong learning, and Venture capital expenditures.

Structural differences with the EU are shown in the table below. Germany shows the highest positive difference to the EU in Top R&D spending enterprises, Employment share high and medium high-tech manufacturing and Government procurement of advanced technology products, and the biggest negative difference in Average annual change in GDP, Enterprise births and FDI net inflows.

Germany	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**119.9**	**131.0**	**130.5**
Human resources	**94.4**	**98.7**	**108.7**
New doctorate graduates	146.8	170.9	161.7
Population with tertiary education	59.1	38.0	75.2
Lifelong learning	75.3	77.8	81.1
Attractive research systems	**92.2**	**95.3**	**105.4**
International scientific co-publications	97.3	110.2	142.9
Most cited publications	110.2	114.3	110.2
Foreign doctorate students	53.8	42.3	62.0
Innovation-friendly environment	**97.6**	**91.2**	**169.8**
Broadband penetration	91.3	90.0	210.0
Opportunity-driven entrepreneurship	104.8	92.0	142.7
Finance and support	**119.8**	**115.9**	**138.4**
R&D expenditure in the public sector	148.5	138.5	145.8
Venture capital expenditures	87.0	78.0	125.8
Firm investments	**146.3**	**163.7**	**190.0**
R&D expenditure in the business sector	150.2	151.0	172.0
Non-R&D innovation expenditures	138.9	196.6	194.7
Enterprises providing ICT training	150.0	146.2	207.7
Innovators	**136.9**	**158.5**	**122.4**
SMEs product/process innovations	127.3	155.3	126.8
SMEs marketing/organizational innovations	144.2	163.4	118.4
SMEs innovating in-house	140.4	156.4	122.2
Linkages	**135.6**	**152.6**	**139.6**
Innovative SMEs collaborating with others	90.1	156.6	89.9
Public-private co-publications	163.9	169.2	185.3
Private co-funding of public R&D exp.	148.0	143.4	149.3
Intellectual assets	**128.2**	**139.2**	**119.8**
PCT patent applications	134.8	138.9	125.1
Trademark applications	110.8	126.6	117.9
Design applications	135.8	149.7	113.9
Employment impacts	**105.6**	**129.2**	**113.9**
Employment in knowledge-intensive activities	113.8	131.1	123.0
Employment fast-growing enterprises	98.9	127.7	106.6
Sales impacts	**119.8**	**122.5**	**119.1**
Medium and high-tech product exports	128.5	136.9	142.4
Knowledge-intensive services exports	112.9	119.5	116.6
Sales of new-to-market/firm innovations	116.3	110.2	97.1

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	DE	EU
Performance and structure of the economy		
GDP per capita (PPS)	36,900	29,100
Average annual GDP growth (%)	1.05	1.84
Employment share manufacturing (NACE C) (%)	19.1	16.6
of which High and medium high-tech (%)	51.5	37.5
Employment share services (NACE G-N) (%)	40.7	41.4
of which Knowledge-intensive services (%)	34.1	34.3
Turnover share SMEs (%)	36.2	38.3
Turnover share large enterprises (%)	52.2	43.2
Foreign-controlled enterprises – share of value added (%)	12.2	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.6	1.1
Total Entrepreneurial Activity (TEA) (%)	6.0	6.7
FDI net inflows (% GDP)	2.3	2.6
Top R&D spending enterprises per 10 million population	26.7	16.2
Buyer sophistication (1 to 7 best)	4.6	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	79.5	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.8	1.9
Govt. procurement of advanced technology products (1 to 7 best)	4.6	3.5
Rule of law (-2.5 to 2.5 best)	1.6	1.1
Demography		
Population size (millions)	82.8	446.2
Average annual population growth (%)	0.30	0.14
Population density (inhabitants/km^2)	233.9	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	2.93	3.13	3.00
Tertiary educational attainment (% of population aged 30-34)	32.3	35.2	42.0

1 Sources are provided in the introduction to the country profiles.

**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Germany

Estonia is a **Strong Innovator**.

Over time, performance has increased relative to that of the EU in 2012. The strong increase in 2018 is largely explained by improved performance on the indicators using CIS data.

Relative to EU in 2012 ◆ Relative to EU in 2019

Linkages, Human resources, and *Intellectual assets* are the strongest innovation dimensions. Estonia scores high on Innovative SMEs collaborating with others, Trademark applications, Lifelong learning, and Non-R&D innovation expenditures. *Sales impacts, Employment impacts* and *Innovation-friendly environment* are the weakest innovation dimensions. Low-scoring indicators include SMEs with marketing or organizational innovations, R&D expenditures in the business sector, Employment in fast-growing enterprises of innovative sectors, and Medium and high-tech product exports.

Structural differences with the EU are shown in the table below. Estonia shows the highest positive difference to the EU in Total Entrepreneurial Activity, Average annual change in GDP and FDI net inflows, and the biggest negative difference in Top R&D spending enterprises, Turnover share large enterprises and Employment share high and medium high-tech manufacturing.

Estonia	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**99.0**	**92.7**	**107.7**
Human resources	**122.0**	**105.7**	**140.5**
New doctorate graduates	60.8	62.1	66.9
Population with tertiary education	126.0	138.8	160.3
Lifelong learning	193.8	122.2	208.9
Attractive research systems	**106.5**	**75.1**	**121.6**
International scientific co-publications	171.8	121.5	252.4
Most cited publications	81.1	72.3	81.1
Foreign doctorate students	79.6	40.1	91.7
Innovation-friendly environment	**79.3**	**94.6**	**138.0**
Broadband penetration	73.9	80.0	170.0
Opportunity-driven entrepreneurship	85.5	104.4	116.4
Finance and support	**90.8**	**119.0**	**104.9**
R&D expenditure in the public sector	113.1	116.5	111.0
Venture capital expenditures	65.4	123.2	94.6
Firm investments	**95.0**	**110.3**	**123.3**
R&D expenditure in the business sector	39.2	113.8	45.0
Non-R&D innovation expenditures	178.5	161.7	250.2
Enterprises providing ICT training	66.7	53.8	92.3
Innovators	**106.3**	**102.3**	**95.0**
SMEs product/process innovations	128.5	125.2	128.1
SMEs marketing/organizational innovations	38.7	85.5	31.8
SMEs innovating in-house	148.2	97.9	129.1
Linkages	**129.9**	**108.0**	**133.8**
Innovative SMEs collaborating with others	267.0	211.7	265.1
Public-private co-publications	81.4	54.1	92.1
Private co-funding of public R&D exp.	74.5	70.4	75.2
Intellectual assets	**120.7**	**92.7**	**112.7**
PCT patent applications	67.3	76.2	62.4
Trademark applications	209.2	133.9	222.7
Design applications	112.8	82.8	94.6
Employment impacts	**73.3**	**57.4**	**79.1**
Employment in knowledge-intensive activities	105.0	68.9	113.5
Employment fast-growing enterprises	47.7	48.2	51.4
Sales impacts	**66.8**	**67.3**	**66.4**
Medium and high-tech product exports	55.2	63.1	61.2
Knowledge-intensive services exports	64.8	57.4	66.9
Sales of new-to-market/firm innovations	85.5	81.8	71.4

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	EE	EU
Performance and structure of the economy		
GDP per capita (PPS)	23,700	29,100
Average annual GDP growth (%)	4.55	1.84
Employment share manufacturing (NACE C) (%)	18.8	16.6
of which High and medium high-tech (%)	21.0	37.5
Employment share services (NACE G-N) (%)	40.9	41.4
of which Knowledge-intensive services (%)	31.7	34.3
Turnover share SMEs (%)	48.7	38.3
Turnover share large enterprises (%)	21.7	43.2
Foreign-controlled enterprises – share of value added (%)	12.3	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.0	1.1
Total Entrepreneurial Activity (TEA) (%)	19.4	6.7
FDI net inflows (% GDP)	4.7	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	3.7	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	80.7	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	3.0	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.7	3.5
Rule of law (-2.5 to 2.5 best)	1.2	1.1
Demography		
Population size (millions)	1.3	446.2
Average annual population growth (%)	0.35	0.14
Population density (inhabitants/km²)	30.3	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.46	1.40	3.00
Tertiary educational attainment (% of population aged 30-34)	45.3	46.6	40.0

1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Estonia

Ireland is a **Strong Innovator**.
Over time, performance has increased relative to that of the EU in 2012.

- Relative to EU in 2012 ◆ Relative to EU in 2019

Employment impacts, *Human resources* and *Attractive research systems* are the strongest innovation dimensions. Ireland scores particularly well on Population with tertiary education, Employment in fast-growing enterprises of innovative sectors, Employment in knowledge-intensive activities, and International scientific co-publications. *Intellectual assets*, *Finance and support* and *Linkages* are the weakest innovation dimensions. Low-scoring indicators include R&D expenditures in the public sector, Design applications, Private co-funding of public R&D expenditures, and Trademark applications.

Structural differences with the EU are shown in the table below. Ireland shows the highest positive difference to the EU in FDI net inflows, Average annual change in GDP and Top R&D spending enterprises, and the biggest negative difference in Employment share in manufacturing, Turnover share SMEs and Enterprise births.

Ireland	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**112.0**	**112.1**	**121.9**
Human resources	**152.2**	**157.5**	**175.2**
New doctorate graduates	119.0	123.5	131.1
Population with tertiary education	208.4	255.4	265.3
Lifelong learning	119.6	90.0	128.9
Attractive research systems	**149.8**	**159.3**	**171.1**
International scientific co-publications	180.0	170.0	264.4
Most cited publications	123.7	115.9	123.8
Foreign doctorate students	163.5	241.5	188.5
Innovation–friendly environment	**86.0**	**62.3**	**149.5**
Broadband penetration	95.7	100.0	220.0
Opportunity-driven entrepreneurship	75.0	37.0	102.2
Finance and support	**72.0**	**117.2**	**72.0**
R&D expenditure in the public sector	19.7	52.3	19.7
Venture capital expenditures	131.5	226.1	131.5
Firm investments	**87.7**	**102.2**	**113.9**
R&D expenditure in the business sector	58.3	85.4	66.8
Non-R&D innovation expenditures	62.0	49.2	86.9
Enterprises providing ICT training	144.4	176.9	200.0
Innovators	**132.8**	**128.4**	**118.7**
SMEs product/process innovations	114.8	127.5	114.4
SMEs marketing/organizational innovations	156.8	116.6	128.8
SMEs innovating in-house	129.0	141.7	112.3
Linkages	**81.7**	**82.2**	**84.1**
Innovative SMEs collaborating with others	128.5	131.2	127.3
Public-private co-publications	120.7	115.9	136.5
Private co-funding of public R&D exp.	36.8	39.7	37.1
Intellectual assets	**57.1**	**61.4**	**53.4**
PCT patent applications	70.5	75.9	65.4
Trademark applications	58.1	80.8	61.9
Design applications	35.6	25.7	29.8
Employment impacts	**186.2**	**172.4**	**200.9**
Employment in knowledge-intensive activities	181.3	204.1	195.9
Employment fast-growing enterprises	190.2	146.9	204.8
Sales impacts	**129.4**	**98.3**	**128.7**
Medium and high-tech product exports	99.8	86.4	110.6
Knowledge-intensive services exports	147.6	152.5	152.5
Sales of new-to-market/firm innovations	147.5	55.0	123.2

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	IE	EU
Performance and structure of the economy		
GDP per capita (PPS)	54,900	29,100
Average annual GDP growth (%)	6.85	1.84
Employment share manufacturing (NACE C) (%)	11.5	16.6
of which High and medium high-tech (%)	39.9	37.5
Employment share services (NACE G-N) (%)	46.7	41.4
of which Knowledge-intensive services (%)	39.4	34.3
Turnover share SMEs (%)	32.4	38.3
Turnover share large enterprises (%)	45.2	43.2
Foreign-controlled enterprises – share of value added (%)	35.3	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.0	1.1
Total Entrepreneurial Activity (TEA) (%)	10.3	6.7
FDI net inflows (% GDP)	20.2	2.6
Top R&D spending enterprises per 10 million population	58.6	16.2
Buyer sophistication (1 to 7 best)	4.3	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	79.8	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.1	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.5	3.5
Rule of law (-2.5 to 2.5 best)	1.5	1.1
Demography		
Population size (millions)	4.8	446.2
Average annual population growth (%)	1.24	0.14
Population density (inhabitants/km^2)	70.1	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.18	1.15	2.00
Tertiary educational attainment (% of population aged 30-34)	53.8	55.9	60.0

1 Sources are provided in the introduction to the country profiles.

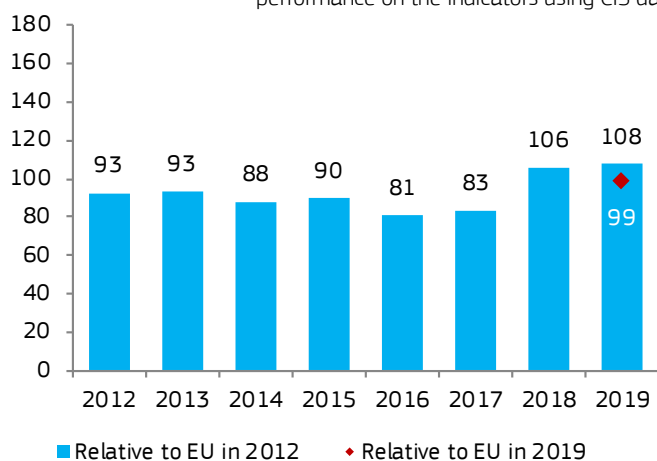**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Ireland

Greece is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2012. The strong increase in 2018 is largely explained by improved performance on the indicators using CIS data.

Relative to EU in 2012 ◆ Relative to EU in 2019
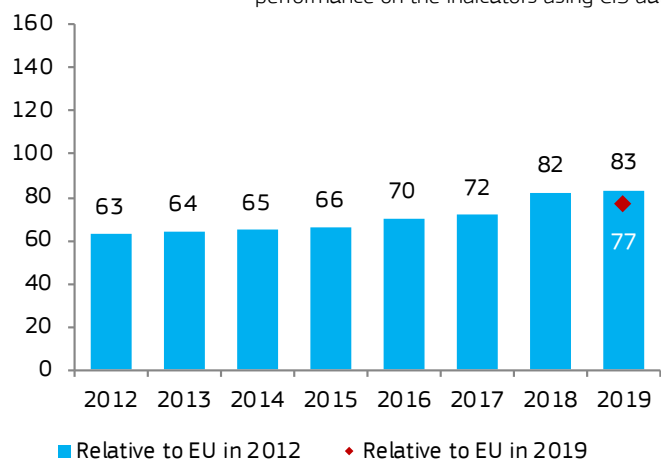
Innovators and *Linkages* are the strongest innovation dimensions where Greece performs above the EU average. Greece performs particularly well on Innovative SMEs collaborating with others, SMEs innovating in-house, SMEs with marketing or /organizational innovations and Sales of new-to-market and new-to-firm innovations. *Intellectual assets*, *Innovation-friendly environment*, and *Employment impacts* are the weakest innovation dimensions. Greece's lowest indicator scores are for Foreign doctorate students, Medium and high-tech product exports, Design applications, and Venture capital expenditures.

Structural differences with the EU are shown in the table below. Greece shows the highest positive difference to the EU in Enterprise births, Employment share in services and Average annual change in GDP, and the biggest negative difference in Top R&D spending enterprises, Value-added share foreign-controlled enterprises and Employment share high and medium high-tech manufacturing.

Greece	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**76.7**	**62.8**	**83.5**
Human resources	**80.5**	**64.7**	**92.7**
New doctorate graduates	72.0	46.9	79.3
Population with tertiary education	121.4	123.1	154.5
Lifelong learning	37.1	21.1	40.0
Attractive research systems	**68.3**	**64.1**	**78.0**
International scientific co-publications	85.8	83.9	126.0
Most cited publications	91.2	81.3	91.3
Foreign doctorate students	6.7	10.6	7.8
Innovation-friendly environment	**44.1**	**31.7**	**76.7**
Broadband penetration	34.8	20.0	80.0
Opportunity-driven entrepreneurship	54.7	39.6	74.5
Finance and support	**53.3**	**31.4**	**61.5**
R&D expenditure in the public sector	75.7	45.0	74.3
Venture capital expenditures	27.6	8.6	39.9
Firm investments	**65.7**	**73.9**	**85.4**
R&D expenditure in the business sector	37.8	15.8	43.3
Non-R&D innovation expenditures	103.7	142.3	145.4
Enterprises providing ICT training	55.6	76.9	76.9
Innovators	**146.5**	**93.4**	**131.0**
SMEs product/process innovations	139.8	83.8	139.3
SMEs marketing/organizational innovations	147.3	116.5	120.9
SMEs innovating in-house	153.4	78.6	133.4
Linkages	**125.9**	**86.3**	**129.7**
Innovative SMEs collaborating with others	264.3	137.3	262.4
Public-private co-publications	45.4	34.8	51.4
Private co-funding of public R&D exp.	84.8	78.2	85.5
Intellectual assets	**41.9**	**23.1**	**39.1**
PCT patent applications	39.9	31.1	37.0
Trademark applications	67.8	26.7	72.2
Design applications	18.7	9.3	15.7
Employment impacts	**53.2**	**100.1**	**57.4**
Employment in knowledge-intensive activities	80.0	77.0	86.5
Employment fast-growing enterprises	31.5	118.7	33.9
Sales impacts	**67.9**	**51.5**	**67.6**
Medium and high-tech product exports	10.1	0.0	11.2
Knowledge-intensive services exports	70.6	79.5	72.9
Sales of new-to-market/firm innovations	145.4	76.8	121.4

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	EL	EU
Performance and structure of the economy		
GDP per capita (PPS)	20,400	29,100
Average annual GDP growth (%)	1.91	1.84
Employment share manufacturing (NACE C) (%)	9.5	16.6
of which High and medium high-tech (%)	14.4	37.5
Employment share services (NACE G-N) (%)	46.1	41.4
of which Knowledge-intensive services (%)	28.4	34.3
Turnover share SMEs (%)	n/a	38.3
Turnover share large enterprises (%)	n/a	43.2
Foreign-controlled enterprises – share of value added (%)	4.1	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	2.3	1.1
Total Entrepreneurial Activity (TEA) (%)	6.5	6.7
FDI net inflows (% GDP)	1.6	2.6
Top R&D spending enterprises per 10 million population	3.4	16.2
Buyer sophistication (1 to 7 best)	3.3	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	67.6	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.8	1.9
Govt. procurement of advanced technology products (1 to 7 best)	2.6	3.5
Rule of law (-2.5 to 2.5 best)	0.1	1.1
Demography		
Population size (millions)	10.7	446.2
Average annual population growth (%)	-0.20	0.14
Population density (inhabitants/km^2)	82.4	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.96	1.18	1.20
Tertiary educational attainment (% of population aged 30-34)	40.4	43.6	32.0

1 Sources are provided in the introduction to the country profiles.

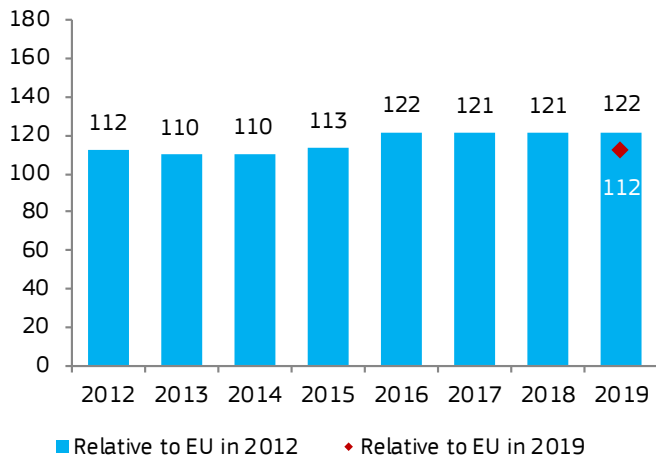**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Greece

Spain is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2012, with a temporary decline in 2014 and 2015.

Human resources, *Innovation-friendly environment* and *Employment impacts* are the strongest innovation dimensions. Spain scores high on New doctorate graduates, Sales of new-to-market and new-to-firm product innovations, Broadband penetration, and Population with tertiary education. *Innovators*, *Firm investments* and *Linkages* are the weakest innovation dimensions. Low-scoring indicators include Exports of knowledge-intensive services, SMEs innovating in-house, SMEs with product or process innovations, and R&D expenditures in the business sector.

Structural differences with the EU are shown in the table below. Spain shows the highest positive difference to the EU in Enterprise births, Employment share in services and Average annual change in GDP, and the biggest negative difference in Top R&D spending enterprises, Employment share in manufacturing and Value-added share foreign-controlled enterprises.

Spain	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**85.1**	**78.1**	**92.6**
Human resources	**154.5**	**111.1**	**177.9**
New doctorate graduates	208.1	86.4	229.2
Population with tertiary education	145.5	146.3	185.1
Lifelong learning	99.0	102.2	106.7
Attractive research systems	**92.1**	**105.0**	**105.2**
International scientific co-publications	91.7	88.7	134.7
Most cited publications	87.6	91.9	87.7
Foreign doctorate students	100.8	146.8	116.2
Innovation-friendly environment	**113.4**	**69.7**	**197.3**
Broadband penetration	169.6	100.0	390.0
Opportunity-driven entrepreneurship	49.7	49.3	67.7
Finance and support	**78.3**	**85.4**	**90.4**
R&D expenditure in the public sector	66.4	83.5	65.2
Venture capital expenditures	91.8	88.7	132.8
Firm investments	**64.4**	**67.4**	**83.6**
R&D expenditure in the business sector	47.0	53.9	53.9
Non-R&D innovation expenditures	52.5	67.2	73.6
Enterprises providing ICT training	94.4	84.6	130.8
Innovators	**45.8**	**51.7**	**40.9**
SMEs product/process innovations	40.7	67.5	40.6
SMEs marketing/organizational innovations	67.2	57.1	55.1
SMEs innovating in-house	30.4	30.8	26.5
Linkages	**66.0**	**76.2**	**67.9**
Innovative SMEs collaborating with others	64.4	56.3	63.9
Public-private co-publications	56.8	56.6	64.2
Private co-funding of public R&D exp.	71.2	95.9	71.8
Intellectual assets	**75.1**	**77.5**	**70.1**
PCT patent applications	61.3	65.5	56.9
Trademark applications	106.2	104.8	113.0
Design applications	64.7	72.4	54.3
Employment impacts	**106.5**	**66.7**	**114.8**
Employment in knowledge-intensive activities	81.3	82.4	87.8
Employment fast-growing enterprises	126.8	54.0	136.6
Sales impacts	**84.4**	**80.8**	**84.0**
Medium and high-tech product exports	71.8	73.0	79.6
Knowledge-intensive services exports	29.1	30.4	30.0
Sales of new-to-market/firm innovations	172.7	141.1	144.3

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	ES	EU
Performance and structure of the economy		
GDP per capita (PPS)	27,500	29,100
Average annual GDP growth (%)	2.15	1.84
Employment share manufacturing (NACE C) (%)	12.6	16.6
of which High and medium high-tech (%)	31.9	37.5
Employment share services (NACE G-N) (%)	49.3	41.4
of which Knowledge-intensive services (%)	31.3	34.3
Turnover share SMEs (%)	39.2	38.3
Turnover share large enterprises (%)	37.9	43.2
Foreign-controlled enterprises – share of value added (%)	9.2	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.4	1.1
Total Entrepreneurial Activity (TEA) (%)	6.2	6.7
FDI net inflows (% GDP)	3.0	2.6
Top R&D spending enterprises per 10 million population	4.4	16.2
Buyer sophistication (1 to 7 best)	3.5	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	77.8	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.0	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.2	3.5
Rule of law (-2.5 to 2.5 best)	1.0	1.1
Demography		
Population size (millions)	46.7	446.2
Average annual population growth (%)	0.44	0.14
Population density (inhabitants/km^2)	92.8	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.22	1.24	2.00
Tertiary educational attainment (% of population aged 30-34)	40.9	44.4	44.0

1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Spain

France is a **Strong Innovator**.
Over time, performance has increased relative to that of the EU in 2012, with a small decline in the latest two years.
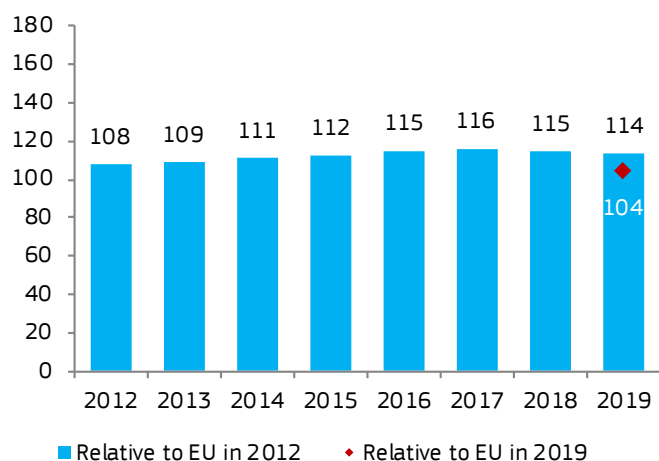
■ Relative to EU in 2012   ◆ Relative to EU in 2019

Human resources, Finance and support and *Innovators* are the strongest innovation dimensions. France scores particularly well on Foreign doctorate students, Lifelong learning, Venture capital expenditures, and Population with tertiary education. *Innovation-friendly environment, Firm investments* and *Intellectual assets* are the weakest innovation dimensions. Overall, France's lowest indicator scores include Broadband penetration, Non-R&D innovation expenditures, Employment in knowledge-intensive activities, and Design applications.

Structural differences with the EU are shown in the table below. France shows the highest positive difference to the EU in Buyer sophistication, Employment share knowledge-intensive services and Government procurement of advanced technology products, and the biggest negative difference in Enterprise births, Value-added share foreign-controlled enterprises and FDI net inflows

France	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**104.5**	**107.6**	**113.7**
Human resources	**138.4**	**147.7**	**159.4**
New doctorate graduates	85.1	95.4	93.7
Population with tertiary education	155.8	169.4	198.3
Lifelong learning	182.5	187.8	196.7
Attractive research systems	**123.4**	**144.8**	**140.9**
International scientific co-publications	87.2	101.3	128.1
Most cited publications	90.5	101.8	90.6
Foreign doctorate students	224.0	273.5	258.2
Innovation-friendly environment	**82.3**	**114.4**	**143.1**
Broadband penetration	56.5	90.0	130.0
Opportunity-driven entrepreneurship	111.6	130.8	152.0
Finance and support	**137.8**	**128.4**	**159.1**
R&D expenditure in the public sector	101.9	105.5	100.0
Venture capital expenditures	178.7	166.7	258.4
Firm investments	**83.9**	**97.4**	**108.9**
R&D expenditure in the business sector	99.3	110.5	113.8
Non-R&D innovation expenditures	63.5	63.4	88.9
Enterprises providing ICT training	88.9	115.4	123.1
Innovators	**127.5**	**94.9**	**114.0**
SMEs product/process innovations	115.7	87.3	115.3
SMEs marketing/organizational innovations	142.8	108.9	117.3
SMEs innovating in-house	125.5	87.8	109.3
Linkages	**100.1**	**97.2**	**103.1**
Innovative SMEs collaborating with others	150.0	121.0	148.9
Public-private co-publications	89.0	112.1	100.6
Private co-funding of public R&D exp.	76.9	77.2	77.6
Intellectual assets	**84.4**	**88.2**	**78.9**
PCT patent applications	101.4	101.3	94.1
Trademark applications	76.9	83.5	81.8
Design applications	66.0	73.9	55.4
Employment impacts	**86.2**	**108.9**	**93.0**
Employment in knowledge-intensive activities	112.5	112.2	121.6
Employment fast-growing enterprises	64.9	106.2	69.9
Sales impacts	**89.2**	**92.1**	**88.7**
Medium and high-tech product exports	104.3	110.6	115.7
Knowledge-intensive services exports	86.2	92.0	89.1
Sales of new-to-market/firm innovations	71.6	72.5	59.8

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	FR	EU
Performance and structure of the economy		
GDP per capita (PPS)	31,300	29,100
Average annual GDP growth (%)	1.51	1.84
Employment share manufacturing (NACE C) (%)	12.2	16.6
of which High and medium high-tech (%)	36.5	37.5
Employment share services (NACE G-N) (%)	41.1	41.4
of which Knowledge-intensive services (%)	37.3	34.3
Turnover share SMEs (%)	33.6	38.3
Turnover share large enterprises (%)	45.0	43.2
Foreign-controlled enterprises – share of value added (%)	6.8	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.5	1.1
Total Entrepreneurial Activity (TEA) (%)	5.0	6.7
FDI net inflows (% GDP)	1.6	2.6
Top R&D spending enterprises per 10 million population	16.5	16.2
Buyer sophistication (1 to 7 best)	4.1	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	76.5	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.8	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.8	3.5
Rule of law (-2.5 to 2.5 best)	1.4	1.1
Demography		
Population size (millions)	66.9	446.2
Average annual population growth (%)	0.15	0.14
Population density (inhabitants/km^2)	105.5	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	2.27	2.20	3.00
Tertiary educational attainment (% of population aged 30-34)	45.0	47.3	50.0

1 Sources are provided in the introduction to the country profiles.

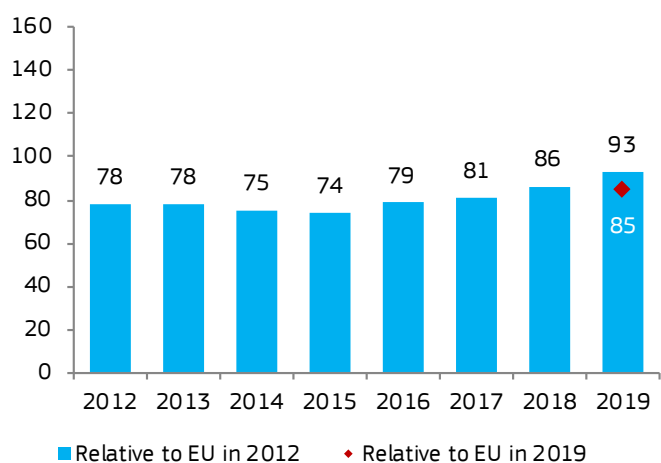**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/France

Croatia is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2011. The strong increase in 2018 is entirely explained by improved performance on the indicators using CIS data.

