European Commission

European Innovation Scoreboard 2019

Innovation

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The European Innovation Scoreboard report and annexes, and the indicators database are available at:
https://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm

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European **Innovation** Scoreboard 2019

Foreword

"We need to leverage Europe's scientific strengths into leadership in breakthrough and disruptive innovation."

(Commission Communication "Preparing for a more united, stronger and more democratic Union in a more uncertain world"; contribution to the informal EU27 Leaders' meeting in Sibiu on 9 May 2019)

From tracking emissions with satellites to saving lives on the road with high-tech safety features, innovation is changing the world we live in. It drives economic transformation and brings about positive social change. Citizens across the continent expect the EU to bring prosperity and to grow the economy in a sustainable way. Innovation can help us deliver on these expectations. It helps us face new challenges, supports our industry in delivering on a climate-neutral and circular economy, and allows our companies to compete globally.

The time has come to turn Europe's excellence in science into cutting-edge technology and innovation. We need investment in research and innovation, and in digital capacities to boost our technological leadership. We need to embrace innovation to support sustainable growth and maintain a globally competitive industry. Working together will make us innovation leaders.

The 2019 European Innovation Scoreboard shows that our innovation performance continues to increase. For the first time, the EU has surpassed the United States, but it continues to lose some ground to Japan and South Korea, and China is catching up fast. Within the EU, 25 Member States have increased their innovation performance since 2011. In addition, in 2018 lower performing countries were catching up with higher performing ones faster than before.

To stay ahead, the EU has to prioritise research, innovation and investment. That is why under the next EU budget, the European Commission proposed an ambitious €100 billion research and innovation programme, Horizon Europe. It will promote innovation by identifying ground-breaking ideas and making them scale up and open up new markets. The European Innovation Council will provide financing to high-risk and breakthrough innovations to help them get to the stage where private financing kicks in. EU cohesion policy funds will be another essential instrument to unleash innovation in all regions of Europe. Other programmes such as the EU Space Programme, the European Defence Fund, the Digital Europe Programme will be key to boost also investment in key strategic technologies.

We will continue to improve how the EU Single Market works creating a launch pad for our innovative companies. Building a business friendly environment for companies to start up and scale up will remain a priority. Our initiatives on improving access to finance and boosting venture capital investment in the EU are already bearing fruits. The Commission is planning to complement these with a European Scale-Up Action for Risk Capital (ESCALAR) to enable venture capital funds to increase their investment capacity. In addition, our Smart Specialisation partnerships will foster a strategic approach to innovation and encourage cooperation between authorities, companies and industry at the regional level.

We are confident that the 2019 European Innovation Scoreboard, together with the accompanying Regional Innovation Scoreboard, will support the development of policies to enhance innovation in Europe. We count on you – researchers, innovators, investors, and policy-makers – to accelerate this process and give innovation the attention it deserves.

Elżbieta Bieńkowska
European Commissioner for
Internal Market, Industry,
Entrepreneurship and SMEs

Carlos Moedas
European Commissioner
for Research,
Science and Innovation

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Executive summary

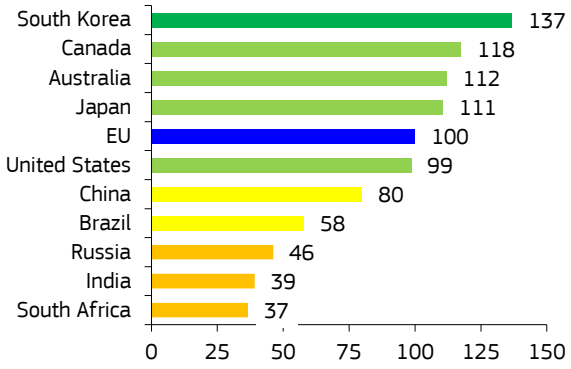
The annual European Innovation Scoreboard (EIS) provides a comparative assessment of the research and innovation performance of the EU Member States and selected third countries, and the relative strengths and weaknesses of their research and innovation systems. It helps countries assess areas in which 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 improvement is expected for the near future, but progress remains uneven within the EU.

The EU has overtaken the United States, while it is losing ground to Japan and South Korea

At the global level, the EU continues to lag behind South Korea, Canada, Australia and Japan, but, compared to last year, it has overtaken the United States (***Figure 1***). Relative to Japan and South Korea, the EU has been falling behind, and the performance gap is expected to further increase in the coming years. The EU has improved its position vis-à-vis Australia, Canada and the United States. China is catching up at two times the EU's innovation performance growth rate. The EU's performance lead over Brazil, India, Russia, and South Africa remains considerable.

Figure 1: Global performance



Bars show countries' performance in 2018 relative to that of the EU in 2018.

Innovation performance has increased for the EU and almost all Member States

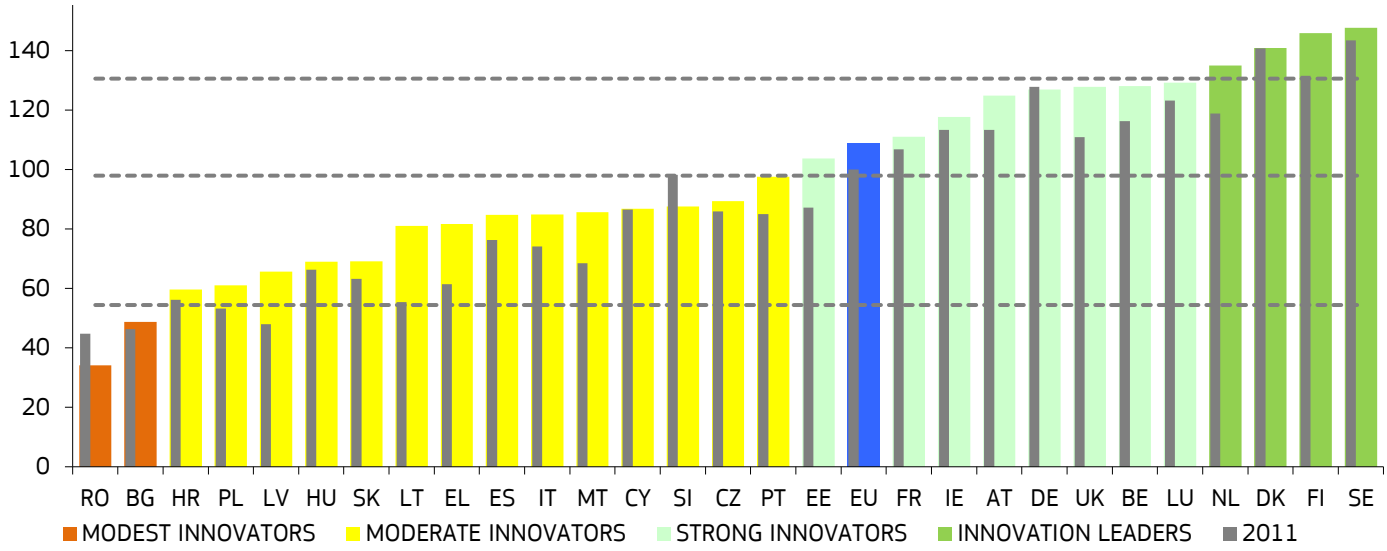
On average, the innovation performance of the EU has increased by 8.8 percentage points since 2011, in particular due to strong performance increases in the following indicators: New doctorate graduates, International scientific co-publications, and Broadband penetration. Since 2011, innovation performance increased in 25 EU countries and decreased in three. Performance has increased the most in Lithuania, Greece, Latvia, Malta, the United Kingdom, Estonia, and the Netherlands, and decreased the most in Romania and Slovenia. The process of convergence, where lower performing countries are growing faster than higher performing countries, has accelerated in the EU in 2018.

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, the Netherlands, and Sweden are *Innovation Leaders* with innovation performance well above the EU average. Austria, Belgium, Estonia, France, Germany, Ireland, Luxembourg, and the United Kingdom are *Strong Innovators* with performance above or close to the EU average. The performance of Croatia, Cyprus, the Czech Republic, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, 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, Estonia (previously a Moderate Innovator) joins the group of Strong Innovators. Luxembourg and the United Kingdom (both previously Innovation Leaders) drop to the group of Strong Innovators, and Slovenia (previously a Strong Innovator) drops to the group of Moderate Innovators.

Figure 2: Performance of EU Member States' innovation systems



Coloured columns show Member States' performance in 2018, using the most recent data for 27 indicators, relative to that of the EU in 2011. Grey columns show Member States' performance in 2011 relative to that of the EU in 2011. For all years, the same measurement methodology has been used. The dashed lines show the threshold values between the performance groups in 2018, comparing Member States' performance in 2018 relative to that of the EU in 2018.

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

The EIS measurement framework distinguishes between four main types of indicators and ten innovation dimensions, capturing 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 2011, progress has been strongest in the *Innovation-friendly environment* (notably Broadband penetration), *Human resources* (notably Doctorate graduates), *Firm investments* (notably Enterprises providing ICT training), 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 2011 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. 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.

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 2019[1], the 18th edition since the introduction of the EIS in 2001, follows the methodology of the previous EIS 2018 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 indicators – 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 onto 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.

Data revisions and changes to the normalisation process

For the 2017 edition of the European Innovation Scoreboard, the main measurement framework was significantly modified. For this year's edition, no changes have been made to the main measurement framework. However, the results in the 2019 edition are not comparable to the 2018 edition due to data revisions made by the suppliers of the data. Compared to the 2018 edition, the following changes are the most prominent:[2]

Data have been revised for all Member States for the full time period for four indicators. For the three indicators using bibliometric data, data have been extracted by Science-Metrix from Scopus, a large abstract and citation database of peer-reviewed literature from Elsevier, whereas data for previous EIS reports were extracted by CWTS (Leiden University) from Web of Science, a competing abstract and citation database. Data extracted from these two databases are not directly comparable. International scientific co-publications using Scopus are, on average, about 34% higher than the number of such publications using Web of Science, with large differences between countries ranging from 23% to 62%. Top 10% most cited publications using Scopus are, on average, only 0.1% lower than the number of such publications using Web of Science, but there are large differences between countries ranging from data being 2.1% lower to data being 1.4% higher. Public-private co-publications using Scopus are, on average, about 175% higher than the number of such publications using Web of Science, with large differences between countries ranging from 3.5% to 1425%. For Venture capital expenditures, data have been restated by Invest Europe. Restated data are, on average, about 16% higher, with large differences between countries ranging from 12% lower restated data to 92% 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 for most indicators, the period underlying the time series used in the analysis has changed. As explained in Section 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 2018, 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 2018 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 2018. 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 2018. This update in the time period becomes most visible for the benchmark year relative to the EU which has been 2010 in the EIS 2018 and previous reports, but which has changed to 2011 in this year's report as 2010 is no longer within the analysed 2011-2018 time period.

[2] A more detailed explanation of these changes is provided in the EIS 2019 Methodology Report, available at https://ec.europa.eu/docsroom/documents/35644

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[3]. For this year's report, no changes have been introduced. The analysis of structural differences by country will be 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 2019 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[4] 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 2016-2018. In economies that grow faster, expanding markets may provide more favourable conditions for enterprises to sell their goods and services.

Of particular importance are differences in economic structures, with differences in the share of manufacturing industry in GDP and in so-called high-tech activities in manufacturing and services, being 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 techno-

Table 2: Contextual indicators in the European Innovation Scoreboard

	Period	Source
PERFORMANCE AND STRUCTURE OF THE ECONOMY		
GDP per capita (PPS)	Average 2015-2017	Eurostat
Average annual GDP growth (%)	2016-2018	Eurostat
Employment share Manufacturing (NACE C) (%)	Average 2015-2017	Eurostat
of which High and Medium high-tech (%)	Average 2015-2017	Eurostat
Employment share Services (NACE G-N) (%)	Average 2015-2017	Eurostat
of which Knowledge-intensive services (%)	Average 2015-2017	Eurostat
Turnover share SMEs (%)	Average 2013-2016	Eurostat
Turnover share large enterprises (%)	Average 2013-2016	Eurostat
Foreign-controlled enterprises – share of value added (%)	Average 2014-2016	Eurostat
BUSINESS AND ENTREPRENEURSHIP		
Enterprise births (10+ employees) (%)	Average 2014-2016	Eurostat
Total Entrepreneurial Activity (TEA) (%)	Average 2016-2018	Global Entrepreneurship Monitor
FDI net inflows (% GDP)	Average 2015-2017	World Bank: World Development Indicators
Top R&D spending enterprises per 10 mln population	Average 2016-2018	EU Industrial R&D Investment Scoreboard
Buyer sophistication (1 to 7 best)	Average 2016-2018	World Economic Forum
GOVERNANCE AND POLICY FRAMEWORK		
Ease of starting a business (0 to 100 best)	Average 2016-2018	World Bank: Doing Business
Basic-school entrepren. education and training (1 to 5 best)	Average 2016-2018	Global Entrepreneurship Monitor
Govt. procurement of advanced tech products (1 to 7 best)	Average 2015-2017	World Economic Forum
Rule of law (-2.5 to 2.5 best)	Average 2015-2017	World Bank: Worldwide Governance Indicators
DEMOGRAPHY		
Population size (millions)	Average 2015-2017	Eurostat
Average annual population growth (%)	2016-2018	Eurostat
Population density (inhabitants/km^2)	Average 2015-2017	Eurostat

[3] 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/29306

[4] 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.

logical intensities than other industries[5]. These industries, 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 EU28 on average, 85% of R&D expenditures in manufacturing are accounted for by medium-high and high-technology manufacturing industries . 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[6] .

Foreign ownership, including ownership from both other EU Member States and non-Member States, is important as, on average, about 40% of business R&D expenditures in EU Member States is made by foreign affiliates, which is significantly higher compared to major international competitors. The indicator measuring 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[7].

Demand is an important driver of innovation. According to the Oslo Manual (2018)[8], 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 providing the most lenient regulatory framework for doing business. Countries

[5] Based on NACE Rev. 2 3-digit level, manufacturing industries can be classified as follows: High-technology (HT): Basic pharmaceutical products and pharmaceutical preparations (21); Computer, electronic and optical products (26); Air and spacecraft and related machinery (30.3*); Medium-high-technology (MHT): Chemicals and chemical products (20); Weapons and ammunition (25.4**); 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) and excluding Air and spacecraft and related machinery (30.3); Medical and dental instruments and supplies (32.5***); Medium-low-technology (MLT): Reproduction of recorded media (18.2***); Coke and refined petroleum products (19); Rubber and plastic products (22); Other non-metallic mineral products (23); Basic metals (24); Fabricated metal products, except machinery and equipment (25) excluding Manufacture of weapons and ammunition (25.4); Building of ships and boats (30.1*); Repair and installation of machinery and equipment (33); Low-technology (LT): Food products (10); Beverages (11); Tobacco products (12); Textiles (13); Wearing apparel (14); Leather and related products (15); Wood and products of wood and cork, except furniture; articles of straw and plaiting materials (16); Paper and paper products (17); Printing and reproduction of recorded media (18) excluding Reproduction of recorded media (18.2); Furniture (31); Other manufacturing (32) excluding 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-high-technology, industries identified with an ** are classified as medium-low-technology, and industries identified with an *** are classified as low-technology (Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:High-tech_classification_of_manufacturing_industries).

[6] 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).

[7] http://iri.jrc.ec.europa.eu/scoreboard.html

[8] 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

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 include population size and the average annual growth rate of population for 2016-2018 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 2 May 2019. International sources have been used wherever possible to improve comparability between countries. The data relates to actual performance in 2018 for 10 indicators, 2017 for seven indicators, and 2016 for 10 indicators (these are the most recent years for which data are available, cf. ***Annex E***).

Data availability is complete for 27 Member States, with data being available for all 27 indicators. For Malta, data is not available for Opportunity-driven entrepreneurship, as the Global Entrepreneurship Monitor is not carried out in Malta, and data is not available for Venture capital expenditures.

2. Innovation performance and trends

2.1 Most recent innovation performance

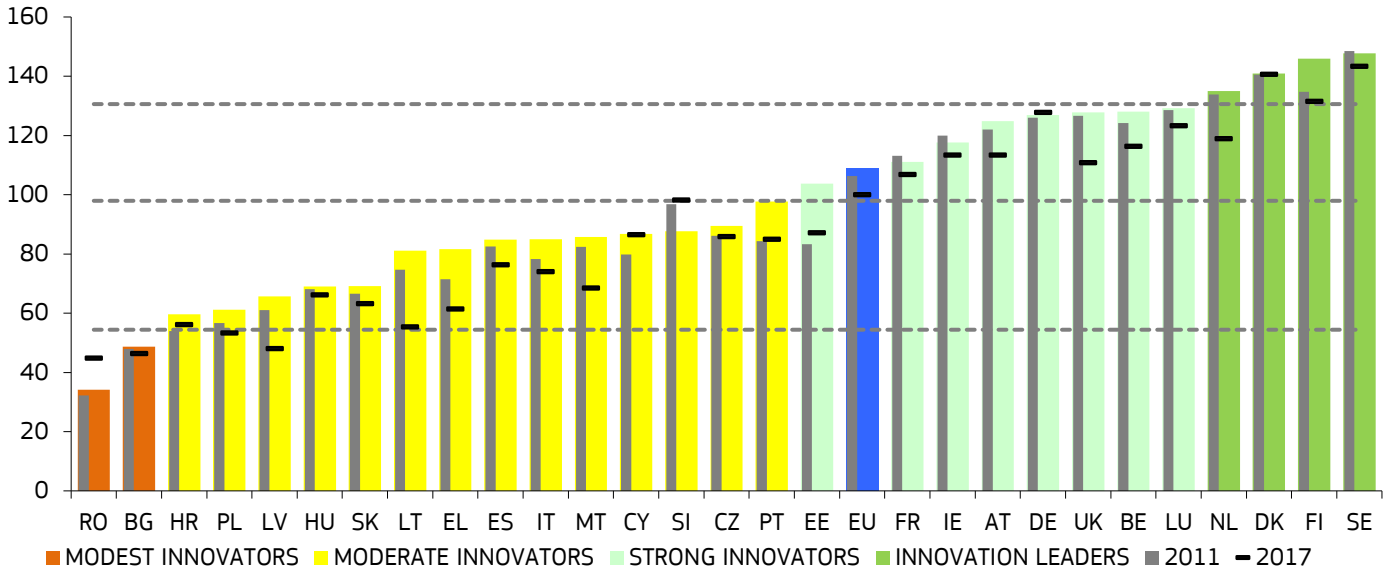
The performance of EU national innovation systems is measured by the Summary Innovation Index, which is a composite indicator obtained by taking an unweighted average of the 27 indicators (cf. ***Table 1***)[9]. ***Figure 3*** shows the scores for the Summary Innovation Index for all EU Member States in 2018, i.e. the most recent or 'this year', 2017 (referred to as 'last year'), and the reference year 2011. Based on this year's results, the Member States fall into four performance groups[10]:

- The first group of **Innovation Leaders** includes 4 Member States where performance is above 120% of the EU average. The Innovation Leaders are Denmark, Finland, the Netherlands, and Sweden;
- The second group of **Strong Innovators** includes 8 Member States with a performance between 90% and 120% of the EU average. Austria, Belgium, Estonia, France, Germany, Ireland, Luxembourg, and the United Kingdom are Strong Innovators;
- The third group of **Moderate Innovators** includes 14 Member States where performance is between 50% and 90% of the EU average. Croatia, Cyprus, Czechia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, Slovenia, and Spain belong to this group;
- The fourth group of **Modest Innovators** includes 2 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, Estonia (previously a Moderate Innovator) joins the group of Strong Innovators. Luxembourg and the United Kingdom (both previously Innovation Leaders) drop to the group of Strong Innovators, and Slovenia (previously a Strong Innovator) drops to the group of Moderate Innovators.