- Relative to EU in 2012   ◆ Relative to EU in 2019

Innovators and *Firm investments* are the strongest innovation dimensions. Croatia scores well on Non-R&D innovation expenditures, SMEs with marketing or organizational innovations, Innovative SMEs collaborating with others, and Enterprises providing ICT training. *Intellectual assets*, *Sales impacts* and *Finance and support* are the weakest innovation dimensions. Croatia's lowest indicator scores are for Exports of knowledge-intensive services, Design applications, Venture capital expenditures, and Lifelong learning.

Structural differences with the EU are shown in the table below. Croatia shows the highest positive difference to the EU in Enterprise births, Average annual change in GDP and Total Entrepreneurial Activity, and the biggest negative difference in Top R&D spending enterprises, Employment share high and medium high-tech manufacturing and GDP per capita.

Croatia	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**58.8**	**54.5**	**64.0**
Human resources	**57.1**	**57.5**	**65.7**
New doctorate graduates	62.8	75.8	69.1
Population with tertiary education	79.2	66.9	100.8
Lifelong learning	20.6	24.4	22.2
Attractive research systems	**44.0**	**26.7**	**50.2**
International scientific co-publications	69.3	59.3	101.8
Most cited publications	26.8	19.5	26.8
Foreign doctorate students	47.0	13.2	54.2
Innovation-friendly environment	**41.0**	**22.0**	**71.4**
Broadband penetration	52.2	10.0	120.0
Opportunity-driven entrepreneurship	28.4	30.1	38.7
Finance and support	**38.8**	**43.0**	**44.8**
R&D expenditure in the public sector	58.9	43.2	57.8
Venture capital expenditures	15.9	42.6	23.0
Firm investments	**90.8**	**96.4**	**117.9**
R&D expenditure in the business sector	30.8	24.7	35.2
Non-R&D innovation expenditures	142.2	105.1	199.3
Enterprises providing ICT training	100.0	176.9	138.5
Innovators	**96.2**	**74.6**	**86.0**
SMEs product/process innovations	88.6	82.6	88.3
SMEs marketing/organizational innovations	110.9	71.4	91.1
SMEs innovating in-house	90.1	70.1	78.5
Linkages	**65.5**	**81.8**	**67.5**
Innovative SMEs collaborating with others	106.2	98.6	105.4
Public-private co-publications	87.5	80.4	99.0
Private co-funding of public R&D exp.	32.1	72.7	32.4
Intellectual assets	**35.1**	**30.2**	**32.8**
PCT patent applications	36.5	43.3	33.9
Trademark applications	55.1	42.7	58.6
Design applications	12.8	2.1	10.7
Employment impacts	**75.0**	**49.2**	**80.9**
Employment in knowledge-intensive activities	85.0	66.2	91.9
Employment fast-growing enterprises	66.9	35.6	72.0
Sales impacts	**38.5**	**43.1**	**38.3**
Medium and high-tech product exports	58.4	58.8	64.7
Knowledge-intensive services exports	6.0	4.8	6.2
Sales of new-to-market/firm innovations	52.3	65.9	43.7

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	HR	EU
Performance and structure of the economy		
GDP per capita (PPS)	18,600	29,100
Average annual GDP growth (%)	2.79	1.84
Employment share manufacturing (NACE C) (%)	17.2	16.6
of which High and medium high-tech (%)	20.5	37.5
Employment share services (NACE G-N) (%)	41.1	41.4
of which Knowledge-intensive services (%)	30.7	34.3
Turnover share SMEs (%)	42.3	38.3
Turnover share large enterprises (%)	39.1	43.2
Foreign-controlled enterprises – share of value added (%)	11.7	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	2.2	1.1
Total Entrepreneurial Activity (TEA) (%)	9.7	6.7
FDI net inflows (% GDP)	3.1	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	2.8	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	73.1	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.6	1.9
Govt. procurement of advanced technology products (1 to 7 best)	2.5	3.5
Rule of law (-2.5 to 2.5 best)	0.4	1.1
Demography		
Population size (millions)	4.1	446.2
Average annual population growth (%)	-0.94	0.14
Population density (inhabitants/km²)	73.9	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.84	0.97	1.40
Tertiary educational attainment (% of population aged 30-34)	30.8	34.3	35.0

1 Sources are provided in the introduction to the country profiles.

**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Croatia

Italy is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2012. The strong increase in 2018 is largely explained by improved performance on the indicators using CIS data.

■ Relative to EU in 2012   ◆ Relative to EU in 2019
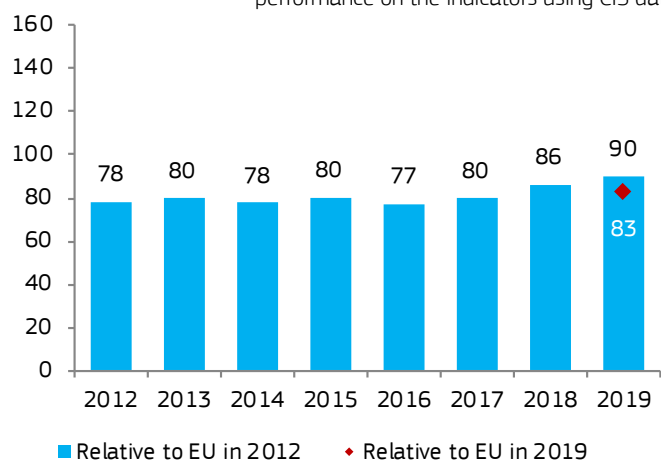
Innovators, *Intellectual assets* and *Attractive research systems* are the strongest innovation dimensions. Italy scores high on SMEs innovating in-house, Design applications, SMEs with product or process innovations, and SMEs with marketing or organizational innovations. *Human resources*, *Finance and support*, and *Linkages* are the weakest innovation dimensions. Low-scoring indicators include Population with tertiary education, Venture capital expenditures, Innovative SMEs collaborating with others, and Broadband penetration.

Structural differences with the EU are shown in the table below. Italy shows the highest positive difference to the EU in Turnover share SMEs, Employment share in manufacturing and Employment share in services , and the biggest negative difference in Average annual change in GDP, Top R&D spending enterprises and FDI net inflows.

Italy	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**82.8**	**78.3**	**90.1**
Human resources	**53.4**	**47.3**	**61.5**
New doctorate graduates	66.2	82.4	72.9
Population with tertiary education	25.3	3.3	32.2
Lifelong learning	74.2	53.3	80.0
Attractive research systems	**97.3**	**84.4**	**111.1**
International scientific co-publications	82.5	76.4	121.2
Most cited publications	114.1	99.7	114.2
Foreign doctorate students	83.2	59.2	95.9
Innovation–friendly environment	**69.7**	**83.7**	**121.2**
Broadband penetration	56.5	50.0	130.0
Opportunity-driven entrepreneurship	84.6	106.3	115.2
Finance and support	**56.5**	**60.9**	**65.2**
R&D expenditure in the public sector	60.8	57.8	59.7
Venture capital expenditures	51.5	66.1	74.5
Firm investments	**73.1**	**70.8**	**94.9**
R&D expenditure in the business sector	58.3	64.4	66.8
Non-R&D innovation expenditures	83.3	102.9	116.7
Enterprises providing ICT training	77.8	46.2	107.7
Innovators	**130.7**	**112.1**	**116.9**
SMEs product/process innovations	126.0	113.1	125.6
SMEs marketing/organizational innovations	116.3	109.7	95.5
SMEs innovating in-house	150.1	113.6	130.7
Linkages	**67.1**	**46.6**	**69.0**
Innovative SMEs collaborating with others	56.0	39.3	55.6
Public-private co-publications	80.5	68.5	91.0
Private co-funding of public R&D exp.	67.0	41.7	67.6
Intellectual assets	**103.0**	**90.8**	**96.2**
PCT patent applications	76.9	70.8	71.4
Trademark applications	104.7	88.0	111.4
Design applications	141.1	120.7	118.3
Employment impacts	**80.6**	**72.0**	**87.0**
Employment in knowledge-intensive activities	103.8	105.4	112.2
Employment fast-growing enterprises	62.0	45.0	66.7
Sales impacts	**80.8**	**87.3**	**80.4**
Medium and high-tech product exports	84.9	87.8	94.1
Knowledge-intensive services exports	62.2	70.2	64.2
Sales of new-to-market/firm innovations	98.8	104.5	82.6

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	IT	EU
Performance and structure of the economy		
GDP per capita (PPS)	29,100	29,100
Average annual GDP growth (%)	0.55	1.84
Employment share manufacturing (NACE C) (%)	18.3	16.6
of which High and medium high-tech (%)	33.2	37.5
Employment share services (NACE G-N) (%)	45.2	41.4
of which Knowledge-intensive services (%)	37.0	34.3
Turnover share SMEs (%)	43.5	38.3
Turnover share large enterprises (%)	31.4	43.2
Foreign-controlled enterprises – share of value added (%)	6.3	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.1	1.1
Total Entrepreneurial Activity (TEA) (%)	3.8	6.7
FDI net inflows (% GDP)	1.3	2.6
Top R&D spending enterprises per 10 million population	6.4	16.2
Buyer sophistication (1 to 7 best)	3.8	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	73.0	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.9	1.9
Govt. procurement of advanced technology products (1 to 7 best)	2.9	3.5
Rule of law (-2.5 to 2.5 best)	0.3	1.1
Demography		
Population size (millions)	60.5	446.2
Average annual population growth (%)	-0.19	0.14
Population density (inhabitants/km^2)	203.9	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.34	1.39	1.53
Tertiary educational attainment (% of population aged 30-34)	25.39	27.5	26.0

1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:
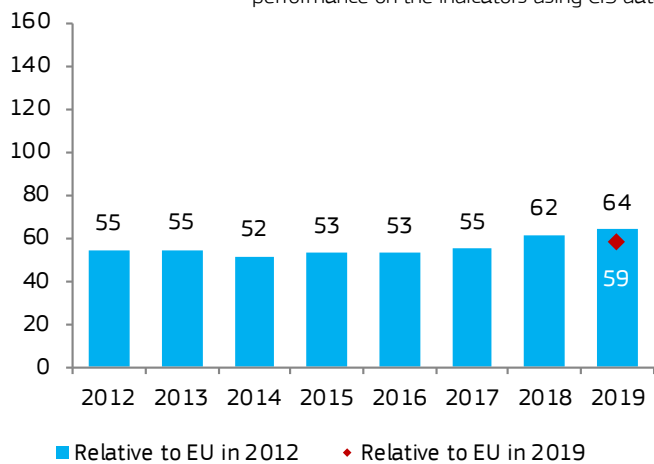
https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Italy

Cyprus is a **Moderate Innovator**.

Over time, performance has remained the same relative to that of the EU in 2012. The strong increase in 2018 is partly explained by improved performance on the indicators using CIS data.

- ■ Relative to EU in 2012
- ◆ Relative to EU in 2019

Attractive research systems, Intellectual assets, and *Human resources* are the strongest innovation dimensions. Cyprus scores particularly well on Trademark applications, International scientific co-publications, Population with tertiary education, and Employment in knowledge-intensive activities. *Linkages, Employment impacts,* and *Finance and support* are the weakest innovation dimensions. Overall, Cyprus' lowest indicator scores comprise Employment in fast-growing enterprises of innovative sectors, R&D expenditures in the business sector, Private co-funding of public R&D expenditures, and R&D expenditures in the public sector.

Structural differences with the EU are shown in the table below. Cyprus shows the highest positive difference to the EU in FDI net inflows, Average annual change in GDP and Turnover share SMEs, and the biggest negative difference in Top R&D spending enterprises, Employment share high and medium high-tech manufacturing and Employment share in manufacturing.

Cyprus	Relative to EU 2019 in 2019		Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**88.9**		**86.0**	**96.8**
Human resources	**103.1**		**106.5**	**118.8**
New doctorate graduates	19.5		0.7	21.4
Population with tertiary education	215.6		249.6	274.4
Lifelong learning	59.8		76.7	64.4
Attractive research systems	**127.2**		**94.8**	**145.3**
International scientific co-publications	230.3		163.9	338.2
Most cited publications	86.8		85.5	86.9
Foreign doctorate students	85.4		53.7	98.4
Innovation-friendly environment	**80.6**		**44.8**	**140.1**
Broadband penetration	73.9		0.0	170.0
Opportunity-driven entrepreneurship	88.1		74.8	120.1
Finance and support	**75.2**		**29.5**	**86.9**
R&D expenditure in the public sector	17.9		23.0	17.5
Venture capital expenditures	140.7		40.5	203.4
Firm investments	**77.8**		**126.1**	**101.1**
R&D expenditure in the business sector	11.7		2.9	13.4
Non-R&D innovation expenditures	79.4		227.5	111.3
Enterprises providing ICT training	144.4		176.9	200.0
Innovators	**82.3**		**91.9**	**73.5**
SMEs product/process innovations	80.0		103.2	79.7
SMEs marketing/organizational innovations	68.8		88.9	56.5
SMEs innovating in-house	98.1		84.1	85.4
Linkages	**59.6**		**95.8**	**61.4**
Innovative SMEs collaborating with others	98.1		248.1	97.4
Public-private co-publications	108.8		69.6	123.0
Private co-funding of public R&D exp.	14.7		18.4	14.8
Intellectual assets	**104.9**		**87.9**	**98.0**
PCT patent applications	39.7		27.0	36.8
Trademark applications	235.3		250.5	250.5
Design applications	72.9		42.6	61.1
Employment impacts	**70.1**		**56.7**	**75.6**
Employment in knowledge-intensive activities	150.0		127.0	162.2
Employment fast-growing enterprises	5.4		0.0	5.9
Sales impacts	**99.0**		**84.3**	**98.5**
Medium and high-tech product exports	95.6		48.7	106.0
Knowledge-intensive services exports	104.2		102.4	107.6
Sales of new-to-market/firm innovations	97.2		103.1	81.2

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	CY	EU
Performance and structure of the economy		
GDP per capita (PPS)	26,500	29,100
Average annual GDP growth (%)	3.64	1.84
Employment share manufacturing (NACE C) (%)	7.1	16.6
of which High and medium high-tech (%)	12.1	37.5
Employment share services (NACE G-N) (%)	54.2	41.4
of which Knowledge-intensive services (%)	36.9	34.3
Turnover share SMEs (%)	50.6	38.3
Turnover share large enterprises (%)	22.5	43.2
Foreign-controlled enterprises – share of value added (%)	5.2	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.2	1.1
Total Entrepreneurial Activity (TEA) (%)	7.8	6.7
FDI net inflows (% GDP)	47.6	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	3.9	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	72.8	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.0	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.1	3.5
Rule of law (-2.5 to 2.5 best)	0.8	1.1
Demography		
Population size (millions)	0.9	446.2
Average annual population growth (%)	1.23	0.14
Population density (inhabitants/km^2)	93.4	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.48	0.55	0.50
Tertiary educational attainment (% of population aged 30-34)	54.5	58.2	46.0

1 Sources are provided in the introduction to the country profiles.

**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Cyprus

Latvia is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2012. The strong increase in 2018 is entirely explained by improved performance on the indicators using CIS data.

Finance and support, *Employment impacts* and *Innovation-friendly environment* are the strongest innovation dimensions. Performance is relatively high for Venture capital expenditures, Population with tertiary education, Employment in fast-growing enterprises of innovative sectors, and Trademark applications. *Innovators, Attractive research systems* and *Sales impacts* are the weakest innovation dimensions. Latvia's lowest indicator scores are on R&D expenditures in the business sector, New doctorate graduates, Public-private co-publications, and SMEs innovating in-house.

■ Relative to EU in 2012   ◆ Relative to EU in 2019

Structural differences with the EU are shown in the table below. Latvia shows the highest positive difference to the EU in Total Entrepreneurial Activity, Average annual change in GDP and Enterprise births, and the biggest negative difference in Top R&D spending enterprises, Employment share high and medium high-tech manufacturing and Turnover share large enterprises.

Latvia	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**63.0**	**45.7**	**68.6**
Human resources	**66.0**	**77.6**	**76.0**
New doctorate graduates	12.7	53.4	13.9
Population with tertiary education	121.4	128.9	154.5
Lifelong learning	59.8	50.0	64.4
Attractive research systems	**46.0**	**9.1**	**52.5**
International scientific co-publications	46.9	23.2	68.8
Most cited publications	40.7	4.2	40.8
Foreign doctorate students	54.6	6.9	62.9
Innovation-friendly environment	**79.5**	**112.5**	**138.3**
Broadband penetration	73.9	180.0	170.0
Opportunity-driven entrepreneurship	85.9	67.1	117.0
Finance and support	**109.7**	**45.5**	**126.7**
R&D expenditure in the public sector	55.2	57.8	54.2
Venture capital expenditures	171.9	24.8	248.5
Firm investments	**56.9**	**35.9**	**73.8**
R&D expenditure in the business sector	8.9	12.6	10.1
Non-R&D innovation expenditures	90.1	61.9	126.3
Enterprises providing ICT training	72.2	38.5	100.0
Innovators	**39.9**	**29.9**	**35.7**
SMEs product/process innovations	42.7	25.8	42.5
SMEs marketing/organizational innovations	43.0	39.7	35.3
SMEs innovating in-house	33.9	23.7	29.5
Linkages	**54.7**	**60.7**	**56.3**
Innovative SMEs collaborating with others	54.2	36.5	53.8
Public-private co-publications	28.5	8.0	32.2
Private co-funding of public R&D exp.	67.3	96.7	67.9
Intellectual assets	**63.3**	**51.6**	**59.1**
PCT patent applications	47.9	34.7	44.5
Trademark applications	105.3	89.9	112.1
Design applications	44.1	44.5	37.0
Employment impacts	**92.9**	**50.2**	**100.3**
Employment in knowledge-intensive activities	67.5	44.6	73.0
Employment fast-growing enterprises	113.5	54.6	122.2
Sales impacts	**51.1**	**31.8**	**50.8**
Medium and high-tech product exports	36.4	28.1	40.4
Knowledge-intensive services exports	66.5	66.5	68.7
Sales of new-to-market/firm innovations	51.9	0.0	43.4

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	LV	EU
Performance and structure of the economy		
GDP per capita (PPS)	20,000	29,100
Average annual GDP growth (%)	3.24	1.84
Employment share manufacturing (NACE C) (%)	13.4	16.6
of which High and medium high-tech (%)	12.5	37.5
Employment share services (NACE G-N) (%)	42.0	41.4
of which Knowledge-intensive services (%)	29.3	34.3
Turnover share SMEs (%)	52.8	38.3
Turnover share large enterprises (%)	22.2	43.2
Foreign-controlled enterprises – share of value added (%)	13.8	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.9	1.1
Total Entrepreneurial Activity (TEA) (%)	14.8	6.7
FDI net inflows (% GDP)	2.1	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	3.1	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	80.2	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.6	1.9
Govt. procurement of advanced technology products (1 to 7 best)	2.9	3.5
Rule of law (-2.5 to 2.5 best)	0.9	1.1
Demography		
Population size (millions)	1.9	446.2
Average annual population growth (%)	-0.78	0.14
Population density (inhabitants/km^2)	30.7	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.62	0.64	1.50
Tertiary educational attainment (% of population aged 30-34)	41.3	43.4	34.0

1 Sources are provided in the introduction to the country profiles.

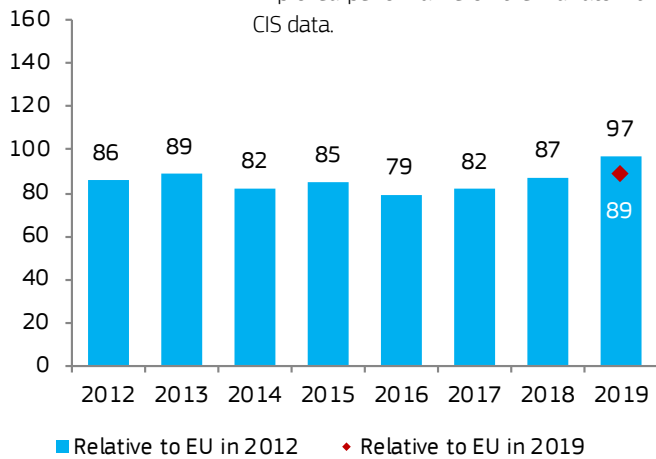**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Latvia

Lithuania is a **Moderate Innovator**. Over time, performance has increased relative to that of the EU in 2012. The strong increase in 2018 is largely explained by improved performance on the indicators using CIS data.

- Relative to EU in 2012 ◆ Relative to EU in 2019
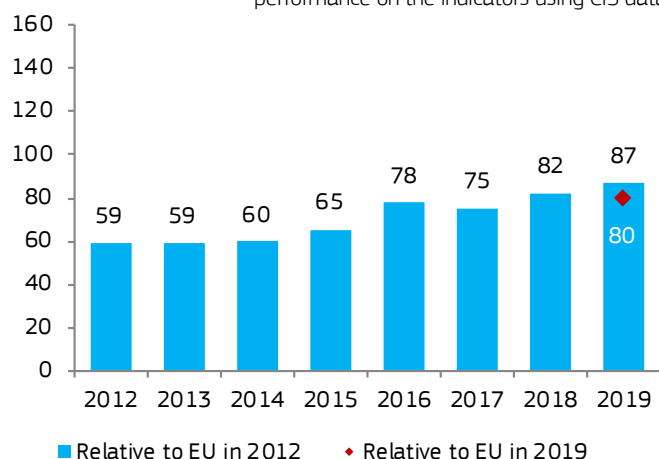
Innovators, Innovation-friendly environment, and *Linkages* are the strongest innovation dimensions. Lithuania scores high on Population with tertiary education, Innovative SMEs collaborating with others, Non-R&D innovation expenditures, and Broadband penetration. *Attractive research systems, Sales impacts* and *Intellectual assets* are the weakest innovation dimensions. Low-scoring indicators include Exports of knowledge-intensive services, R&D expenditures in the business sector, Public-private co-publications, and Foreign doctorate students.

Structural differences with the EU are shown in the table below. Lithuania shows the highest positive difference to the EU in Average annual change in GDP, Total Entrepreneurial Activity and Enterprise births, and the biggest negative difference in Top R&D spending enterprises, Employment share high and medium high-tech manufacturing and Employment share knowledge-intensive services.

Lithuania	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**79.7**	**59.1**	**86.8**
Human resources	**103.8**	**117.9**	**119.5**
New doctorate graduates	33.7	58.4	37.1
Population with tertiary education	204.5	238.0	260.3
Lifelong learning	58.8	56.7	63.3
Attractive research systems	**47.5**	**20.3**	**54.3**
International scientific co-publications	64.6	39.3	94.9
Most cited publications	50.1	21.0	50.1
Foreign doctorate students	23.7	2.0	27.4
Innovation-friendly environment	**107.8**	**105.6**	**187.5**
Broadband penetration	147.8	160.0	340.0
Opportunity-driven entrepreneurship	62.4	69.0	85.0
Finance and support	**84.6**	**66.0**	**97.7**
R&D expenditure in the public sector	64.5	89.0	63.3
Venture capital expenditures	107.4	27.3	155.3
Firm investments	**77.9**	**76.8**	**101.1**
R&D expenditure in the business sector	20.9	16.6	23.9
Non-R&D innovation expenditures	178.5	188.6	250.2
Enterprises providing ICT training	33.3	38.5	46.2
Innovators	**110.6**	**44.3**	**98.8**
SMEs product/process innovations	115.3	46.1	114.9
SMEs marketing/organizational innovations	93.1	52.5	76.4
SMEs innovating in-house	122.5	34.1	106.6
Linkages	**105.8**	**93.2**	**109.0**
Innovative SMEs collaborating with others	191.1	92.5	189.7
Public-private co-publications	21.5	14.5	24.3
Private co-funding of public R&D exp.	96.7	126.5	97.6
Intellectual assets	**56.1**	**38.2**	**52.4**
PCT patent applications	38.3	33.4	35.5
Trademark applications	105.7	71.9	112.5
Design applications	33.2	18.0	27.8
Employment impacts	**60.0**	**68.1**	**64.7**
Employment in knowledge-intensive activities	58.8	43.2	63.5
Employment fast-growing enterprises	61.0	88.2	65.7
Sales impacts	**53.5**	**22.7**	**53.2**
Medium and high-tech product exports	48.2	36.6	53.5
Knowledge-intensive services exports	4.3	0.3	4.4
Sales of new-to-market/firm innovations	123.6	31.2	103.2

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	LT	EU
Performance and structure of the economy		
GDP per capita (PPS)	23,500	29,100
Average annual GDP growth (%)	3.77	1.84
Employment share manufacturing (NACE C) (%)	15.7	16.6
of which High and medium high-tech (%)	13.9	37.5
Employment share services (NACE G-N) (%)	40.0	41.4
of which Knowledge-intensive services (%)	25.0	34.3
Turnover share SMEs (%)	49.6	38.3
Turnover share large enterprises (%)	31.9	43.2
Foreign-controlled enterprises – share of value added (%)	11.4	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.9	1.1
Total Entrepreneurial Activity (TEA) (%)	11.3	6.7
FDI net inflows (% GDP)	2.1	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	3.3	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	81.1	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.4	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.0	3.5
Rule of law (-2.5 to 2.5 best)	1.0	1.1
Demography		
Population size (millions)	2.8	446.2
Average annual population growth (%)	-0.95	0.14
Population density (inhabitants/km^2)	45.2	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.04	0.94	1.90
Tertiary educational attainment (% of population aged 30-34)	57.6	57.6	48.7

1 Sources are provided in the introduction to the country profiles.

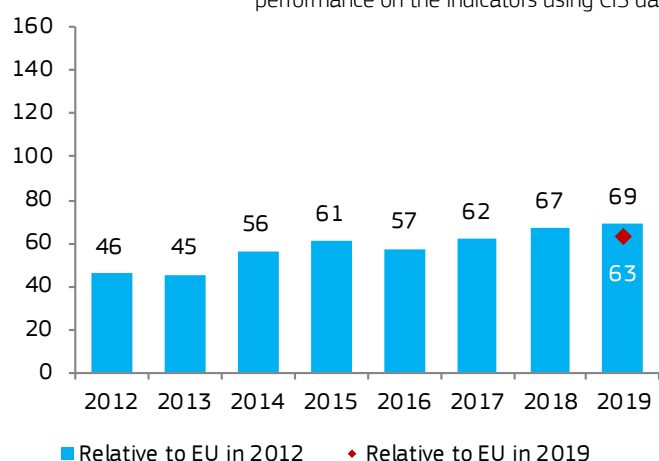**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Lithuania

Luxembourg is an **Innovation Leader**. Over time, performance has increased relative to that of the EU in 2012. The strong increase in 2019 is mainly due to improved performance in Doctorate graduates and Broadband penetration.

	2012	2013	2014	2015	2016	2017	2018	2019
	134	135	129	132	134	130	133	137

■ Relative to EU in 2012   ◆ Relative to EU in 2019
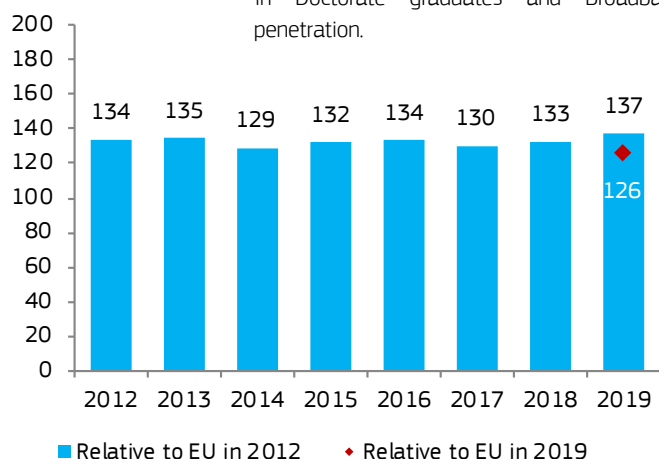
Attractive research systems, Employment impacts and *Human resources* are the strongest innovation dimensions. Luxembourg scores particularly well on Foreign doctorate students, International scientific co-publications, Trademark applications, and Employment in knowledge-intensive activities. *Firm investments, Sales impacts* and *Linkages* are the weakest innovation dimensions. Overall, Luxembourg's lowest indicator scores comprise Sales of new-to-market or new-to-firm innovations, Non-R&D innovation expenditures, Private co-funding of public R&D expenditures, and R&D expenditures in the business sector.

Structural differences with the EU are shown in the table below. Luxembourg shows the highest positive difference to the EU in Top R&D spending enterprises, FDI net inflows and GDP per capita, and the biggest negative difference in Employment share in manufacturing, Employment share high and medium high-tech manufacturing and Turnover share large enterprises.