Figure 3 illustrates that performance in 2018 when compared to 2011 is higher for 25 Member States. Compared to 2017, performance in 2018 has improved for 24 Member States. Section 2.2 discusses the performance changes in more detail. As shown on the map in As shown on the map in ***Figure 4***, the performance groups tend to be geographically concentrated. Their average performance decreases with increasing geographical distance from the Innovation Leaders.

Figure 3: Performance of EU Member States' innovation systems

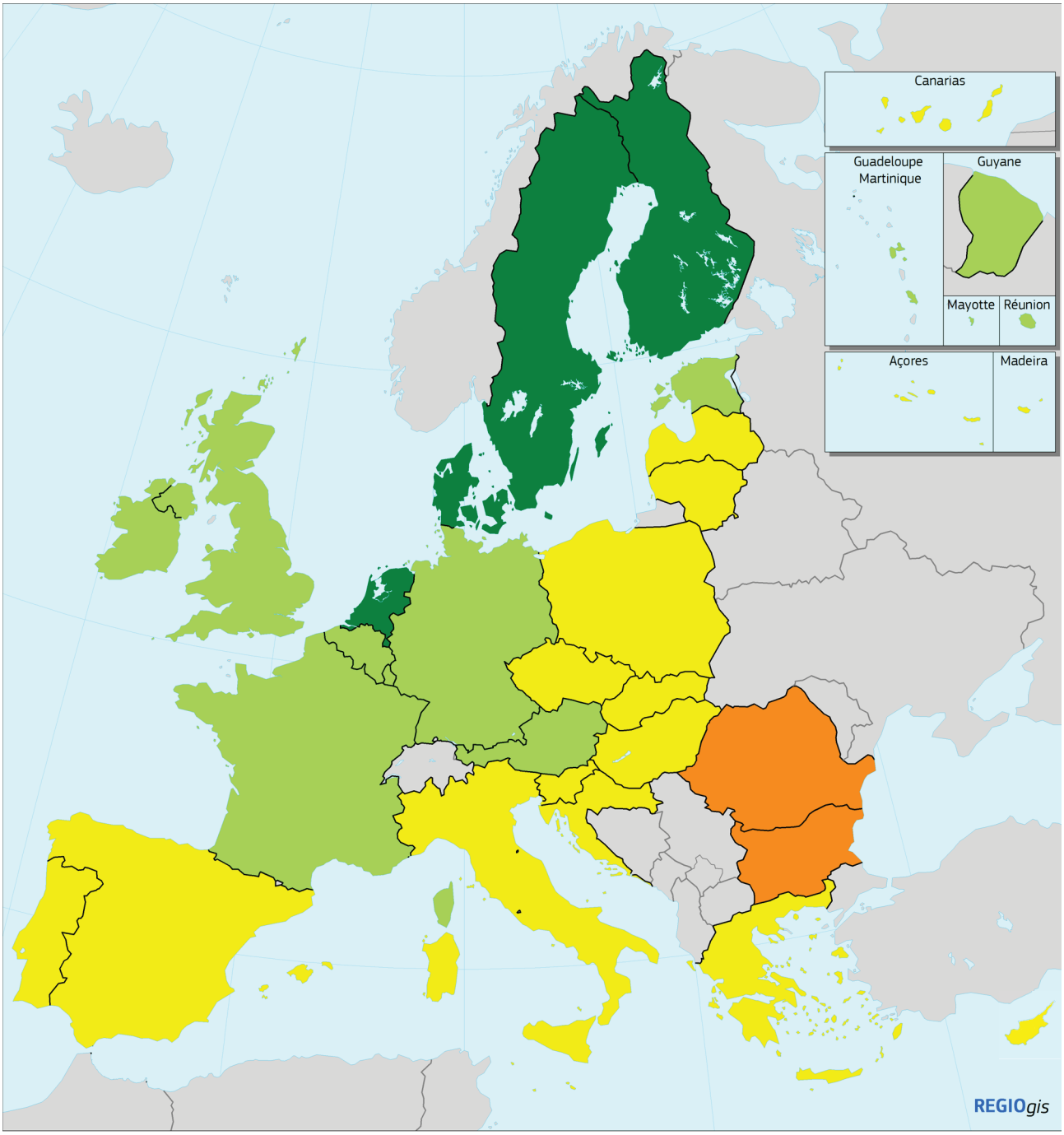


Coloured columns show Member States' performance in 2018, using the most recent data for 27 indicators, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for 27 indicators, relative to that of the EU in 2011. Grey columns show Member States' performance in 2011 relative to that of the EU in 2011. For all years, the same measurement methodology has been used. The dashed lines show the threshold values between the performance groups in 2018, comparing Member States' performance in 2017 relative to that of the EU in 2018.

[9] Section 8.1 gives a brief explanation of the calculation methodology. The EIS 2019 Methodology Report provides a detailed explanation.

[10] The EIS performance groups are relative performance groups with countries' group membership depending on their performance relative to that of the EU. With a growing EU innovation performance, the absolute thresholds between these groups will also increase over time.

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 2019

0 500 km

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.

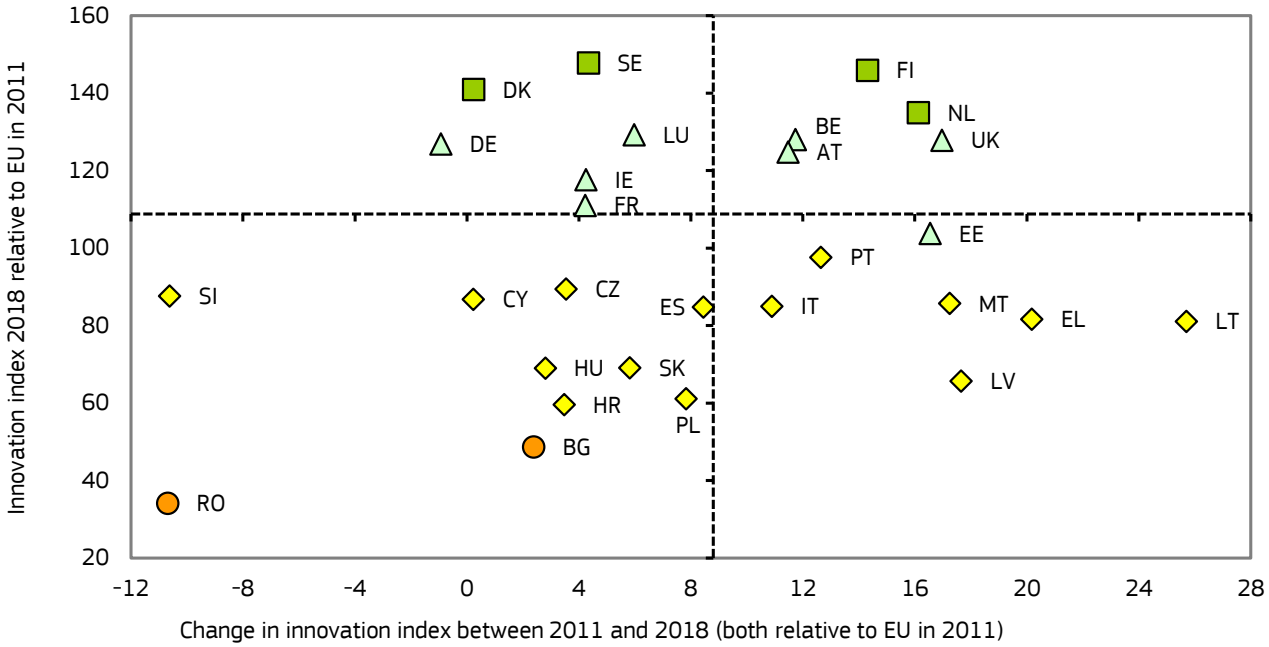
For the EU, performance between 2011 and 2018 improved by 8.8 percentage points. Performance improved for 25 Member States and worsened for three Member States (***Figure 5***):

- For seven Member States, performance improved by 15 percentage points or more: Lithuania (25.7%-points), Greece (20.2%-points), Latvia (17.7%-points), Malta (17.2%-points), United Kingdom (17.0%-points), Estonia (16.5%-points), and the Netherlands (16.1%)-points;
- For five Member States, performance improved between 10 and 15 percentage points: Finland (14.3%-points), Portugal (12.6%)-points, Belgium (11.7%), Austria (11.5%-points), and Italy (10.9%-points);
- For four Member States, performance improved between 5 and 10 percentage points: Spain (8.4%-points), Poland (7.8%-points), Luxembourg (6.0%-points), and Slovakia (5.8%-points);
- For nine Member States, performance improved between 0 and 5 percentage points: Sweden (4.3%-points), Ireland (4.2%-points), France (4.2%-points), Czechia (3.5%-points), Croatia (3.5%-points), Hungary (2.8%-points), Bulgaria (2.4%-points), Denmark (0.2%-points), and Cyprus (0.2%-points);
- For one Member State innovation performance declined by less than 5 percentage points: Germany (-0.9%-points);
- For two Member States, performance declined by more than 10 percentage points: Slovenia (-10.6%-points) and Romania (-10.7%-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. This year's report shows that, more recently, the change in performance is not related to the level of performance[11]. Between 2011 and 2018, there has been a strong 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[12].

Compared to 2017, performance in 2018 has improved for 24 Member States, most notably for Estonia, Portugal, Finland, and Greece. Performance has declined for four Member States, most notably for Slovenia (cf. ***Figure 3***).

Figure 5: Performance and change of EU Member States' innovation systems



The vertical axis shows Member States' performance in 2018 relative to that of the EU in 201. The horizontal axis shows the change in performance between 2011 and 2018 relative to that of the EU in 2011. The dashed lines show the respective scores for the EU..

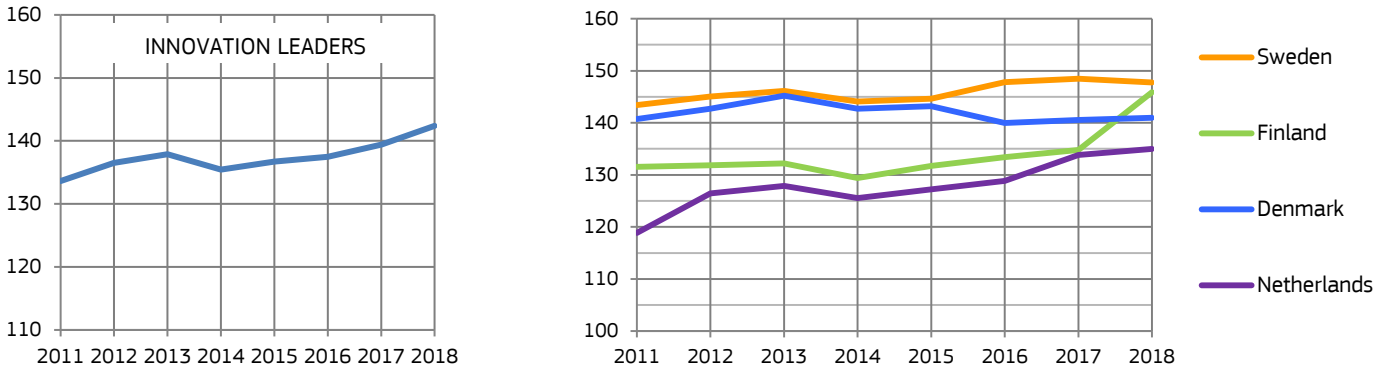
[11] The correlation coefficient between the change and the levels in both 2011 and 2018 is statistically not significant.

[12] The level of sigma-convergence declined from 0.360 in 2012 to 0.336 in 2017 and then to 0.314 in 2018.

Innovation Leaders

Performance of the Innovation Leaders improved until 2013, after which it declined in 2014. Performance improved again from 2015 onwards. Compared to 2011, average performance has improved by 8.5 percentage points. Performance has improved most in the Netherlands and Finland, with increases of more than 10 percentage points. Strong annual increases are observed for 2012 and 2017 for the Netherlands. A strong annual increase in Finland is observed in 2018. Performance also improved for Denmark and Sweden, but at a lower rate of respectively 0.2 and 4.3 percentage points. For all Innovation Leaders performance declined in 2014. Performance also declined for Denmark in 2016 and for Sweden in 2018.

Figure 6: Performance Innovation Leaders

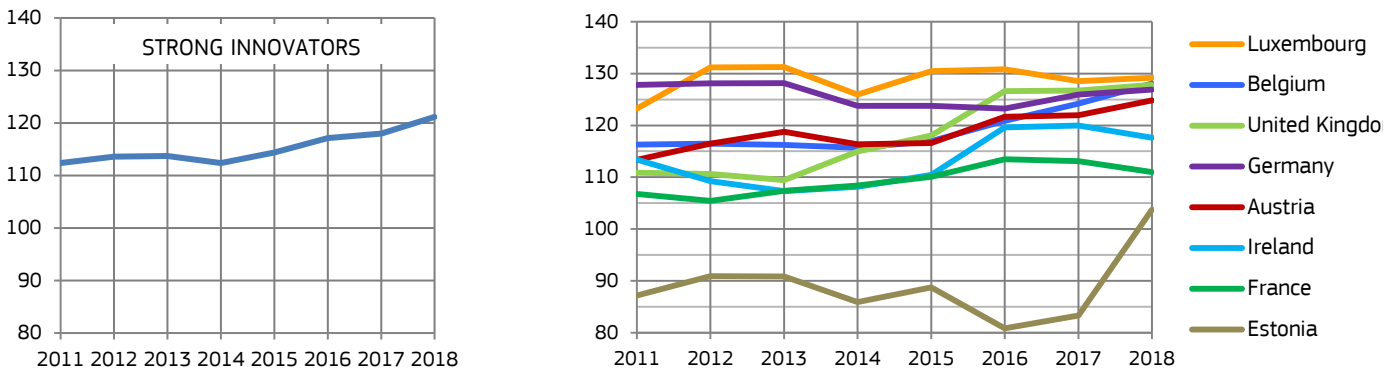


Performance is relative to that of the EU in 2011. The graph on the left shows the average performance of the Innovation Leaders, calculated as the unweighted average of the respective Member States.

Strong Innovators

For the Strong Innovators, performance remained relatively stable until 2014, after which it improved annually, raising average performance by 8.5 percentage points compared to 2011. The performance gap to the Innovation Leaders slightly increased between 2011 and 2018. Performance has improved for all Strong Innovators, except for Germany. The largest performance improvements occurred in the United Kingdom (17.0 percentage points) and Estonia (16.5 percentage points). The strong increase in Estonia is entirely due to increasing performance in 2018, which results from the highly improved performance for the six indicators using CIS data; between 2011 and 2017 performance in Estonia decreased by 3.9 percentage points. For Belgium, performance compared to 2011 increased by 11.7 percentage points, resulting from annual performance increases since 2015. For Austria, performance between 2011 and 2018 increased strongly (11.5 percentage points), due to a strong performance increase in 2016. For Luxembourg, performance increased by 6.0 percentage points, with performance in 2018 below that in 2013 due to relatively strong declines in 2014 and 2017. For Ireland, performance increased strongly in 2016, leading to an overall performance increase compared to 2011 of 4.2 percentage points. For France, performance compared to 2011 also increased by 4.2 percentage points, with a strong increase in 2016 being followed by moderate declines in 2017 and 2018. For Germany, performance has declined by almost 1 percentage point, with performance in 2018 below that in 2013 due to a relatively strong decline in 2014.

Figure 7: Performance Strong Innovators



Performance is relative to that of the EU in 2011. The graph on the left shows the average performance of the Strong Innovators, calculated as the unweighted average of the respective Member States.

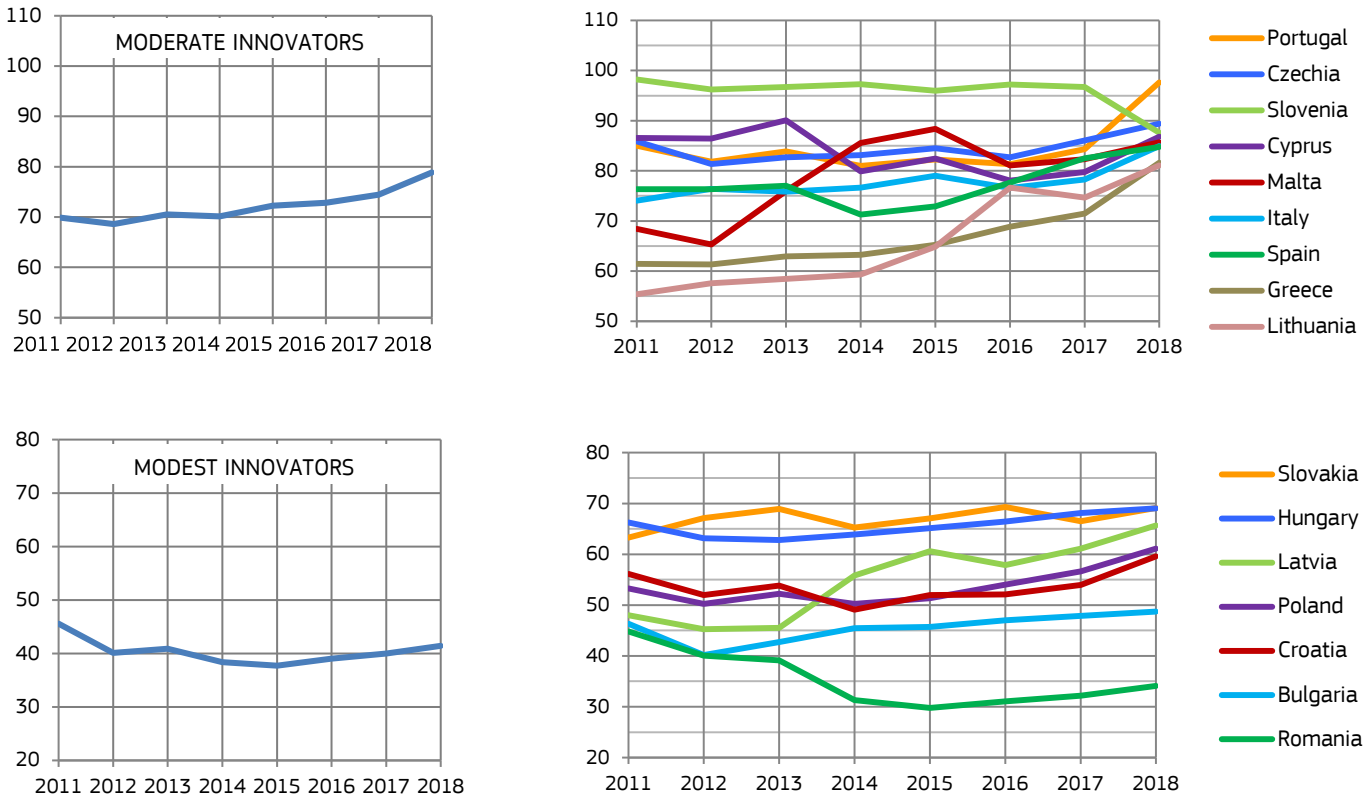
Moderate Innovators

For the Moderate Innovators, performance has been increasing since 2014, with a growth acceleration in 2017 and 2018. Compared to 2011, average performance has improved by 9.0 percentage points, which is slightly higher than average performance increases for both the Innovation Leaders and Moderate Innovators. For 13 Moderate Innovators, performance has increased. For Lithuania, performance improved very strongly by 25.7 percentage points, with performance improvements in most years, most notably in 2015, 2016 and 2018. Performance also increased strongly for Greece between 2011 and 2018 (20.2 percentage points), with annual performance improvements since 2012 and a very strong performance increase in 2018 (10.1 percentage points). For Latvia, performance increased by 17.7 percentage points, with strong performance increases in 2014, 2015 and 2018. Performance also increased strongly for Malta between 2011 and 2018 (17.2 percentage points), most notably in 2013 and 2014. For Portugal, performance increased strongly by 12.6 percentage points, with a very strong performance increase in 2018 (13.3 percentage points), entirely due to highly improved performance for the six indicators using CIS data. For Italy, performance increased by 10.9 percentage points, with annual performance increases in 2012, 2014, 2015, 2017 and 2018. For Spain, performance increased by 8.4 percentage points, with strong increases in 2016 and 2017. For Poland, strong growth after 2015 has led to an overall performance increase of 7.8 percentage points compared to 2011. For Slovakia, performance increased by 5.8 percentage points, with a strong decline in 2017 and almost equally strong increase in 2018. For Czechia, relatively strong performance increases in 2017 and 2018 have led to an overall performance increase of 3.5 percentage points. For Croatia, performance declined strongly in 2012 and 2014, but annual performance has increased since 2014 and a relatively strong increase in 2018 have led to an overall performance increase of 3.5 percentage points. For Hungary, performance increased by 2.8 percentage points with annual performance increases since 2014. For Cyprus performance has increased by only 0.2 percentage points, and despite a strong increase in 2018, the country has not yet recovered from the more than 10% percentage point decline in 2014. Only for Slovenia performance has declined at a high rate of 10.6 percentage points, almost entirely due to declining performance in 2018 on doctorate graduates and the six indicators using CIS data..

Modest Innovators

For the Modest Innovators, performance declined between 2011 and 2018, leading to a widening of the performance gap to the Moderate Innovators. For Bulgaria, performance increased by 2.4 percentage points, but performance in 2018 is still below the performance level in 2011, where the strong performance decline in 2012 has only partially been met by annual performance increases since 2013. For Romania, performance has declined strongly by 10.7 percentage points, mainly due to strong decreases for New doctorate graduates and the indicators using CIS data, but, after four years of declining performance, performance increased again in 2015, 2016 and 2017.

Figure 8: Performance Moderate and Modest Innovators

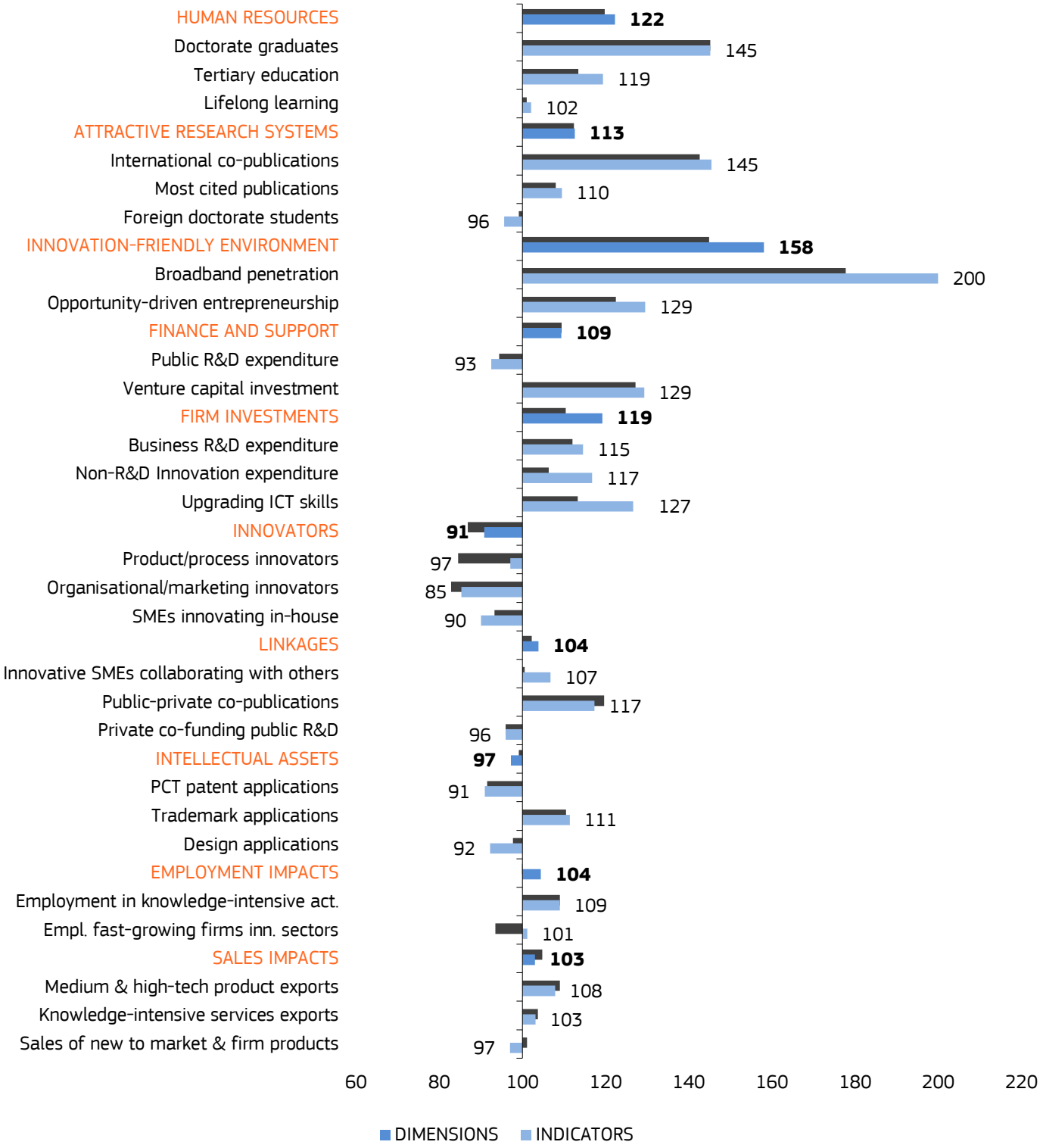


Performance is relative to that of the EU in 2011. The graph on the top-left shows the average performance of the Moderate Innovators, calculated as the unweighted average of the respective Member States. The graph on the bottom-left shows the average performance of the Modest Innovators, calculated 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 28 Member States, has improved by 8.8 percentage points between 2011 and 2018. There are differences in performance changes for the different dimensions and indicators. ***Figure 9*** shows the change for each dimension and indicator in 2018 compared to the 2011 performance level (the blue coloured bars) and in 2017 (the black coloured bars). The difference between the respective blue and black coloured bar thus illustrates the change in the most recent year. Performance has improved most (58.1 percentage points) in Innovation-friendly environment, with strongly increasing performance in Broadband penetration. Performance has also increased in Human resources (22.3 percentage points) with increasing performance for all three indicators. Performance has also increased strongly in Firm investments (19.2 percentage points) with increasing performance for all three indicators. A strong increase in International scientific co-publications has led to a 12.6 percentage point increase for Attractive research systems. Performance in Finance and support has increased (9.4 percentage points) because of increasing Venture capital expenditures. Performance has increased more moderately for Employment impacts (4.4 percentage points) and for Linkages (3.9 percentage points). Performance has decreased in Intellectual assets, where a strong increase in Trademark applications has been offset by declining performance in PCT patent applications and Design applications, and Innovators, where performance has decreased for all three indicators.

Figure 9: EU Performance change between 2011 and 2018 by dimension and indicator



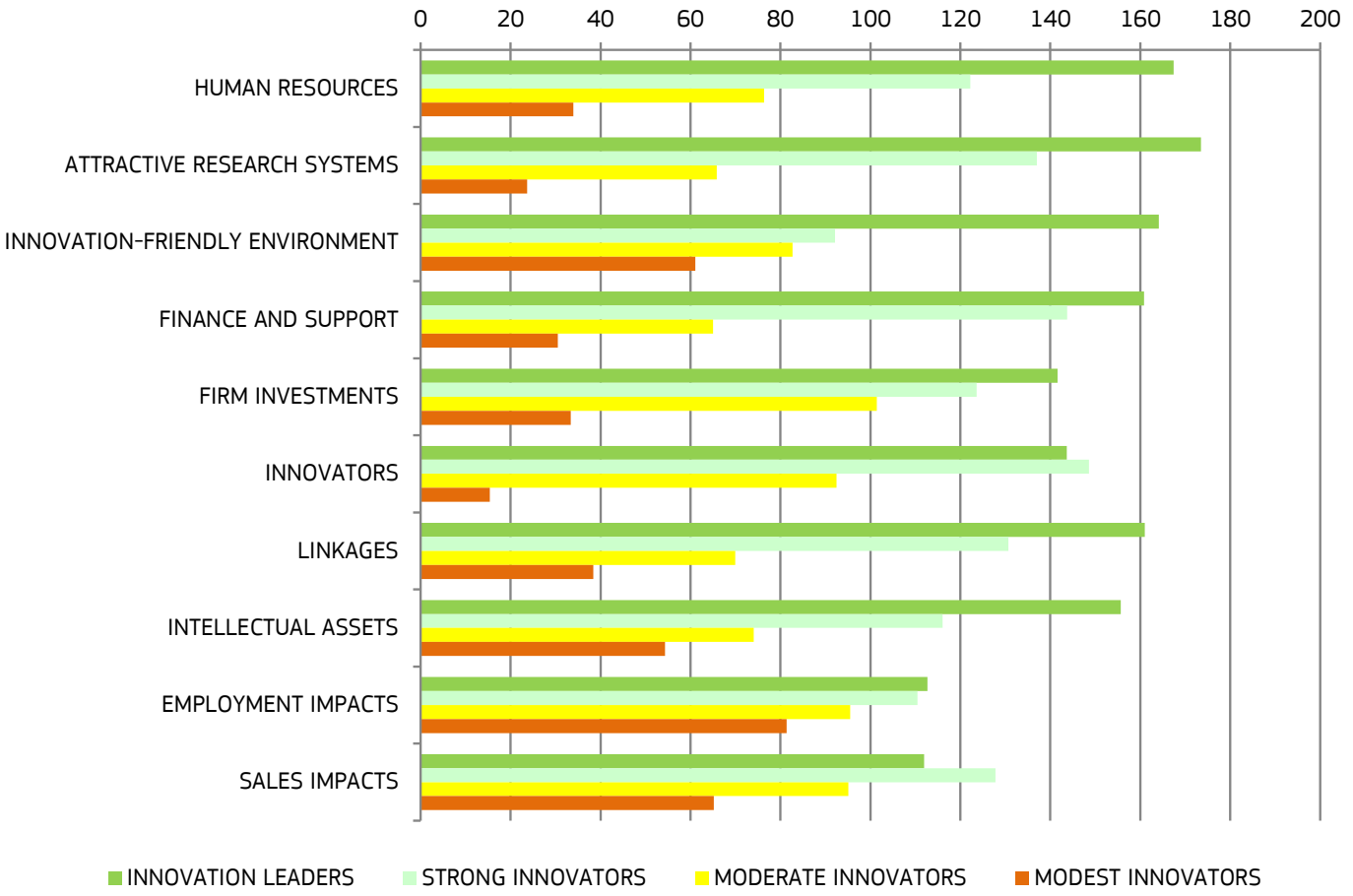
Normalised scores in 2018 (blue coloured bars) and 2017 (black coloured bars) relative to those in 2011 (=100)

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, followed by the Strong Innovators, the Moderate Innovators and the Modest Innovators (***Figure 10***). In the *Innovators* and *Sales impacts* dimensions, the Strong Innovators show the best performance. In other dimensions, performance differences can be small between the country groups. In *Employment impacts*, the performance difference between the Innovation Leaders and the Strong Innovators is relatively small, compared to the average difference across all dimensions. Between the Strong and Moderate Innovators, performance differences are relatively small for Innovation-friendly environment and Employment impacts. Between the Moderate and Modest Innovators, performance differences are relatively small for *Innovation-friendly environment*, *Intellectual assets*, and *Employment impacts*. Performance differences between the Innovation Leaders and Strong Innovators are relatively high for *Human resources* and *Innovation-friendly environment*. Performance differences between the Strong Innovators and Moderate Innovators are relatively high for *Attractive research systems* and *Linkages*. Performance differences between the Moderate Innovators and Modest Innovators are relatively high for *Firm investments* and *Innovators*.

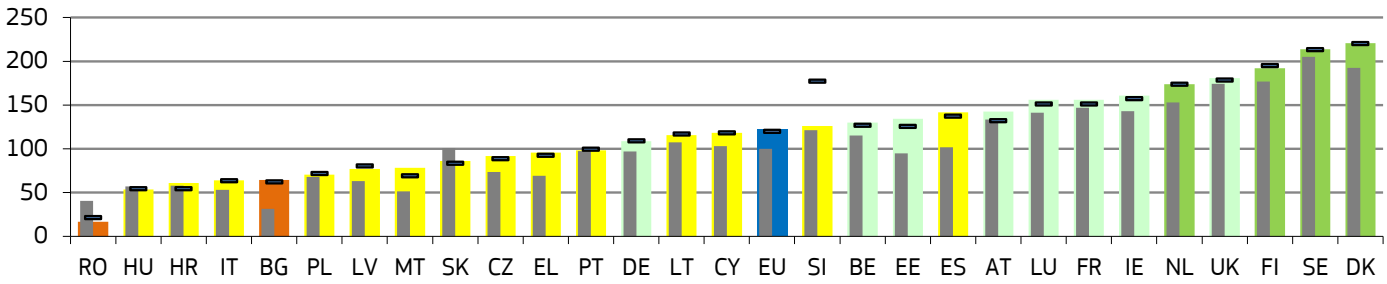
The country rankings in *Human resources* and *Attractive research systems* come close to the overall classification of performance groups. This also holds, although to a lesser extent, for *Finance and support* and *Linkages*. The dimensions *Innovation-friendly environment*, *Innovators*, *Employments impacts*, and *Sales impacts* deviate most from the overall classification. The dimensions *Intellectual assets* and *Firm investments* 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 take into account 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



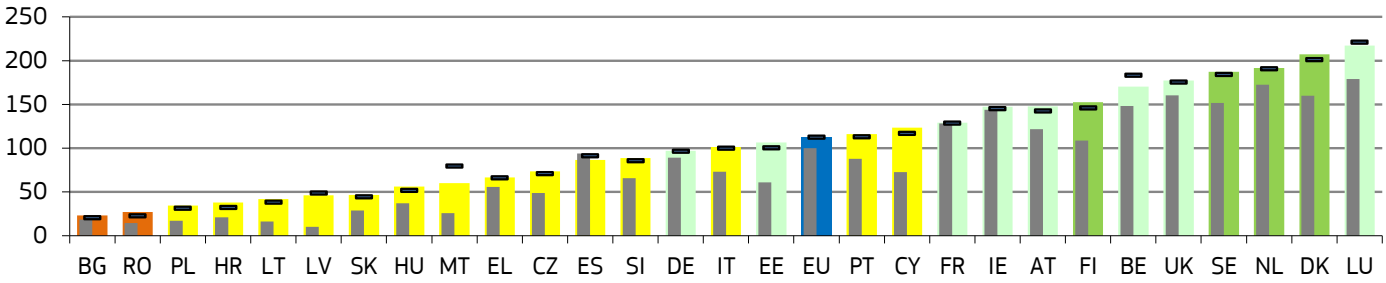
Coloured columns show Member States' performance in 2018, using the most recent data for the indicators in this dimension, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2011. Grey columns show performance in 2011 relative to that of the EU in 2011.

Performance in *Human resources* largely reflects the overall classification into four performance groups. The four Innovation Leaders are all included in the top 5. All Strong Innovators, except Germany, perform above the EU average. Most of the Moderate Innovators perform below the EU average, with only Spain and Slovenia performing above this average. The Modest Innovators perform below the EU average, with Romania being the worst performer but with Bulgaria performing better than three Moderate Innovators.

For 25 Member States, performance has improved between 2011 and 2018. The highest rate of performance increase is for Spain (39.8%), followed by Estonia (39.2%) and Bulgaria (33.0%). For Hungary (-3.3%), Slovakia (-14.9%) and Romania (-23.6%), performance has decreased. The EU average increased by 22.3% between 2011 and 2018.

Compared to 2017, performance has improved for 18 Member States, with the highest rate of performance increase for Austria (10.6%), Malta (9.0%) and Estonia (8.5%). Performance declined for 10 Member States, with the strongest declines for Slovenia (-51.4%), Romania (-4.6%) and Latvia (-3.3%). The EU average increased by 2.4% between 2017 and 2018.