Luxembourg	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**126.0**	**133.9**	**137.1**
Human resources	**154.5**	**141.8**	**177.9**
New doctorate graduates	86.0	32.4	94.7
Population with tertiary education	203.2	219.0	258.7
Lifelong learning	176.3	190.0	190.0
Attractive research systems	**206.8**	**217.2**	**236.2**
International scientific co-publications	263.6	246.4	387.1
Most cited publications	115.2	138.1	115.3
Foreign doctorate students	310.5	358.0	358.0
Innovation-friendly environment	**135.8**	**217.1**	**236.2**
Broadband penetration	147.8	130.0	340.0
Opportunity-driven entrepreneurship	122.2	275.6	166.4
Finance and support	**106.2**	**138.0**	**122.7**
R&D expenditure in the public sector	66.4	57.8	65.2
Venture capital expenditures	151.6	272.6	219.2
Firm investments	**63.1**	**68.2**	**81.9**
R&D expenditure in the business sector	45.6	52.2	52.2
Non-R&D innovation expenditures	23.0	33.8	32.3
Enterprises providing ICT training	122.6	123.1	169.2
Innovators	**141.9**	**149.9**	**126.8**
SMEs product/process innovations	124.6	147.9	124.2
SMEs marketing/organizational innovations	171.3	163.4	140.7
SMEs innovating in-house	132.1	137.7	115.0
Linkages	**87.6**	**90.8**	**90.2**
Innovative SMEs collaborating with others	106.1	164.9	105.4
Public-private co-publications	174.0	125.0	196.7
Private co-funding of public R&D exp.	36.5	33.4	36.8
Intellectual assets	**151.0**	**154.3**	**141.0**
PCT patent applications	70.1	65.8	65.1
Trademark applications	235.3	250.5	250.5
Design applications	189.4	200.0	158.9
Employment impacts	**175.4**	**131.9**	**189.2**
Employment in knowledge-intensive activities	235.0	232.4	254.1
Employment fast-growing enterprises	127.1	50.9	136.9
Sales impacts	**85.2**	**96.0**	**84.8**
Medium and high-tech product exports	76.4	94.4	84.7
Knowledge-intensive services exports	147.6	146.4	152.4
Sales of new-to-market/firm innovations	17.9	45.7	14.9

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	LU	EU
Performance and structure of the economy		
GDP per capita (PPS)	79,400	29,100
Average annual GDP growth (%)	2.69	1.84
Employment share manufacturing (NACE C) (%)	4.5	16.6
of which High and medium high-tech (%)	17.2	37.5
Employment share services (NACE G-N) (%)	46.8	41.4
of which Knowledge-intensive services (%)	59.8	34.3
Turnover share SMEs (%)	51.6	38.3
Turnover share large enterprises (%)	33.6	43.2
Foreign-controlled enterprises – share of value added (%)	18.8	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.9	1.1
Total Entrepreneurial Activity (TEA) (%)	10.0	6.7
FDI net inflows (% GDP)	11.3	2.6
Top R&D spending enterprises per 10 million population	271.4	16.2
Buyer sophistication (1 to 7 best)	5.0	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	69.6	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.3	1.9
Govt. procurement of advanced technology products (1 to 7 best)	4.7	3.5
Rule of law (-2.5 to 2.5 best)	1.8	1.1
Demography		
Population size (millions)	0.6	446.2
Average annual population growth (%)	1.95	0.14
Population density (inhabitants/km^2)	230.3	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.30	1.22	2.30
Tertiary educational attainment (% of population aged 30-34)	52.3	56.5	66.0

1 Sources are provided in the introduction to the country profiles.

**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Luxembourg

Hungary is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2012. Particularly since 2017.

Employment impacts, Sales impacts and *Innovation-friendly environment* are the strongest innovation dimensions. Performance is highest for Employment in fast-growing enterprises of innovative sectors, Medium and high-tech product exports, Non-R&D innovation expenditures, and Broadband penetration. *Innovators, Human resources* and *Finance and support* are the weakest innovation dimensions. Hungary's lowest indicator scores are on Design applications, SMEs innovating in-house, SMEs with marketing or organizational innovations, and R&D expenditures in the public sector.

■ Relative to EU in 2012   ◆ Relative to EU in 2019

Structural differences with the EU are shown in the table below. Hungary shows the highest positive difference to the EU in Average annual change in GDP, Value-added share foreign-controlled enterprises and Enterprise births, and the biggest negative difference in Top R&D spending enterprises, FDI net inflows and GDP per capita.

Hungary	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**66.4**	**64.8**	**72.3**
Human resources	**44.7**	**55.2**	**51.5**
New doctorate graduates	38.3	31.8	42.2
Population with tertiary education	44.8	68.6	57.0
Lifelong learning	52.6	68.9	56.7
Attractive research systems	**58.4**	**45.5**	**66.8**
International scientific co-publications	52.6	55.6	77.3
Most cited publications	48.8	43.0	48.9
Foreign doctorate students	82.5	41.9	95.1
Innovation-friendly environment	**83.1**	**63.6**	**144.5**
Broadband penetration	91.3	90.0	210.0
Opportunity-driven entrepreneurship	73.7	45.9	100.4
Finance and support	**46.2**	**43.6**	**53.4**
R&D expenditure in the public sector	32.8	45.0	32.2
Venture capital expenditures	61.6	41.1	89.0
Firm investments	**82.1**	**64.6**	**106.6**
R&D expenditure in the business sector	79.5	57.1	91.1
Non-R&D innovation expenditures	105.0	69.4	147.2
Enterprises providing ICT training	61.1	69.2	84.6
Innovators	**34.0**	**25.8**	**30.4**
SMEs product/process innovations	40.0	27.4	39.8
SMEs marketing/organizational innovations	30.8	38.6	25.2
SMEs innovating in-house	30.6	11.1	26.7
Linkages	**58.9**	**83.6**	**60.7**
Innovative SMEs collaborating with others	57.4	67.0	57.0
Public-private co-publications	68.0	58.9	76.9
Private co-funding of public R&D exp.	55.5	103.6	56.0
Intellectual assets	**47.6**	**43.5**	**44.5**
PCT patent applications	56.9	61.3	52.8
Trademark applications	54.6	46.2	58.2
Design applications	26.3	16.7	22.1
Employment impacts	**139.2**	**139.8**	**150.2**
Employment in knowledge-intensive activities	76.3	98.6	82.4
Employment fast-growing enterprises	190.2	172.9	204.8
Sales impacts	**85.1**	**98.3**	**84.7**
Medium and high-tech product exports	132.9	137.4	147.3
Knowledge-intensive services exports	61.8	62.5	63.8
Sales of new-to-market/firm innovations	48.2	94.0	40.3

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	HU	EU
Performance and structure of the economy		
GDP per capita (PPS)	20,800	29,100
Average annual GDP growth (%)	5.00	1.84
Employment share manufacturing (NACE C) (%)	22.2	16.6
of which High and medium high-tech (%)	43.9	37.5
Employment share services (NACE G-N) (%)	35.7	41.4
of which Knowledge-intensive services (%)	29.5	34.3
Turnover share SMEs (%)	38.1	38.3
Turnover share large enterprises (%)	42.4	43.2
Foreign-controlled enterprises – share of value added (%)	24.1	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.8	1.1
Total Entrepreneurial Activity (TEA) (%)	7.9	6.7
FDI net inflows (% GDP)	1.6	2.6
Top R&D spending enterprises per 10 million population	1.0	16.2
Buyer sophistication (1 to 7 best)	3.2	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	73.1	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.5	1.9
Govt. procurement of advanced technology products (1 to 7 best)	2.8	3.5
Rule of law (-2.5 to 2.5 best)	0.5	1.1
Demography		
Population size (millions)	9.8	446.2
Average annual population growth (%)	-0.13	0.14
Population density (inhabitants/km^2)	107.3	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.35	1.53	1.80
Tertiary educational attainment (% of population aged 30-34)	34.3	33.9	34.0

1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Hungary

Malta is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2012.

■ Relative to EU in 2012   ♦ Relative to EU in 2019
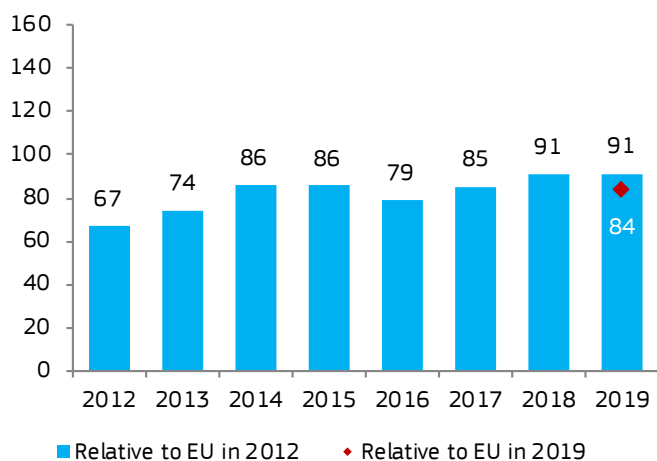
Employment impacts, *Intellectual assets* and *Innovation-friendly environment* are the strongest innovation dimensions. Malta scores high on Trademark applications, Venture capital expenditures, Employment in fast-growing enterprises of innovative sectors, and Employment in knowledge-intensive activities. *Linkages*, *Finance and support* and *Innovators* are the weakest innovation dimensions. Low-scoring indicators include Private co-funding of public R&D expenditures, R&D expenditures in the public sector, R&D expenditures in the business sector, and Public-private co-publications.

Structural differences with the EU are shown in the table below. Malta shows the highest positive difference to the EU in FDI net inflows, Average annual change in GDP and Enterprise births, and the biggest negative difference in Turnover share large enterprises, Employment share in manufacturing and Employment share high and medium high-tech manufacturing.

Malta	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**84.0**	**66.7**	**91.4**
Human resources	**77.1**	**54.0**	**88.7**
New doctorate graduates	24.7	3.0	27.2
Population with tertiary education	107.1	62.0	136.4
Lifelong learning	103.1	107.8	111.1
Attractive research systems	**76.7**	**49.8**	**87.6**
International scientific co-publications	90.4	65.2	132.8
Most cited publications	60.8	59.2	60.9
Foreign doctorate students	90.2	16.6	104.0
Innovation–friendly environment §	**134.1**	**104.5**	**233.1**
Broadband penetration	126.1	130.0	290.0
Opportunity-driven entrepreneurship	N/A	N/A	N/A
Finance and support	**92.6**	**21.1**	**107.0**
R&D expenditure in the public sector	8.5	10.2	8.4
Venture capital expenditures	188.5	39.5	272.6
Firm investments	**81.4**	**105.0**	**105.7**
R&D expenditure in the business sector	20.9	32.8	23.9
Non-R&D innovation expenditures	108.0	153.0	151.3
Enterprises providing ICT training	116.7	146.2	161.5
Innovators	**59.5**	**66.0**	**53.2**
SMEs product/process innovations	57.3	70.5	57.1
SMEs marketing/organizational innovations	61.7	68.2	50.6
SMEs innovating in-house	59.9	59.4	52.2
Linkages	**16.6**	**23.6**	**17.1**
Innovative SMEs collaborating with others	26.1	41.1	25.9
Public-private co-publications	23.2	13.2	26.2
Private co-funding of public R&D exp.	8.1	17.9	8.2
Intellectual assets	**137.7**	**92.6**	**128.6**
PCT patent applications	62.8	43.3	58.3
Trademark applications	235.3	240.6	250.5
Design applications	153.4	42.7	128.7
Employment impacts	**173.6**	**134.3**	**187.2**
Employment in knowledge-intensive activities	161.3	141.9	174.3
Employment fast-growing enterprises	183.5	128.1	197.6
Sales impacts	**59.3**	**47.5**	**59.0**
Medium and high-tech product exports	90.4	93.6	100.2
Knowledge-intensive services exports	29.5	9.8	30.4
Sales of new-to-market/firm innovations	54.1	38.0	45.2

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

§ Due to missing data, the relative dimension score does not necessarily reflect that of the indicators.

	MT	EU
Performance and structure of the economy		
GDP per capita (PPS)	29,000	29,100
Average annual GDP growth (%)	5.86	1.84
Employment share manufacturing (NACE C) (%)	11.7	16.6
of which High and medium high-tech (%)	29.7	37.5
Employment share services (NACE G-N) (%)	47.6	41.4
of which Knowledge-intensive services (%)	38.3	34.3
Turnover share SMEs (%)	45.9	38.3
Turnover share large enterprises (%)	15.5	43.2
Foreign-controlled enterprises – share of value added (%)	13.2	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	2.1	1.1
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	30.4	2.6
Top R&D spending enterprises per 10 million population	14.4	16.2
Buyer sophistication (1 to 7 best)	3.7	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	65.6	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.7	3.5
Rule of law (-2.5 to 2.5 best)	1.1	1.1
Demography		
Population size (millions)	0.5	446.2
Average annual population growth (%)	3.55	0.14
Population density (inhabitants/km^2)	1569.1	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.74	0.57	2.00
Tertiary educational attainment (% of population aged 30-34)	29.1	36.9	33.0

1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:
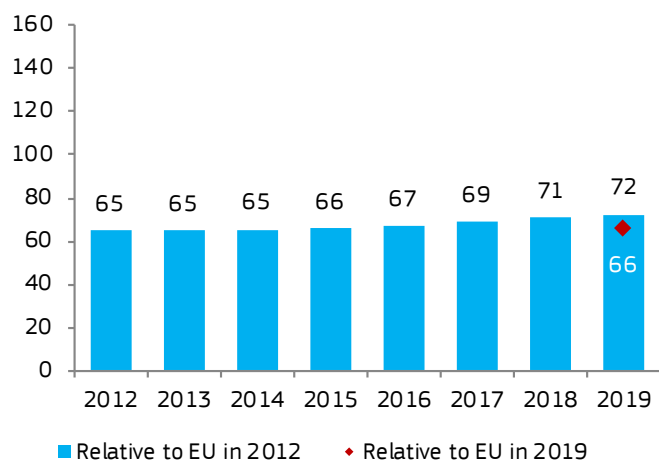
https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Malta

The Netherlands is an **Innovation Leader**. Over time, performance has increased relative to that of the EU in 2012.

■ Relative to EU in 2012   ◆ Relative to EU in 2019
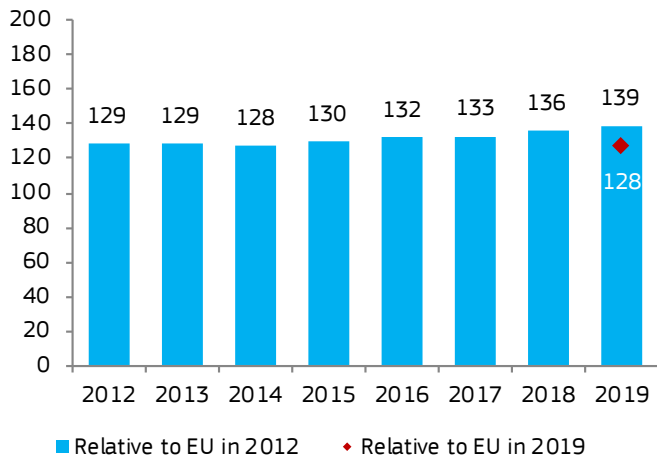
Attractive research systems, *Innovation-friendly environment* and *Linkages* are the strongest innovation dimensions. The Netherlands scores particularly well on Foreign doctorate students, International scientific co-publications, Public-private co-publications, and Lifelong learning. *Firm investments*, *Sales impacts* and *Intellectual assets* are the weakest innovation dimensions. Overall, the Netherlands' lowest indicator scores comprise Non-R&D innovation expenditures, Sales of new-to-market and new-to-firm product innovations, Medium and high-tech product exports, and SMEs with marketing organizational innovations.

Structural differences with the EU are shown in the table below. The Netherlands shows the highest positive difference to the EU in FDI net inflows, Top R&D spending enterprises and Basic-school entrepreneurial education and training, and the biggest negative difference in Employment share in manufacturing, Enterprise births and Employment share high and medium high-tech manufacturing.

Netherlands	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**127.8**	**128.7**	**139.1**
Human resources	**152.4**	**158.2**	**175.5**
New doctorate graduates	118.8	123.1	130.8
Population with tertiary education	157.8	169.4	200.8
Lifelong learning	187.6	188.9	202.2
Attractive research systems	**193.5**	**200.3**	**221.0**
International scientific co-publications	208.5	219.1	306.2
Most cited publications	156.8	168.0	156.9
Foreign doctorate students	243.6	251.8	280.8
Innovation–friendly environment	**161.3**	**206.4**	**280.5**
Broadband penetration	152.2	150.0	350.0
Opportunity-driven entrepreneurship	171.7	244.3	233.8
Finance and support	**120.4**	**115.8**	**139.0**
R&D expenditure in the public sector	100.0	120.2	98.2
Venture capital expenditures	143.6	108.5	207.6
Firm investments	**75.6**	**91.3**	**98.2**
R&D expenditure in the business sector	100.0	84.6	114.6
Non-R&D innovation expenditures	11.2	106.0	15.6
Enterprises providing ICT training	116.7	84.6	161.5
Innovators	**125.6**	**118.6**	**112.2**
SMEs product/process innovations	155.4	139.7	154.8
SMEs marketing/organizational innovations	85.7	88.6	70.4
SMEs innovating in-house	131.7	129.6	114.7
Linkages	**154.8**	**161.3**	**159.4**
Innovative SMEs collaborating with others	163.2	167.1	162.1
Public-private co-publications	203.9	219.2	230.5
Private co-funding of public R&D exp.	127.0	133.7	128.1
Intellectual assets	**112.6**	**104.5**	**105.2**
PCT patent applications	117.5	114.3	109.0
Trademark applications	112.9	112.9	120.1
Design applications	105.0	84.3	88.1
Employment impacts	**128.5**	**129.4**	**138.6**
Employment in knowledge-intensive activities	150.0	154.1	162.2
Employment fast-growing enterprises	111.0	109.6	119.6
Sales impacts	**94.2**	**85.1**	**93.7**
Medium and high-tech product exports	83.5	68.7	92.5
Knowledge-intensive services exports	119.0	121.3	122.9
Sales of new-to-market/firm innovations	77.6	65.2	64.8

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	NL	EU
Performance and structure of the economy		
GDP per capita (PPS)	38,600	29,100
Average annual GDP growth (%)	2.17	1.84
Employment share manufacturing (NACE C) (%)	10.3	16.6
of which High and medium high-tech (%)	30.6	37.5
Employment share services (NACE G-N) (%)	46.8	41.4
of which Knowledge-intensive services (%)	39.9	34.3
Turnover share SMEs (%)	47.2	38.3
Turnover share large enterprises (%)	37.6	43.2
Foreign-controlled enterprises – share of value added (%)	13.6	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.8	1.1
Total Entrepreneurial Activity (TEA) (%)	10.9	6.7
FDI net inflows (% GDP)	5.4	2.6
Top R&D spending enterprises per 10 million population	29.7	16.2
Buyer sophistication (1 to 7 best)	4.5	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	76.1	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	3.3	1.9
Govt. procurement of advanced technology products (1 to 7 best)	4.0	3.5
Rule of law (-2.5 to 2.5 best)	1.8	1.1
Demography		
Population size (millions)	17.2	446.2
Average annual population growth (%)	0.59	0.14
Population density (inhabitants/km^2)	501.1	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.98	2.16	2.50
Tertiary educational attainment (% of population aged 30-34)	46.3	50.1	40.0

1 Sources are provided in the introduction to the country profiles.

**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Netherlands

Austria is a **Strong Innovator**.
Over time, performance has increased relative to that of the EU in 2012.

■ Relative to EU in 2012 ◆ Relative to EU in 2019
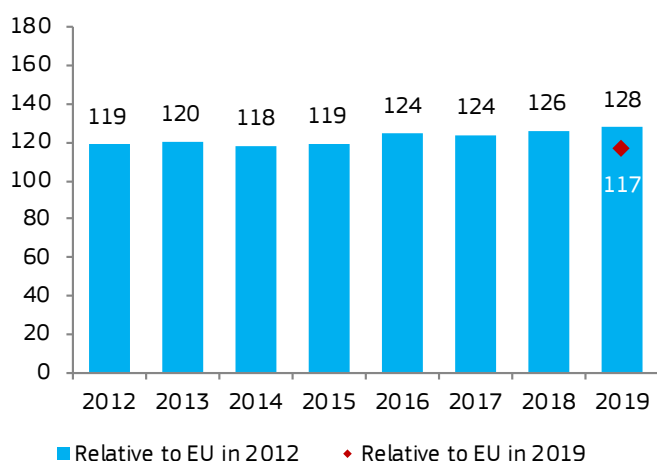
Linkages, Innovators and *Attractive research systems* are the strongest innovation dimensions. Austria scores particularly well on Public-private co-publications, Innovative SMEs collaborating with others, International scientific co-publications, and Foreign doctorate students. *Employment impacts, Innovation-friendly environment* and *Sales impacts* are the weakest innovation dimensions. Low-scoring indicators include Employment in fast-growing enterprises of innovative sectors, Venture capital expenditures, Exports of knowledge-intensive services, and Non-R&D innovation expenditures.

Structural differences with the EU are shown in the table below. Austria shows the highest positive difference to the EU in Top R&D spending enterprises, Total Entrepreneurial Activity and GDP per capita, and the biggest negative difference in FDI net inflows, Turnover share large enterprises and Basic-school entrepreneurial education and training.

Austria	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**117.5**	**119.0**	**127.9**
Human resources	**124.4**	**124.4**	**143.3**
New doctorate graduates	116.2	115.0	127.9
Population with tertiary education	115.6	120.7	147.1
Lifelong learning	146.4	140.0	157.8
Attractive research systems	**146.9**	**140.5**	**167.9**
International scientific co-publications	181.4	189.0	266.4
Most cited publications	112.7	112.1	112.8
Foreign doctorate students	170.9	157.6	197.1
Innovation-friendly environment	**75.1**	**128.9**	**130.6**
Broadband penetration	73.9	120.0	170.0
Opportunity-driven entrepreneurship	76.5	134.8	104.2
Finance and support	**94.9**	**92.4**	**109.6**
R&D expenditure in the public sector	141.1	116.5	138.5
Venture capital expenditures	42.2	51.8	61.0
Firm investments	**98.0**	**131.4**	**127.2**
R&D expenditure in the business sector	154.4	146.1	176.9
Non-R&D innovation expenditures	66.3	60.8	92.9
Enterprises providing ICT training	72.2	184.6	100.0
Innovators	**151.1**	**117.0**	**135.1**
SMEs product/process innovations	142.3	125.4	141.8
SMEs marketing/organizational innovations	164.6	107.3	135.1
SMEs innovating in-house	147.6	119.0	128.6
Linkages	**182.3**	**161.9**	**187.7**
Innovative SMEs collaborating with others	257.3	236.2	255.4
Public-private co-publications	268.6	240.5	303.6
Private co-funding of public R&D exp.	99.1	85.9	100.0
Intellectual assets	**135.2**	**142.9**	**126.3**
PCT patent applications	116.5	115.6	108.2
Trademark applications	143.3	152.6	152.5
Design applications	155.5	173.1	130.5
Employment impacts	**69.9**	**74.8**	**75.4**
Employment in knowledge-intensive activities	116.3	112.2	125.7
Employment fast-growing enterprises	32.4	44.8	34.9
Sales impacts	**84.4**	**79.7**	**83.9**
Medium and high-tech product exports	102.9	104.8	114.1
Knowledge-intensive services exports	51.3	55.6	53.0
Sales of new-to-market/firm innovations	100.8	78.2	84.2

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	AT	EU
Performance and structure of the economy		
GDP per capita (PPS)	38,400	29,100
Average annual GDP growth (%)	1.98	1.84
Employment share manufacturing (NACE C) (%)	16.0	16.6
of which High and medium high-tech (%)	38.1	37.5
Employment share services (NACE G-N) (%)	42.1	41.4
of which Knowledge-intensive services (%)	32.3	34.3
Turnover share SMEs (%)	47.5	38.3
Turnover share large enterprises (%)	33.7	43.2
Foreign-controlled enterprises – share of value added (%)	13.6	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.2	1.1
Total Entrepreneurial Activity (TEA) (%)	10.9	6.7
FDI net inflows (% GDP)	-1.1	2.6
Top R&D spending enterprises per 10 million population	35.4	16.2
Buyer sophistication (1 to 7 best)	3.8	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	78.7	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.6	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.4	3.5
Rule of law (-2.5 to 2.5 best)	1.8	1.1
Demography		
Population size (millions)	8.8	446.2
Average annual population growth (%)	0.49	0.14
Population density (inhabitants/km²)	106.6	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	3.05	3.17	3.76
Tertiary educational attainment (% of population aged 30-34)	38.7	42.3	38.0

1 Sources are provided in the introduction to the country profiles.

**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Austria

Poland is a **Moderate Innovator**.

Over time, performance has increased relative to that of the EU in 2012. The strong increase in the last two years is mainly due to improved performance in Broadband penetration and Opportunity-driven entrepreneurship.

Innovation-friendly environment and *Employment impacts* are the strongest innovation dimensions. Poland scores high on Opportunity-driven entrepreneurship, Employment in fact-growing enterprises of innovative sectors, Population with tertiary education, and Design applications. *Innovators*, *Attractive research systems* and *Linkages* are the weakest innovation dimensions. Low-scoring indicators include SMEs with marketing or organizational innovations, Foreign doctorate students, New doctorate graduates, and SMEs innovating in-house.

Bar chart: Relative to EU in 2012 values — 2012: 51, 2013: 53, 2014: 51, 2015: 52, 2016: 54, 2017: 55, 2018: 60, 2019: 64. Relative to EU in 2019 (2019): 59.

■ Relative to EU in 2012   ◆ Relative to EU in 2019

Structural differences with the EU are shown in the table below. Poland shows the highest positive difference to the EU in Average annual change in GDP, Enterprise births and Employment share in manufacturing, and the biggest negative difference in Top R&D spending enterprises, GDP per capita and Employment share high and medium high-tech manufacturing.

Poland	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**58.9**	**51.0**	**64.1**
Human resources	**65.4**	**69.7**	**75.4**
New doctorate graduates	12.5	17.8	13.8
Population with tertiary education	127.9	155.4	162.8
Lifelong learning	49.5	37.8	53.3
Attractive research systems	**32.1**	**19.2**	**36.7**
International scientific co-publications	35.8	25.9	52.6
Most cited publications	41.2	18.9	41.2
Foreign doctorate students	11.3	13.9	13.1
Innovation-friendly environment	**121.3**	**28.3**	**211.0**
Broadband penetration	104.3	70.0	240.0
Opportunity-driven entrepreneurship	140.6	0.3	191.5
Finance and support	**40.5**	**58.1**	**46.8**
R&D expenditure in the public sector	40.3	61.5	39.5
Venture capital expenditures	40.8	52.4	59.0
Firm investments	**73.8**	**67.5**	**95.8**
R&D expenditure in the business sector	54.1	15.0	62.0
Non-R&D innovation expenditures	122.2	160.6	171.3
Enterprises providing ICT training	44.4	38.5	61.5
Innovators	**16.0**	**20.8**	**14.3**
SMEs product/process innovations	27.9	23.1	27.8
SMEs marketing/organizational innovations	0.0	30.3	0.0
SMEs innovating in-house	18.6	8.6	16.2
Linkages	**39.5**	**45.2**	**40.7**
Innovative SMEs collaborating with others	40.3	36.1	40.0
Public-private co-publications	29.4	14.5	33.2
Private co-funding of public R&D exp.	43.8	63.3	44.2
Intellectual assets	**70.5**	**56.3**	**65.8**
PCT patent applications	35.8	34.0	33.2
Trademark applications	68.5	47.6	72.9
Design applications	125.7	94.0	105.4
Employment impacts	**98.4**	**98.2**	**106.2**
Employment in knowledge-intensive activities	58.8	47.3	63.5
Employment fast-growing enterprises	130.5	139.2	140.5
Sales impacts	**56.0**	**57.0**	**55.7**
Medium and high-tech product exports	79.6	84.6	88.2
Knowledge-intensive services exports	47.7	42.0	49.3
Sales of new-to-market/firm innovations	33.5	43.3	28.0

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	PL	EU
Performance and structure of the economy		
GDP per capita (PPS)	20,800	29,100
Average annual GDP growth (%)	4.75	1.84
Employment share manufacturing (NACE C) (%)	20.8	16.6
of which High and medium high-tech (%)	28.2	37.5
Employment share services (NACE G-N) (%)	35.0	41.4
of which Knowledge-intensive services (%)	29.9	34.3
Turnover share SMEs (%)	34.1	38.3
Turnover share large enterprises (%)	44.2	43.2
Foreign-controlled enterprises – share of value added (%)	13.0	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.9	1.1
Total Entrepreneurial Activity (TEA) (%)	6.5	6.7
FDI net inflows (% GDP)	3.0	2.6
Top R&D spending enterprises per 10 million population	0.9	16.2
Buyer sophistication (1 to 7 best)	3.4	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	77.1	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.6	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.0	3.5
Rule of law (-2.5 to 2.5 best)	0.5	1.1
Demography		
Population size (millions)	38.0	446.2
Average annual population growth (%)	0.00	0.14
Population density (inhabitants/km^2)	123.6	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.00	1.21	1.70
Tertiary educational attainment (% of population aged 30-34)	43.4	46.6	45.0

1 Sources are provided in the introduction to the country profiles.

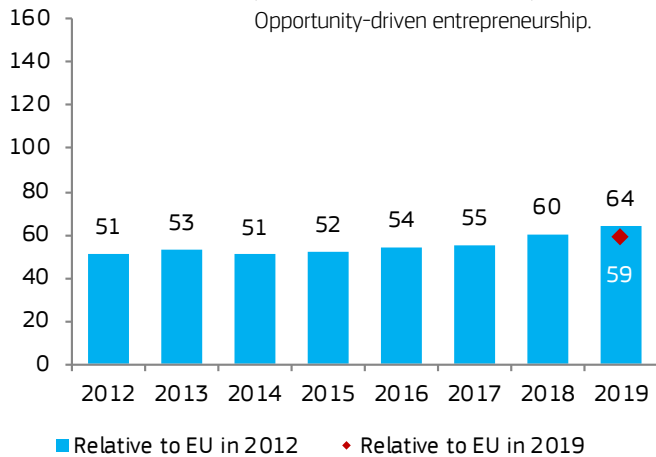**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Poland

Portugal is a **Strong Innovator**.
Over time, performance has increased relative to that of the EU in 2012. The strong increase in 2018 is almost entirely explained by improved performance on the indicators using CIS data.

■ Relative to EU in 2012 ◆ Relative to EU in 2019

Innovators, *Innovation-friendly environment* and *Attractive research systems* are the strongest innovation dimensions. Portugal scores particularly well on SMEs innovating in-house, Broadband penetration, SMEs with product or process innovations, and Foreign doctorate students. *Sales impacts*, *Linkages* and *Intellectual assets* are the weakest innovation dimensions. Portugal's lowest indicator scores comprise Exports of knowledge-intensive services, R&D expenditures in the business sector, Private co-funding of public R&D expenditures, and Public-private co-publications.

Structural differences with the EU are shown in the table below. Portugal shows the highest positive difference to the EU in Total Entrepreneurial Activity, FDI net inflows and Enterprise births, and the biggest negative difference in Top R&D spending enterprises, Employment share high and medium high-tech manufacturing and GDP per capita.

Portugal	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**96.7**	**83.8**	**105.3**
Human resources	**91.2**	**94.7**	**105.1**
New doctorate graduates	93.2	104.9	102.7
Population with tertiary education	85.1	62.8	108.3
Lifelong learning	96.9	117.8	104.4
Attractive research systems	**118.4**	**95.6**	**135.2**
International scientific co-publications	130.9	110.8	192.2
Most cited publications	91.4	94.4	91.5
Foreign doctorate students	153.6	84.7	177.1
Innovation-friendly environment	**130.7**	**118.1**	**227.2**
Broadband penetration	178.3	130.0	410.0
Opportunity-driven entrepreneurship	76.6	110.1	104.4
Finance and support	**83.3**	**84.2**	**83.3**
R&D expenditure in the public sector	86.9	90.8	86.9
Venture capital expenditures	79.2	73.0	79.2
Firm investments	**95.8**	**91.5**	**124.5**
R&D expenditure in the business sector	46.3	53.0	53.0
Non-R&D innovation expenditures	114.5	92.6	160.5
Enterprises providing ICT training	127.8	138.5	176.9
Innovators	**174.9**	**124.1**	**156.3**
SMEs product/process innovations	177.0	138.8	176.4
SMEs marketing/organizational innovations	151.8	124.6	124.6
SMEs innovating in-house	195.2	109.3	170.0
Linkages	**63.0**	**53.2**	**64.9**
Innovative SMEs collaborating with others	105.0	84.3	104.3
Public-private co-publications	47.4	41.3	53.6
Private co-funding of public R&D exp.	46.4	40.2	46.9
Intellectual assets	**75.8**	**69.1**	**70.8**
PCT patent applications	49.7	39.4	46.1
Trademark applications	102.9	76.9	109.5
Design applications	88.2	104.0	74.0
Employment impacts	**89.1**	**48.1**	**96.1**
Employment in knowledge-intensive activities	65.0	45.9	70.3
Employment fast-growing enterprises	108.6	49.8	117.0
Sales impacts	**55.7**	**67.1**	**55.4**
Medium and high-tech product exports	60.7	50.3	67.3
Knowledge-intensive services exports	38.5	52.1	39.8
Sales of new-to-market/firm innovations	70.7	100.2	59.1

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	PT	EU
Performance and structure of the economy		
GDP per capita (PPS)	23,100	29,100
Average annual GDP growth (%)	2.39	1.84
Employment share manufacturing (NACE C) (%)	17.2	16.6
of which High and medium high-tech (%)	19.2	37.5
Employment share services (NACE G-N) (%)	41.4	41.4
of which Knowledge-intensive services (%)	30.7	34.3
Turnover share SMEs (%)	n/a	38.3
Turnover share large enterprises (%)	n/a	43.2
Foreign-controlled enterprises – share of value added (%)	9.5	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.5	1.1
Total Entrepreneurial Activity (TEA) (%)	12.9	6.7
FDI net inflows (% GDP)	3.6	2.6
Top R&D spending enterprises per 10 million population	4.2	16.2
Buyer sophistication (1 to 7 best)	3.7	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	76.5	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.9	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.5	3.5
Rule of law (-2.5 to 2.5 best)	1.1	1.1
Demography		
Population size (millions)	10.3	446.2
Average annual population growth (%)	-0.16	0.14
Population density (inhabitants/km²)	113.2	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.24	1.36	2.70
Tertiary educational attainment (% of population aged 30-34)	31.9	35.5	40.0

1 Sources are provided in the introduction to the country profiles.

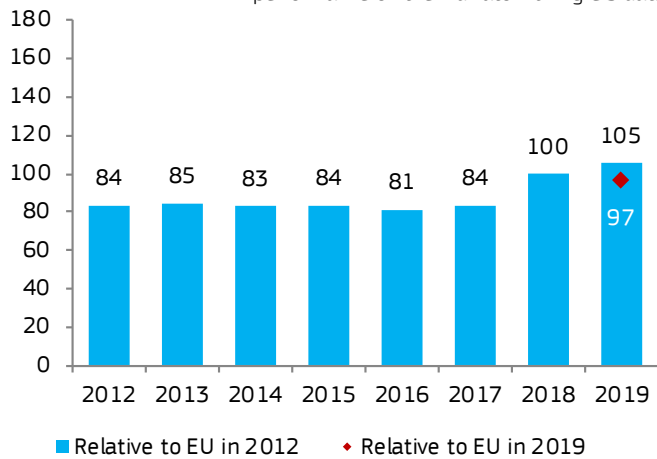**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Portugal

Romania is a **Modest Innovator**.

Over time, performance has declined relative to that of the EU in 2012. After a strong decline until 2014 – mainly due to reduced performance on the indicators using CIS data – , performance remained stable until 2016 and increased slightly in 2017 and 2019.
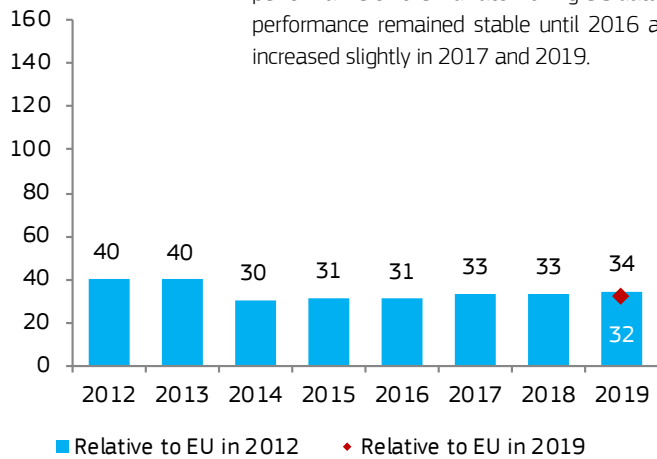
- Relative to EU in 2012
- Relative to EU in 2019

Innovation-friendly environment and *Sales impacts* are the strongest innovation dimensions. Broadband penetration and Medium and high-tech product exports are the only two indicators showing close to EU average performance. *Innovators, Firm investments* and *Human resources* are the weakest innovation dimensions. Romania's lowest indicator scores are on Lifelong learning, SMEs with product or process innovations, SMEs with marketing or organizational innovations, and SMEs innovating in-house (for all four indicators performance is lowest across all countries resulting in a relative score to the EU of 0).

Structural differences with the EU are shown in the table below. Romania shows the highest positive difference to the EU in Average annual change in GDP, Enterprise births and Total Entrepreneurial Activity, and the biggest negative difference in Top R&D spending enterprises, GDP per capita and Government procurement of advanced technology products, and total entrepreneurial activity are well above the EU average.

Romania	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**31.6**	**40.2**	**34.4**
Human resources	**11.8**	**46.7**	**13.6**
New doctorate graduates	24.2	108.7	26.6
Population with tertiary education	9.1	13.2	11.6
Lifelong learning	0.0	7.8	0.0
Attractive research systems	**28.7**	**19.8**	**32.8**
International scientific co-publications	20.9	18.2	30.6
Most cited publications	36.2	21.4	36.3
Foreign doctorate students	23.6	17.6	27.3
Innovation–friendly environment	**64.9**	**68.7**	**112.9**
Broadband penetration	100.0	110.0	230.0
Opportunity-driven entrepreneurship	25.1	40.9	34.3
Finance and support	**41.7**	**28.7**	**48.1**
R&D expenditure in the public sector	2.9	23.0	2.9
Venture capital expenditures	85.8	38.3	124.1
Firm investments	**8.1**	**29.6**	**10.6**
R&D expenditure in the business sector	18.7	11.8	21.5
Non-R&D innovation expenditures	0.0	80.6	0.0
Enterprises providing ICT training	5.6	0.0	7.7
Innovators	**0.0**	**26.7**	**0.0**
SMEs product/process innovations	0.0	19.9	0.0
SMEs marketing/organizational innovations	0.0	49.6	0.0
SMEs innovating in-house	0.0	9.6	0.0
Linkages	**39.3**	**59.7**	**40.5**
Innovative SMEs collaborating with others	6.3	21.2	6.3
Public-private co-publications	25.6	19.9	28.9
Private co-funding of public R&D exp.	64.6	98.7	65.1
Intellectual assets	**25.5**	**19.3**	**23.8**
PCT patent applications	23.5	20.3	21.8
Trademark applications	28.8	27.8	30.7
Design applications	25.1	11.2	21.1
Employment impacts	**41.9**	**16.7**	**45.2**
Employment in knowledge-intensive activities	25.0	10.8	27.0
Employment fast-growing enterprises	55.6	21.4	59.8
Sales impacts	**62.4**	**78.9**	**62.1**
Medium and high-tech product exports	100.7	90.4	111.6
Knowledge-intensive services exports	56.0	47.4	57.8
Sales of new-to-market/firm innovations	17.1	99.3	14.3

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	RO	EU
Performance and structure of the economy		
GDP per capita (PPS)	18,900	29,100
Average annual GDP growth (%)	4.26	1.84
Employment share manufacturing (NACE C) (%)	19.1	16.6
of which High and medium high-tech (%)	31.5	37.5
Employment share services (NACE G–N) (%)	31.3	41.4
of which Knowledge-intensive services (%)	27.5	34.3
Turnover share SMEs (%)	42.8	38.3
Turnover share large enterprises (%)	41.6	43.2
Foreign-controlled enterprises – share of value added (%)	14.2	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	2.4	1.1
Total Entrepreneurial Activity (TEA) (%)	10.8	6.7
FDI net inflows (% GDP)	3.1	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	2.8	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	73.0	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.4	1.9
Govt. procurement of advanced technology products (1 to 7 best)	2.5	3.5
Rule of law (-2.5 to 2.5 best)	0.4	1.1
Demography		
Population size (millions)	19.5	446.2
Average annual population growth (%)	-0.59	0.14
Population density (inhabitants/km^2)	84.6	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.49	0.50	2.00
Tertiary educational attainment (% of population aged 30-34)	25.6	25.4	26.7

1 Sources are provided in the introduction to the country profiles.

**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Romania

Slovenia is a **Moderate Innovator**. Over time, performance has declined relative to that of the EU in 2012. The decrease starting in 2018 is explained by worsened performance for New doctorate graduates and the indicators using CIS data.

Linkages, Human resources, and *Firm investments* are the strongest innovation dimensions. Slovenia scores high on International scientific co-publications, Public-private co-publications, Innovative SMEs collaborating with others, and Enterprises providing ICT training. *Finance and support, Sales impacts* and *Innovators* are the weakest innovation dimensions. Low-scoring indicators include Venture capital expenditures, Exports of knowledge-intensive services, Foreign doctorate students, and Design applications.

Structural differences with the EU are shown in the table below. Slovenia shows the highest positive difference to the EU in Average annual change in GDP, Employment share in manufacturing and Turnover share SMEs, and the biggest negative difference in Top R&D spending enterprises, Enterprise births and Government procurement of advanced technology products.

■ Relative to EU in 2012   ◆ Relative to EU in 2019

Slovenia	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**84.9**	**102.3**	**92.4**
Human resources	**110.6**	**180.9**	**127.3**
New doctorate graduates	100.3	249.5	110.4
Population with tertiary education	122.1	117.4	155.4
Lifelong learning	108.2	167.8	116.7
Attractive research systems	**88.4**	**80.1**	**101.0**
International scientific co-publications	147.3	159.9	216.9
Most cited publications	73.3	59.1	73.4
Foreign doctorate students	49.4	54.1	57.0
Innovation-friendly environment	**82.2**	**167.6**	**143.0**
Broadband penetration	95.7	130.0	220.0
Opportunity-driven entrepreneurship	67.0	192.8	91.3
Finance and support	**31.7**	**56.0**	**36.6**
R&D expenditure in the public sector	57.1	79.8	56.0
Venture capital expenditures	2.7	16.0	3.9
Firm investments	**103.7**	**136.1**	**134.7**
R&D expenditure in the business sector	100.0	141.3	114.6
Non-R&D innovation expenditures	84.0	97.1	117.7
Enterprises providing ICT training	127.8	169.2	176.9
Innovators	**68.6**	**87.0**	**61.4**
SMEs product/process innovations	70.0	95.0	69.7
SMEs marketing/organizational innovations	66.5	91.2	54.6
SMEs innovating in-house	69.3	75.0	60.4
Linkages	**112.9**	**138.5**	**116.3**
Innovative SMEs collaborating with others	135.2	152.0	134.2
Public-private co-publications	144.2	198.0	163.0
Private co-funding of public R&D exp.	85.5	105.8	86.3
Intellectual assets	**87.7**	**87.7**	**81.9**
PCT patent applications	83.9	88.6	77.8
Trademark applications	125.1	108.1	133.2
Design applications	55.7	70.1	46.7
Employment impacts	**97.6**	**72.4**	**105.3**
Employment in knowledge-intensive activities	102.5	108.1	110.8
Employment fast-growing enterprises	93.6	43.6	100.8
Sales impacts	**68.1**	**66.9**	**67.7**
Medium and high-tech product exports	106.6	99.6	118.1
Knowledge-intensive services exports	33.0	33.5	34.1
Sales of new-to-market/firm innovations	59.1	66.9	49.3

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	SI	EU
Performance and structure of the economy		
GDP per capita (PPS)	25,500	29,100
Average annual GDP growth (%)	3.25	1.84
Employment share manufacturing (NACE C) (%)	25.3	16.6
of which High and medium high-tech (%)	39.4	37.5
Employment share services (NACE G-N) (%)	35.9	41.4
of which Knowledge-intensive services (%)	34.4	34.3
Turnover share SMEs (%)	45.9	38.3
Turnover share large enterprises (%)	32.6	43.2
Foreign-controlled enterprises – share of value added (%)	13.0	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.8	1.1
Total Entrepreneurial Activity (TEA) (%)	7.0	6.7
FDI net inflows (% GDP)	2.8	2.6
Top R&D spending enterprises per 10 million population	9.7	16.2
Buyer sophistication (1 to 7 best)	3.4	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	76.4	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.0	1.9
Govt. procurement of advanced technology products (1 to 7 best)	2.6	3.5
Rule of law (-2.5 to 2.5 best)	1.1	1.1
Demography		
Population size (millions)	2.1	446.2
Average annual population growth (%)	0.36	0.14
Population density (inhabitants/km^2)	102.7	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	2.20	1.95	3.00
Tertiary educational attainment (% of population aged 30-34)	43.4	43.7	40.0

1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Slovenia

Slovakia is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2012.

■ Relative to EU in 2012   ◆ Relative to EU in 2019

Employment impacts and *Sales impacts* are the strongest innovation dimensions, with Slovakia performing above the EU average. Slovakia scores particularly well on Employment in fast-growing enterprises of innovative sectors, Sales of new-to-market and new-to-firm product innovations, Medium and high-tech product exports, and New doctorate graduates. *Finance and support*, *Innovators* and *Intellectual assets* are the weakest innovation dimensions. Overall, Slovakia's lowest indicator scores include Venture capital expenditures, R&D expenditures in the business sector, Lifelong learning, and Opportunity-driven entrepreneurship.

Structural differences with the EU are shown in the table below. Slovakia shows the highest positive difference to the EU in Total Entrepreneurial Activity, Value-added share foreign-controlled enterprises and Average annual change in GDP, and the biggest negative difference in Top R&D spending enterprises, GDP per capita and Buyer sophistication.

Slovakia	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**66.6**	**70.4**	**72.5**
Human resources	**81.9**	**79.5**	**94.3**
New doctorate graduates	104.0	142.4	114.5
Population with tertiary education	98.7	49.6	125.6
Lifelong learning	32.0	35.6	34.4
Attractive research systems	**49.4**	**34.4**	**56.4**
International scientific co-publications	63.5	55.3	93.3
Most cited publications	38.2	19.9	38.3
Foreign doctorate students	53.8	46.7	62.0
Innovation-friendly environment	**50.2**	**57.0**	**87.3**
Broadband penetration	65.2	90.0	150.0
Opportunity-driven entrepreneurship	33.2	34.8	45.2
Finance and support	**24.5**	**31.8**	**28.3**
R&D expenditure in the public sector	36.5	41.4	35.9
Venture capital expenditures	10.8	15.9	15.6
Firm investments	**63.7**	**88.1**	**82.7**
R&D expenditure in the business sector	29.3	16.6	33.6
Non-R&D innovation expenditures	89.9	111.0	126.1
Enterprises providing ICT training	72.2	153.8	100.0
Innovators	**41.7**	**60.0**	**37.2**
SMEs product/process innovations	45.8	68.0	45.6
SMEs marketing/organizational innovations	37.2	55.4	30.5
SMEs innovating in-house	41.5	57.1	36.1
Linkages	**61.2**	**66.7**	**63.0**
Innovative SMEs collaborating with others	86.1	86.7	85.4
Public-private co-publications	38.1	33.7	43.1
Private co-funding of public R&D exp.	57.8	69.0	58.4
Intellectual assets	**42.7**	**36.0**	**39.9**
PCT patent applications	38.7	34.6	35.9
Trademark applications	57.5	46.7	61.2
Design applications	33.7	29.5	28.3
Employment impacts	**130.3**	**141.7**	**140.5**
Employment in knowledge-intensive activities	56.3	63.5	60.8
Employment fast-growing enterprises	190.2	204.8	204.8
Sales impacts	**114.8**	**105.4**	**114.2**
Medium and high-tech product exports	132.5	124.2	146.9
Knowledge-intensive services exports	42.2	35.7	43.6
Sales of new-to-market/firm innovations	182.9	157.5	152.8

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	SK	EU
Performance and structure of the economy		
GDP per capita (PPS)	21,800	29,100
Average annual GDP growth (%)	3.13	1.84
Employment share manufacturing (NACE C) (%)	24.6	16.6
of which High and medium high-tech (%)	45.2	37.5
Employment share services (NACE G-N) (%)	34.1	41.4
of which Knowledge-intensive services (%)	29.1	34.3
Turnover share SMEs (%)	35.2	38.3
Turnover share large enterprises (%)	42.8	43.2
Foreign-controlled enterprises – share of value added (%)	19.9	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.6	1.1
Total Entrepreneurial Activity (TEA) (%)	12.4	6.7
FDI net inflows (% GDP)	n/a	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	3.0	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	n/a	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.9	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.1	3.5
Rule of law (-2.5 to 2.5 best)	n/a	1.1
Demography		
Population size (millions)	5.4	446.2
Average annual population growth (%)	0.14	0.14
Population density (inhabitants/km^2)	111.7	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.16	0.84	1.20
Tertiary educational attainment (% of population aged 30-34)	28.4	39.8	40.0

1 Sources are provided in the introduction to the country profiles.

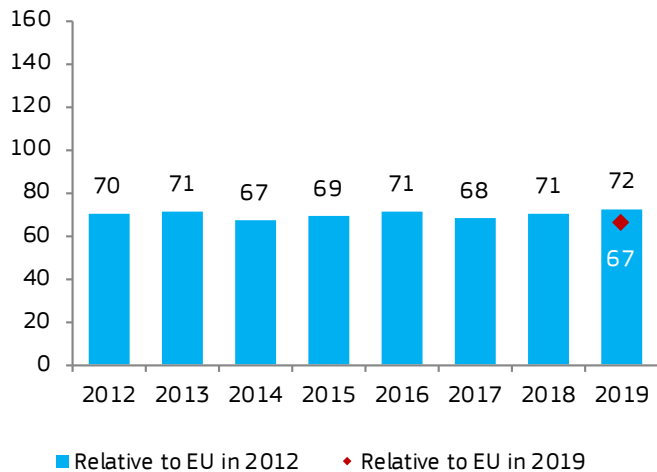**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Slovakia

Finland is an **Innovation Leader**.

Over time, performance has increased relative to that of the EU in 2012. The strong increase in 2018 is almost entirely explained by improved performance on the indicators using CIS data.

Relative to EU in 2012　◆ Relative to EU in 2019

Innovation-friendly environment, *Human resources* and *Innovators* are the strongest innovation dimensions. Indicator performance on Lifelong learning, Innovative SMEs collaborating with others, Public-private co-publications, and International scientific co-publications is well above the EU average. *Employment impacts*, *Sales impacts* and *Intellectual assets* are the weakest innovation dimensions. Finland's lowest indicator scores are on Employment in fast-growing enterprises of innovative sectors, Medium and high-tech product exports, Private co-funding of public R&D expenditures, and Sales of new-to-market and new-to-firm product innovations.

Structural differences with the EU are shown in the table below. Finland shows the highest positive difference to the EU in Top R&D spending enterprises, Buyer sophistication and Basic-school entrepreneurial education and training, and the biggest negative difference in Enterprise births, Average annual change in GDP and Employment share in manufacturing.

Finland	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**139.8**	**133.3**	**152.2**
Human resources	**172.4**	**183.1**	**198.5**
New doctorate graduates	143.5	167.6	158.1
Population with tertiary education	114.9	136.4	146.3
Lifelong learning	284.5	254.4	306.7
Attractive research systems	**151.9**	**126.1**	**173.5**
International scientific co-publications	227.8	212.8	334.6
Most cited publications	120.5	117.8	120.6
Foreign doctorate students	124.4	67.4	143.4
Innovation-friendly environment	**184.9**	**159.2**	**321.6**
Broadband penetration	169.6	210.0	390.0
Opportunity-driven entrepreneurship	202.3	125.1	275.6
Finance and support	**137.4**	**155.7**	**158.7**
R&D expenditure in the public sector	137.3	156.8	134.8
Venture capital expenditures	137.6	153.8	198.9
Firm investments	**129.9**	**183.3**	**168.7**
R&D expenditure in the business sector	124.7	203.6	142.9
Non-R&D innovation expenditures	88.5	88.7	124.1
Enterprises providing ICT training	177.8	253.8	246.2
Innovators	**171.5**	**111.8**	**153.3**
SMEs product/process innovations	177.0	126.1	176.4
SMEs marketing/organizational innovations	141.1	95.4	115.8
SMEs innovating in-house	195.2	114.9	170.0
Linkages	**163.1**	**169.1**	**167.9**
Innovative SMEs collaborating with others	247.9	187.0	246.1
Public-private co-publications	230.4	259.4	260.4
Private co-funding of public R&D exp.	83.1	120.9	83.9
Intellectual assets	**127.1**	**116.5**	**118.7**
PCT patent applications	149.5	144.4	138.8
Trademark applications	126.0	106.9	134.1
Design applications	93.8	85.6	78.7
Employment impacts	**86.7**	**92.0**	**93.5**
Employment in knowledge-intensive activities	133.8	132.4	144.6
Employment fast-growing enterprises	48.6	59.4	52.4
Sales impacts	**90.6**	**85.3**	**90.1**
Medium and high-tech product exports	71.9	61.6	79.7
Knowledge-intensive services exports	113.8	87.1	117.5
Sales of new-to-market/firm innovations	87.1	108.3	72.7

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	FI	EU
Performance and structure of the economy		
GDP per capita (PPS)	33,100	29,100
Average annual GDP growth (%)	1.31	1.84
Employment share manufacturing (NACE C) (%)	13.3	16.6
of which High and medium high-tech (%)	36.4	37.5
Employment share services (NACE G-N) (%)	39.9	41.4
of which Knowledge-intensive services (%)	39.5	34.3
Turnover share SMEs (%)	40.2	38.3
Turnover share large enterprises (%)	44.4	43.2
Foreign-controlled enterprises – share of value added (%)	9.5	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.4	1.1
Total Entrepreneurial Activity (TEA) (%)	6.7	6.7
FDI net inflows (% GDP)	2.2	2.6
Top R&D spending enterprises per 10 million population	64.8	16.2
Buyer sophistication (1 to 7 best)	4.6	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	80.1	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.4	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.9	3.5
Rule of law (-2.5 to 2.5 best)	2.0	1.1
Demography		
Population size (millions)	5.5	446.2
Average annual population growth (%)	0.13	0.14
Population density (inhabitants/km^2)	18.1	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	2.87	2.75	4.00
Tertiary educational attainment (% of population aged 30-34)	45.5	46.6	42.0

1 Sources are provided in the introduction to the country profiles.

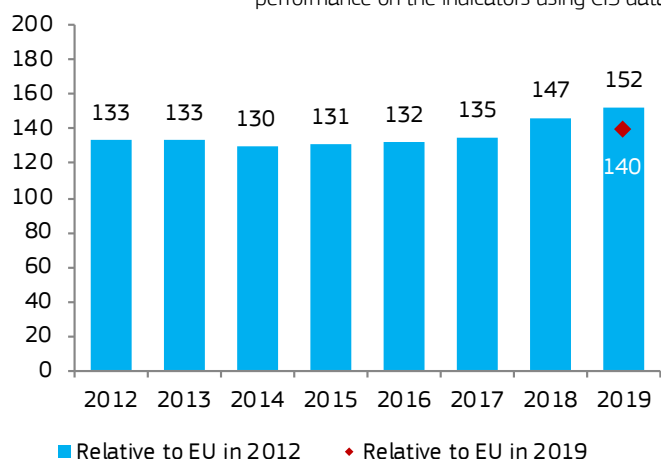**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Finland

Sweden is an **Innovation Leader**.
Over time, performance has increased relative to that of the EU in 2012.

- Relative to EU in 2012 ◆ Relative to EU in 2019

Human resources, *Attractive research systems* and *Innovation-friendly environment* are the strongest innovation dimensions. Sweden scores high on most indicators compared to the EU but particularly on Public-private co-publications, Lifelong learning, International scientific co-publications, and Foreign doctorate students. *Sales impacts* is the weakest innovation dimension with performance below the EU average. Low-scoring indicators include Sales of new-to-market and new-to-firm product innovations, Private co-funding of public R&D expenditures, Enterprises providing ICT training, and Venture capital expenditures.

Structural differences with the EU are shown in the table below. Sweden shows the highest positive difference to the EU in Top R&D spending enterprises, Basic-school entrepreneurial education and training and Employment share knowledge-intensive services, and the biggest negative difference in Enterprise births, Employment share in manufacturing and Average annual change in GDP.