Attractive research systems



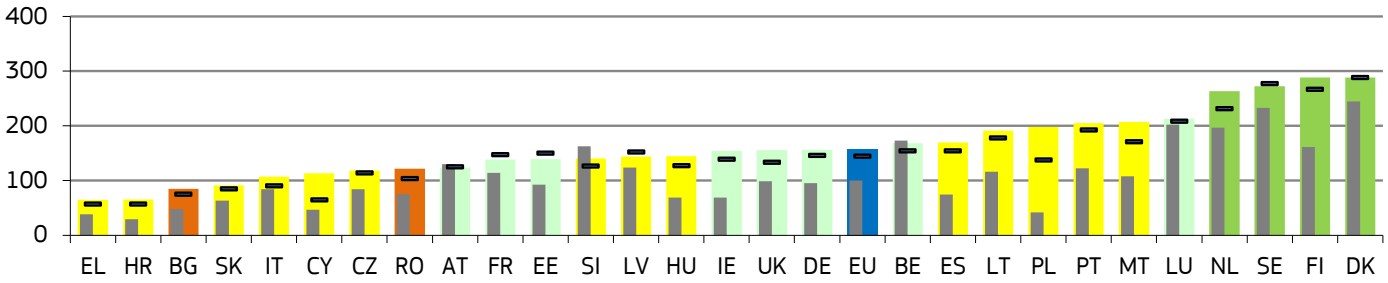
Coloured columns show Member States' performance in 2018, using the most recent data for the indicators in this dimension, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2011. Grey columns show performance in 2011 relative to that of the EU in 2011.

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

For 27 Member States, performance has improved between 2011 and 2018. The highest rate of performance increase is for Cyprus (50.7%), followed by Denmark (47.1%) and Estonia (45.5%). Only for Spain (-7.4%), performance has decreased. The EU average increased by 12.6% between 2011 and 2018.

Compared to 2017, performance has improved for 23 Member States, with the highest rate of performance increase for Cyprus and Finland (both 6.6%), and Denmark (6.1%). Performance declined for five Member States, in particular for Malta (-19.3%) and Belgium (-13.2%). The EU average increased by 0.2% between 2017 and 2018.

Innovation-friendly environment



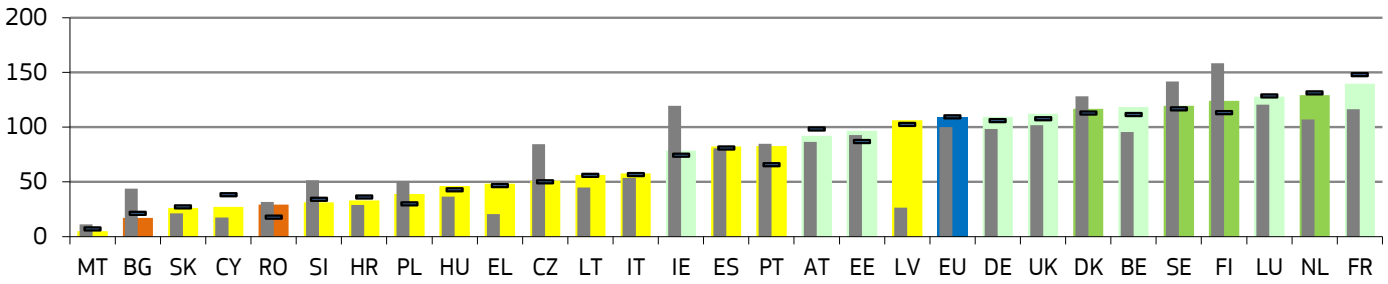
Coloured columns show Member States' performance in 2018, using the most recent data for the indicators in this dimension, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2011. Grey columns show performance in 2011 relative to that of the EU in 2011.

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 4 positions. The Strong Innovators are more dispersed, with Belgium and Luxembourg performing above the EU average, and the other Strong Innovators below the EU average. The Moderate Innovators show a strong performance on this dimension, in particular Malta, Portugal, Poland, Lithuania and Spain, who all perform above the EU average. For the Modest Innovators, this is a relatively strong innovation dimension, with Bulgaria outperforming two and Romania six Moderate Innovators.

For 25 Member States, performance has improved between 2011 and 2018. The highest rate of performance increase is observed in Poland (155.7%), Finland (126.9%), and Malta (99.0%). Performance decreased for Belgium (-4.8%), Austria (-5.8%) and Slovenia (-22.2%). The EU average increased by 58.1% between 2011 and 2018.

Compared to 2017, performance has improved for 23 Member States, with the highest rate of performance increase for Poland (60.3%), Cyprus (48.7%), and Malta (36.0%). Performance declined for five Member States, in particular for Latvia (-8.9%), France (-9.0%) and Estonia (-11.2%). The EU average increased by 13.2% between 2017 and 2018.

Finance and support



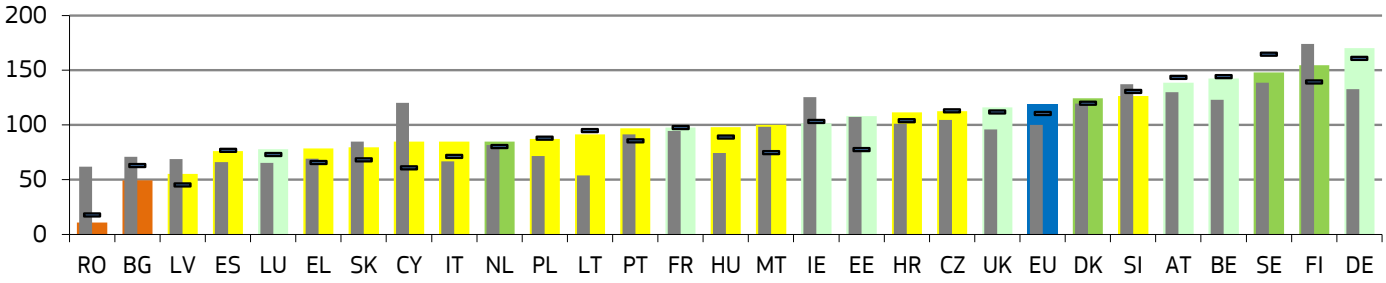
Coloured columns show Member States' performance in 2018, using the most recent data for the indicators in this dimension, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2011. Grey columns show performance in 2011 relative to that of the EU in 2011.

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. Five Strong Innovators perform above the EU average, with France being the overall leader. Three Strong Innovators perform below the EU average. All Moderate Innovators perform below the EU average. The Modest Innovators perform below the EU average, with Romania performing better than three Moderate Innovators.

Performance has increased for 17 Member States. The highest rate of performance increase between 2011 and 2018 is observed in Latvia (79.8%), followed by Greece (27.9%) and France (23.3%). For 11 Member States, performance has decreased, in particular for Czechia (-33.5%), Finland (-34.4%) and Ireland (40.9%). The EU average increased by 9.4% between 2011 and 2018.

Compared to 2017, performance has improved for only 18 Member States, with the highest rate of performance increase for Portugal (17.2%), Romania (11.5%) and Finland (11.1%). Performance declined for 10 Member States, with the strongest declines for Austria (-6.2%), France (-8.2%), and Cyprus (-11.2%). The EU average remained the same between 2017 and 2018.

Firm investments



Coloured columns show Member States' performance in 2018, using the most recent data for the indicators in this dimension, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2011. Grey columns show performance in 2011 relative to that of the EU in 2011..

Performance in *Firm investments* deviates to some extent from the overall classification into four performance groups with two Innovation Leaders in the top 5; the Netherlands as Innovation Leader and several Strong Innovators perform below the EU average. Germany is the overall leader, and the Modest Innovators perform worst.

For 20 Member States, performance increased between 2011 and 2018. The highest rate of performance increase is observed in Lithuania (37.5%), followed by Germany (37.3%) and Hungary (23.7%). The EU average increased by 19.2% between 2011 and 2018. For eight Member States, performance decreased, in particular for Ireland (-24.0%), Cyprus (-35.6%) and Romania (-51.0%).

Compared to 2017, performance has improved for 16 Member States, with the highest rate of performance increase for Estonia (30.6%), followed by Malta (25.3%) and Cyprus (23.9%). Performance declined for 12 Member States, with the strongest decline for Romania (-6.9%), Bulgaria (-13.4%) and Sweden (-16.5%). The EU average increased by 8.8% between 2017 and 2018.

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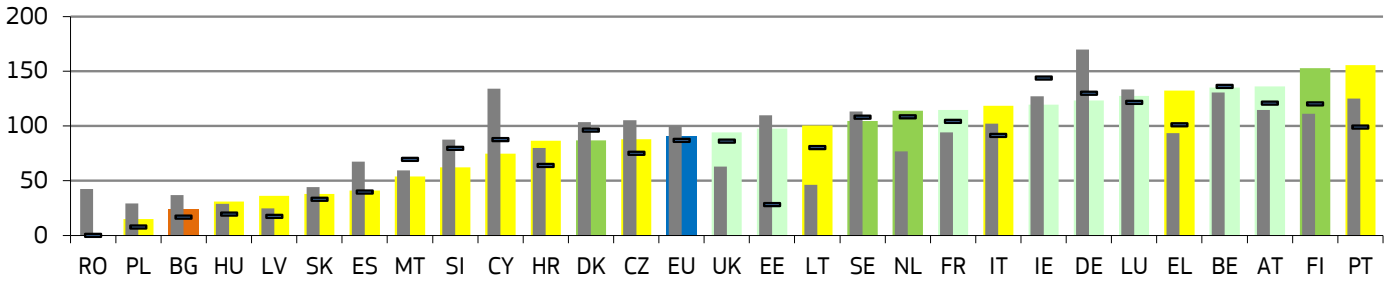
Innovators



Coloured columns show Member States' performance in 2018, using the most recent data for the indicators in this dimension, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2011. Grey columns show performance in 2011 relative to that of the EU in 2011.

Performance in the *Innovators* dimension deviates from the overall classification into four performance groups. Portugal, a Moderate Innovator, is the overall best performing country. Three other Moderate Innovators perform above the EU average, which are Greece, Italy and Lithuania. Finland is the only Innovation Leader in the top-10, and Denmark performs below the EU average.

For only 13 Member States, performance increased between 2011 and 2018. The highest rate of performance increase is observed in Lithuania (53.9%), followed by Finland (41.5%) and Greece (38.8%). For 15 Member States performance declined, in particular for Romania (-42.5%), Germany (-46.3%) and Cyprus (-59.4%). The EU average decreased by 9.2% between 2011 and 2018.

Compared to 2017, performance has improved for 20 Member States, with the highest rate of performance increase for Estonia (69.6%), followed by Portugal (56.6%) and Finland (32.6%). Performance declined for eight Member States, with the strongest decline for Malta (-15.8), Slovenia (-17.6%) and Ireland (-24.6%). The EU average increased by 4.0% between 2017 and 2018.

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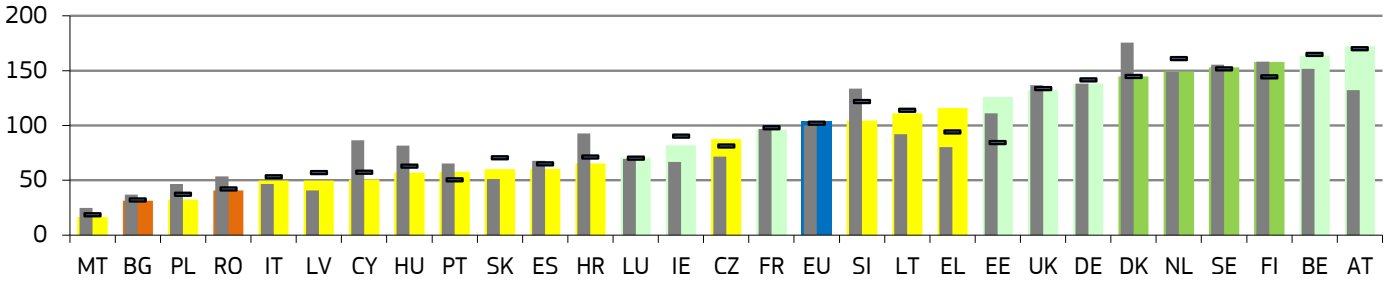
Linkages



Coloured columns show Member States' performance in 2018, using the most recent data for the indicators in this dimension, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2011. Grey columns show performance in 2011 relative to that of the EU in 2011..

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. Three Strong Innovators perform below the EU average, which are Luxembourg, Ireland and France. Three Moderate Innovators – Greece, Lithuania and Slovenia - perform above the EU average.

For 12 Member States, performance increased between 2011 and 2018. The highest rate of performance increase is observed in Austria (40.1%), Greece (35.7%), and Lithuania (19.0%). For 16 Member States, performance declined, in particular for Slovenia (-29.1%), Denmark (-31.0%) and Cyprus (-35.6%). The EU average increased by 3.9% between 2011 and 2018.

Compared to 2017, performance has improved for only eight Member States, with the highest rate of performance increase for Estonia (41.5%), followed by Greece (21.7%) and Finland (13.4%). Performance declined for 20 Member States, with the strongest declines for Slovakia (-10.5%), the Netherlands (-12.0%) and Slovenia (-17.3%). The EU average increased by 1.6% between 2017 and 2018.

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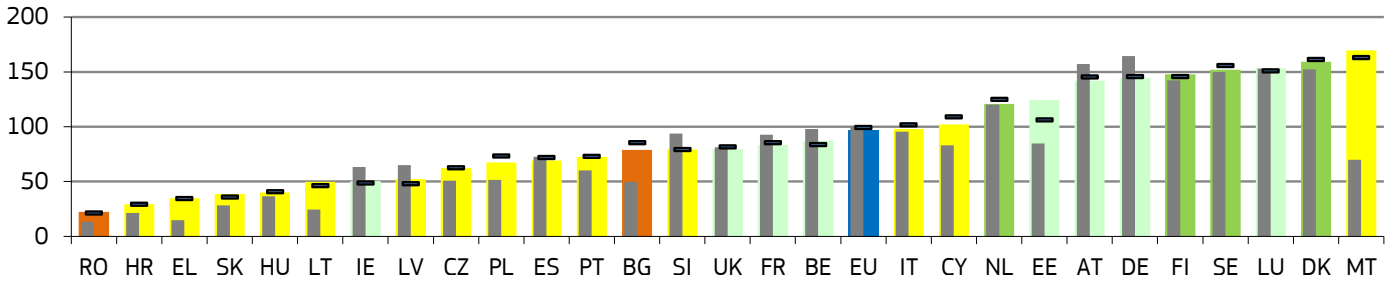
Intellectual assets



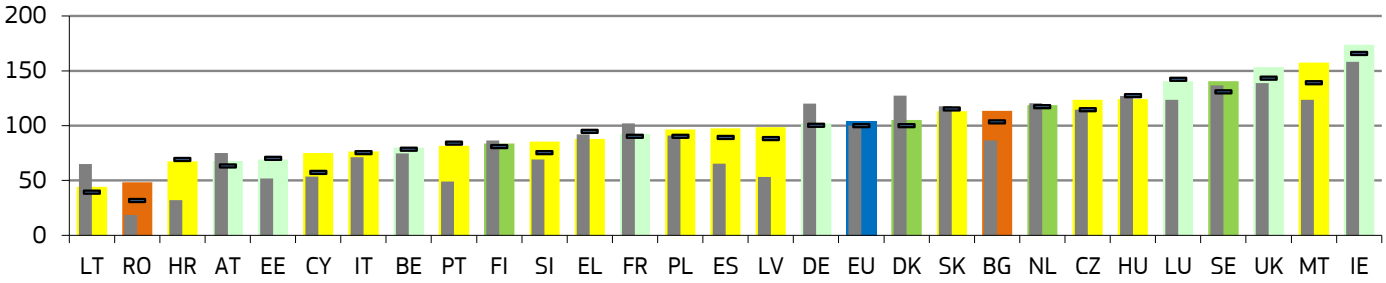
Coloured columns show Member States' performance in 2018, using the most recent data for the indicators in this dimension, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2011. Grey columns show performance in 2011 relative to that of the EU in 2011.

Performance in *Intellectual assets* deviates to some extent from the overall classification into four performance groups. Malta, a Moderate Innovator, is the overall best performing country. Three Innovation Leaders and Luxembourg, a Strong Innovator, take up the other top 5 positions, with Denmark ranking second and Luxembourg third. Ireland, one of the Strong Innovators, performs well below the EU average. Three other Strong Innovators perform below the EU average, which are the United Kingdom, France and Belgium. Bulgaria, a Modest Innovator, is performing at a level close to that of the EU average.

For 19 Member States, performance has increased between 2011 and 2018. The highest rate of performance increase is observed in Malta (99.7%), followed by Estonia (39.5%), and Bulgaria (28.9%). Performance decreased for nine Member States, in particular for Slovenia (-14.6%), Austria (-15.2%), and Germany (-20.0%). The EU average has decreased by 2.7% between 2011 and 2018.

Compared to 2017, performance has improved for only 12 Member States, with the highest rate of performance increase for Estonia (17.9%), Malta (6.5%) and Latvia (3.9%). Performance declined for 16 Member States, with the strongest declines for Poland (-5.9%), Bulgaria (-6.7%) and Cyprus (-7.1%). The EU average decreased by 1.9% between 2017 and 2018.

Employment impacts



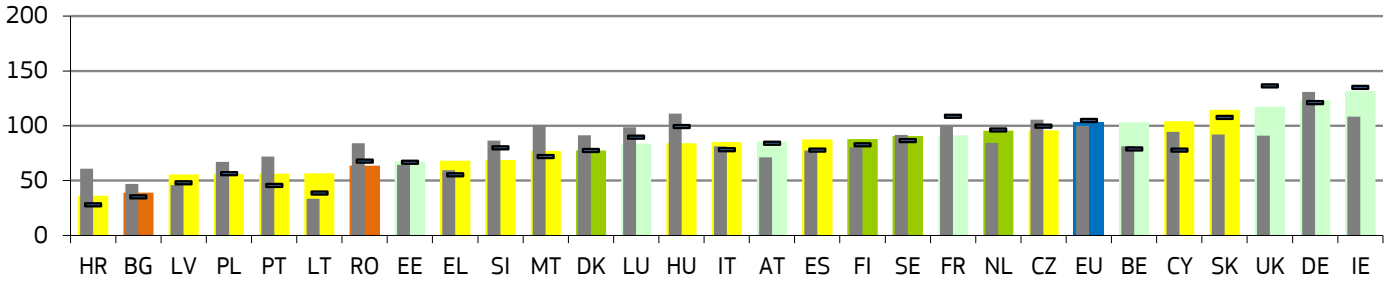
Coloured columns show Member States' performance in 2018, using the most recent data for the indicators in this dimension, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2011. Grey columns show performance in 2011 relative to that of the EU in 2011.