Sweden	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**140.7**	**146.2**	**153.1**
Human resources	**188.4**	**219.3**	**217.0**
New doctorate graduates	144.8	168.8	159.5
Population with tertiary education	157.1	196.7	200.0
Lifelong learning	284.5	306.7	306.7
Attractive research systems	**184.7**	**172.0**	**210.9**
International scientific co-publications	257.3	257.8	377.9
Most cited publications	132.8	131.2	132.9
Foreign doctorate students	198.1	182.5	228.4
Innovation-friendly environment	**178.3**	**240.4**	**310.2**
Broadband penetration	178.3	220.0	410.0
Opportunity-driven entrepreneurship	178.4	254.1	243.1
Finance and support	**122.1**	**146.6**	**141.1**
R&D expenditure in the public sector	144.8	145.8	142.2
Venture capital expenditures	96.3	147.8	139.2
Firm investments	**135.2**	**143.8**	**175.5**
R&D expenditure in the business sector	163.6	176.1	187.4
Non-R&D innovation expenditures	92.2	109.4	129.2
Enterprises providing ICT training	150.0	138.5	207.7
Innovators	**115.7**	**123.8**	**103.4**
SMEs product/process innovations	117.0	137.1	116.6
SMEs marketing/organizational innovations	105.5	106.6	86.6
SMEs innovating in-house	124.3	128.7	108.2
Linkages	**150.5**	**162.9**	**154.9**
Innovative SMEs collaborating with others	147.8	199.0	146.8
Public-private co-publications	298.5	297.2	337.5
Private co-funding of public R&D exp.	82.5	85.7	83.3
Intellectual assets	**131.3**	**122.9**	**122.6**
PCT patent applications	155.6	144.4	144.4
Trademark applications	125.0	117.3	133.1
Design applications	100.4	97.7	84.2
Employment impacts	**155.5**	**159.9**	**167.8**
Employment in knowledge-intensive activities	163.8	177.0	177.0
Employment fast-growing enterprises	148.9	146.2	160.3
Sales impacts	**89.7**	**85.2**	**89.2**
Medium and high-tech product exports	96.7	93.5	107.2
Knowledge-intensive services exports	105.8	114.1	109.3
Sales of new-to-market/firm innovations	59.4	46.6	49.6

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	SE	EU
Performance and structure of the economy		
GDP per capita (PPS)	36,700	29,100
Average annual GDP growth (%)	1.70	1.84
Employment share manufacturing (NACE C) (%)	10.2	16.6
of which High and medium high-tech (%)	43.1	37.5
Employment share services (NACE G-N) (%)	41.3	41.4
of which Knowledge-intensive services (%)	44.3	34.3
Turnover share SMEs (%)	38.5	38.3
Turnover share large enterprises (%)	43.1	43.2
Foreign-controlled enterprises – share of value added (%)	13.2	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.4	1.1
Total Entrepreneurial Activity (TEA) (%)	7.5	6.7
FDI net inflows (% GDP)	2.9	2.6
Top R&D spending enterprises per 10 million population	79.1	16.2
Buyer sophistication (1 to 7 best)	4.6	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	82.1	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.5	1.9
Govt. procurement of advanced technology products (1 to 7 best)	4.0	3.5
Rule of law (-2.5 to 2.5 best)	2.0	1.1
Demography		
Population size (millions)	10.1	446.2
Average annual population growth (%)	1.17	0.14
Population density (inhabitants/km^2)	24.7	108.6

EU targets for 2020

Indicator	2015	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	3.23	3.32	4.00
Tertiary educational attainment (% of population aged 30-34)	50.2	52.3	45.0

1 Sources are provided in the introduction to the country profiles.

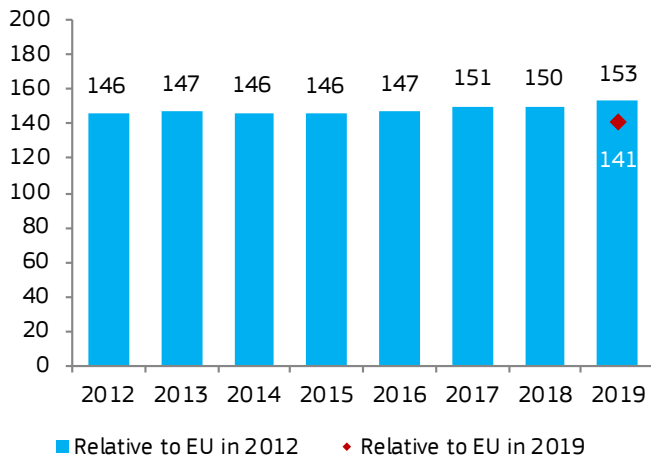**European Semester country report and country specific recommendations:**

https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

https://rio.jrc.ec.europa.eu/en/country-analysis/Sweden

Iceland is a **Strong Innovator**.
Over time, performance has declined relative to that of the EU in 2012.
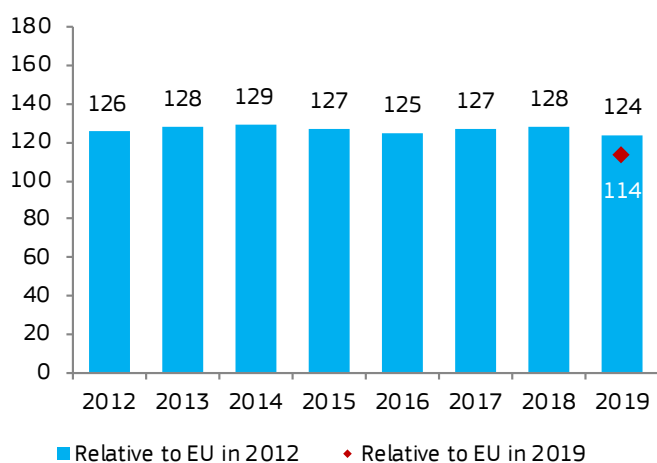
Innovation-friendly environment, *Attractive research systems* and *Linkages* are the strongest innovation dimensions. Iceland scores particularly well on Public-private co-publications, International scientific co-publications, Innovative SMEs collaborating with others, and Lifelong learning. *Sales impacts* and *Intellectual assets* are the weakest innovation dimensions. Iceland's lowest indicator scores are on Medium and high-tech product exports, Sales of new-to-market and new-to-firm product innovations, and Private co-funding of public R&D expenditures.

Structural differences with the EU are shown in the table below. Iceland shows the highest positive difference to the EU in Top R&D spending enterprises, Average annual change in GDP and Enterprise births, and the biggest negative difference in FDI net inflows, Employment share high and medium high-tech manufacturing and Employment share in manufacturing.

Bar chart: values 126 (2012), 128 (2013), 129 (2014), 127 (2015), 125 (2016), 127 (2017), 128 (2018), 124 (2019) with 114 marked for 2019.

■ Relative to EU in 2012   ◆ Relative to EU in 2019

Iceland	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**114.1**	**125.8**	**124.2**
Human resources	**136.4**	**153.6**	**157.1**
New doctorate graduates	60.3	60.1	66.4
Population with tertiary education	151.3	140.5	192.6
Lifelong learning	212.4	283.3	228.9
Attractive research systems	**176.5**	**193.1**	**201.6**
International scientific co-publications	277.1	375.7	406.9
Most cited publications	123.4	144.6	123.5
Foreign doctorate students	160.9	134.5	185.5
Innovation–friendly environment §	**189.5**	**329.6**	**329.6**
Broadband penetration	N/A	N/A	N/A
Opportunity-driven entrepreneurship	202.3	275.6	275.6
Finance and support §	**106.5**	**132.2**	**123.1**
R&D expenditure in the public sector	100.0	105.5	98.2
Venture capital expenditures	N/A	N/A	N/A
Firm investments §	**99.7**	**127.4**	**129.5**
R&D expenditure in the business sector	89.4	74.1	102.4
Non-R&D innovation expenditures	N/A	N/A	N/A
Enterprises providing ICT training	111.1	184.6	153.8
Innovators §	**131.0**	**147.0**	**117.1**
SMEs product/process innovations	140.2	176.3	139.7
SMEs marketing/organizational innovations	117.0	119.7	96.1
SMEs innovating in-house	N/A	N/A	N/A
Linkages	**166.2**	**162.3**	**171.1**
Innovative SMEs collaborating with others	266.8	198.8	264.9
Public-private co-publications	324.9	277.3	367.3
Private co-funding of public R&D exp.	34.4	93.0	34.7
Intellectual assets	**76.3**	**82.0**	**71.3**
PCT patent applications	96.4	84.2	89.5
Trademark applications	86.9	146.3	92.4
Design applications	34.8	27.8	29.2
Employment impacts	**134.6**	**117.9**	**145.2**
Employment in knowledge-intensive activities	178.8	173.0	193.2
Employment fast-growing enterprises	98.9	73.4	106.5
Sales impacts	**31.7**	**36.8**	**31.6**
Medium and high-tech product exports	0.0	0.0	0.0
Knowledge-intensive services exports	66.9	84.9	69.1
Sales of new-to-market/firm innovations	31.2	26.1	26.1

Performance and structure of the economy	IS	EU
GDP per capita (PPS)	38,900	29,100
Average annual GDP growth (%)	2.85	1.84
Employment share manufacturing (NACE C) (%)	9.6	16.6
of which High and medium high-tech (%)	15.0	37.5
Employment share services (NACE G-N) (%)	44.8	41.4
of which Knowledge-intensive services (%)	40.9	34.3
Turnover share SMEs (%)	n/a	38.3
Turnover share large enterprises (%)	n/a	43.2
Foreign-controlled enterprises – share of value added (%)	n/a	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.5	1.1
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	-11.8	2.6
Top R&D spending enterprises per 10 million population	29.4	16.2
Buyer sophistication (1 to 7 best)	4.1	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	79.0	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.6	3.5
Rule of law (-2.5 to 2.5 best)	1.6	1.1
Demography		
Population size (millions)	0.3	446.2
Average annual population growth (%)	2.72	0.14
Population density (inhabitants/km²)	3.4	108.6

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

§ Due to missing data, the relative dimension score does not necessarily reflect that of the indicators.

Israel is a **Strong Innovator**.
Over time, performance has remained the same compared to that of the EU in 2012.

■ Relative to EU in 2012   ◆ Relative to EU in 2019
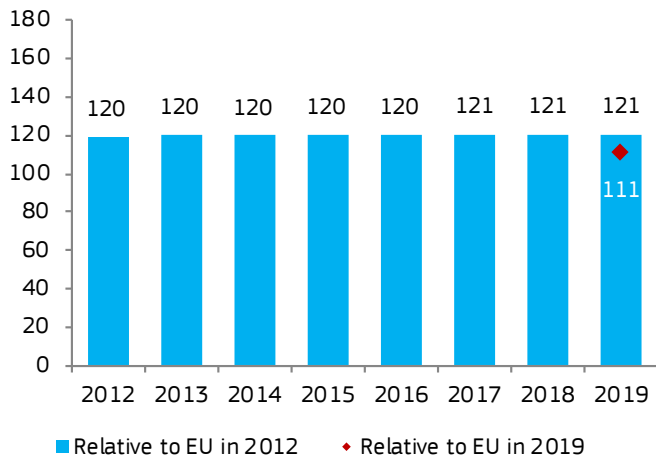
Firm investments, Employment impacts and *Linkages* are the strongest innovation dimensions. Israel scores high on Employment in knowledge-intensive activities, R&D expenditures in the business sector, Population with tertiary education, and PCT patent applications. *Innovation-friendly environment, Finance and support* and *Innovators* are the weakest innovation dimensions. Low-scoring indicators include Design applications, Trademark applications, and SMEs with product or process innovations.

Structural differences with the EU are shown in the table below. Israel shows the highest positive difference to the EU in Total Entrepreneurial Activity, FDI net inflows and Average annual change in GDP, and the biggest negative difference in Employment share in manufacturing, GDP per capita and Ease of starting a business.

Israel	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**111.1**	**119.7**	**120.9**
Human resources §	**121.5**	**129.7**	**139.9**
New doctorate graduates	65.3	68.5	71.9
Population with tertiary education	157.3	183.5	200.2
Lifelong learning	N/A	N/A	N/A
Attractive research systems §	**113.0**	**128.3**	**129.1**
International scientific co-publications	110.5	128.6	162.2
Most cited publications	95.0	108.2	95.1
Foreign doctorate students	N/A	N/A	N/A
Innovation-friendly environment §	**70.2**	**106.6**	**122.0**
Broadband penetration	N/A	N/A	N/A
Opportunity-driven entrepreneurship	74.9	89.1	102.0
Finance and support §	**80.5**	**95.9**	**93.0**
R&D expenditure in the public sector	75.6	76.5	74.2
Venture capital expenditures	N/A	N/A	N/A
Firm investments §	**179.8**	**233.5**	**233.5**
R&D expenditure in the business sector	177.7	203.6	203.6
Non-R&D innovation expenditures	N/A	N/A	N/A
Enterprises providing ICT training	N/A	N/A	N/A
Innovators	**86.2**	**77.1**	**77.1**
SMEs product/process innovations	56.0	55.8	55.8
SMEs marketing/organizational innovations	141.4	116.1	116.1
SMEs innovating in-house	65.4	57.0	57.0
Linkages	**132.3**	**139.0**	**136.2**
Innovative SMEs collaborating with others	144.1	143.1	143.1
Public-private co-publications	75.3	98.5	85.2
Private co-funding of public R&D exp.	152.3	153.7	153.7
Intellectual assets	**90.0**	**80.1**	**84.1**
PCT patent applications	155.6	144.4	144.4
Trademark applications	50.3	34.2	53.6
Design applications	29.7	27.6	24.9
Employment impacts	**172.5**	**215.4**	**186.1**
Employment in knowledge-intensive activities	235.0	254.1	254.1
Employment fast-growing enterprises	121.9	184.3	131.3
Sales impacts	**98.1**	**85.4**	**97.6**
Medium and high-tech product exports	99.2	95.2	109.9
Knowledge-intensive services exports	100.6	82.6	103.9
Sales of new-to-market/firm innovations	93.5	78.1	78.1

	IL	EU
Performance and structure of the economy		
GDP per capita (PPS)	26,980	29,100
Average annual GDP growth (%)	3.03	1.84
Employment share manufacturing (NACE C) (%)	10.8	16.6
of which High and medium high-tech (%)	n/a	37.5
Employment share services (NACE G-N) (%)	42.1	41.4
of which Knowledge-intensive services (%)	n/a	34.3
Turnover share SMEs (%)	n/a	38.3
Turnover share large enterprises (%)	n/a	43.2
Foreign-controlled enterprises – share of value added (%)	n/a	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	n/a	1.1
Total Entrepreneurial Activity (TEA) (%)	12.7	6.7
FDI net inflows (% GDP)	4.8	2.6
Top R&D spending enterprises per 10 million population	24.9	16.2
Buyer sophistication (1 to 7 best)	4.2	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	75.3	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.9	1.9
Govt. procurement of advanced technology products (1 to 7 best)	4.4	3.5
Rule of law (-2.5 to 2.5 best)	1.0	1.1
Demography		
Population size (millions)	8.7	446.2
Average annual population growth (%)	1.95	0.14
Population density (inhabitants/km²)	402.7	108.6

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

§ Due to missing data, the relative dimension score does not necessarily reflect that of the indicators.

North Macedonia is a **Modest Innovator**. Over time, performance has increased relative to that of the EU in 2012, most notably due to improved performance in Foreign doctorate students, Medium- and high-tech product exports, Tertiary education, and Broadband penetration.

Relative to EU in 2012 ◆ Relative to EU in 2019
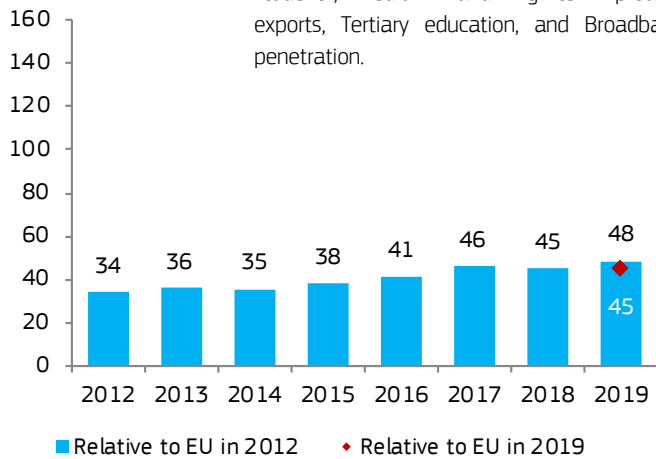
Attractive research systems, Innovators and *Firm investments,* are the strongest innovation dimensions. North Macedonia scores particularly well on Foreign doctorate students, Medium and high-tech product exports, Non-R&D innovation expenditures, and Population with tertiary education. *Employment impacts, Finance and support* and *Intellectual assets* are the weakest innovation dimensions. Overall, North Macedonia's lowest indicator scores include Public-private co-publications, Private co-funding of public R&D expenditures, Design applications, and Sales of new-to-market and new-to-firm product innovations.

Structural differences with the EU are shown in the table below. North Macedonia shows the highest positive difference to the EU in FDI net inflows, Employment share in manufacturing and Turnover share SMEs, and the biggest negative difference in Top R&D spending enterprises, GDP per capita and Employment share high and medium high-tech manufacturing.

North Macedonia	Relative to EU 2019 in 2019		Performance relative to EU 2012 in	
			2012	2019
SUMMARY INNOVATION INDEX	**44.5**		**33.7**	**48.5**
Human resources	**38.2**		**29.2**	**44.0**
New doctorate graduates	18.7		22.7	20.6
Population with tertiary education	74.0		35.5	94.2
Lifelong learning	15.5		30.0	16.7
Attractive research systems	**81.0**		**19.3**	**92.6**
International scientific co-publications	17.2		12.6	25.3
Most cited publications	44.8		10.1	44.8
Foreign doctorate students	218.9		44.7	252.3
Innovation-friendly environment §	**50.8**		**56.3**	**88.4**
Broadband penetration	47.8		70.0	110.0
Opportunity-driven entrepreneurship	N/A		N/A	N/A
Finance and support §	**13.1**		**41.5**	**15.1**
R&D expenditure in the public sector	12.3		33.1	12.0
Venture capital expenditures	N/A		N/A	N/A
Firm investments	**61.8**		**70.9**	**80.3**
R&D expenditure in the business sector	5.3		0.0	6.1
Non-R&D innovation expenditures	113.9		159.7	159.7
Enterprises providing ICT training	66.7		69.2	92.3
Innovators §	**73.9**		**62.8**	**66.0**
SMEs product/process innovations	73.6		68.6	73.3
SMEs marketing/organizational innovations	72.1		57.4	59.2
SMEs innovating in-house	N/A		N/A	N/A
Linkages	**17.1**		**21.5**	**17.6**
Innovative SMEs collaborating with others	61.1		71.9	60.7
Public-private co-publications	0.0		3.1	0.0
Private co-funding of public R&D exp.	0.0		0.0	0.0
Intellectual assets	**14.3**		**2.5**	**13.4**
PCT patent applications	28.0		0.0	26.0
Trademark applications	6.2		9.4	6.6
Design applications	1.5		0.6	1.3
Employment impacts §	**6.7**		**18.1**	**7.2**
Employment in knowledge-intensive activities	7.5		20.3	8.1
Employment fast-growing enterprises	N/A		N/A	N/A
Sales impacts	**54.3**		**33.4**	**54.0**
Medium and high-tech product exports	118.2		63.7	131.1
Knowledge-intensive services exports	23.7		31.4	24.5
Sales of new-to-market/firm innovations	4.1		3.4	3.4

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.
*§ Due to missing data, the relative dimension score does not necessarily reflect that of the indicators.*

	MK	EU
Performance and structure of the economy		
GDP per capita (PPS)	10,700	29,100
Average annual GDP growth (%)	1.88	1.84
Employment share manufacturing (NACE C) (%)	19.4	16.6
of which High and medium high-tech (%)	19.4	37.5
Employment share services (NACE G-N) (%)	30.8	41.4
of which Knowledge-intensive services (%)	21.0	34.3
Turnover share SMEs (%)	44.1	38.3
Turnover share large enterprises (%)	32.0	43.2
Foreign-controlled enterprises – share of value added (%)	n/a	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	n/a	1.1
Total Entrepreneurial Activity (TEA) (%)	6.2	6.7
FDI net inflows (% GDP)	4.5	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	2.9	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	80.6	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.1	1.9
Govt. procurement of advanced technology products (1 to 7 best)	2.7	3.5
Rule of law (-2.5 to 2.5 best)	n/a	1.1
Demography		
Population size (millions)	2.1	446.2
Average annual population growth (%)	0.08	0.14
Population density (inhabitants/km^2)	83.3	108.6

Montenegro is a **Modest Innovator**. Over time, performance has increased relative to that of the EU in 2012. The strong increase between 2018 and 2019 is mostly due to improved performance on Broadband penetration, Most cited publications, and Private co-funding of public R&D.
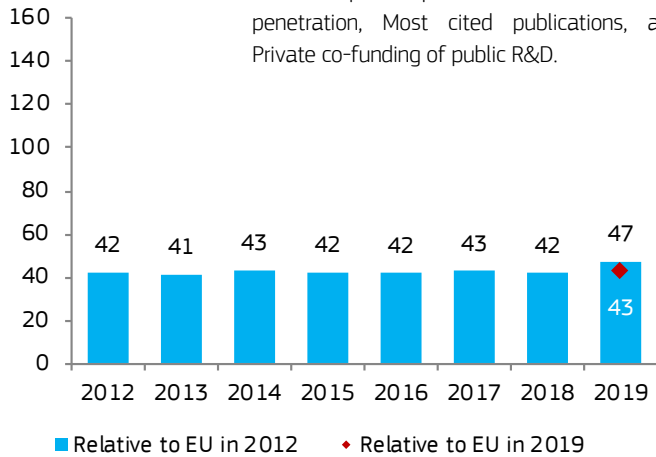
Innovators, *Innovation-friendly environment* and *Employment impacts* are the strongest innovation dimensions. Montenegro performs well on SMEs with product or process innovations, Foreign doctorate students, Enterprises providing ICT training, and Innovative SMEs collaborating with others. *Sales impacts*, *Intellectual assets* and *Finance and support* are the weakest innovation dimensions. Montenegro's lowest indicator scores are on New doctorate graduates, Design applications, Medium and high-tech product exports, and R&D expenditures in the business sector.

Structural differences with the EU are shown in the table below. Montenegro shows the highest positive difference to the EU in FDI net inflows, Average annual change in GDP and Employment share in services, and the biggest negative difference in Top R&D spending enterprises, Employment share in manufacturing and GDP per capita.

Chart (bar values by year): 2012: 42, 2013: 41, 2014: 43, 2015: 42, 2016: 42, 2017: 43, 2018: 42, 2019: 47 (with 43 marked)

■ Relative to EU in 2012 ◆ Relative to EU in 2019

Montenegro	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**43.4**	**42.2**	**47.2**
Human resources	**40.4**	**29.3**	**46.5**
New doctorate graduates	0.0	0.0	0.0
Population with tertiary education	91.6	72.7	116.5
Lifelong learning	23.7	16.7	25.6
Attractive research systems	**55.7**	**44.3**	**63.6**
International scientific co-publications	48.3	29.7	70.9
Most cited publications	32.4	13.1	32.4
Foreign doctorate students	106.6	122.9	122.9
Innovation-friendly environment §	**78.6**	**64.3**	**136.7**
Broadband penetration	73.9	80.0	170.0
Opportunity-driven entrepreneurship	N/A	N/A	N/A
Finance and support §	**23.0**	**8.2**	**26.6**
R&D expenditure in the public sector	21.6	6.5	21.2
Venture capital expenditures	N/A	N/A	N/A
Firm investments	**37.0**	**42.2**	**48.0**
R&D expenditure in the business sector	1.1	4.5	1.2
Non-R&D innovation expenditures	6.2	8.8	8.8
Enterprises providing ICT training	105.6	123.1	146.2
Innovators §	**135.4**	**121.0**	**121.0**
SMEs product/process innovations	165.0	164.4	164.4
SMEs marketing/organizational innovations	98.2	80.6	80.6
SMEs innovating in-house	N/A	N/A	N/A
Linkages	**38.9**	**56.0**	**40.1**
Innovative SMEs collaborating with others	99.4	98.7	98.7
Public-private co-publications	19.8	8.3	22.4
Private co-funding of public R&D exp.	13.4	51.1	13.5
Intellectual assets	**15.4**	**17.0**	**14.3**
PCT patent applications	34.4	39.1	31.9
Trademark applications	1.8	0.0	1.9
Design applications	0.0	0.0	0.0
Employment impacts §	**57.0**	**57.9**	**61.5**
Employment in knowledge-intensive activities	63.8	64.9	68.9
Employment fast-growing enterprises	N/A	N/A	N/A
Sales impacts	**12.1**	**13.2**	**12.0**
Medium and high-tech product exports	0.0	0.0	0.0
Knowledge-intensive services exports	1.1	4.6	1.2
Sales of new-to-market/firm innovations	42.9	35.8	35.8

	ME	EU
Performance and structure of the economy		
GDP per capita (PPS)	13,800	29,100
Average annual GDP growth (%)	4.89	1.84
Employment share manufacturing (NACE C) (%)	5.8	16.6
of which High and medium high-tech (%)	n/a	37.5
Employment share services (NACE G-N) (%)	48.6	41.4
of which Knowledge-intensive services (%)	27.5	34.3
Turnover share SMEs (%)	n/a	38.3
Turnover share large enterprises (%)	n/a	43.2
Foreign-controlled enterprises – share of value added (%)	n/a	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	n/a	1.1
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	8.5	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	3.2	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	73.8	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.2	3.5
Rule of law (-2.5 to 2.5 best)	0.0	1.1
Demography		
Population size (millions)	0.6	446.2
Average annual population growth (%)	-0.02	0.14
Population density (inhabitants/km²)	45.7	108.6
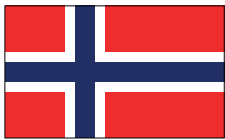
The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.
*§ Due to missing data, the relative dimension score does not necessarily reflect that of the indicators.*

Norway is a **Strong Innovator**.
Over time, performance has increased relative to that of the EU in 2012. The strong increase in 2018 is almost entirely explained by improved performance on the indicators using CIS data.

Relative to EU in 2012   ◆ Relative to EU in 2019
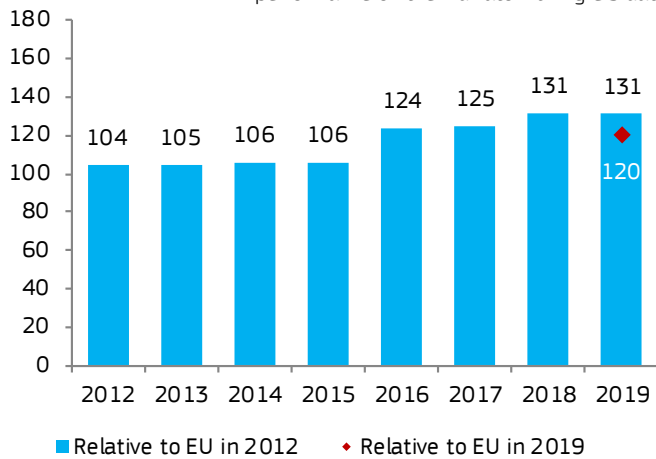
Innovators, *Linkages* and *Attractive research systems* are the strongest innovation dimensions. Norway performs well on International scientific co-publications, Public-private co-publications, Innovative SMEs collaborating with others, and SMEs innovating in-house. *Sales impacts*, *Intellectual assets* and *Employment impacts* are the weakest innovation dimensions. Norway's lowest indicator scores are on Medium and high-tech product exports, Design applications, Employment in fast-growing enterprises of innovative sectors, and Sales of new-to-market and new-to-firm product innovations.

Structural differences with the EU are shown in the table below. Norway shows the highest positive difference to the EU in Basic-school entrepreneurial education and training, GDP per capita and Total Entrepreneurial Activity, and the biggest negative difference in FDI net inflows, Employment share in manufacturing and Average annual change in GDP.

| Norway	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**120.4**	**104.5**	**131.1**
Human resources	**150.7**	**181.9**	**173.6**
New doctorate graduates	107.7	136.9	118.6
Population with tertiary education	159.1	218.2	202.5
Lifelong learning	193.8	196.7	208.9
Attractive research systems	**160.5**	**169.7**	**183.3**
International scientific co-publications	259.3	244.3	380.8
Most cited publications	123.9	123.6	124.0
Foreign doctorate students	116.5	201.0	134.3
Innovation-friendly environment	**143.4**	**217.1**	**249.3**
Broadband penetration	130.4	130.0	300.0
Opportunity-driven entrepreneurship	158.0	275.6	215.3
Finance and support	**118.2**	**105.5**	**136.5**
R&D expenditure in the public sector	150.4	109.2	147.7
Venture capital expenditures	81.4	99.3	117.7
Firm investments	**112.7**	**105.2**	**146.3**
R&D expenditure in the business sector	73.9	66.0	84.6
Non-R&D innovation expenditures	82.8	6.8	116.1
Enterprises providing ICT training	183.3	253.8	253.8
Innovators	**183.8**	**65.1**	**164.3**
SMEs product/process innovations	177.0	71.7	176.4
SMEs marketing/organizational innovations	179.7	61.9	147.5
SMEs innovating in-house	195.2	62.2	170.0
Linkages	**168.9**	**135.0**	**174.0**
Innovative SMEs collaborating with others	252.0	102.2	250.2
Public-private co-publications	255.1	284.1	288.4
Private co-funding of public R&D exp.	81.2	91.7	81.9
Intellectual assets	**59.0**	**52.9**	**55.1**
PCT patent applications	93.8	92.8	87.0
Trademark applications	48.6	36.2	51.7
Design applications	16.2	10.9	13.6
Employment impacts	**78.4**	**98.7**	**84.6**
Employment in knowledge-intensive activities	126.3	120.3	136.5
Employment fast-growing enterprises	39.7	81.3	42.8
Sales impacts	**53.1**	**48.4**	**52.8**
Medium and high-tech product exports	0.0	0.0	0.0
Knowledge-intensive services exports	118.4	119.0	122.3
Sales of new-to-market/firm innovations	43.9	26.3	36.6

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	NO	EU
Performance and structure of the economy		
GDP per capita (PPS)	44,300	29,100
Average annual GDP growth (%)	1.19	1.84
Employment share manufacturing (NACE C) (%)	8.0	16.6
of which High and medium high-tech (%)	33.2	37.5
Employment share services (NACE G-N) (%)	38.6	41.4
of which Knowledge-intensive services (%)	38.5	34.3
Turnover share SMEs (%)	36.0	38.3
Turnover share large enterprises (%)	40.9	43.2
Foreign-controlled enterprises – share of value added (%)	12.7	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.1	1.1
Total Entrepreneurial Activity (TEA) (%)	8.4	6.7
FDI net inflows (% GDP)	-2.5	2.6
Top R&D spending enterprises per 10 million population	19.7	16.2
Buyer sophistication (1 to 7 best)	4.4	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	82.7	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	3.1	1.9
Govt. procurement of advanced technology products (1 to 7 best)	4.1	3.5
Rule of law (-2.5 to 2.5 best)	2.0	1.1
Demography		
Population size (millions)	5.3	446.2
Average annual population growth (%)	0.66	0.14
Population density (inhabitants/km²)	17.1	108.6

Serbia is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2012.
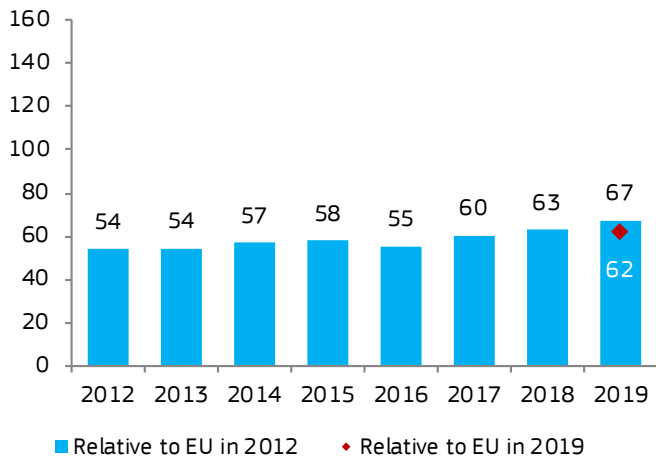
Innovators, Firm investments, and *Innovation-friendly environment* are the strongest innovation dimensions. Serbia scores high on Enterprises providing ICT training, SMEs innovating in-house, Non-R&D innovation expenditures, and SMEs with product or process innovations. *Intellectual assets, Attractive research systems* and *Finance and support* are the weakest innovation dimensions. Low-scoring indicators include Venture capital expenditures, Design applications, Public-private co-publications, and R&D expenditures in the business sector.