Performance in *Employment impacts* deviates from the overall classification into four performance groups with only one Innovation Leader, Sweden, in the top-5 performing countries. Ireland, a Strong Innovator, is the best performing country, followed by Malta, a Moderate Innovator. Most of the Innovation Leaders, except Finland, perform above the EU average. Bulgaria, a Modest Innovator, shows a strong performance above the EU average. Strong Innovators Austria, Estonia, Belgium, France and Germany all perform below the EU average.

For 18 Member States, performance has increased between 2011 and 2018. The highest rate of performance increase is observed in Latvia (45.2%), followed by Croatia (35.4%), and Malta (34.3%). Performance decreased for 10 Member States, in particular for Germany (-17.9%), Lithuania (-20.7%) and Denmark (-22.1%). The EU average has increased by 4.4% between 2011 and 2018.

Compared to 2017, performance has improved for 21 Member States, with the highest rate of performance increase for Malta (18.5%), followed by Cyprus (17.4%) and Romania (16.6%). Performance declined for seven Member States, with the strongest declines for Portugal (-2.2%), Hungary (-3.2%) and Greece (-6.8%). The EU average increased by 4.5% between 2017 and 2018.

Sales impacts



Coloured columns show Member States' performance in 2018, using the most recent data for the indicators in this dimension, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2011. Grey columns show performance in 2011 relative to that of the EU in 2011..

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 includes three Strong Innovators: Ireland, Germany and the United Kingdom. Slovakia and Cyprus, both Moderate Innovators, also belong to the strong performing countries in this dimension. The Strong Innovators are also dispersed with four performing above the EU average[13] and four performing below the EU average. The Modest Innovators perform below the EU average, but Romania performs relatively well by performing better than 5 Moderate Innovators.

Performance between 2011 and 2018 has increased for 14 Member States. The highest rate of performance increase is observed in the United Kingdom (26.4%), followed by Lithuania (23.2%) and Ireland (23.0%). For 14 Member States, performance has declined, in particular for Malta (-23.5%), Croatia (-24.4%) and Hungary (-27.1%). The EU average has increased by 3.0% between 2011 and 2018.

Compared to 2017, performance has improved for 18 Member States, with the highest rate of performance increase for Cyprus (26.5%), Belgium (24.4%) and Lithuania (17.9%). Performance declined for 10 Member States, with the strongest declines for Hungary (-15.1%), France (-17.3%) and the United Kingdom (-19.1%). The EU average decreased by 1.8% between 2017 and 2018.

[13] Compared to the other dimensions, the EU's rank position is relatively high. This can be explained by the strong performance of Germany, the United Kingdom and France, which are among the biggest Member States, and which have a strong positive impact on the EU average.

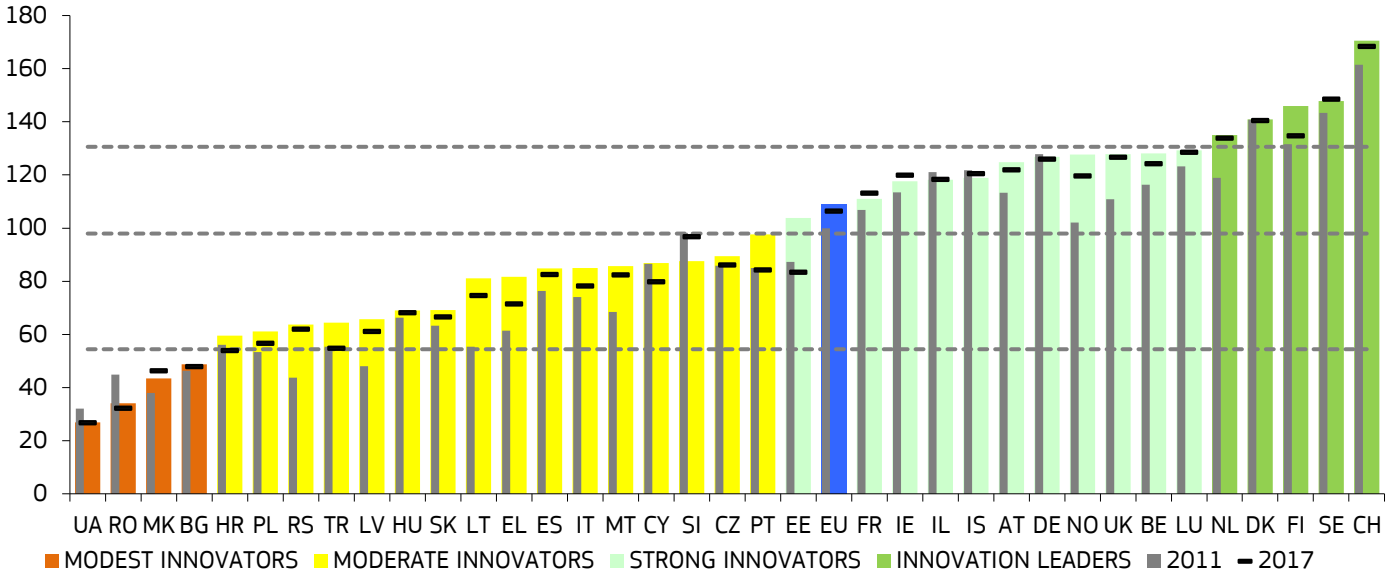
5. Benchmarking innovation performance with non-EU countries

5.1 Benchmarking against other European countries and regional neighbours

This section discusses the results for eight more European countries or regional neighbours using the same methodology as used for the EU Member States.[14] 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 seven indicators. In both dimensions Human resources and Attractive research systems it has the best performance on two out of three indicators (New doctorate graduates and Lifelong learning, and International scientific co-publications and Foreign doctorate students). Switzerland's performance relative to the EU in 2011 has improved strongly by 9.2%-points.

Iceland, Israel, and Norway are Strong Innovators. The performance of Norway relative to the EU in 2011 has increased strongly by 25.6%[15], whereas the relative performance of both Iceland (-2.9%) and Israel has declined (-4.5%). Norway is also the overall leader on three indicators: Enterprises upgrading ICT skills, SMEs with product or process innovations, and SMEs innovating inn-house. Serbia and Turkey are Moderate Innovators, and for both countries performance relative to the EU has increased strongly by 19.9% and 9.1%, respectively. North Macedonia and Ukraine are Modest Innovators. Performance relative to the EU has increased for North Macedonia (5.5%) but decreased for Ukraine (-5.2%). The performance groups for all countries are shown in ***Figure 12***.

Figure 11: Performance of European and neighbouring countries' systems of innovation



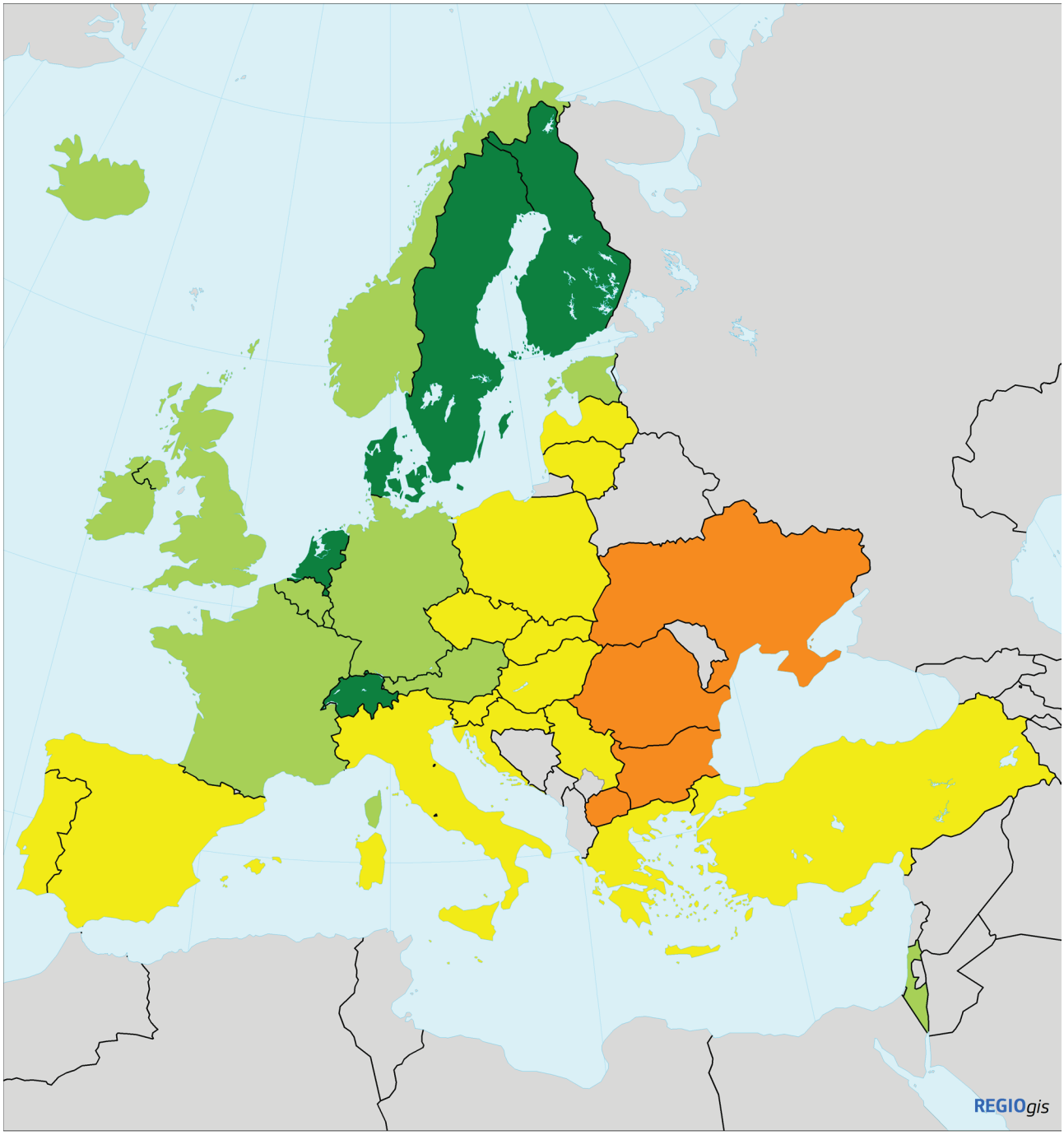
Coloured columns show countries' performance in 2018, using the most recent data for 27 indicators, relative to that of the EU in 2011. The horizontal hyphens show performance in 2017, using the next most recent data for 27 indicators, relative to that of the EU in 2011. Grey columns show countries' performance in 2011 relative to that of the EU in 2011. For all years, the same measurement methodology has been used. The dashed lines show the threshold values between the performance groups in 2018, comparing countries' performance in 2018 relative to that of the EU in 2018.

European and neighbouring countries include Iceland (IS), Israel (IL), Norway (NO), North Macedonia (MK), Serbia (RS), Switzerland (CH), Turkey (TR) and Ukraine (UA).

[14] Average data availability for this year's report is good with data available for 27 indicators for Norway, 25 indicators for Switzerland, 24 indicators for North Macedonia and Turkey, 22 indicators for Iceland and Serbia, 21 indicators for Ukraine, and 20 indicators for Israel. Data availability for Israel is below the threshold of 75%, which has been used in previous years to decide to include a European country in the EIS. In the interest of continuity, Israel is included in the EIS 2018.

[15] 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.

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 2019

0 500 km

5.2 Prospect for including Western Balkan countries

Western Balkan countries

In February 2018, the European Commission adopted a strategy for 'A credible enlargement perspective for and enhanced EU engagement with the Western Balkans', confirming the European future of the region as a geostrategic investment in a stable, strong and united Europe based on common values.[16] The Strategy spells out the priorities and areas of joint reinforced cooperation, addressing the specific challenges facing the Western Balkans, in particular the need for fundamental reforms and good neighbourly relations. The Strategy includes six flagship initiatives - specific actions that the Commission will take over the next years to support the transformation efforts of the Western Balkans in areas of mutual interest. These range from strengthening the rule of law, reinforcing cooperation on security and migration and expanding the EU Energy Union to the Western Balkans, to lowering roaming charges and rolling out broadband in the region. The Strategy also underlines the need for the EU to be prepared to welcome new members once they have met the rigorous criteria for doing so. In June 2018, the Council set out a path towards opening accession negotiations with the former Yugoslav Republic of Macedonia and Albania in June 2019, based on continued progress and tangible results.

Following the adoption of this Strategy, the inclusion of all Western Balkan countries in the European Innovation Scoreboard is foreseen. Three of these countries are already included: Croatia, as one of the 28 Member States, as well as North Macedonia and Serbia. As a rule, countries can only be included if data are available for at least 20 indicators. The 2018 edition of the EIS included a section discussing data availability for four Western Balkan countries: Albania, Bosnia and Herzegovina, Kosovo[17] and Montenegro.

For Albania, last year's data inventory showed that data were available for eight indicators from international sources. Albania has introduced an innovation survey covering the years 2014-2016 closely following the CIS 2016, but results are not yet available, and even with data for the six indicators using innovation survey data, data availability would still not be good enough to include the country in the EIS.

For Bosnia and Herzegovina, last year's data inventory showed that data were available for ten indicators from international sources. Bosnia and Herzegovina has introduced an innovation survey covering the years 2014-2016, but results are not yet available, and even with data for the six indicators using innovation survey data, data availability would not be sufficient to include the country in the EIS.

For Kosovo, last year's data inventory showed that almost no data were available. Kosovo does not have an innovation survey, and data availability is relatively poor.

For Montenegro, last year's data inventory showed that data were available from international and national data sources for 15 indicators. Montenegro has introduced its first innovation survey for the years 2014-2016, but no data will become available as the status of the survey was that of a pilot survey primarily aimed at gaining experience in collecting such data, Last year's report suggested that Montenegro could be included if innovation survey data would become available. But without such data, data availability remains insufficient to include the country in the EIS.

Eastern partnership countries

The Eastern Partnership (EaP)[18] is a joint initiative involving the EU, its Member States and six Eastern European Partners: Armenia, Azerbaijan, Belarus, Georgia, the Republic of Moldova and Ukraine. It is a specific dimension of the European Neighbourhood Policy and aims at building a common area of shared democracy, prosperity, stability and increased cooperation. Additionally, bonds forged through the Eastern Partnership help strengthening state and societal resilience: it makes both the EU and the partners stronger and better able to deal with internal and external challenges.

Ukraine is already included in the EIS. For the other five countries, currently data availability is insufficient to include these countries in the EIS. Most other countries do not have an innovation survey and with data missing for several other countries specific for the European Statistical System (e.g. Enterprises providing training to develop or upgrade ICT skills of their personnel), data availability is and will be insufficient to include these countries in the EIS. A possible exception is Belarus which is already collecting data for 15 of the indicators included in the EIS. In addition, data are available for the three indicators using publication data, increasing data availability to 18 indicators, which is below the threshold for having data for at least 20 indicators. However, using the data for these 18 indicators suggests that Belarus would perform in the higher range of Modest Innovators.

[16] https://ec.europa.eu/commission/news/strategy-western-balkans-2018-feb-06_en

[17] This designation is without prejudice to positions on status and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

[18] https://eeas.europa.eu/diplomatic-network/eastern-partnership_en

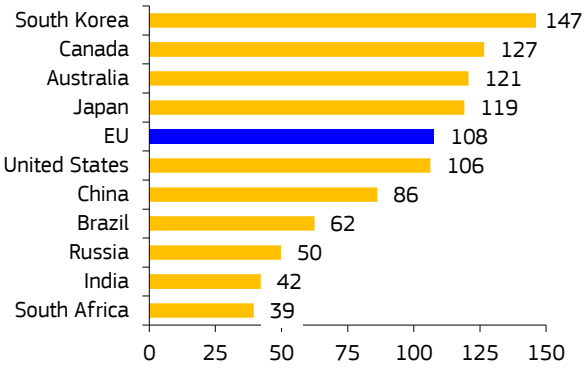
5.3 Benchmarking against global competitors

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 almost 37 per cent above the performance score of the EU in 2018 (***Figure 13*** graph on the left). Canada, Australia, and Japan also maintain a performance lead over the EU, while the EU has a performance lead over the United States, China, Brazil, South Africa, Russia, and India..

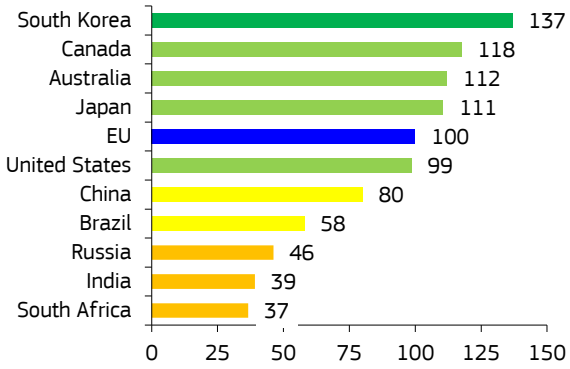
Based on relative-to-EU performance in 2018, South Korea would be an Innovation Leader, Canada, Australia, Japan, and the United States would be Strong Innovators, China and Brazil would be Moderate Innovators, and Russia, India, and South Africa, would be Modest Innovators.

Performance over the whole period has increased most in South Korea, China, and Brazil, and for all three countries, performance has increased at a higher rate compared to the EU. For South Africa and Japan performance has also increased at a higher rate compared to the EU, but for the other countries, performance has increased at a lower rate compared to the EU (***Figure 14*** graph on the left). For Canada, the United States, and India performance has decreased. Combining current and growth performance shows that Japan and South Korea have an increasing performance lead over the EU, while Australia and Canada have a decreasing performance lead. The EU has an increasing performance lead over India, Russia, and the United States, and a decreasing performance lead over Brazil, China, and South Africa. Compared to one year before, performance has increased most in Japan, South Korea and the EU (***Figure 14*** graph on the right). The most recent performance increase for the EU and decrease for the United States explains why the EU has overtaken the United States.

Figure 13: Global performance

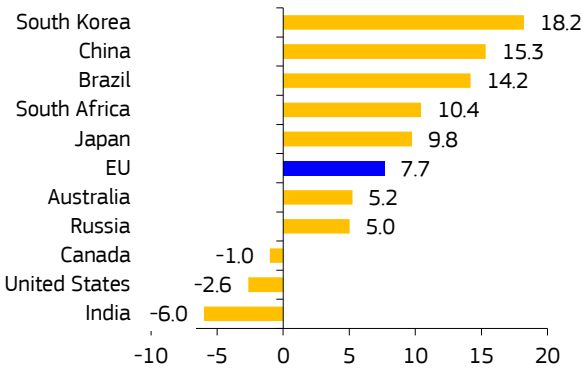


Bars show countries' performance in 2018 relative to that of the EU in 2011.

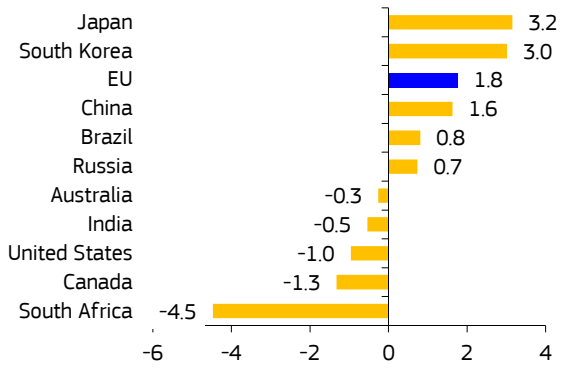


Bars show countries' performance in 2018 relative to that of the EU in 2018.

Figure 14: Change in global performance



Change in performance is measured as the difference between the performance in 2018 relative to the EU in 2011 and the performance in 2011 relative to the EU in 2011.



Change in performance is measured as the difference between the performance in 2018 relative to the EU in 2011 and the performance in 2017 relative to the EU in 2011.

Methodology

The economic and population size of most global competitors outweighs that of many of the individual EU Member States, and innovation performance is therefore 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[19]:

- 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 (so-called intra-EU trade), and only include exports to non-Member States (so-called 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,

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	2016
1.1.2 Population aged 25-64 having completed tertiary education	OECD – Education at a Glance	2017
ATTRACTIVE RESEARCH SYSTEMS		
1.2.1 International scientific co-publications (per million population)	Scopus*	2018
1.2.2 Scientific publications among the top 10% most cited publications worldwide (share of total scientific publications of the country)	Scopus*	2016
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	2017
FIRM INVESTMENTS		
2.2.1 R&D expenditure in the business sector (percentage of GDP)	OECD, UIS	2017
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*	2018
3.2.3 Private co-funding of public R&D expenditures (percentage of GDP)	OECD	2017
INTELLECTUAL ASSETS		
3.3.1 PCT patent applications	Patents: OECD GDP World Bank	2016
3.3.2 Trademark applications (per billion GDP)	World Bank – WDI**	2017
3.3.3 Design applications (per billion GDP)	World Bank – WDI**	2017
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	2017
4.2.2 Knowledge-intensive services exports (share of total service exports)	United Nations	2016

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

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

Scopus, World Bank (World Development Indicators), and National Statistical Offices for some of the countries included in this international comparison.

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 twice that of the EU. Top R&D spending firms in South Korea spend almost twice as much on R&D, and FDI net inflows as a percentage of GDP are much 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 about 65% 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 almost 90% more on R&D. The number of Unicorns is more than five 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 more than twice that of the EU. Entrepreneurial activities in China are at a higher level, and the number of Unicorns is almost 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, and top R&D spending firms spend more 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.

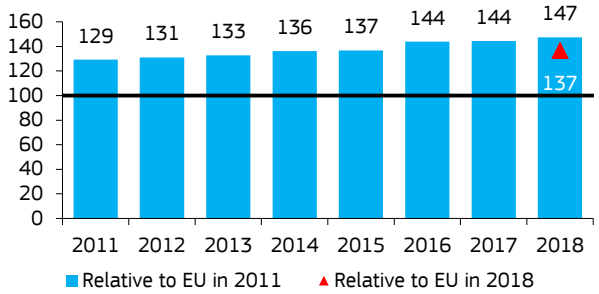
Table 4: Contextual indicators in the international comparison

	Period	Source
PERFORMANCE AND STRUCTURE OF THE ECONOMY		
GDP per capita, PPP (international dollars)	Average 2015-2017	World Development Indicators*
Average annual GDP growth (%)	2015-2017	World Development Indicators*
Employment share in Agriculture (%)	Average 2015-2017	World Development Indicators*
Employment share in Industry (%)	Average 2015-2017	World Development Indicators*
Employment share in Services (%)	Average 2015-2017	World Development Indicators*
Manufacturing – share in total value added **	Average 2016-2018	UNIDO
BUSINESS AND ENTREPRENEURSHIP		
Total early-stage Entrepreneurial Activity (TEA) (%)	Average 2016-2018	Global Entrepreneurship Monitor
FDI net inflows (% GDP)	Average 2015-2017	World Development Indicators*
Top R&D spending enterprises per 10 million population	Average 2016-2018	EU Industrial R&D Investment Scoreboard
Top R&D spending enterprises, average R&D spending, million Euros	Average 2016-2018	EU Industrial R&D Investment Scoreboard
Number of Unicorns	Total	CB Insights***
Buyer sophistication (1 to 7 best)	Average 2016-2018	World Economic Forum
GOVERNANCE AND POLICY FRAMEWORK		
Ease of starting a business (0 to 100 best)	Average 2016-2018	Doing Business*
Basic-school entrepreneurial education and training (1 to 5 best)	Average 2016-2018	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 2015-2017	Worldwide Governance Indicators*
DEMOGRAPHY		
Population size (millions)	Average 2015-2017	World Development Indicators*
Average annual population growth (%)	2015-2017	World Development Indicators
Population density (inhabitants / km2)	Average 2015-2017	World Development Indicators*

** Database from the World Bank ** Value added data are used in the international comparison as employment data are not available.*

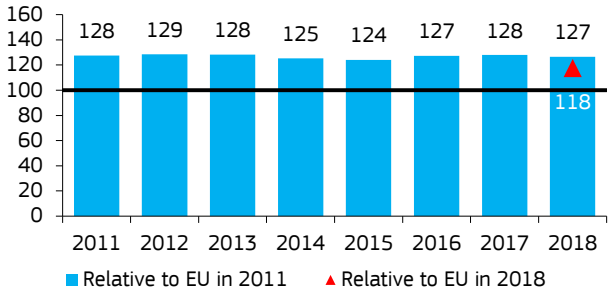
**** https://www.cbinsights.com/research-unicorn-companies*

The performance of **South Korea** is well above that of the EU, and the country is an Innovation Leader. Performance has increased since 2011. South Korea's relative strengths are in Business R&D expenditures and Intellectual Property applications..



Columns show performance relative to EU in 2011. The red triangle shows performance relative to EU in 2018.

The performance of **Canada** is well above that of the EU, and the country is a Strong Innovator. Performance has decreased slightly since 2011. Canada's relative strengths are in Tertiary education, International co-publications, and Trademark applications.



Columns show performance relative to EU in 2011. The red triangle shows performance relative to EU in 2018.

Performance in 2011 and 2018 relative to the EU in 2011

South Korea	2011	2018	2011-2018
Doctorate graduates	79.1	90.3	11.2
Tertiary education	141.6	139.0	-2.6
International co-publications	97.3	92.9	-4.4
Most cited publications	72.6	64.1	-8.5
R&D expenditure public sector	119.3	132.9	13.6
R&D expenditure business sector	244.9	238.1	-6.8
Product/process innovators	52.2	100.8	48.6
Marketing/organisational innovators	50.1	98.3	48.3
Innovation collaboration	179.6	134.9	-44.8
Public-private co-publications	126.1	112.7	-13.4
Private co-funding public R&D exp.	167.9	212.2	44.3
PCT patent applications	151.4	171.8	20.4
Trademark applications	254.6	225.8	-28.8
Design applications	212.7	226.8	14.1
Medium & high-tech product exports	126.6	119.4	-7.2
Knowledge-intensive services exports	91.6	87.8	-3.8

Best three and worst three indicators highlighted.

Performance in 2011 and 2018 relative to EU in 2011

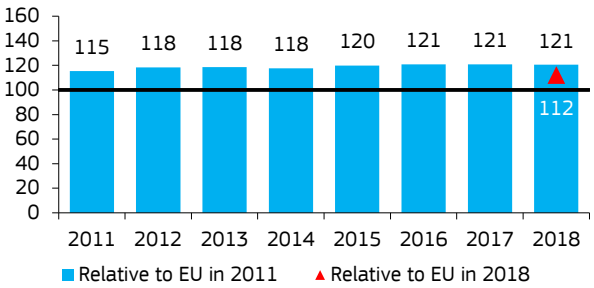
Canada	2011	2018	2011-2018
Doctorate graduates	76.9	79.6	2.7
Tertiary education	179.9	165.1	-14.8
International co-publications	173.7	165.2	-8.5
Most cited publications	119.1	104.1	-15.1
R&D expenditure public sector	121.1	115.8	-5.4
R&D expenditure business sector	81.6	63.9	-17.7
Product/process innovators	171.5	153.5	-18.0
Marketing/organisational innovators	156.7	157.2	0.5
Innovation collaboration	n/a	n/a	n/a
Public-private co-publications	116.9	106.5	-10.4
Private co-funding public R&D exp.	178.5	161.0	-17.5
PCT patent applications	86.8	83.8	-3.0
Trademark applications	216.9	210.7	-6.2
Design applications	68.4	76.4	8.0
Medium & high-tech product exports	63.4	59.9	-3.5
Knowledge-intensive services exports	87.1	82.9	-4.2

Best three and worst three indicators highlighted.

Structural differences	KR	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	37,200	40,500
Average annual GDP growth, %	2.5	2.0
Employment share in Agriculture	4.9	4.3
Employment share in Industry	25.1	24.1
Employment share in Services	70.0	71.6
Manufacturing - share in total value added	28.6	14.6
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	5.9	6.7
FDI net inflows (% GDP)	0.76	4.27
Top R&D spending firms per 10 million population	13.9	19.6
- average R&D spending, million Euros	314.7	172.6
Number of Unicorns	6	31
Buyer sophistication 1-7 (best)	4.98	3.67
Governance and policy framework		
Ease of starting a business	83.9	76.8
Basic-school entrepreneurial education and training	1.88	1.87
Govt. procurement of advanced technology products	3.88	3.54
Rule of law (-2.5 to 2.5 best)	1.09	1.16
Demography		
Population size, million	51.2	511.1
Average annual population growth, %	0.4	0.3
Share of population aged 15-64	72.9	65.1
Population density (inhabitants / km2)	525.7	120.6

Structural differences	CA	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	45,200	40,500
Average annual GDP growth, %	1.0	2.0
Employment share in Agriculture	1.7	4.3
Employment share in Industry	19.7	24.1
Employment share in Services	78.6	71.6
Manufacturing - share in total value added	10.0	14.6
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	18.1	6.7
FDI net inflows (% GDP)	2.62	4.27
Top R&D spending firms per 10 million population	8.0	19.6
- average R&D spending, million Euros	158.4	172.6
Number of Unicorns	1	31
Buyer sophistication 1-7 (best)	4.37	3.67
Governance and policy framework		
Ease of starting a business	79.0	76.8
Basic-school entrepreneurial education and training	2.35	1.87
Govt. procurement of advanced technology products	3.45	3.54
Rule of law (-2.5 to 2.5 best)	1.83	1.16
Demography		
Population size, million	36.3	511.1
Average annual population growth, %	1.2	0.3
Share of population aged 15-64	67.4	65.1
Population density (inhabitants / km2)	4.0	120.6

The performance of **Australia** is above that of the EU, and the country is a Strong Innovator. Performance has increased since 2011. Australia's strengths are in International co-publications, Product and process innovation, and Trademark applications.



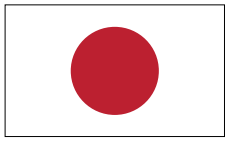
Columns show performance relative to EU in 2011. The red triangle shows performance relative to EU in 2018.

Performance in 2011 and 2018 relative to the EU in 2011

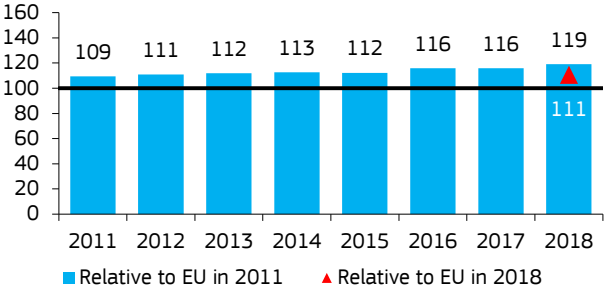
Australia	2011	2018	2011-2018
Doctorate graduates	117.1	126.7	9.7
Tertiary education	134.4	132.0	-2.3
International co-publications	191.2	171.7	-19.5
Most cited publications	119.9	118.7	-1.2
R&D expenditure public sector	121.1	122.0	1.0
R&D expenditure business sector	104.4	77.7	-26.7
Product/process innovators	161.6	145.0	-16.6
Marketing/organisational innovators	126.8	93.8	-32.9
Innovation collaboration	146.3	184.4	38.1
Public-private co-publications	89.0	96.2	7.3
Private co-funding public R&D exp.	145.6	155.1	9.5
PCT patent applications	82.8	78.9	-4.0
Trademark applications	273.7	222.5	-51.2
Design applications	90.3	98.4	8.1
Medium & high-tech product exports	15.3	13.6	-1.7
Knowledge-intensive services exports	29.1	36.0	7.0

Best three and worst three indicators highlighted.

Structural differences	AU	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	47,600	40,500
Average annual GDP growth, %	0.7	2.0
Employment share in Agriculture	2.6	4.3
Employment share in Industry	19.9	24.1
Employment share in Services	77.5	71.6
Manufacturing - share in total value added	6.1	14.6
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	13.4	6.7
FDI net inflows (% GDP)	3.27	4.27
Top R&D spending firms per 10 million population	5.9	19.6
- average R&D spending, million Euros	213.2	172.6
Number of Unicorns	1	31
Buyer sophistication 1-7 (best)	3.87	3.67
Governance and policy framework		
Ease of starting a business	80.2	76.8
Basic-school entrepreneurial education and training	2.05	1.87
Govt. procurement of advanced technology products	3.34	3.54
Rule of law (-2.5 to 2.5 best)	1.75	1.16
Demography		
Population size, million	24.2	511.1
Average annual population growth, %	1.6	0.3
Share of population aged 15-64	65.8	65.1
Population density (inhabitants / km2)	3.1	120.6



The performance of **Japan** is above that of the EU, and the country is a Strong Innovator. Performance has increased since 2011. Japan's relative strengths are in Business R&D expenditures and Intellectual Property applications.



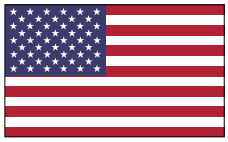
Columns show performance relative to EU in 2011. The red triangle shows performance relative to EU in 2018.

Performance in 2011 and 2018 relative to the EU in 2011

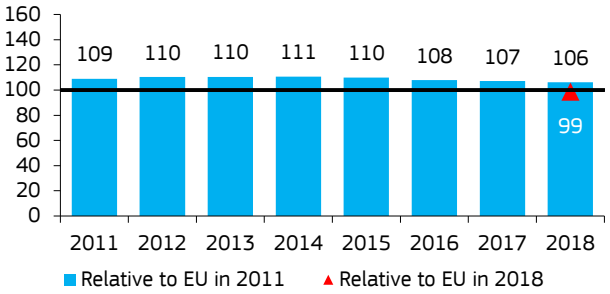
Japan	2011	2018	2011-2018
Doctorate graduates	65.8	63.6	-2.2
Tertiary education	162.5	149.8	-12.7
International co-publications	79.0	74.2	-4.9
Most cited publications	59.6	55.3	-4.3
R&D expenditure public sector	102.3	96.6	-5.6
R&D expenditure business sector	213.4	195.9	-17.6
Product/process innovators	78.9	71.4	-7.5
Marketing/organisational innovators	94.5	96.7	2.2
Innovation collaboration	118.0	143.0	25.0
Public-private co-publications	121.7	104.4	-17.4
Private co-funding public R&D exp.	50.9	55.8	4.9
PCT patent applications	165.9	172.4	6.5
Trademark applications	95.4	205.7	110.3
Design applications	92.8	96.3	3.5
Medium & high-tech product exports	120.6	118.5	-2.0
Knowledge-intensive services exports	123.5	110.2	-13.2

Best three and worst three indicators highlighted.

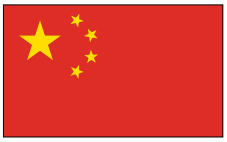
Structural differences	JP	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	41,300	40,500
Average annual GDP growth, %	1.5	2.0
Employment share in Agriculture	3.5	4.3
Employment share in Industry	25.4	24.1
Employment share in Services	71.1	71.6
Manufacturing - share in total value added	21.1	14.6
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	5.0	6.7
FDI net inflows (% GDP)	0.43	4.27
Top R&D spending firms per 10 million population	27.8	19.6
- average R&D spending, million Euros	286.4	172.6
Number of Unicorns	1	31
Buyer sophistication 1-7 (best)	4.98	3.67
Governance and policy framework		
Ease of starting a business	75.5	76.8
Basic-school entrepreneurial education and training	1.55	1.87
Govt. procurement of advanced technology products	4.06	3.54
Rule of law (-2.5 to 2.5 best)	1.50	1.16
Demography		
Population size, million	127.0	511.1
Average annual population growth, %	-0.1	0.3
Share of population aged 15-64	60.5	65.1
Population density (inhabitants / km2)	348.3	120.6



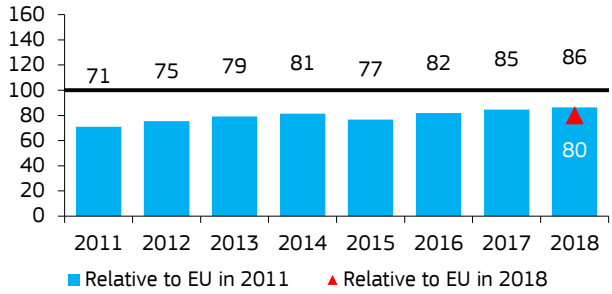
The performance of the **United States** is just below that of the EU, and the country is a Strong Innovator. Performance has decreased since 2011. Relative strengths are in Tertiary education, Business R&D expenditures, and Public-private co-publications



Columns show performance relative to EU in 2011. The red triangle shows performance relative to EU in 2018.



The performance of **China** is below that of the EU, and the country is a Moderate Innovator. Performance has increased strongly since 2011. Relative strengths are in Business R&D expenditures and Trademark and Design applications.



Columns show performance relative to EU in 2011. The red triangle shows performance relative to EU in 2018.