■ Relative to EU in 2012   ◆ Relative to EU in 2019

Structural differences with the EU are shown in the table below. Serbia shows the highest positive difference to the EU in FDI net inflows, Average annual change in GDP and Enterprise births, and the biggest negative difference in Top R&D spending enterprises, GDP per capita and Employment share high and medium high-tech manufacturing.

Serbia	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**61.7**	**53.9**	**67.1**
Human resources	**61.1**	**31.5**	**70.4**
New doctorate graduates	82.9	29.3	91.3
Population with tertiary education	61.7	27.3	78.5
Lifelong learning	33.0	38.9	35.6
Attractive research systems	**38.9**	**36.9**	**44.4**
International scientific co-publications	47.6	42.5	69.9
Most cited publications	33.5	37.4	33.5
Foreign doctorate students	39.1	30.9	45.1
Innovation-friendly environment §	**69.3**	**24.1**	**120.6**
Broadband penetration	65.2	30.0	150.0
Opportunity-driven entrepreneurship	N/A	N/A	N/A
Finance and support	**39.9**	**43.5**	**46.1**
R&D expenditure in the public sector	70.1	59.7	68.8
Venture capital expenditures	5.5	16.2	7.9
Firm investments	**85.6**	**68.0**	**111.2**
R&D expenditure in the business sector	23.0	14.2	26.3
Non-R&D innovation expenditures	102.1	72.3	143.2
Enterprises providing ICT training	133.3	130.8	184.6
Innovators	**96.4**	**107.7**	**86.2**
SMEs product/process innovations	98.9	108.1	98.6
SMEs marketing/organizational innovations	84.3	107.4	69.3
SMEs innovating in-house	105.5	107.5	91.9
Linkages	**67.6**	**59.3**	**69.6**
Innovative SMEs collaborating with others	92.3	95.2	91.7
Public-private co-publications	20.9	28.6	23.6
Private co-funding of public R&D exp.	75.5	51.2	76.1
Intellectual assets	**8.9**	**14.2**	**8.3**
PCT patent applications	0.0	27.6	0.0
Trademark applications	24.3	8.6	25.9
Design applications	6.9	0.1	5.7
Employment impacts §	**44.7**	**41.0**	**48.3**
Employment in knowledge-intensive activities	50.0	45.9	54.1
Employment fast-growing enterprises	N/A	N/A	N/A
Sales impacts	**67.5**	**54.8**	**67.1**
Medium and high-tech product exports	50.4	40.5	55.9
Knowledge-intensive services exports	66.4	48.4	68.5
Sales of new-to-market/firm innovations	92.8	76.4	77.5

|	RS	EU
Performance and structure of the economy		
GDP per capita (PPS)	11,700	29,100
Average annual GDP growth (%)	4.31	4.31
Employment share manufacturing (NACE C) (%)	17.5	16.6
of which High and medium high-tech (%)	22.8	37.5
Employment share services (NACE G-N) (%)	36.4	41.4
of which Knowledge-intensive services (%)	37.5	34.3
Turnover share SMEs (%)	n/a	38.3
Turnover share large enterprises (%)	n/a	43.2
Foreign-controlled enterprises – share of value added (%)	n/a	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.9	1.1
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	6.8	2.6
Top R&D spending enterprises per 10 million population	0.0	16.2
Buyer sophistication (1 to 7 best)	2.5	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	74.4	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced technology products (1 to 7 best)	2.8	3.5
Rule of law (-2.5 to 2.5 best)	-0.2	1.1
Demography		
Population size (millions)	7.0	446.2
Average annual population growth (%)	-0.54	0.14
Population density (inhabitants/km²)	91.3	108.6

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

§ Due to missing data, the relative dimension score does not necessarily reflect that of the indicators.

Switzerland is an **Innovation Leader**.
Over time, performance has increased relative to that of the EU in 2012.

- ■ Relative to EU in 2012
- ◆ Relative to EU in 2019
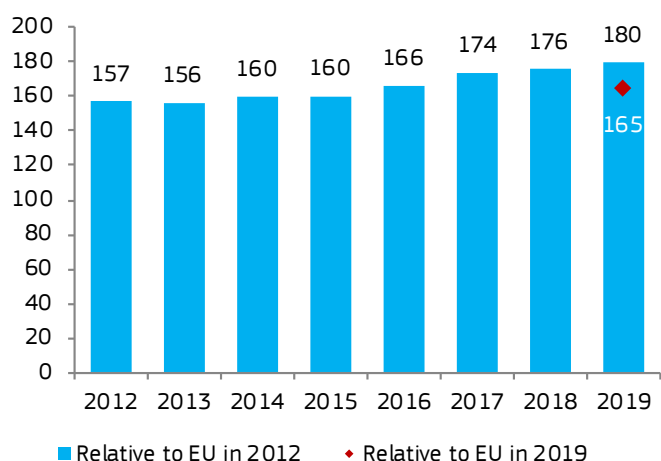
Attractive research systems, *Human resources* and *Firm investments* are the strongest innovation dimensions. Switzerland scores particularly well on Public-private co-publications, Foreign doctorate students, Lifelong learning, and International scientific co-publications. *Employment impacts*, *Sales impacts* and *Intellectual assets* are the weakest innovation dimensions. Overall, Switzerland's lowest indicator scores comprise Employment in fast-growing enterprises of innovative sectors, Medium and high-tech product exports, Exports of knowledge-intensive services, and Innovative SMEs collaborating with others.

Structural differences with the EU are shown in the table below. Switzerland shows the highest positive difference to the EU in Top R&D spending enterprises, GDP per capita and FDI net inflows, and the biggest negative difference in Enterprise births, Employment share in manufacturing and Average annual change in GDP.

Switzerland	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**165.1**	**157.1**	**179.7**
Human resources	**219.6**	**223.7**	**252.9**
New doctorate graduates	202.1	206.2	222.6
Population with tertiary education	187.0	168.6	238.0
Lifelong learning	284.5	306.7	306.7
Attractive research systems	**226.9**	**253.0**	**259.1**
International scientific co-publications	277.1	406.9	406.9
Most cited publications	150.3	159.7	150.4
Foreign doctorate students	310.5	314.0	358.0
Innovation-friendly environment	**169.8**	**137.1**	**295.2**
Broadband penetration	178.3	104.0	410.0
Opportunity-driven entrepreneurship	160.1	159.4	218.1
Finance and support	**165.2**	**103.0**	**190.8**
R&D expenditure in the public sector	144.8	122.0	142.2
Venture capital expenditures	188.5	71.2	272.6
Firm investments §	**172.3**	**221.0**	**223.8**
R&D expenditure in the business sector	162.9	181.8	186.6
Non-R&D innovation expenditures	178.5	250.2	250.2
Enterprises providing ICT training	N/A	N/A	N/A
Innovators	**159.1**	**139.8**	**142.2**
SMEs product/process innovations	141.4	95.0	140.8
SMEs marketing/organizational innovations	197.8	163.4	162.4
SMEs innovating in-house	140.7	158.4	122.5
Linkages	**168.5**	**169.2**	**173.6**
Innovative SMEs collaborating with others	104.4	92.3	103.6
Public-private co-publications	324.9	367.3	367.3
Private co-funding of public R&D exp.	131.9	131.0	133.0
Intellectual assets	**158.9**	**155.8**	**148.4**
PCT patent applications	140.4	137.4	130.3
Trademark applications	183.3	203.8	195.1
Design applications	162.5	143.0	136.3
Employment impacts	**115.9**	**113.3**	**125.0**
Employment in knowledge-intensive activities	200.0	185.1	216.2
Employment fast-growing enterprises	47.9	55.3	51.5
Sales impacts	**118.5**	**96.3**	**117.8**
Medium and high-tech product exports	93.0	76.9	103.0
Knowledge-intensive services exports	101.4	97.5	104.7
Sales of new-to-market/firm innovations	175.9	115.4	147.0

	CH	EU
Performance and structure of the economy		
GDP per capita (PPS)	47,300	29,100
Average annual GDP growth (%)	1.81	1.84
Employment share manufacturing (NACE C) (%)	12.8	16.6
of which High and medium high-tech (%)	45.0	37.5
Employment share services (NACE G–N) (%)	45.1	41.4
of which Knowledge-intensive services (%)	46.4	34.3
Turnover share SMEs (%)	n/a	38.3
Turnover share large enterprises (%)	n/a	43.2
Foreign-controlled enterprises – share of value added (%)	n/a	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.2	1.1
Total Entrepreneurial Activity (TEA) (%)	8.5	6.7
FDI net inflows (% GDP)	3.7	2.6
Top R&D spending enterprises per 10 million population	67.0	16.2
Buyer sophistication (1 to 7 best)	5.0	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	76.6	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.4	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.8	3.5
Rule of law (-2.5 to 2.5 best)	1.9	1.1
Demography		
Population size (millions)	8.5	446.2
Average annual population growth (%)	0.74	0.14
Population density (inhabitants/km²)	211.9	108.6

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

§ Due to missing data, the relative dimension score does not necessarily reflect that of the indicators.

Turkey is a **Moderate Innovator**.
Over time, performance has increased relative to that of the EU in 2012. The strong increase in 2018 is almost entirely explained by improved performance on the indicators using CIS data.

■ Relative to EU in 2012　　◆ Relative to EU in 2019
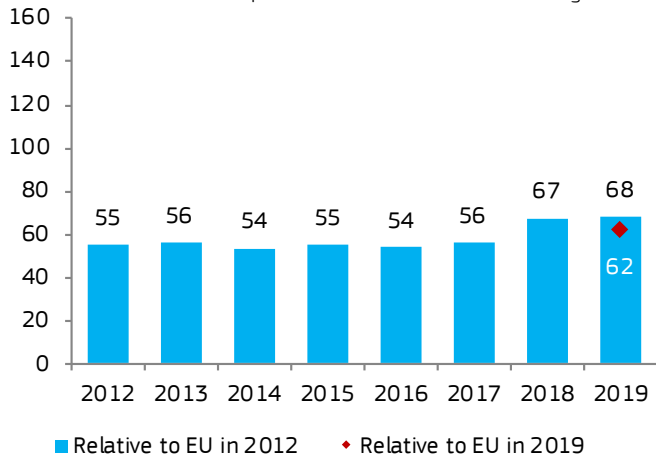
Innovators, *Firm investments*, and *Innovation-friendly environment* are the strongest innovation dimensions. Turkey performs particularly well on Non-R&D innovation expenditures, SMEs with marketing or organisational innovations, SMEs innovating in-house, and SMEs with product or process innovations. *Employment impacts*, *Intellectual assets* and *Attractive research systems* are the weakest innovation dimensions. Turkey's lowest indicator scores are on Design applications, Trademark applications, International scientific co-publications, and Employment in knowledge-intensive activities.

Structural differences with the EU are shown in the table below. Turkey shows the highest positive difference to the EU in Enterprise births, Average annual change in GDP and Total Entrepreneurial Activity, and the biggest negative difference in Top R&D spending enterprises, Employment share high and medium high-tech manufacturing and Employment share knowledge-intensive services.

Turkey	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	Performance relative to EU 2012 in 2019
SUMMARY INNOVATION INDEX	**62.3**	**55.2**	**67.8**
Human resources	**41.5**	**8.5**	**47.8**
New doctorate graduates	8.5	0.4	9.4
Population with tertiary education	63.0	0.0	80.2
Lifelong learning	54.6	27.8	58.9
Attractive research systems	**36.4**	**30.7**	**41.6**
International scientific co-publications	7.1	2.3	10.4
Most cited publications	49.1	49.9	49.1
Foreign doctorate students	46.3	15.2	53.3
Innovation-friendly environment	**69.0**	**85.8**	**120.0**
Broadband penetration	87.0	140.0	200.0
Opportunity-driven entrepreneurship	48.6	49.3	66.2
Finance and support §	**44.9**	**61.0**	**51.8**
R&D expenditure in the public sector	42.1	48.7	41.4
Venture capital expenditures	N/A	N/A	N/A
Firm investments	**88.6**	**111.2**	**115.0**
R&D expenditure in the business sector	36.4	25.5	41.7
Non-R&D innovation expenditures	178.5	250.2	250.2
Enterprises providing ICT training	50.0	76.9	69.2
Innovators	**151.0**	**93.0**	**135.0**
SMEs product/process innovations	129.8	94.8	129.3
SMEs marketing/organizational innovations	164.4	106.2	135.0
SMEs innovating in-house	161.3	77.5	140.5
Linkages	**46.9**	**31.7**	**48.3**
Innovative SMEs collaborating with others	114.0	60.6	113.2
Public-private co-publications	9.2	5.1	10.4
Private co-funding of public R&D exp.	26.4	26.1	26.6
Intellectual assets	**21.7**	**18.8**	**20.3**
PCT patent applications	44.0	38.5	40.9
Trademark applications	6.7	2.9	7.1
Design applications	2.6	4.3	2.2
Employment impacts §	**6.7**	**0.0**	**7.2**
Employment in knowledge-intensive activities	7.5	0.0	8.1
Employment fast-growing enterprises	N/A	N/A	N/A
Sales impacts	**55.5**	**71.3**	**55.2**
Medium and high-tech product exports	55.4	43.2	61.4
Knowledge-intensive services exports	37.6	16.5	38.8
Sales of new-to-market/firm innovations	78.6	157.5	65.7

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

§ Due to missing data, the relative dimension score does not necessarily reflect that of the indicators.

	TR	EU
Performance and structure of the economy		
GDP per capita (PPS)	19,300	29,100
Average annual GDP growth (%)	5.13	1.84
Employment share manufacturing (NACE C) (%)	18.0	16.6
of which High and medium high-tech (%)	18.5	37.5
Employment share services (NACE G-N) (%)	35.3	41.4
of which Knowledge-intensive services (%)	20.0	34.3
Turnover share SMEs (%)	n/a	38.3
Turnover share large enterprises (%)	n/a	43.2
Foreign-controlled enterprises – share of value added (%)	n/a	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	5.4	1.1
Total Entrepreneurial Activity (TEA) (%)	14.2	6.7
FDI net inflows (% GDP)	1.6	2.6
Top R&D spending enterprises per 10 million population	0.7	16.2
Buyer sophistication (1 to 7 best)	3.5	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	74.3	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	1.8	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.5	3.5
Rule of law (-2.5 to 2.5 best)	-0.3	1.1
Demography		
Population size (millions)	80.9	446.2
Average annual population growth (%)	1.36	0.14
Population density (inhabitants/km²)	104.8	108.6

Ukraine is a **Modest Innovator**.
Over time, performance has decreased relative to that of the EU in 2012.
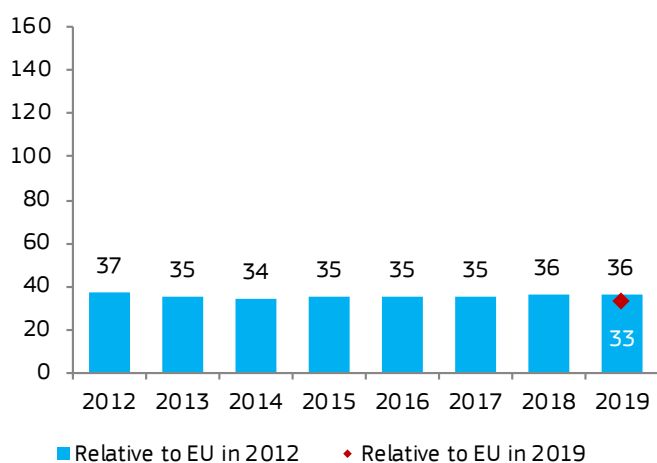
Innovation-friendly environment and *Employment impacts* are the strongest innovation dimensions. Ukraine scores high on Broadband penetration, Employment in knowledge-intensive activities, Non-R&D innovation expenditures, and Exports of knowledge-intensive services. *Finance and support*, *Attractive research systems* and *Intellectual assets* are the weakest innovation dimensions. Low-scoring indicators include Design applications, R&D expenditures in the public sector, SMEs with marketing or organizational innovations, and International scientific co-publications.

Bar chart: 2012: 37, 2013: 35, 2014: 34, 2015: 35, 2016: 35, 2017: 35, 2018: 36, 2019: 36 (33)

■ Relative to EU in 2012   ◆ Relative to EU in 2019

Structural differences with the EU are shown in the table below. Ukraine shows the highest positive difference to the EU in Average annual change in GDP, FDI net inflows and Ease of starting a business, and the biggest negative difference in Top R&D spending enterprises, GDP per capita and Employment share in manufacturing.

Ukraine	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**32.9**	**36.8**	**35.8**
Human resources §	**46.4**	**66.0**	**53.4**
New doctorate graduates	44.0	59.9	48.5
Population with tertiary education	N/A	N/A	N/A
Lifelong learning	N/A	N/A	N/A
Attractive research systems	**15.1**	**10.6**	**17.3**
International scientific co-publications	5.5	0.0	8.0
Most cited publications	8.1	2.2	8.1
Foreign doctorate students	38.7	37.4	44.6
Innovation-friendly environment §	**97.5**	**118.2**	**169.6**
Broadband penetration	91.7	147.0	211.0
Opportunity-driven entrepreneurship	N/A	N/A	N/A
Finance and support	**9.8**	**39.3**	**11.3**
R&D expenditure in the public sector	2.1	26.1	2.1
Venture capital expenditures	18.5	61.4	26.8
Firm investments	**34.8**	**54.4**	**45.1**
R&D expenditure in the business sector	17.0	30.5	19.5
Non-R&D innovation expenditures	68.6	104.0	96.1
Enterprises providing ICT training	18.3	33.8	25.4
Innovators	**22.6**	**16.7**	**20.2**
SMEs product/process innovations	11.9	1.5	11.9
SMEs marketing/organizational innovations	5.5	0.2	4.5
SMEs innovating in-house	51.1	48.4	44.5
Linkages	**36.5**	**33.7**	**37.6**
Innovative SMEs collaborating with others	51.7	6.1	51.3
Public-private co-publications	8.3	2.4	9.3
Private co-funding of public R&D exp.	41.0	62.8	41.4
Intellectual assets	**22.4**	**19.7**	**20.9**
PCT patent applications	41.4	39.0	38.5
Trademark applications	14.3	10.6	15.2
Design applications	1.3	0.4	1.1
Employment impacts §	**80.5**	**77.2**	**86.9**
Employment in knowledge-intensive activities	90.0	86.5	97.3
Employment fast-growing enterprises	N/A	N/A	N/A
Sales impacts	**35.3**	**38.7**	**35.1**
Medium and high-tech product exports	19.4	55.1	21.5
Knowledge-intensive services exports	64.5	53.9	66.7
Sales of new-to-market/firm innovations	20.4	5.9	17.0

	UA	EU
Performance and structure of the economy		
GDP per capita (PPS)	6,090	29,100
Average annual GDP growth (%)	2.44	1.84
Employment share manufacturing (NACE C) (%)	12.5	16.6
of which High and medium high-tech (%)	n/a	37.5
Employment share services (NACE G-N) (%)	34.5	41.4
of which Knowledge-intensive services (%)	n/a	34.3
Turnover share SMEs (%)	n/a	38.3
Turnover share large enterprises (%)	n/a	43.2
Foreign-controlled enterprises – share of value added (%)	n/a	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	n/a	1.1
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	2.7	2.6
Top R&D spending enterprises per 10 million population	0.1	16.2
Buyer sophistication (1 to 7 best)	3.3	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	69.1	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.0	3.5
Rule of law (-2.5 to 2.5 best)	-0.7	1.1
Demography		
Population size (millions)	42.2	446.2
Average annual population growth (%)	-0.51	0.14
Population density (inhabitants/km²)	77.4	108.6

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

The **United Kingdom** is a **Strong Innovator**. Over time, performance has increased relative to that of the EU in 2012.
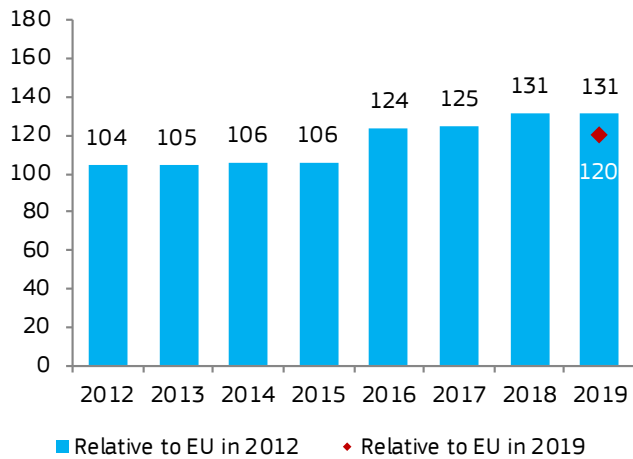
Attractive research systems, Human resources and *Employment impacts* are the strongest innovation dimensions. The UK scores particularly well on Innovative SMEs collaborating with others, Foreign doctorate students, Venture capital expenditures, and New doctorate graduates. *Intellectual assets, Innovation-friendly environment* and *Firm investments* are the weakest innovation dimensions. Overall, the UKs lowest indicator scores comprise R&D expenditures in the public sector, Private co-funding of public R&D expenditures, Design applications, and SMEs innovating in-house.

Structural differences with the EU are shown in the table below. The United Kingdom shows the highest positive difference to the EU in Enterprise births, Top R&D spending enterprises and FDI net inflows, and the biggest negative difference in Employment share in manufacturing, Average annual change in GDP and Turnover share SMEs.

United Kingdom	Relative to EU 2019 in 2019	Performance relative to EU 2012 in 2012	2019
SUMMARY INNOVATION INDEX	**120.9**	**114.3**	**131.6**
Human resources	**160.8**	**179.4**	**185.1**
New doctorate graduates	176.0	184.0	193.8
Population with tertiary education	161.0	181.8	205.0
Lifelong learning	141.2	171.1	152.2
Attractive research systems	**175.3**	**183.3**	**200.3**
International scientific co-publications	159.8	150.2	234.7
Most cited publications	150.8	137.5	150.9
Foreign doctorate students	237.6	308.9	273.9
Innovation-friendly environment	**93.4**	**102.0**	**162.4**
Broadband penetration	78.3	80.0	180.0
Opportunity-driven entrepreneurship	110.5	116.9	150.6
Finance and support	**117.5**	**107.2**	**135.7**
R&D expenditure in the public sector	55.2	70.7	54.2
Venture capital expenditures	188.5	168.6	272.6
Firm investments	**98.5**	**101.3**	**127.9**
R&D expenditure in the business sector	80.9	82.2	92.7
Non-R&D innovation expenditures	82.2	50.4	115.2
Enterprises providing ICT training	133.3	176.9	184.6
Innovators	**105.1**	**71.2**	**94.0**
SMEs product/process innovations	115.8	83.7	115.4
SMEs marketing/organizational innovations	121.7	83.8	100.0
SMEs innovating in-house	77.1	45.9	67.1
Linkages	**135.6**	**143.0**	**139.7**
Innovative SMEs collaborating with others	267.0	265.1	265.1
Public-private co-publications	146.0	143.1	165.1
Private co-funding of public R&D exp.	55.8	72.1	56.3
Intellectual assets	**81.1**	**81.0**	**75.7**
PCT patent applications	91.2	91.6	84.6
Trademark applications	82.9	88.9	88.2
Design applications	63.8	60.1	53.5
Employment impacts	**152.6**	**150.8**	**164.6**
Employment in knowledge-intensive activities	163.8	155.4	177.0
Employment fast-growing enterprises	143.5	147.0	154.5
Sales impacts	**113.3**	**85.3**	**112.7**
Medium and high-tech product exports	90.2	101.1	100.0
Knowledge-intensive services exports	123.8	134.2	127.8
Sales of new-to-market/firm innovations	132.2	18.1	110.4

The colours show normalised performance in 2019 relative to that of the EU in 2019: dark green: above 125%; light green: between 95% and 125%; yellow: between 50% and 95%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

	UK	EU
Performance and structure of the economy		
GDP per capita (PPS)	32,000	29,100
Average annual GDP growth (%)	1.38	1.84
Employment share manufacturing (NACE C) (%)	9.2	16.6
of which High and medium high-tech (%)	39.5	37.5
Employment share services (NACE G-N) (%)	45.2	41.4
of which Knowledge-intensive services (%)	39.8	34.3
Turnover share SMEs (%)	30.7	38.3
Turnover share large enterprises (%)	54.3	43.2
Foreign-controlled enterprises – share of value added (%)	15.6	11.1
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	4.0	1.1
Total Entrepreneurial Activity (TEA) (%)	8.7	6.7
FDI net inflows (% GDP)	5.9	2.6
Top R&D spending enterprises per 10 million population	42.4	16.2
Buyer sophistication (1 to 7 best)	4.7	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	83.4	76.5
Basic-school entrepreneurial education and training (1 to 5 best)	2.0	1.9
Govt. procurement of advanced technology products (1 to 7 best)	3.8	3.5
Rule of law (-2.5 to 2.5 best)	1.7	1.1
Demography		
Population size (millions)	66.3	446.2
Average annual population growth (%)	0.61	0.14
Population density (inhabitants/km^2)	272.3	108.6

8. 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 2020 Methodology Report[29]. The methodology used for calculating the Summary Innovation Index is explained below. "All countries" include all Member States and other European and neighbouring countries included in **Section 5.1**[30].

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 "2019", 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	"2019"	"2018"	"2017"	"2016"	"2015"
Available data	N/A	45	40	35	30
Use most recent year	**45**	45	40	35	30

Year-in-between missing	"2019"	"2018"	"2017"	"2016"	"2015"
Available data	50	N/A	40	35	30
Substitute with previous year	50	**40**	40	35	30

Beginning-of-period missing	"2019"	"2018"	"2017"	"2016"	"2015"
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 for all years plus twice the standard deviation. Negative outliers are identified as those country scores which are smaller than the mean across all countries for all years 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: Opportunity-driven entrepreneurship, Non-R&D innovation expenditures, Public-private co-publications, Private co-funding of public R&D expenditures, PCT patent applications, and Trademark applications. A square root transformation means using 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 (1/27 if data are available for all 27 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 2012 and for the latest year also to that of the EU in 2019. For the definition of the performance groups, only the performance scores relative to the EU in 2019 have been used.

---

[29] http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm

[30] Excluding Montenegro, as the country was initially not included as data for several of the indicators became available after the cut-off date of 17 April 2020.

International benchmark

The methodology for calculating average innovation performance for the EU and its major global competitors is the same as 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

The thresholds to distinguish between performance groups have been raised compared to the thresholds used in previous EIS report (50%, 90%, 120%) to compensate for the effect on the EU average scores from the UK leaving the EU. The average for the EU including the UK would be almost 3% higher than the average for the EU not including the UK. To ensure consistency of performance groups between the EIS 2020 and earlier EIS reports, the thresholds used in previous reports were increased from 50% to 51.5%, from 90% to 92.6% and from 120% to 123.5%. For ease of understanding, these percentages are 'rounded' to the nearest quintuple in the scheme below. But for assigning countries to performance groups and for assigning color codes to the tables in the Country profiles in Chapter 7 the precise thresholds have been used.

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

• Innovation Leaders are all countries with a relative performance in 2019 above 125% of the EU average in 2019.

• Strong Innovators are all countries with a relative performance in 2019 between 95% and 125% of the EU average in 2019.

• Moderate Innovators are all countries with a relative performance in 2019 between 50% and 95% of the EU average in 2019.

• Modest Innovators are all countries with a relative performance in 2019 below 50% of the EU average in 2019.