Performance in 2011 and 2018 relative to EU in 2011

United States	2011	2018	2011-2018
Doctorate graduates	100.0	80.6	-19.4
Tertiary education	148.8	135.0	-13.8
International co-publications	117.9	113.6	-4.4
Most cited publications	138.8	123.2	-15.5
R&D expenditure public sector	110.3	96.6	-13.7
R&D expenditure business sector	161.7	158.1	-3.6
Product/process innovators	68.3	64.7	-3.7
Marketing/organisational innovators	n/a	n/a	n/a
Innovation collaboration	n/a	n/a	n/a
Public-private co-publications	172.7	144.9	-27.9
Private co-funding public R&D exp.	94.2	60.6	-33.6
PCT patent applications	102.4	103.4	1.0
Trademark applications	61.1	61.7	0.6
Design applications	50.1	59.9	9.9
Medium & high-tech product exports	86.3	80.9	-5.4
Knowledge-intensive services exports	82.6	86.3	3.8

Best three and worst three indicators highlighted.

Performance in 2011 and 2018 relative to EU in 2011

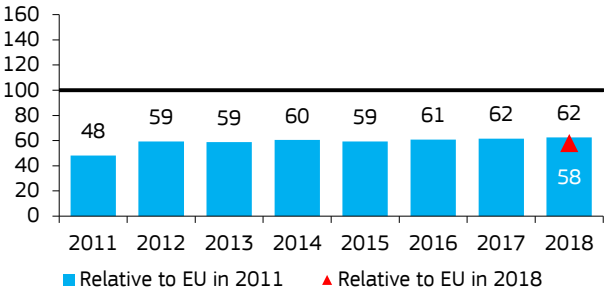
China	2011	2018	2011-2018
Doctorate graduates	13.0	11.0	-2.0
Tertiary education	35.2	40.4	5.1
International co-publications	36.1	43.0	7.0
Most cited publications	62.4	79.6	17.2
R&D expenditure public sector	62.9	72.6	9.7
R&D expenditure business sector	114.9	126.7	11.8
Product/process innovators	n/a	n/a	n/a
Marketing/organisational innovators	n/a	n/a	n/a
Innovation collaboration	n/a	n/a	n/a
Public-private co-publications	116.9	106.5	-10.4
Private co-funding public R&D exp.	8.5	5.4	-3.1
PCT patent applications	66.9	91.7	24.8
Trademark applications	234.3	296.6	62.3
Design applications	212.7	202.6	-10.0
Medium & high-tech product exports	96.5	91.9	-4.6
Knowledge-intensive services exports	91.8	72.4	-19.4

Best three and worst three indicators highlighted.

Structural differences	US	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	58,200	40,500
Average annual GDP growth, %	1.2	2.0
Employment share in Agriculture	1.4	4.3
Employment share in Industry	19.8	24.1
Employment share in Services	78.8	71.6
Manufacturing - share in total value added	11.4	14.6
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	14.0	6.7
FDI net inflows (% GDP)	2.43	4.27
Top R&D spending firms per 10 million population	25.1	19.6
- average R&D spending, million Euros	331.2	172.6
Number of Unicorns	151	31
Buyer sophistication 1-7 (best)	4.80	3.67
Governance and policy framework		
Ease of starting a business	82.8	76.8
Basic-school entrepreneurial education and training	2.18	1.87
Govt. procurement of advanced technology products	4.52	3.54
Rule of law (-2.5 to 2.5 best)	1.62	1.16
Demography		
Population size, million	323.0	511.1
Average annual population growth, %	0.7	0.3
Share of population aged 15-64	65.9	65.1
Population density (inhabitants / km2)	35.3	120.6

Structural differences	CN	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	15,600	40,500
Average annual GDP growth, %	6.2	2.0
Employment share in Agriculture	27.8	4.3
Employment share in Industry	29.1	24.1
Employment share in Services	43.2	71.6
Manufacturing - share in total value added	31.3	14.6
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	10.2	6.7
FDI net inflows (% GDP)	1.71	4.27
Top R&D spending firms per 10 million population	2.8	19.6
- average R&D spending, million Euros	160.3	172.6
Number of Unicorns	82	31
Buyer sophistication 1-7 (best)	4.33	3.67
Governance and policy framework		
Ease of starting a business	64.1	76.8
Basic-school entrepreneurial education and training	1.91	1.87
Govt. procurement of advanced technology products	4.38	3.54
Rule of law (-2.5 to 2.5 best)	-0.34	1.16
Demography		
Population size, million	1378.8	511.1
Average annual population growth, %	0.6	0.3
Share of population aged 15-64	72.2	65.1
Population density (inhabitants / km2)	146.9	120.6

The performance of **Brazil** is below that of the EU, and the country is a Moderate Innovator. Performance has increased since 2011. Brazil's relative strengths are in the share of enterprises introducing innovations and Trademark applications.



Columns show performance relative to EU in 2011. The red triangle shows performance relative to EU in 2018.

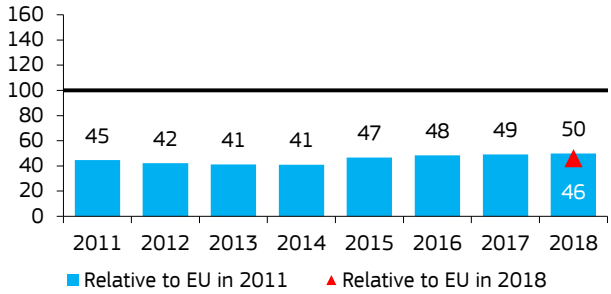
Performance in 2011 and 2018 relative to EU in 2011

Brazil	2011	2018	2011-2018
Doctorate graduates	23.6	23.4	-0.2
Tertiary education	51.8	43.1	-8.8
International co-publications	42.6	47.7	5.1
Most cited publications	46.1	46.2	0.1
R&D expenditure public sector	92.0	95.8	3.9
R&D expenditure business sector	44.4	40.3	-4.1
Product/process innovators	104.6	102.3	-2.3
Marketing/organisational innovators	166.2	184.6	18.5
Innovation collaboration	61.1	41.2	-19.9
Public-private co-publications	7.7	7.2	-0.5
Private co-funding public R&D exp.	n/a	n/a	n/a
PCT patent applications	27.6	29.2	1.5
Trademark applications	118.7	111.9	-6.7
Design applications	54.2	53.0	-1.2
Medium & high-tech product exports	45.1	40.6	-4.6
Knowledge-intensive services exports	103.9	114.8	10.9

Best three and worst three indicators highlighted.

Structural differences	BR	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	15,500	40,500
Average annual GDP growth, %	-1.9	2.0
Employment share in Agriculture	10.0	4.3
Employment share in Industry	21.2	24.1
Employment share in Services	68.9	71.6
Manufacturing - share in total value added	11.0	14.6
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	19.2	6.7
FDI net inflows (% GDP)	3.97	4.27
Top R&D spending firms per 10 million population	0.4	19.6
- average R&D spending, million Euros	181.8	172.6
Number of Unicorns	2	31
Buyer sophistication 1-7 (best)	3.44	3.67
Governance and policy framework		
Ease of starting a business	56.8	76.8
Basic-school entrepreneurial education and training	1.46	1.87
Govt. procurement of advanced technology products	2.96	3.54
Rule of law (-2.5 to 2.5 best)	-0.20	1.16
Demography		
Population size, million	207.6	511.1
Average annual population growth, %	0.8	0.3
Share of population aged 15-64	69.6	65.1
Population density (inhabitants / km2)	24.8	120.6

The performance of **Russia** is below that of the EU, and the country is a Modest Innovator. Performance has increased since 2011. Russia's relative strengths are in Tertiary education, Private co-funding of public R&D, and Trademark applications..



Columns show performance relative to EU in 2011. The red triangle shows performance relative to EU in 2018.

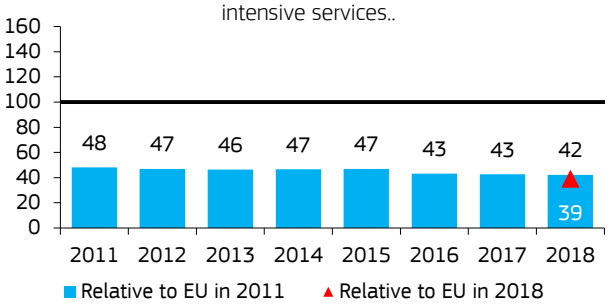
Performance in 2011 and 2018 relative to EU in 2011

Russia	2011	2018	2011-2018
Doctorate graduates	26.9	57.7	30.8
Tertiary education	187.4	161.9	-25.6
International co-publications	47.9	53.6	5.7
Most cited publications	15.6	28.2	12.6
R&D expenditure public sector	57.5	66.5	9.1
R&D expenditure business sector	52.8	51.7	-1.0
Product/process innovators	13.0	13.0	0.1
Marketing/organisational innovators	2.6	2.9	0.3
Innovation collaboration	9.0	9.1	0.1
Public-private co-publications	8.3	17.2	8.9
Private co-funding public R&D exp.	158.5	98.3	-60.1
PCT patent applications	32.5	32.9	0.4
Trademark applications	137.8	151.0	13.2
Design applications	47.3	54.6	7.3
Medium & high-tech product exports	18.1	21.5	3.4
Knowledge-intensive services exports	94.1	95.8	1.7

Best three and worst three indicators highlighted.

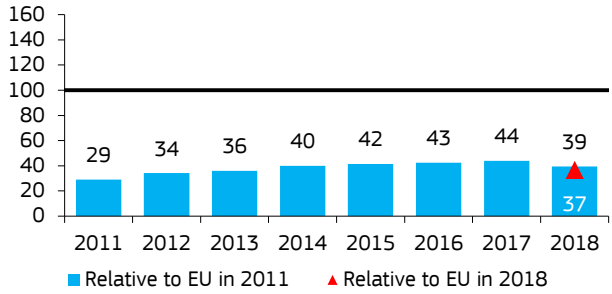
Structural differences	RU	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	24,600	40,500
Average annual GDP growth, %	0.6	2.0
Employment share in Agriculture	6.4	4.3
Employment share in Industry	27.0	24.1
Employment share in Services	66.5	71.6
Manufacturing - share in total value added	13.6	14.6
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	11.4	6.7
FDI net inflows (% GDP)	1.61	4.27
Top R&D spending firms per 10 million population	0.2	19.6
- average R&D spending, million Euros	96.1	172.6
Number of Unicorns	0	31
Buyer sophistication 1-7 (best)	3.66	3.67
Governance and policy framework		
Ease of starting a business	75.5	76.8
Basic-school entrepreneurial education and training	1.82	1.87
Govt. procurement of advanced technology products	3.33	3.54
Rule of law (-2.5 to 2.5 best)	-0.78	1.16
Demography		
Population size, million	144.3	511.1
Average annual population growth, %	0.1	0.3
Share of population aged 15-64	68.9	65.1
Population density (inhabitants / km2)	8.8	120.6

The performance of **India** is below that of the EU, and the country is a Modest Innovator. Performance has decreased since 2011. Relative strengths are in Marketing and organisational innovation, Trademark applications, and Exports of knowledge-intensive services..



Columns show performance relative to EU in 2011. The red triangle shows performance relative to EU in 2018.

The performance of **South Africa** is below that of the EU, and the country is a Modest Innovator. Performance has increased since 2010. Relative strengths are in Public R&D expenditures, Private co-funding of public R&D, and Trademark applications.



Columns show performance relative to EU in 2011. The red triangle shows performance relative to EU in 2018.

Performance in 2011 and 2018 relative to EU in 2011

India	2011	2018	2011-2018
Doctorate graduates	6.9	5.6	-1.3
Tertiary education	n/a	n/a	n/a
International co-publications	18.3	19.6	1.3
Most cited publications	50.0	47.2	-2.8
R&D expenditure public sector	77.5	53.2	-24.3
R&D expenditure business sector	24.9	21.0	-4.0
Product/process innovators	53.3	52.0	-1.2
Marketing/organisational innovators	122.4	136.6	14.2
Innovation collaboration	n/a	n/a	n/a
Public-private co-publications	2.7	2.9	0.2
Private co-funding public R&D exp.	n/a	n/a	n/a
PCT patent applications	36.0	33.2	-2.7
Trademark applications	79.4	57.9	-21.5
Design applications	42.6	42.0	-0.6
Medium & high-tech product exports	44.4	47.6	3.2
Knowledge-intensive services exports	119.5	120.1	0.6

Best three and worst three indicators highlighted.

Performance in 2011 and 2018 relative to EU in 2011

South Africa	2011	2018	2011-2018
Doctorate graduates	8.5	11.0	2.5
Tertiary education	39.2	21.7	-17.5
International co-publications	56.7	62.6	5.9
Most cited publications	68.9	64.2	-4.7
R&D expenditure public sector	56.7	69.5	12.9
R&D expenditure business sector	29.6	26.5	-3.1
Product/process innovators	n/a	n/a	n/a
Marketing/organisational innovators	n/a	n/a	n/a
Innovation collaboration	n/a	n/a	n/a
Public-private co-publications	5.6	5.3	-0.3
Private co-funding public R&D exp.	86.3	165.2	78.9
PCT patent applications	44.2	38.5	-5.7
Trademark applications	122.2	67.0	-55.2
Design applications	64.2	65.0	0.8
Medium & high-tech product exports	48.9	50.0	1.1
Knowledge-intensive services exports	37.7	36.7	-1.0

Best three and worst three indicators highlighted.

Structural differences	IN	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	6,600	40,500
Average annual GDP growth, %	6.4	2.0
Employment share in Agriculture	45.1	4.3
Employment share in Industry	24.4	24.1
Employment share in Services	30.6	71.6
Manufacturing - share in total value added	16.9	14.6
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	10.4	6.7
FDI net inflows (% GDP)	1.86	4.27
Top R&D spending firms per 10 million population	0.2	19.6
- average R&D spending, million Euros	169.4	172.6
Number of Unicorns	13	31
Buyer sophistication 1-7 (best)	4.36	3.67
Governance and policy framework		
Ease of starting a business	57.0	76.8
Basic-school entrepreneurial education and training	2.44	1.87
Govt. procurement of advanced technology products	4.14	3.54
Rule of law (-2.5 to 2.5 best)	-0.02	1.16
Demography		
Population size, million	1324.1	511.1
Average annual population growth, %	1.1	0.3
Share of population aged 15-64	66.0	65.1
Population density (inhabitants / km2)	445.4	120.6

Structural differences	SA	EU
Performance and structure of the economy		
GDP per capita, PPP (international $)	13,300	40,500
Average annual GDP growth, %	-0.3	2.0
Employment share in Agriculture	5.5	4.3
Employment share in Industry	23.5	24.1
Employment share in Services	71.0	71.6
Manufacturing - share in total value added	12.4	14.6
Business and entrepreneurship		
Total Entrepreneurial Activity (TEA)	8.9	6.7
FDI net inflows (% GDP)	0.54	4.27
Top R&D spending firms per 10 million population	0.2	19.6
- average R&D spending, million Euros	67.3	172.6
Number of Unicorns	2	31
Buyer sophistication 1-7 (best)	3.95	3.67
Governance and policy framework		
Ease of starting a business	65.0	76.8
Basic-school entrepreneurial education and training	1.84	1.87
Govt. procurement of advanced technology products	3.02	3.54
Rule of law (-2.5 to 2.5 best)	0.06	1.16
Demography		
Population size, million	56.0	511.1
Average annual population growth, %	1.3	0.3
Share of population aged 15-64	65.6	65.1
Population density (inhabitants / km2)	46.2	120.6

6. Expected short-term changes in EU innovation performance

This year's report 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.

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 2011 from 109 in 2018 to 114 in two years' time (***Figure 15***). Of the expected 4.7 percentage point increase, about 30% can be explained by the expected increase of Broadband penetration, 15% by the expected increase of Venture capital expenditures, and 10% by the expected increase of Non-R&D innovation expenditures.

Figure 15: Expected EU innovation performance

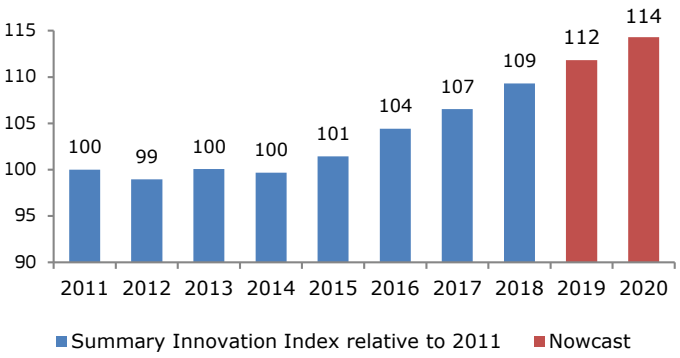


Table 5 shows a summary of the results for 14 indicators for which the calculation of relatively reliable short-term changes proved possible. EU innovation performance is expected to increase strongly by at least 10 percent for four indicators, to increase between five and 10 percent for four indicators, to increase more moderately between one and five percent for five indicators, and to decrease in performance for one indicator.

Section 6.1 examines trend performance of the EU compared to four of its main international competitors. Section 6.2 explores EU trend performance for individual indicators.