Annex A: Country abbreviations

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

Annex B: Performance per indicator

Available on the EIS website: https://ec.europa.eu/docsroom/documents/41461

Annex C: Current performance

	EU	EU28	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT
FRAMEWORK CONDITIONS																				
Human resources																				
1.1.1 New doctorate graduates (2017)	1.9	2.1	2.0	1.5	1.7	3.2	2.7	1.3	2.2	1.5	3.7	1.7	1.3	1.4	0.7	0.5	0.9	1.7	1.0	0.7
1.1.2 Population completed tertiary education (2019)	39.2	40.5	47.9	33.0	32.6	45.6	32.9	43.2	55.9	42.5	46.2	47.8	36.0	27.7	59.8	42.5	55.3	55.1	30.7	40.3
1.1.3 Lifelong learning (2018)	10.6	11.1	8.5	2.5	8.5	23.5	8.2	19.7	12.5	4.5	10.5	18.6	2.9	8.1	6.7	6.7	6.6	18.0	6.0	10.9
Attractive research systems																				
1.2.1 International scientific co-publications (2019)	1092	1172	1944	319	1085	3203	1065	1827	1911	947	1008	962	779	914	2424	549	731	2764	608	995
1.2.2 Scientific publications among top 10% most cited (2017)	10.0	10.8	12.8	3.0	5.2	14.1	10.9	8.4	12.1	9.3	8.9	9.2	3.5	11.3	8.9	4.8	5.6	114	5.5	6.6
1.2.3 Foreign doctorate students (2017)	17.8	21.4	37.9	6.6	17.0	35.2	9.7	14.2	29.0	1.4	18.0	39.7	8.5	14.9	15.3	9.8	4.4	85.2	14.7	16.1
Innovation-friendly environment																				
1.3.1 Broadband penetration (2019)	23.0	22.0	31.0	15.0	15.0	62.0	21.0	17.0	22.0	8.0	39.0	13.0	12.0	13.0	17.0	17.0	34.0	34.0	21.0	29.0
1.3.2 Opportunity-driven entrepreneurship (2018)	3.6	3.6	1.6	1.0	2.7	11.1	3.8	3.0	2.6	2.0	1.8	4.0	1.3	3.0	3.1	3.0	2.2	4.5	2.6	n/a
INVESTMENTS																				
Finance and support																				
2.1.1 R&D expenditure in the public sector (2018)	0.72	0.69	0.80	0.21	0.73	1.07	0.98	0.79	0.29	0.59	0.54	0.73	0.50	0.51	0.28	0.48	0.53	0.54	0.36	0.23
2.1.2 Venture capital expenditures (2019)	0.124	0.132	0.139	0.024	0.009	0.153	0.108	0.081	0.164	0.034	0.114	0.222	0.020	0.064	0.175	0.214	0.134	0.189	0.077	0.383
Firm investments																				
2.2.1 R&D expenditure in the business sector (2018)	1.45	1.41	1.95	0.54	1.19	1.95	2.16	0.59	0.86	0.57	0.70	1.44	0.47	0.86	0.20	0.16	0.33	0.68	1.16	0.33
2.2.2 Non-R&D innovation expenditures (2016)	0.86	0.86	0.49	0.47	0.74	0.35	1.33	1.92	0.49	0.90	0.42	0.51	1.37	0.69	0.65	0.75	2.00	0.23	0.91	0.95
2.2.3 Enterprises providing ICT training (2019)	23.0	24.0	36.0	10.0	25.0	31.0	32.0	17.0	31.0	15.0	22.0	21.0	23.0	19.0	31.0	18.0	11.0	27.0	16.0	26.0
INNOVATION ACTIVITIES																				
Innovators																				
3.1.1 SMEs with product or process innovations (2016)	33.8	34.3	47.3	16.3	33.0	33.3	41.0	41.4	37.7	44.4	18.2	38.0	30.8	40.7	28.5	18.7	37.9	40.4	18.0	22.5
3.1.2 SMEs with marketing or organisational innovations (2016)	35.0	35.6	45.1	15.7	31.3	39.2	45.6	20.4	48.6	46.3	27.2	45.2	37.6	38.9	27.6	21.4	33.4	52.0	18.5	25.9
3.1.3 SMEs innovating in-house (2016)	28.6	28.1	39.8	13.8	30.6	23.6	36.8	38.4	34.5	39.4	14.5	33.8	26.6	38.8	28.2	15.2	33.2	35.1	14.5	20.5
Linkages																				
3.2.1 Innovative SMEs collaborating with others (2016)	9.3	11.8	22.1	3.6	12.6	12.9	8.5	24.6	11.6	22.7	6.4	13.4	9.8	5.7	9.2	5.6	16.7	9.8	5.9	3.3
3.2.2 Public-private co-publications (2019)	91.4	95.0	131.8	15.3	658	293.8	149.0	74.7	110.1	42.3	52.6	81.6	80.2	73.9	993	27.1	20.8	158.0	62.6	22.3
3.2.3 Private co-funding of public R&D expenditures (2017)	0.055	0.050	0.075	0.014	0.029	0.030	0.113	0.032	0.010	0.041	0.050	0.034	0.008	0.027	0.003	0.027	0.052	0.010	0.019	0.001
Intellectual assets																				
3.3.1 PCT patent applications (2017)	3.39	3.31	2.98	0.50	0.70	5.96	6.15	1.53	1.68	0.54	1.27	3.49	0.45	2.00	0.53	0.78	0.50	1.66	1.10	1.34
3.3.2 Trademark applications (2019)	8.21	7.99	7.96	9.00	5.35	11.88	9.34	22.97	4.53	5.28	8.85	6.04	4.30	8.70	38.33	8.76	8.81	30.97	4.27	49.56
3.3.3 Design applications (2019)	4.05	3.85	2.74	5.16	2.30	7.42	5.49	4.56	1.44	0.76	2.62	2.67	0.52	5.71	2.95	1.79	1.34	7.66	1.06	6.21
IMPACTS																				
Employment impacts																				
4.1.1 Employment in knowledge-intensive activities (2018)	13.7	14.4	15.7	10.2	13.2	15.4	14.8	14.1	20.2	12.1	12.2	14.7	12.5	14.0	17.7	11.1	10.4	24.5	11.8	18.6
4.1.2 Employment fast-growing firms innovative sectors (2017)	5.2	5.4	3.6	7.3	8.0	5.2	5.1	3.1	10.3	2.5	6.2	3.8	3.9	3.7	1.5	5.7	3.6	6.2	9.4	8.4
Sales impacts																				
4.2.1 Medium & high-tech product exports (2019)	57.1	56.9	51.0	35.7	68.1	51.7	67.9	40.2	57.1	23.2	46.5	58.8	41.4	51.4	55.5	33.2	37.6	48.2	69.6	53.5
4.2.2 Knowledge-intensive services exports (2018)	68.4	68.4	70.8	40.9	43.5	68.7	74.9	50.6	94.1	53.6	32.6	61.5	20.9	49.3	70.5	51.5	20.1	92.4	49.1	32.8
4.2.3 Sales of new-to-market/new-to-firm innovations (2016)	12.51	12.96	15.61	5.98	12.96	5.47	14.04	11.15	16.96	16.76	19.32	9.85	8.04	12.40	12.25	8.01	14.72	4.82	7.66	8.21

	EU	NL	AT	PL	PT	RO	SI	SK	FI	SE	IS	IL	MK	ME	NO	RS	CH	TR	UA	UK
FRAMEWORK CONDITIONS																				
Human resources																				
1.1.1 New doctorate graduates (2017)	1.9	2.2	2.2	0.5	1.8	0.7	1.9	2.0	2.6	2.7	1.3	1.4	0.6	0.2	2.1	1.7	3.6	0.5	1.0	3.1
1.1.2 Population completed tertiary education (2019)	39.2	48.1	41.6	43.5	36.9	25.2	42.6	39.0	41.5	48.0	47.1	48.0	35.2	37.9	48.3	33.3	52.6	33.5	n/a	48.6
1.1.3 Lifelong learning (2018)	10.6	19.1	15.1	5.7	10.3	0.9	11.4	4.0	28.5	31.4	21.5	n/a	2.4	3.2	19.7	4.1	31.6	6.2	n/a	14.6
Attractive research systems																				
1.2.1 International scientific co-publications (2019)	1092	2202	1925	436	1408	284	1580	720	2399	2700	3916	1199	246	564	2720	557	3713	143	126	1704
1.2.2 Scientific publications among top 10% most cited (2017)	10.0	15.1	11.2	4.8	9.3	4.4	7.7	4.6	11.8	12.9	12.1	9.6	5.1	4.0	12.1	4.1	14.5	5.5	1.9	14.5
1.2.3 Foreign doctorate students (2017)	17.8	43.1	30.3	2.2	27.3	4.4	8.9	9.7	22.1	35.1	28.6	n/a	38.8	19.0	20.7	7.1	55.3	8.4	7.0	42.1
Innovation-friendly environment																				
1.3.1 Broadband penetration (2019)	23.0	35.0	17.0	24.0	41.0	23.0	22.0	15.0	39.0	59.0	n/a	n/a	11.0	17.0	30.0	15.0	43.6	20.0	21.1	18.0
1.3.2 Opportunity-driven entrepreneurship (2018)	3.6	7.0	2.7	5.4	2.7	1.2	2.4	1.4	9.7	7.4	10.0	2.6	n/a	n/a	6.3	n/a	6.4	1.8	n/a	4.0
INVESTMENTS																				
Finance and support																				
2.1.1 R&D expenditure in the public sector (2018)	0.72	0.72	0.94	0.40	0.65	0.20	0.49	0.38	0.92	0.96	0.72	0.59	0.25	0.30	0.99	0.56	0.96	0.41	0.20	0.48
2.1.2 Venture capital expenditures (2019)	0.124	0.179	0.052	0.051	0.099	0.107	0.003	0.013	0.171	0.120	n/a	n/a	n/a	n/a	0.101	0.007	0.240	n/a	0.023	0.270
Firm investments																				
2.2.1 R&D expenditure in the business sector (2018)	1.45	1.45	2.22	0.80	0.69	0.30	1.45	0.45	1.80	2.35	1.30	3.91	0.11	0.05	1.08	0.36	2.34	0.55	0.28	1.18
2.2.2 Non-R&D innovation expenditures (2016)	0.86	0.16	0.53	1.11	1.02	0.12	0.69	0.75	0.74	0.77	n/a	n/a	1.01	0.14	0.68	0.88	2.01	2.70	0.55	0.67
2.2.3 Enterprises providing ICT training (2019)	23.0	26.0	18.0	13.0	28.0	6.0	28.0	18.0	37.0	32.0	25.0	n/a	17.0	24.0	44.0	29.0	n/a	14.0	8.3	29.0
INNOVATION ACTIVITIES																				
Innovators																				
3.1.1 SMEs with product or process innovations (2016)	33.8	48.5	45.0	14.8	56.0	4.6	25.9	19.5	54.2	38.3	44.5	22.2	26.8	51.0	55.6	33.6	44.8	41.7	10.6	38.0
3.1.2 SMEs with marketing or organisational innovations (2016)	35.0	31.6	50.4	11.1	47.4	7.4	27.0	20.0	44.8	36.3	39.1	44.9	28.3	34.6	54.0	31.3	58.4	50.4	12.4	40.2
3.1.3 SMEs innovating in-house (2016)	28.6	35.0	38.3	12.1	51.2	4.2	22.4	16.8	48.5	33.5	n/a	21.6	n/a	n/a	47.9	29.7	36.9	41.0	18.7	24.0
Linkages																				
3.2.1 Innovative SMEs collaborating with others (2016)	9.3	14.5	22.1	4.5	9.7	1.7	12.2	8.2	21.3	13.2	22.9	12.9	6.2	9.3	21.7	8.7	9.7	10.5	5.4	30.6
3.2.2 Public-private co-publications (2019)	91.4	184.9	243.1	27.9	44.1	24.5	131.2	35.8	208.8	270.1	296.9	69.2	1.4	19.3	231.0	20.2	432.4	9.7	8.9	132.9
3.2.3 Private co-funding of public R&D expenditures (2017)	0.055	0.085	0.054	0.013	0.014	0.025	0.041	0.021	0.039	0.039	0.009	0.545	0.000	0.002	0.038	0.033	0.091	0.006	0.012	0.020
Intellectual assets																				
3.3.1 PCT patent applications (2017)	3.39	4.67	4.60	0.43	0.84	0.19	2.38	0.51	7.57	8.65	3.15	8.86	0.27	0.40	2.98	0.40	6.68	0.66	0.58	2.81
3.3.2 Trademark applications (2019)	8.21	9.57	13.18	5.34	8.51	2.59	10.95	4.48	11.06	10.94	6.94	3.96	1.47	1.28	3.84	2.34	18.80	1.49	1.83	6.57
3.3.3 Design applications (2019)	4.05	4.25	6.29	5.09	3.57	1.02	2.25	1.36	3.80	4.06	1.41	1.20	0.06	0.00	0.66	0.28	6.58	0.11	0.05	2.58
IMPACTS																				
Employment impacts																				
4.1.1 Employment in knowledge-intensive activities (2018)	13.7	17.7	15.0	10.4	10.9	7.7	13.9	10.2	16.4	18.8	20.0	33.5	6.3	10.8	15.8	9.7	21.7	6.3	12.9	18.8
4.1.2 Employment fast-growing firms innovative sectors (2017)	5.2	5.6	2.5	6.3	5.5	3.4	4.9	8.6	3.2	7.0	5.1	6.0	n/a	n/a	2.8	n/a	3.1	n/a	n/a	6.8
Sales impacts																				
4.2.1 Medium & high-tech product exports (2019)	57.1	50.9	58.2	49.4	42.3	57.4	59.6	69.4	46.5	55.9	8.7	56.8	64.0	16.7	14.2	38.4	54.5	40.3	26.7	53.5
4.2.2 Knowledge-intensive services exports (2018)	68.4	78.0	43.8	42.0	37.4	46.2	34.6	39.2	75.4	71.3	51.7	68.7	29.9	18.5	77.7	51.4	69.1	36.9	50.5	80.4
4.2.3 Sales of new-to-market/new-to-firm innovations (2016)	12.51	10.41	12.59	6.28	9.77	4.74	8.68	20.27	11.30	8.70	6.07	11.90	3.52	7.16	7.25	11.83	19.62	10.51	5.05	15.53

Annex D: Performance change

Performance change is measured as the difference between performance in 2019 relative to the EU in 2012 and performance in 2012 relative to the EU in 2012 (the relative performance scores in both years are shown in the first table on the Country profiles).

	EU	EU28	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT
FRAMEWORK CONDITIONS																				
Human resources																				
1.1.1 New doctorate graduates	10.1	9.7	19.5	20.4	8.6	18.3	-9.2	4.9	7.5	32.4	142.7	-1.7	-6.6	-9.4	20.8	-39.5	-21.3	62.4	10.4	24.2
1.1.2 Population completed tertiary education	27.3	24.6	18.2	14.0	22.3	3.3	37.2	21.5	9.9	31.4	38.8	28.9	33.9	28.9	24.8	25.6	22.3	39.7	-11.6	74.4
1.1.3 Lifelong learning	7.8	4.1	0.0	10.0	-16.7	-36.7	3.3	86.7	38.9	18.9	4.4	8.9	-2.2	26.7	-12.2	14.4	6.7	0.0	-12.2	3.3
Attractive research systems																				
1.2.1 International scientific co-publications	46.9	48.9	72.4	11.8	65.3	128.2	32.7	130.8	94.4	42.1	46.0	26.7	42.5	44.8	174.3	45.6	55.6	140.7	217	67.6
1.2.2 Scientific publications among top 10% most cited	0.1	1.7	-2.1	0.7	6.2	-8.8	-4.0	8.8	7.9	10.0	-4.3	-11.1	7.3	14.4	1.4	36.5	29.1	-22.8	5.9	1.7
1.2.3 Foreign doctorate students	15.3	11.8	36.6	5.0	40.8	63.6	19.7	51.7	-53.0	-2.8	-30.7	-15.3	41.0	36.7	44.7	56.0	25.3	0.0	53.2	87.4
Innovation-friendly environment																				
1.3.1 Broadband penetration	130.0	144.4	140.0	70.0	70.0	160.0	120.0	90.0	120.0	60.0	290.0	40.0	110.0	80.0	170.0	-10.0	180.0	210.0	120.0	160.0
1.3.2 Opportunity-driven entrepreneurship	36.2	35.8	-130.7	11.2	24.4	15.4	50.7	12.0	65.2	34.9	18.4	21.2	8.6	8.9	45.2	49.9	16.0	-109.1	54.5	n/a
INVESTMENTS																				
Finance and support																				
2.1.1 R&D expenditure in the public sector	-1.8	-1.9	22.0	-5.5	7.3	18.3	7.3	-5.5	-33.0	29.3	-18.3	-5.5	14.7	1.8	-5.5	-3.7	-25.7	7.3	-12.8	-1.8
2.1.2 Venture capital expenditures	44.6	34.0	56.3	-123.1	-33.6	36.1	47.8	-28.6	-35.9	31.3	44.1	91.6	-196	8.4	162.9	223.7	128.0	-53.4	47.9	233.1
Firm investments																				
2.2.1 R&D expenditure in the business sector	14.6	14.1	37.2	21.0	26.7	-0.8	21.0	-68.8	-18.6	27.5	0.0	3.2	10.5	2.4	10.5	-2.4	7.3	0.0	34.0	-8.9
2.2.2 Non-R&D innovation expenditures	40.2	40.2	-6.7	36.7	7.7	8.6	-1.9	88.5	37.7	3.1	6.4	25.5	94.3	13.9	-116.2	64.4	61.6	-1.5	77.8	-1.7
2.2.3 Enterprises providing ICT training	38.5	35.7	46.2	-30.8	23.1	23.1	61.5	38.5	23.1	0.0	46.2	7.7	-38.5	61.5	23.1	61.5	7.7	46.2	15.4	15.4
INNOVATION ACTIVITIES																				
Innovators																				
3.1.1 SMEs with product or process innovations	-0.4	3.1	-1.9	4.8	8.9	-23.4	-28.5	2.9	-13.2	55.5	-26.9	28.0	5.7	12.5	-23.5	16.7	68.8	-23.7	12.5	-13.4
3.1.2 SMEs with marketing or organisational innovations	-17.9	-14.4	11.5	-2.0	-33.7	-11.8	-45.0	-53.7	12.2	4.5	-2.0	8.4	19.6	-14.2	-32.4	-4.4	24.0	-22.8	-13.4	-17.5
3.1.3 SMEs innovating in-house	-12.9	-15.3	4.9	6.3	14.3	-29.2	-34.2	31.2	-29.3	54.8	-4.3	21.5	8.4	17.0	1.3	5.8	72.5	-22.7	15.5	-7.2
Linkages																				
3.2.1 Innovative SMEs collaborating with others	-0.7	38.4	24.1	3.8	28.7	-31.4	-66.7	53.3	-3.9	125.2	7.6	27.9	6.8	16.3	-150.7	17.3	97.3	-59.5	-10.0	-15.2
3.2.2 Public-private co-publications	13.1	13.2	17.8	7.0	4.1	44.7	16.1	37.9	20.6	16.6	7.6	-11.5	18.5	22.6	53.4	24.2	9.8	71.6	18.0	13.0
3.2.3 Private co-funding of public R&D expenditures	0.9	-0.9	9.5	-4.7	19.3	2.0	5.9	4.8	-2.6	7.3	-24.1	0.3	-40.4	26.0	-3.6	-28.8	-28.9	3.4	-47.6	-9.7
Intellectual assets																				
3.3.1 PCT patent applications	-7.2	-7.3	-10.9	5.8	0.3	-3.0	-13.8	-13.8	-10.5	5.9	-8.6	-7.2	-9.4	0.6	9.8	9.7	2.2	-0.7	-8.4	15.0
3.3.2 Trademark applications	6.4	5.6	8.6	7.1	-1.5	15.9	-8.7	88.8	-18.9	45.5	8.2	-1.7	15.9	23.5	0.0	22.2	40.7	0.0	12.0	9.9
3.3.3 Design applications	-16.1	-15.7	-28.8	41.4	-31.5	-6.1	-35.9	11.8	4.2	6.5	-18.1	-18.5	8.6	-2.4	18.5	-7.5	9.8	-41.1	5.4	86.0
IMPACTS																				
Employment impacts																				
4.1.1 Employment in knowledge-intensive activities	8.1	8.7	1.4	23.0	12.2	2.7	-8.1	44.6	-8.1	9.5	5.4	9.5	25.7	6.8	35.1	28.4	20.3	21.6	-16.2	32.4
4.1.2 Employment fast-growing firms in innovative sectors	7.7	7.2	33.0	32.4	35.7	-38.2	-21.1	3.2	57.9	-84.8	82.6	-36.3	36.5	21.7	5.9	67.6	-22.5	86.0	31.9	69.5
Sales impacts																				
4.2.1 Medium & high-tech product exports	10.8	9.9	12.5	29.5	16.3	25.8	5.5	-1.9	24.3	11.2	6.6	5.0	5.9	6.3	57.3	12.3	16.9	-9.6	9.9	6.6
4.2.2 Knowledge-intensive services exports	3.3	2.9	10.7	21.9	7.3	-18.9	-2.9	9.5	0.0	-6.6	-0.4	-3.0	1.3	-5.9	5.1	2.2	4.1	6.0	1.3	20.7
4.2.3 Sales of new-to-market and new-to-firm innovations	-16.5	-4.1	29.0	-14.2	-20.5	-84.6	-13.1	-10.4	68.1	44.7	3.1	-12.7	-22.3	-21.9	-21.9	43.4	72.0	-30.8	-53.7	7.1

Performance change is measured as the difference between performance in 2019 relative to the EU in 2012 and performance in 2012 relative to the EU in 2012 (the relative performance scores in both years are shown in the first table on the Country profiles).

	EU	NL	AT	PL	PT	RO	SI	SK	FI	SE	IS	IL	MK	ME	NO	RS	CH	TR	UA	UK
FRAMEWORK CONDITIONS																				
Human resources																				
1.1.1 New doctorate graduates	10.1	7.7	12.9	-4.0	-2.2	-82.1	-139.0	-27.9	-9.5	-9.4	6.3	3.4	-2.0	0.0	-18.3	62.0	16.4	9.0	-11.4	9.9
1.1.2 Population completed tertiary education	27.3	31.4	26.4	7.4	45.5	-1.7	38.0	76.0	9.9	3.3	52.1	16.7	58.7	43.8	-15.7	51.2	69.4	80.2	n/a	23.1
1.1.3 Lifelong learning	7.8	13.3	17.8	15.6	-13.3	-7.8	-51.1	-1.1	52.2	0.0	-54.4	n/a	-13.3	8.9	12.2	-3.3	0.0	31.1	n/a	-18.9
Attractive research systems																				
1.2.1 International scientific co-publications	46.9	87.1	77.4	26.7	81.5	12.4	57.0	38.0	121.7	120.1	31.3	33.7	12.7	41.2	136.4	27.4	0.0	8.1	8.0	84.5
1.2.2 Scientific publications among top 10% most cited	0.1	-11.0	0.7	22.3	-2.9	14.9	14.3	18.4	2.8	1.7	-21.0	-13.1	34.7	19.3	0.4	-3.9	-9.3	-0.8	5.9	13.5
1.2.3 Foreign doctorate students	15.3	29.0	39.5	-0.8	92.3	9.6	2.8	15.3	76.0	45.9	51.0	n/a	207.6	0.0	-66.6	14.2	43.9	38.2	7.2	-35.0
Innovation-friendly environment																				
1.3.1 Broadband penetration	130.0	200.0	50.0	170.0	280.0	120.0	90.0	60.0	180.0	190.0	n/a	n/a	40.0	90.0	170.0	120.0	306.0	60.0	64.0	1000.0
1.3.2 Opportunity-driven entrepreneurship	36.2	-10.5	-30.6	191.3	-5.7	-6.7	-101.5	10.3	150.5	-11.1	0.0	12.9	n/a	n/a	-60.3	n/a	58.8	16.9	n/a	33.7
INVESTMENTS																				
Finance and support																				
2.1.1 R&D expenditure in the public sector	-1.8	-22.0	22.0	-22.0	-5.5	-20.2	-23.8	-5.5	-22.0	-3.7	-7.3	-2.4	-21.1	14.7	38.5	9.2	20.2	-7.3	-24.0	-16.5
2.1.2 Venture capital expenditures	44.6	99.1	9.1	6.6	41.5	85.8	-12.1	-0.3	45.1	-8.6	n/a	n/a	n/a	n/a	18.4	-8.3	201.4	n/a	-34.7	104.0
Firm investments																				
2.2.1 R&D expenditure in the business sector	14.6	30.0	30.8	47.0	0.0	9.7	-26.7	17.0	-60.7	11.3	28.3	0.0	6.1	-3.2	18.6	12.1	4.9	16.2	-11.0	10.5
2.2.2 Non-R&D innovation expenditures	40.2	-90.3	32.1	10.7	67.9	-80.6	20.6	15.0	35.3	19.8	n/a	n/a	0.0	0.0	109.3	70.8	0.0	0.0	-7.9	64.9
2.2.3 Enterprises providing ICT training	38.5	76.9	-84.6	23.1	38.5	7.7	7.7	-53.8	-7.7	69.2	-30.8	n/a	23.1	23.1	0.0	53.8	n/a	-7.7	-8.5	7.7
INNOVATION ACTIVITIES																				
Innovators																				
3.1.1 SMEs with product or process innovations	-0.4	15.2	16.4	4.8	37.6	-19.9	-25.3	-22.4	50.3	-20.5	-36.6	0.0	4.7	0.0	104.7	-9.5	45.9	34.5	10.4	31.6
3.1.2 SMEs with marketing or organisational innovations	-17.9	-18.2	27.9	-30.3	0.0	-49.6	-36.6	-24.9	20.4	-20.0	-23.7	0.0	1.8	0.0	85.6	-38.2	-1.0	28.8	4.2	16.1
3.1.3 SMEs innovating in-house	-12.9	-14.9	9.5	7.6	60.7	-9.6	-14.6	-20.9	55.1	-20.5	n/a	0.0	n/a	n/a	107.8	-15.7	-35.8	63.0	-3.9	21.2
Linkages																				
3.2.1 Innovative SMEs collaborating with others	-0.7	-5.1	19.2	3.9	20.0	-14.9	-17.7	-1.2	59.1	-52.2	66.1	0.0	-11.2	0.0	148.0	-3.5	11.3	52.5	45.2	0.0
3.2.2 Public-private co-publications	13.1	11.3	63.1	18.7	12.2	9.0	-35.0	9.4	1.1	40.3	90.0	-13.4	-3.1	14.1	4.3	-5.0	0.0	5.3	6.9	21.9
3.2.3 Private co-funding of public R&D expenditures	0.9	-5.6	14.1	-19.1	6.7	-33.6	-19.5	-10.6	-37.0	-2.5	-58.3	0.0	0.0	-37.6	-9.7	24.9	2.0	0.5	-21.5	-15.8
Intellectual assets																				
3.3.1 PCT patent applications	-7.2	-5.3	-7.4	-0.8	6.7	1.5	-10.7	1.3	-5.6	0.0	5.3	0.0	26.0	-7.2	-5.8	4.3	-7.0	2.4	-0.5	-7.0
3.3.2 Trademark applications	6.4	7.2	-0.1	25.3	32.7	2.8	25.0	14.4	27.2	15.8	-53.8	19.3	-2.8	1.9	15.5	17.3	-8.8	4.3	4.6	-0.7
3.3.3 Design applications	-16.1	3.8	-42.7	11.4	-30.0	9.9	-23.4	-1.2	-6.9	-13.5	1.4	-2.7	0.7	0.0	2.7	5.6	-6.7	-2.1	0.7	-6.6
IMPACTS																				
Employment impacts																				
4.1.1 Employment in knowledge-intensive activities	8.1	8.1	13.5	16.2	24.3	16.2	2.7	-2.7	12.2	0.0	20.3	0.0	-12.2	4.1	16.2	8.1	31.1	8.1	10.8	21.6
4.1.2 Employment fast-growing firms in innovative sectors	7.7	10.0	-9.9	1.4	67.2	38.4	57.2	0.0	-7.0	14.1	33.1	-53.0	n/a	n/a	-38.5	n/a	-3.8	n/a	n/a	7.5
Sales impacts																				
4.2.1 Medium & high-tech product exports	10.8	23.8	9.2	3.7	17.0	21.1	18.5	22.7	18.1	13.6	0.0	14.8	67.4	0.0	0.0	15.4	26.2	18.1	-33.6	-1.0
4.2.2 Knowledge-intensive services exports	3.3	1.6	-2.6	7.3	-12.3	10.4	0.6	7.8	30.4	-4.8	-15.8	21.3	-7.0	-3.5	3.3	20.1	7.2	22.3	12.8	-6.3
4.2.3 Sales of new-to-market and new-to-firm innovations	-16.5	-0.4	6.0	-15.4	-41.1	-85.0	-17.6	-4.7	-35.6	3.0	0.0	0.0	0.0	0.0	10.3	1.1	31.6	-91.8	11.1	92.3

Annex E: Definitions of indicators

INDICATOR	DEFINITION NUMERATOR Source	DEFINITION DENOMINATOR Source	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
1.1.1 New doctorate graduates per 1000 population aged 25-34	Number of doctorate graduates Eurostat	Population between and including 25 and 34 years Eurostat	2017 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
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	2019 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, in particular in the service sectors, 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 (LFS). 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	2018 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 Scopus *	Total population Eurostat	2019 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 Web of Science *	2017 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	2017 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.
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	2019 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.

INDICATOR	DEFINITION NUMERATOR Source	DEFINITION DENOMINATOR Source	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
1.3.2 Opportunity-driven entrepreneurship (Motivational index)	This index is calculated as the ratio between the share of persons involved in improvement-driven entre¬preneurship and the share of persons involved in necessity-driven entrepreneurship. Global Entrepreneurship Monitor (GEM) Comment: Three-year averages have been used.		2018 Data from GEM distinguish between two types of entrepreneurship: 1) improvement-driven entrepreneurship and 2) necessity-driven entrepreneurship. The first includes persons involved in TEA (Total Early-Stage Entrepreneurial Activity) who (i) claim to be driven by opportunity as opposed to finding no other option for work; and (ii) who indicate the main driver for being involved in this opportunity is being independent or increasing their income, rather than just maintaining their income; the second includes persons involved in TEA who are involved in entrepreneurship because they had no other option for work. Countries with high relative prevalence of improvement-driven opportunity entrepreneurship appear to be primarily innovation-driven countries. In these countries, opportunities may be expected to be more abundant, and individuals may have more alternatives to make a living. GEM has constructed the Motivational index to measure the relative degree of improvement-driven entrepreneurship.
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	2018 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	2019 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.
2.2.1 R&D expenditure in the business sector (percentage of GDP)	All R&D expenditures in the business sector (BERD) Eurostat	Gross Domestic Product Eurostat	2018 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.
2.2.2 Non-R&D innovation expenditures (percentage of turnover)	Sum of total innovation expenditure for enterprises, excluding intramural and extramural R&D expenditures Eurostat (Community Innovation Survey)	Total turnover for all enterprises Eurostat (Community Innovation Survey)	2016 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.

INDICATOR	DEFINITION NUMERATOR Source	DEFINITION DENOMINATOR Source	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
2.2.3 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	2019 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.
3.1.1 SMEs introducing product or process innovations (percentage of SMEs)	Number of Small and medium-sized enterprises (SMEs) who introduced at least one product innovation or process innovation either new to the enterprise or new to their market. 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. A process innovation is the implementation of a new or significantly improved production process, distribution method, or supporting activity Eurostat (Community Innovation Survey)	Total number of Small and medium-sized enterprises Eurostat (Community Innovation Survey)	2016 Technological innovation, as measured by the introduction of new products (goods or services) and processes, is a key ingredient to innovation in manufacturing activities. Higher shares of technological innovators should reflect a higher level of innovation activities.
3.1.2 SMEs introducing marketing or organisational innovations (percentage of SMEs)	Number of Small and medium-sized enterprises (SMEs) who introduced at least one new organisational innovation or marketing innovation. An organisational innovation is a new organisational method in an enterprise's business practices (including knowledge management), workplace organisation or external relations that has not been previously used by the enterprise. A marketing innovation is the implementation of a new marketing concept or strategy that differs significantly from an enterprise's existing marketing methods and which has not been used before Eurostat (Community Innovation Survey)	Total number of Small and medium-sized enterprises Eurostat (Community Innovation Survey)	2016 The Community Innovation Survey mainly asks firms about their technological innovation. Many firms, in particular in the services sectors, innovate through other non-technological forms of innovation. Examples of these are marketing and organisational innovations. This indicator captures the extent to which SMEs innovate through non-technological innovation.
3.1.3 SMEs innovating in-house (percentage of SMEs)	Number of Small and medium-sized enterprises (SMEs) with in-house innovation activities. In-house innovating enterprises are defined as enterprises which have introduced product or process innovations either themselves or in co-operation with other enterprises or organisations Eurostat (Community Innovation Survey)	Total number of Small and medium-sized enterprises Eurostat (Community Innovation Survey)	2016 This indicator measures the degree to which SMEs, that have introduced any new or significantly improved products or production processes, have innovated in-house. The indicator is limited to SMEs, because almost all large firms innovate and because countries with an industrial structure weighted towards larger firms tend to do better.

INDICATOR	DEFINITION NUMERATOR Source	DEFINITION DENOMINATOR Source	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
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)	2016 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.
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	2019 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 Private co-funding of public R&D expenditures (percentage of GDP)	All R&D expenditures in the government sector (GOVERD) and the higher education sector (HERD) financed by the business sector Eurostat, OECD	Gross Domestic Product Eurostat, OECD	2017 This indicator measures public-private co-operation. University and government R&D financed by the business sector are expected to explicitly serve the more short-term research needs of the business sector.
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	2017 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 Trademarks applications per billion GDP (in PPS)	Number of trademark applications applied for at EUIPO plus number of trademark applications applied for at WIPO ("yearly Madrid applications by origin") European Union Intellectual Property Office (EUIPO), World Intellectual Property Office (WIPO) Comment: Two-year averages have been used.	Gross Domestic Product in Purchasing Power Standard Eurostat	2019 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 fulfills 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	2019 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.

INDICATOR	DEFINITION NUMERATOR Source	DEFINITION DENOMINATOR Source	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
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	2018 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.
4.1.2 Employment in fast-growing enterprises (percentage of total employment)	Number of employees in high-growth enterprises in 50% 'most innovative' industries[22] Eurostat	Total employment for enterprises with 10 or more employees Eurostat	2017 This indicator provides an indication of the dynamism of fast-growing firms in innovative sectors as compared to all fast-growing business activities. It captures the capacity of a country to transform rapidly its economy to respond to new needs and to take advantage of emerging demand.
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 MS, UN ComTrade for non-MS	2019 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[23] Eurostat	Total value of services exports Eurostat	2018 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)	2016 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).

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

---

[22] Defined as B06 (Extraction of crude petroleum and natural gas), B09 (Mining support service activities), C11 (Manufacture of beverages), C12 (Manufacture of tobacco products), C19 (Manufacture of coke and refined petroleum product), C20 (Manufacture of chemicals and chemical products), C21 (Manufacture of basic pharmaceutical products and pharmaceutical preparations), C26 (Manufacture of computer, electronic and optical products), C27 (Manufacture of electrical equipment), C28 (Manufacture of machinery and equipment n.e.c.), C29 (Manufacture of motor vehicles, trailers and semi-trailers), C30 (Manufacture of other transport equipment), C32 (Other manufacturing), D35 (Electricity, gas, steam and air conditioning supply) and E39 (Remediation activities and other waste management services).

[23] 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).

Annex F: Summary Innovation Index (SII)

	SUMMARY INNOVATION INDEX								RELATIVE TO EU IN 2012								... IN 2019
	2012	2013	2014	2015	2016	2017	2018	2019	2012	2013	2014	2015	2016	2017	2018	2019	2019
EU	0.466	0.469	0.462	0.468	0.478	0.487	0.498	0.507	100.0	100.7	99.2	100.3	102.6	104.5	106.9	108.9	100.0
EU28	*0.472*	*0.475*	*0.473*	*0.479*	*0.488*	*0.496*	*0.512*	*0.522*	*101.4*	*101.9*	*101.6*	*102.8*	*104.8*	*106.5*	*110.0*	*112.0*	*102.9*
BE	0.557	0.558	0.560	0.557	0.567	0.583	0.610	0.615	119.5	119.9	120.2	119.5	121.8	125.1	130.9	132.0	121.2
BG	0.197	0.207	0.215	0.214	0.222	0.223	0.227	0.230	42.3	44.5	46.1	45.9	47.7	48.0	48.8	49.5	45.4
CZ	0.388	0.391	0.392	0.401	0.395	0.406	0.423	0.427	83.2	83.9	84.1	86.0	84.7	87.2	90.9	91.7	84.3
DK	0.674	0.683	0.673	0.667	0.657	0.668	0.669	0.682	144.7	146.6	144.4	143.2	141.1	143.4	143.6	146.4	134.5
DE	0.610	0.610	0.586	0.585	0.584	0.592	0.604	0.608	131.0	130.8	125.8	125.5	125.3	127.1	129.5	130.5	119.9
EE	0.432	0.435	0.411	0.418	0.378	0.389	0.493	0.502	92.7	93.3	88.2	89.8	81.0	83.4	105.7	107.7	99.0
IE	0.522	0.511	0.514	0.527	0.567	0.564	0.565	0.568	112.1	109.7	110.3	113.2	121.7	121.1	121.2	121.9	112.0
EL	0.293	0.300	0.302	0.308	0.327	0.334	0.384	0.389	62.8	64.3	64.8	66.1	70.2	71.7	82.4	83.5	76.7
ES	0.364	0.364	0.349	0.344	0.366	0.377	0.402	0.432	78.1	78.0	75.0	73.9	78.6	80.9	86.2	92.6	85.1
FR	0.502	0.508	0.518	0.523	0.537	0.542	0.534	0.530	107.6	109.0	111.2	112.3	115.3	116.3	114.7	113.7	104.5
HR	0.254	0.256	0.241	0.247	0.247	0.256	0.287	0.298	54.5	54.9	51.7	52.9	52.9	55.0	61.6	64.0	58.8
IT	0.365	0.371	0.361	0.375	0.360	0.373	0.401	0.420	78.3	79.7	77.5	80.4	77.3	80.0	86.1	90.1	82.8
CY	0.401	0.413	0.383	0.395	0.370	0.381	0.405	0.451	86.0	88.7	82.2	84.8	79.3	81.8	87.0	96.8	88.9
LV	0.213	0.212	0.261	0.284	0.267	0.288	0.311	0.320	45.7	45.5	56.1	60.9	57.4	61.9	66.8	68.6	63.0
LT	0.275	0.275	0.277	0.305	0.362	0.351	0.382	0.404	59.1	58.9	59.5	65.4	77.6	75.3	81.9	86.8	79.7
LU	0.624	0.627	0.602	0.617	0.622	0.607	0.618	0.639	133.9	134.6	129.2	132.4	133.5	130.2	132.6	137.1	126.0
HU	0.302	0.301	0.305	0.306	0.311	0.320	0.330	0.337	64.8	64.7	65.5	65.7	66.9	68.6	70.7	72.3	66.4
MT	0.311	0.346	0.399	0.399	0.368	0.398	0.423	0.426	66.7	74.3	85.6	85.6	79.0	85.4	90.8	91.4	84.0
NL	0.600	0.601	0.594	0.605	0.616	0.620	0.635	0.648	128.7	128.9	127.5	129.9	132.1	133.1	136.2	139.1	127.8
AT	0.554	0.561	0.551	0.556	0.580	0.578	0.589	0.596	119.0	120.4	118.3	119.3	124.4	124.1	126.4	127.9	117.5
PL	0.238	0.246	0.236	0.243	0.252	0.256	0.281	0.299	51.0	52.9	50.7	52.1	54.2	54.9	60.2	64.1	58.9
PT	0.390	0.395	0.387	0.389	0.379	0.390	0.464	0.490	83.8	84.8	83.1	83.6	81.4	83.8	99.6	105.3	96.7
RO	0.187	0.185	0.142	0.145	0.143	0.154	0.153	0.160	40.2	39.7	30.5	31.1	30.7	33.1	32.9	34.4	31.6
SI	0.477	0.480	0.468	0.472	0.460	0.456	0.440	0.431	102.3	103.1	100.5	101.3	98.8	97.9	94.4	92.4	84.9
SK	0.328	0.333	0.313	0.321	0.332	0.318	0.329	0.338	70.4	71.4	67.2	68.9	71.3	68.2	70.6	72.5	66.6
FI	0.621	0.620	0.606	0.610	0.617	0.629	0.683	0.709	133.3	133.1	130.0	131.0	132.4	134.9	146.6	152.2	139.8
SE	0.681	0.686	0.682	0.679	0.686	0.701	0.701	0.713	146.2	147.2	146.3	145.8	147.3	150.5	150.5	153.1	140.7
IS	0.586	0.598	0.601	0.592	0.584	0.593	0.598	0.579	125.8	128.3	129.1	127.0	125.4	127.3	128.3	124.2	114.1
IL	0.558	0.560	0.560	0.560	0.561	0.563	0.563	0.563	119.7	120.3	120.2	120.3	120.5	120.9	120.9	120.9	111.1
MK	0.157	0.166	0.165	0.176	0.191	0.212	0.209	0.226	33.7	35.6	35.3	37.8	41.1	45.5	44.8	48.5	44.5
ME	0.197	0.193	0.202	0.198	0.196	0.199	0.196	0.220	42.2	41.4	43.4	42.4	42.0	42.6	42.0	47.2	43.4
NO	0.487	0.487	0.493	0.493	0.577	0.580	0.612	0.611	104.5	104.5	105.9	105.9	123.8	124.6	131.4	131.1	120.4
RS	0.251	0.253	0.265	0.269	0.258	0.281	0.291	0.313	53.9	54.3	56.9	57.7	55.5	60.4	62.5	67.1	61.7
CH	0.732	0.728	0.745	0.748	0.775	0.809	0.819	0.837	157.1	156.2	159.8	160.4	166.3	173.6	175.7	179.7	165.1
TR	0.257	0.260	0.250	0.255	0.251	0.261	0.314	0.316	55.2	55.9	53.6	54.8	53.8	56.0	67.3	67.8	62.3
UA	0.172	0.163	0.158	0.162	0.164	0.163	0.168	0.167	36.8	34.9	34.0	34.8	35.1	35.1	36.0	35.8	32.9
UK	0.533	0.528	0.549	0.561	0.599	0.599	0.607	0.613	114.3	113.3	117.7	120.4	128.6	128.6	130.2	131.6	120.9

Annex G: Performance scores per dimension

Performance is measured relative to that of the EU in 2019.

	HUMAN RESOURCES	RESEARCH SYSTEMS	INNOVATION-FRIENDLY ENVIRONMENT	FINANCE AND SUPPORT	FIRM INVESTMENTS	INNOVATORS	LINKAGES	INTELLECTUAL ASSETS	EMPLOYMENT IMPACTS	SALES IMPACTS
	2019	**2019**	**2019**	**2019**	**2019**	**2019**	**2019**	**2019**	**2019**	**2019**
EU	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
EU28	*108.2*	*111.3*	*98.1*	*99.8*	*100.9*	*100.6*	*107.0*	*97.5*	*107.7*	*101.0*
BE	116.0	167.0	90.9	113.5	122.4	149.5	163.7	87.5	88.5	104.5
BG	52.2	25.8	42.9	11.6	40.7	26.8	34.6	83.4	111.3	40.5
CZ	73.3	73.3	69.9	57.8	93.7	97.0	90.0	55.3	137.9	95.2
DK	179.7	196.6	189.5	145.4	107.5	96.9	149.7	147.1	109.7	74.3
DE	94.4	92.2	97.6	119.8	146.3	136.9	135.6	128.2	105.6	119.8
EE	122.0	106.5	79.3	90.8	95.0	106.3	129.9	120.7	73.3	66.8
IE	152.2	149.8	86.0	72.0	87.7	132.8	81.7	57.1	186.2	129.4
EL	80.5	68.3	44.1	53.3	65.7	146.5	125.9	41.9	53.2	67.9
ES	154.5	92.1	113.4	78.3	64.4	45.8	66.0	75.1	106.5	84.4
FR	138.4	123.4	82.3	137.8	83.9	127.5	100.1	84.4	86.2	89.2
HR	57.1	44.0	41.0	38.8	90.8	96.2	65.5	35.1	75.0	38.5
IT	53.4	97.3	69.7	56.5	73.1	130.7	67.1	103.0	80.6	80.8
CY	103.1	127.2	80.6	75.2	77.8	82.3	59.6	104.9	70.1	99.0
LV	66.0	46.0	79.5	109.7	56.9	39.9	54.7	63.3	92.9	51.1
LT	103.8	47.5	107.8	84.6	77.9	110.6	105.8	56.1	60.0	53.5
LU	154.5	206.8	135.8	106.2	63.1	141.9	87.6	151.0	175.4	85.2
HU	44.7	58.4	83.1	46.2	82.1	34.0	58.9	47.6	139.2	85.1
MT	77.1	76.7	134.1	92.6	81.4	59.5	16.6	137.7	173.6	59.3
NL	152.4	193.5	161.3	120.4	75.6	125.6	154.8	112.6	128.5	94.2
AT	124.4	146.9	75.1	94.9	98.0	151.1	182.3	135.2	69.9	84.4
PL	65.4	32.1	121.3	40.5	73.8	16.0	39.5	70.5	98.4	56.0
PT	91.2	118.4	130.7	83.3	95.8	174.9	63.0	75.8	89.1	55.7
RO	11.8	28.7	64.9	41.7	8.1	0.0	39.3	25.5	41.9	62.4
SI	110.6	88.4	82.2	31.7	103.7	68.6	112.9	87.7	97.6	68.1
SK	81.9	49.4	50.2	24.5	63.7	41.7	61.2	42.7	130.3	114.8
FI	172.4	151.9	184.9	137.4	129.9	171.5	163.1	127.1	86.7	90.6
SE	188.4	184.7	178.3	122.1	135.2	115.7	150.5	131.3	155.5	89.7
IS	136.4	176.5	189.5	106.5	99.7	131.0	166.2	76.3	134.6	31.7
IL	121.5	113.0	70.2	80.5	179.8	86.2	132.3	90.0	172.5	98.1
RS	61.1	38.9	69.3	39.9	85.6	96.4	67.6	23.7	44.7	67.5
NO	150.7	160.5	143.4	118.2	112.7	183.8	168.9	59.0	78.4	53.1
MK	38.2	81.0	50.8	13.1	61.8	73.9	17.1	14.3	6.7	54.3
ME	40.4	55.7	78.6	23.0	37.0	135.4	38.9	15.4	57.0	12.1
CH	219.6	226.9	169.8	165.2	172.3	159.1	168.5	158.9	115.9	118.5
TR	41.5	36.4	69.0	44.9	88.6	151.0	46.9	21.7	6.7	55.5
UA	46.4	15.1	97.5	9.8	34.8	22.6	36.5	22.4	80.5	35.3
UK	160.8	175.3	93.4	117.5	98.5	105.1	135.6	81.1	152.6	113.3

Annex H: International data

Performance in 2019 relative to EU in 2012	AU	BR	CA	CN	IN	JP	KR	RU	SA	US
	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019
1.1.1 New doctorate graduates	135.9	n/a	82.3	11.1	6.6	65.1	95.6	62.5	14.1	81.5
1.1.2 Population completed tertiary education	133.1	50.8	160.0	n/a	36.0	157.3	180.2	162.3	14.4	127.9
1.2.1 International scientific co-publications	166.0	47.0	164.3	43.9	19.8	71.9	91.4	52.7	62.3	110.6
1.2.2 Scientific publications among top 10% most cited	131.9	52.5	116.9	101.9	57.9	56.9	76.5	22.8	68.4	133.8
2.1.1 R&D expenditure in the public sector	109.5	n/a	105.6	68.6	56.1	87.6	115.1	60.6	63.4	91.1
2.2.1 R&D expenditure in the business sector	65.1	n/a	54.9	114.8	13.3	178.8	219.8	38.0	23.4	141.4
3.1.1 SMEs with product or process innovations	154.2	103.8	194.2	n/a	n/a	117.4	76.6	12.0	n/a	150.3
3.1.2 SMEs with marketing or organisational innovations	117.8	187.9	200.0	n/a	n/a	49.5	106.8	2.9	n/a	n/a
3.2.1 Innovative SMEs collaborating with others	119.6	52.3	n/a	n/a	n/a	119.7	51.3	17.0	n/a	n/a
3.2.2 Public-private co-publications	94.0	7.6	107.7	35.5	2.9	98.7	111.8	19.1	5.7	138.9
3.2.3 Private co-funding of public R&D expenditures	92.5	n/a	95.4	107.3	n/a	35.0	122.1	110.5	58.2	37.7
3.3.1 PCT patent applications	299.5	84.1	270.7	86.0	54.1	356.8	502.8	79.0	186.7	105.2
3.3.2 Trademark applications	226.4	120.2	208.6	331.5	64.7	187.5	252.7	129.0	96.6	61.8
3.3.3 Design applications	99.5	53.7	78.0	210.8	43.8	96.2	228.8	59.3	62.6	60.5
4.2.1 Medium & high-tech product exports	13.3	40.4	58.4	93.2	50.0	118.7	117.1	18.1	50.1	78.1
4.2.2 Knowledge-intensive services exports	51.6	114.2	95.3	96.4	109.7	106.1	85.7	93.7	n/a	97.2

Change in performance (2012–2019)

Performance change is measured as the difference between performance in 2019 relative to the EU in 2012 and performance in 2012 relative to the EU in 2012 (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	CN	IN	JP	KR	RU	SA	US
1.1.1 New doctorate graduates	21.3	n/a	7.4	-1.6	0.6	-2.5	22.6	-15.5	2.8	3.6
1.1.2 Population completed tertiary education	5.7	15.3	2.9	n/a	-2.7	-5.3	2.7	13.9	4.0	7.8
1.2.1 International scientific co-publications	-19.0	5.4	-4.6	9.2	2.3	-4.6	-2.6	6.5	8.2	-3.9
1.2.2 Scientific publications among top 10% most cited	1.7	1.1	-13.7	33.5	-1.4	-5.9	-4.6	7.7	-5.8	-19.5
2.1.1 R&D expenditure in the public sector	-4.1	n/a	-7.8	9.4	-16.6	-8.4	7.7	6.6	10.9	-12.4
2.2.1 R&D expenditure in the business sector	-31.1	n/a	-20.1	8.6	-9.6	-17.8	3.4	-10.7	-3.9	-7.6
3.1.1 SMEs with product or process innovations	-5.5	0.5	24.8	n/a	n/a	39.4	25.1	0.5	n/a	82.8
3.1.2 SMEs with marketing or organisational innovations	-7.5	23.6	45.1	n/a	n/a	-43.9	57.3	0.4	n/a	n/a
3.2.1 Innovative SMEs collaborating with others	44.4	-5.6	n/a	n/a	n/a	90.1	-6.3	9.6	n/a	n/a
3.2.2 Public-private co-publications	3.9	-0.7	-11.5	18.0	0.5	-16.6	-4.8	10.8	-0.1	-30.2
3.2.3 Private co-funding of public R&D expenditures	3.7	n/a	-13.2	-7.0	n/a	3.9	23.8	4.1	23.2	2.2
3.3.1 PCT patent applications	-9.9	12.2	-6.1	18.6	-12.5	55.2	110.4	9.2	-26.8	6.4
3.3.2 Trademark applications	-41.7	3.7	-4.3	100.9	-13.2	93.9	2.8	-6.3	-23.3	1.8
3.3.3 Design applications	13.9	2.3	13.1	10.8	3.3	8.2	28.7	14.4	1.6	13.0
4.2.1 Medium & high-tech product exports	-2.1	-5.3	-5.8	-4.5	5.0	-3.3	-11.1	-0.3	0.5	-9.2
4.2.2 Knowledge-intensive services exports	-1.2	8.5	-7.3	4.5	-9.9	-16.4	-6.0	-0.5	n/a	-4.9

Annex I: A comparison of the EIS indicators using CIS 2016 and CIS 2018 data

INDICATOR	CIS 2016	CIS 2018	IMPACT
SMEs that introduced a product or process innovation Includes all SMEs with at least one product innovation and/or at least one process innovation	**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.* 2.1 During the three years 2014 to 2016, did your enterprise introduce: • Goods innovations: New or significantly improved goods • Service innovations: New or significantly improved services **PROCESS INNOVATION** *A process innovation is the implementation of a new or significantly improved production process, distribution method, or supporting activity.* 3.1 During the three years 2014 to 2016, did your enterprise introduce: • New or significantly improved methods of manufacturing for producing goods or services • New or significantly improved logistics, delivery or distribution methods for your inputs, goods or services • New or significantly improved supporting activities for your processes	**PRODUCT INNOVATION** *A product innovation is a new or improved good or service that differs significantly from the firm's previous goods or services and which has been implemented on the market.* 3.1 During the three years 2016 to 2018, did your enterprise introduce any: • New or improved goods • New or improved service **BUSINESS PROCESS INNOVATION** New question on business process innovation combines the questions on process, marketing and organisational innovation. *A business process innovation is a new or improved business process for one or more business functions that differs significantly from the firm's previous business processes and which has been implemented within the firm.* 3.6 During the three years 2016 to 2018, did your enterprise introduce any of the following types of new or improved processes that differ significantly from your previous processes? • Methods for producing goods or providing services • Logistics, delivery or distribution methods • Methods for information processing or communication • Methods for accounting or other administrative operations • Business practices for organising procedures or external relations • Methods of organising work responsibility, decision making or human resource management • Marketing methods for promotion, packaging, pricing, product placement or after sales services	In theory the indicator could be calculated combining CIS 2018 question 3.1 and any of the first four items in CIS 2018 question 3.6. However, this indicator is not included in the standard tabulated data that statistical offices will have to submit to Eurostat, and from the CIS 2018 onwards this indicator will not be available from Eurostat's online database including CIS data

INDICATOR	CIS 2016	CIS 2018	IMPACT
SMEs that introduced a marketing or organisational innovation Includes all SMEs with at least one marketing innovation and/or at least one organisational innovation	*An organisational innovation is a new organisational method in your enterprise's business practices (including knowledge management), workplace organisation or external relations that has not been previously used by your enterprise.* 8.1 During the three years 2014 to 2016, did your enterprise introduce: • New business practices for organising procedures • New methods of organising work responsibilities and decision making • New methods of organising external relations with other enterprises or public organisations *A marketing innovation is the implementation of a new marketing concept or strategy that differs significantly from your enterprise's existing marketing methods and which has not been used before.* 9.1 During the three years 2014 to 2016, did your enterprise introduce: • Significant changes to the aesthetic design or packaging of a good or service • New media or techniques for product promotion • New methods for product placement or sales channels • New methods of pricing goods or services	**BUSINESS PROCESS INNOVATION** New question on business process innovation combines the questions on process, marketing and organisational innovation. See above	In theory the indicator could be calculated using any of the last three items in CIS 2018 question 3.6. However, this indicator is not included in the standard tabulated data that statistical offices will have to submit to Eurostat, and from the CIS 2018 onwards this indicator will not be available from Eurostat's online database including CIS data
SMEs innovating in-house	2.2 Who developed these product innovations? • Your enterprise by itself • Your enterprise together with other enterprises or organisations • Your enterprise by adapting or modifying goods or services originally developed by other enterprises or organisations • Other enterprises or organisations 3.2 Who developed these process innovations? • Your enterprise by itself • Your enterprise together with other enterprises or organisations • Your enterprise by adapting or modifying processes originally developed by other enterprises or organisations • Other enterprises or organisations	3.4 Who developed these product innovations? • Your enterprise by itself • Your enterprise together with other enterprises or organisations • Your enterprise by adapting or modifying products originally developed by other enterprises or organisations • Other enterprises or organisations 3.7 Who developed these process innovations? • Your enterprise by itself • Your enterprise together with other enterprises or organisations • Your enterprise by adapting or modifying processes originally developed by other enterprises or organisations • Other enterprises or organisations	The share of SMEs innovating in-house will not be comparable to the CIS 2016 figure due to the inclusion of new/improved methods for marketing innovation and organisational innovation in the CIS 2018 question on business process innovation

INDICATOR	CIS 2016	CIS 2018	IMPACT
Innovative SMEs collaborating with others	Question asked to enteprises with product and/or process innovations 7.2 During the three years 2014 to 2016, did your enterprise co-operate on any of your innovation activities with other enterprises or organisations?	Question asked to enteprises with product and/or business process innovations 3.15 During the three years 2016 to 2018, did your enterprise co-operate with other enterprises or organisations? • On R&D • On other innovation activities (excluding R&D) • On any other business activities	Results might no longer be directly comparable as CIS 2018 results also include enterprises with only organisational and marketing innovations
Non-R&D innovation expenditures	Question asked to enteprises with product and/or process innovations 5.2 How much did your enterprise spend on each of the following innovation activities in 2016 only? • In-house R&D • External R&D • Acquisition of machinery, equipment, software & buildings • Acquisition of existing knowledge from other enterprises or organisations • All other innovation activities including design, training, marketing, and other relevant activities • Total of the above innovation activities	Question asked to enteprises with product and/or business process innovations 3.10 How much did your enterprise spend on innovation and research and development (R&D) in 2018? • R&D performed in-house • R&D contracted out to others • All other innovation expenditures Of which • Own personnel working on innovation • Services, materials, supplies purchased from others for innovation • Capital goods for innovation	Although the wording is slightly different, the basic structure of the question has not changed as it differentiates R&D based innovation expenditures from all other innovation expenditures However, results might no longer be directly comparable as CIS 2018 results also include enterprises with only organisational and marketing innovations
Sales of new to market and new to firm innovations	Question asked to enteprises with product innovations 2.3 Were any of your product innovations during the three years 2014 to 2016: • New to your market? Your enterprise introduced a new or significantly improved product onto your market before your competitors • Only new to your enterprise? Your enterprise introduced a new or significantly improved product that was already available from your competitors in your market 2.4 Using the definitions above, please give the percent of your total turnover in 2016 from: • New or significantly improved products introduced during the three years 2014 to 2016 that were new to your market • New or significantly improved products introduced during the three years 2014 to 2016 that were only new to your enterprise	Question asked to enteprises with product innovations 3.2 In the three years 2016 to 2018, did your enterprise introduce any new or improved products (goods or services) that were: • Not previously offered by any of your competitors? • Identical or very similar to products already offered by your competitors? 3.3 Please estimate the percentage of your enterprise's total turnover in 2018 from products (goods or services) that were, in the three years 2016 to 2018: • New or improved products. Of which: • Not previously offered by any of your competitors • Identical or very similar to products already offered by your competitors • Unchanged products (or with only minor changes)	Although the wording is slightly different, the basic structure of the question has not changed and it is expected that results between the CIS 2016 and CIS 2018 will be comparable

European **Innovation Scoreboard** 2020

Publications Office
of the European Union