Table 5: Changes in two years' time in EU innovation performance

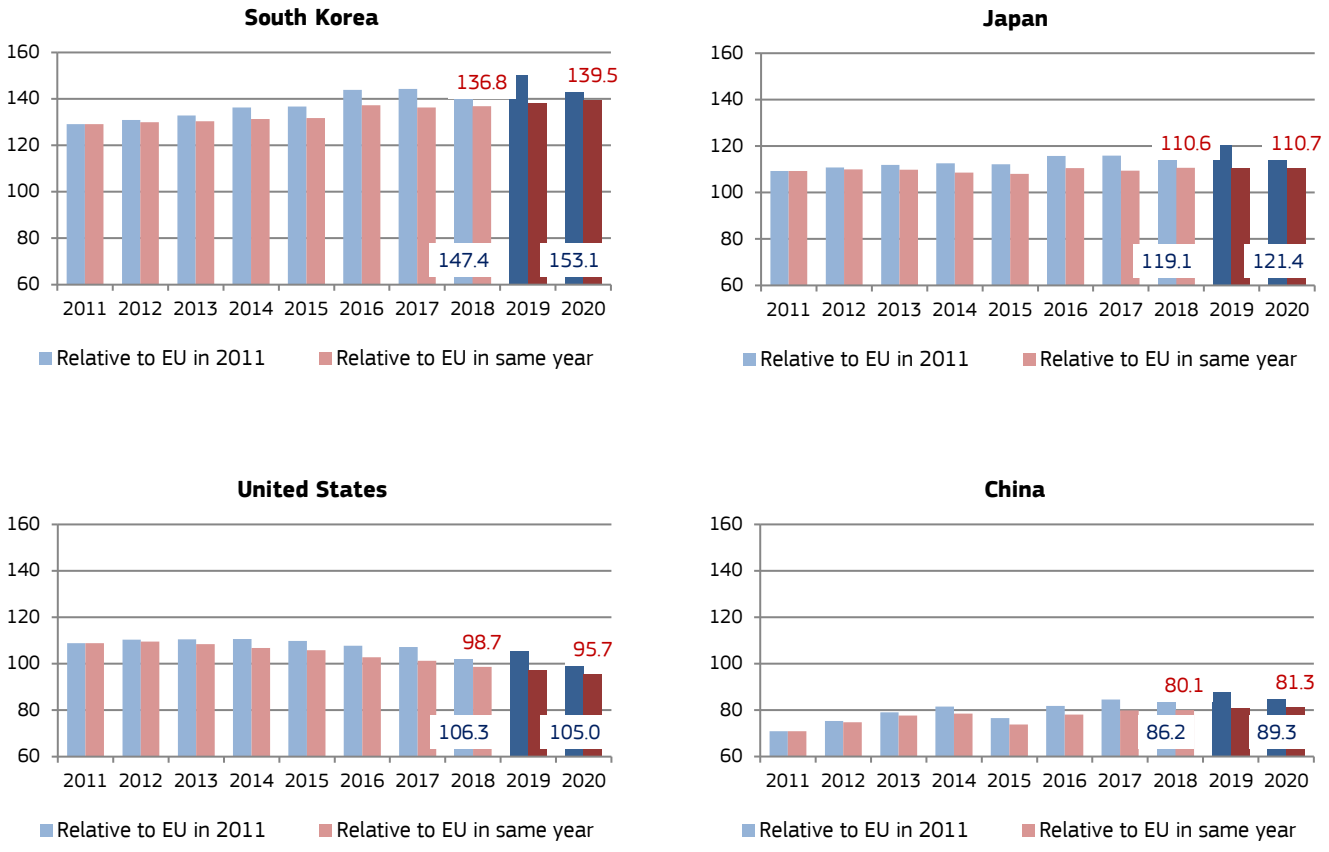
	CURRENT SCORE	EXPECTED CHANGE IN TWO YEARS' TIME	METHODOLOGY FOR ESTIMATING EXPECTED CHANGE
HUMAN RESOURCES			
1.1.1 Doctorate graduates per 1000 population age 25-34	2.09	5-10% increase	Linear regression
1.1.2 Population aged 25-34 with tertiary education	39.8	1-5% increase	Linear regression
ATTRACTIVE RESEARCH SYSTEMS			
1.2.1 International scientific co-publications	1070.4	5-10% increase	Linear regression
1.2.2 Most-cited scientific publications	11.5	1-5% increase	Linear regression
INNOVATION-FRIENDLY ENVIRONMENT			
1.3.1 Broadband penetration	18.0	more than 10% increase	Linear regression
1.3.2 Opportunity-driven entrepreneurship	3.60	more than 10% increase	
FINANCE AND SUPPORT			
2.1.2 Venture capital expenditures	0.149	more than 10% increase	Linear regression
FIRM INVESTMENTS			
2.2.1 R&D expenditure in the business sector	1.36	1-5% increase	Linear regression
2.2.2 Non-R&D innovation expenditures	0.86	more than 10% increase	Linear regression
2.2.3 Enterprises providing training to develop or upgrade ICT skills	23.0	5-10% increase	Linear regression
INNOVATORS			
No reliable forecasts for any of the indicators			
LINKAGES			
3.2.1 Innovative SMEs collaborating with others	11.2	5-10% increase	Linear regression
INTELLECTUAL ASSETS			
3.3.1 PCT patent applications	3.53	1-5% decrease	Linear regression
3.3.2 Trademark applications	7.85	1-5% increase	Linear regression
EMPLOYMENT IMPACTS			
4.1.1 Employment in knowledge-intensive activities	14.20	1-5% increase	Linear regression
SALES IMPACTS			
No reliable forecasts for any of the indicators			

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

A statistical trend analysis using performance data for 2011 to 2018 confirms that stronger growth performance of South Korea between 2011 and 2018 (cf. Section 5.3) is expected to continue. The EU performance gap towards South Korea is expected to increase by 2.7 percentage points between 2018 and 2020 (red-coloured numbers in ***Figure 16***). The performance gap towards Japan is expected to remain stable, increasing only by 0.1 percentage points between 2018 and 2020. The small EU performance lead over the United States in 2018, is expected to increase further by 3.0 percentage points between 2018 and 2020. The EU performance lead over China is expected to decrease by 1.2 percentage point between 2018 and 2020. This declining EU lead is a direct results of much faster performance growth in China than in the EU (cf. Section 5.3). Nowcasts for 2018 and 2019 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 2019 Methodology Report.

For South Korea, the trend analysis foresees an increase in the relative-to-EU performance in 2011 from 147.4 in 2018 to 153.1 in two years' time (blue coloured number in ***Figure 16***). For Japan, the trend analysis foresees an increase of the relative-to-EU performance in 2011 from 119.1 in 2018 to 121.4 in two years' time. For the United States, the trend analysis foresees a decrease of the relative-to-EU performance in 2011 from 106.3 in 2018 to 105.0 in two years' time. For China, the trend analysis foresees an increase of the relative-to-EU performance in 2011 from 86.2 in 2018 to 89.3 in two years' time.

Figure 16: Expected short-term changes in innovation performance for main competitors



6.2 Short-term changes in EU innovation performance by indicator

This section discusses expected short-term changes for 14 indicators. Expected changes have been calculated applying a simple linear regression using time series data (see the EIS 2019 Methodology Report for more details).

Human resources

New doctorate graduates has been increasing from 2011 onwards. A linear regression using data for 2011-2017 has been used to estimate an increase from 2.09 to 2.29 in two years' time. For *Population aged 25-34 having completed tertiary education*, there was a break in series in 2014, and data before 2014 are not comparable to those for 2014-2018. A linear regression using data for 2014-2018 has been used to estimate an increase from 39.8 to 41.1 in two years' time. For *Lifelong learning*, there was a break in series in 2013. The regression results using a linear regression for 2013-2017 are of insufficient quality, and it is therefore assumed that the indicator will be at the same level in two years' time.

Attractive research systems

International scientific co-publications has shown a steady increase between 2011 and 2018 A linear regression for the same period has been used to estimate an increase from 1070.4 to 1160.8 in two years' time. The share of *Most-cited scientific publications* has been increasing consistently between 2009 and 2016, although there was a more significant upward performance shift in 2010 (from 10.6 in 2009 to 10.8). A linear regression for 2009-2016 has been used to estimate an increase from 11.46 to 1.,69 in two years' time. The share of *Foreign doctorate students* has declined for most years between 2010 and 2017, in particular in 2013 when the indicator declined from 21.9 to 19.2. The linear regression using data for 2010-2017 has low predictive power, and it is therefore assumed that the indicator will be at the same level in two years' time.

Innovation-friendly environment

For *Broadband penetration*, data are available for five years only. Although the number of observations is quite small, a linear regression has been used for the years 2014-2018. The results from the linear regression show an expected increase from 18.0 to 22.8 in two years' time. *Opportunity-driven entrepreneurship* has increased from 2.62 in 2011 to 3.60 in 2018. A linear regression for 2011-2018 has low predictive power due a temporary decline in 2013. A regression for the shorter period 2013-2018 does provide a reliable forecast, and the indicator is expected to increase from 3.60 to 4.08 in in two years' time.

Finance and support

R&D expenditure in the public sector has been falling since 2013 after a more stable performance between 2010 and 2013. A linear regression using data for 2010-2017 has only low predictive power, and it has therefore been assumed that the indicator will hold its value in two years' time. *Venture capital expenditures* shows a declining performance from 2011 to 2013 and an increasing performance from 2013 to 2018. A linear regression for 2011-2018 has low predictive power due to declining performance in 2011-2013. A regression for the shorter period 2014-2018 does provide a reliable forecast, and the indicator is expected to increase from 0.149 to 0.169 in in two years' time.

Firm investments

R&D expenditures in the business sector has been increasing steadily over time. A linear regression for 2010-2017 has been used to estimate an increase from 1.36 to 1.40 in two years' time. Non-R&D innovation expenditures, for which biennial data are available from the CIS, has also been increasing steadily over time between 2010 and 2016. A linear regression for 2010-2016 has been used to estimate an increase from 0.86 to 0.95 in two years' time. For *Enterprises providing training to develop or upgrade ICT skills of their personnel*, data are available for 2012 and from 2014 onwards. A linear regression using data for 2012-2018 has been used to estimate an increase from 23.0 to 24.3 in two years' time.

Innovators

SMEs with product and/or process innovations, for which biennial data are available from the CIS, has been declining between 2009 and 2012, remained stable in 2014 and increased n 2016. The linear regression using data for 2009-2016 has low predictive power, and it is therefore assumed that the indicator will be at the same level in two years' time. *SMEs with marketing and/or organisational innovations*, for which biennial data are available from the CIS, has been declining between 2009 and 2014, followed by an increase in 2016. The linear regression using data for 2009-2016 has low predictive power, and it is therefore assumed that the indicator will be at the same level in two years' time. *SMEs innovating in-house*, for which biennial data are available from the CIS, has been decreasing over time from 30.2 in 2009 to 28.1 in 2016. The linear regression using data for 2009-2016 has low predictive power, and it is therefore assumed that the indicator will be at the same level in two years' time.

Linkages

Innovative SMEs collaborating with others is showing an increasing trend over time. The biennial data have increased from 8.9 in 2010 to 11.8 in 2016. A linear regression using data for 2010-2016 estimates a further increase to 12.9 in two years' time. For Public-private co-publications, performance increased between 2011 and 2017, followed by a decrease n 2018. Regression results using a linear regression are of insufficient quality, and it is assumed that the indicator will be at the same level in two years' time. *Private co-funding of public R&D expenditures* has decreased strongly in 2010, followed by annual increases until 2014. Performance declines strongly in 2015 and remained at the same level in 2016 Regression results using a linear regression are of

insufficient quality, and it is assumed that the indicator will be at the same level in two years' time.

Intellectual assets

PCT patent applications per billion GDP has been steadily decreasing over time. A linear regression using data for 2009-2016 estimates a further decrease from 3.53 to 3.42 in two years' time. *Trademark applications per billion GDP* has been increasing between 2011 and 2014 and, after a decline in 2015, has been increasing again between 2015 and 2017. A linear regression using data for 2011-2018 estimates a further increase from 7.85 to 8.08 in two years' time. *Design applications per billion GDP* has been decreasing between 2011 and 2016, followed by a temporary increase in 2017 and a further, relatively strong, decline in 2018. Regression results using a linear regression are of insufficient quality, and it is assumed that the indicator will be at the same level in two years' time.

Employment impacts

Between 2010 and 2017, the *Employment share in knowledge-intensive activities* has been increasing every year. A linear regression using data for 2010-2017 has been used to estimate an increase from 14.2 in 2017 to 14.4 in two years' time. For *Employment in fast-growing enterprises of innovative sectors*, data are only available for four years (2013-2016). The number of observations is too small for a linear regression, and it is assumed that the indicator will be at the same level in two years' time.

Sales impacts

For *Medium and high-tech products exports*, the regression results using a linear regression are of insufficient quality. The value of the indicator declined between 2011 and 2013, followed by an increase of 1.2 percentage points in 2014, and 1.9 percentage points in 2015. After a less strong increase in 2016, the indicator declined in 2017 and 2018. With no reliable forecast, it is assumed that the indicator will be at the same level in two years' time. For *Knowledge-intensive services exports*, data are available from 2010 onwards. Between 2010 and 2015, the indicator increased from 66.8 to 68.8, followed small decreases in 2017 and 2018. Regression results using a linear regression are of insufficient quality, and it is assumed that the indicator will be at the same level in two years' time. *Sales share due to new-to-market or new-to-firm product innovations* is showing a cyclical pattern over time. The biennial data show an increase in 2010, followed by a decrease in 2012, an increase in 2014 and a decrease in 2016. Regression results using a linear regression are of insufficient quality, and it is assumed that the indicator will be at the same level in two years' time.

7. Country profiles

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

- A graph showing the development of the country's innovation index over time between 2011 and 2018 as compared to the EU performance score in 2011 (blue bars) and relative performance to the EU in 2018 (red dot). For all indicators underlying the innovation index, "2018" refers to the most recent data available; depending on data update schedules, the most recent actual performance year by indicator is 2016, 2017 or 2018; "2011" 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 2011 and 2018 by indicator and dimension relative to that of the EU in 2011 and 2018 (Annex D shows the difference between both relative scores for all countries and all indicators). Different colour codes highlight strengths and weaknesses in 2011 and 2018[20];

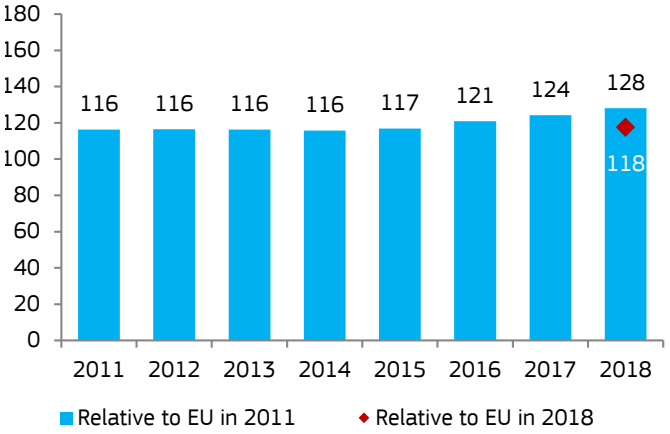
- A table providing data for the contextual indicators, which are used as proxies for structural differences between countries. The EIS 2019 Methodology Report provides detailed definitions for these indicators. Significant differences for those indicators measuring percentage shares or levels, with 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 European Semester Country Report and Country specific recommendations. The European Semester Country Report, compiled by DG Research & Innovation, collects all the research and innovation (R&I) aspects covered by the 2019 European Semester Country Reports. In particular, for each Member State the document shows: (i) the R&I relevant findings from the Executive Summary of the Report; (ii) the R&I specific section of the Report; (ii) any additional references to R&I issues in other sections of the Report; and (iv) the relevant parts of "**Annex D**" on the investment needs. The Country-specific recommendations 2019 - Research and Innovation analysis document provides the specific European Semester recommendations for every Member State.

[20] 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 2011.



Linkages, Innovators and *Attractive research systems*, are the strongest innovation dimensions. Belgium scores particularly well on Innovative SMEs collaborating with others, International scientific co-publications, and Enterprises providing ICT training. *Employment impacts* and *Intellectual assets* are the weakest innovation dimensions. Overall, Belgium scores weakest on Employment fast-growing enterprises of innovative sectors, Opportunity-driven entrepreneurship, and Non-R&D innovation expenditures.

Structural differences with the EU are shown in the table below. Top R&D spending enterprises per 10 million population are well above the EU average, whereas the turnover share of large enterprises, FDI net inflows, and enterprise births are well below the EU average.

Belgium	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**117.7**		**116.3**	**128.1**
Human resources	**106.1**		**115.1**	**129.7**
New doctorate graduates	94.2		100.0	136.7
Population with tertiary education	143.1		163.4	170.9
Lifelong learning	75.5		77.1	77.1
Attractive research systems	**128.5**		**147.9**	**144.7**
International scientific co-publications	176.3		189.8	256.4
Most cited publications	116.6		127.2	127.7
Foreign doctorate students	187.4		152.6	179.2
Innovation-friendly environment	**106.4**		**173.0**	**168.2**
Broadband penetration	161.1		177.8	322.2
Opportunity-driven entrepreneurship	48.9		169.8	63.3
Finance and support	**108.3**		**95.5**	**118.4**
R&D expenditure in the public sector	130.3		90.7	120.5
Venture capital expenditures	89.7		101.1	115.9
Firm investments	**119.6**		**123.0**	**142.6**
R&D expenditure in the business sector	130.0		116.3	148.9
Non-R&D innovation expenditures	62.1		83.5	72.6
Enterprises providing ICT training	168.4		173.3	213.3
Innovators	**148.8**		**130.7**	**135.2**
SMEs product/process innovations	148.9		132.5	144.6
SMEs marketing/organizational innovations	137.6		114.1	117.5
SMEs innovating in-house	159.4		145.7	143.5
Linkages	**157.7**		**151.6**	**163.8**
Innovative SMEs collaborating with others	196.5		210.9	209.8
Public-private co-publications	148.4		142.2	174.2
Private co-funding of public R&D exp.	130.9		112.2	125.7
Intellectual assets	**89.7**		**97.8**	**87.2**
PCT patent applications	98.1		94.4	89.3
Trademark applications	104.6		108.7	116.6
Design applications	66.3		92.2	61.1
Employment impacts	**76.4**		**74.7**	**79.8**
Employment in knowledge-intensive activities	116.5		126.9	126.9
Employment fast-growing enterprises	45.2		36.9	45.8
Sales impacts	**100.1**		**81.1**	**103.1**
Medium and high-tech product exports	79.2		80.8	85.4
Knowledge-intensive services exports	100.6		97.4	103.8
Sales of new-to-market/firm innovations	127.0		62.8	123.2

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	34,600	29,500
Average annual GDP growth (%)	1.5	2.2
Employment share manufacturing (NACE C) (%)	12.6	15.5
of which High and medium high-tech (%)	35.1	37.5
Employment share services (NACE G-N) (%)	40.2	41.8
of which Knowledge-intensive services (%)	36.5	35.0
Turnover share SMEs (%)	39.8	37.9
Turnover share large enterprises (%)	35.7	44.4
Foreign-controlled enterprises – share of value added (%)	13.1	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.6	1.5
Total Entrepreneurial Activity (TEA) (%)	6.2	6.7
FDI net inflows (% GDP)	2.1	4.3
Top R&D spending enterprises per 10 million population	29.2	19.6
Buyer sophistication (1 to 7 best)	4.4	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	71.9	76.8
Basic-school entrepren. education and training (1 to 5 best)	2.0	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.5	3.5
Rule of law (-2.5 to 2.5 best)	1.4	1.2
Demography		
Population size (millions)	11.4	511.3
Average annual population growth (%)	0.4	0.2
Population density (inhabitants/km2)	373.0	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	2.39	2.58	3.00
Tertiary educational attainment (% of population aged 30-34)	43.8	47.6	47.0

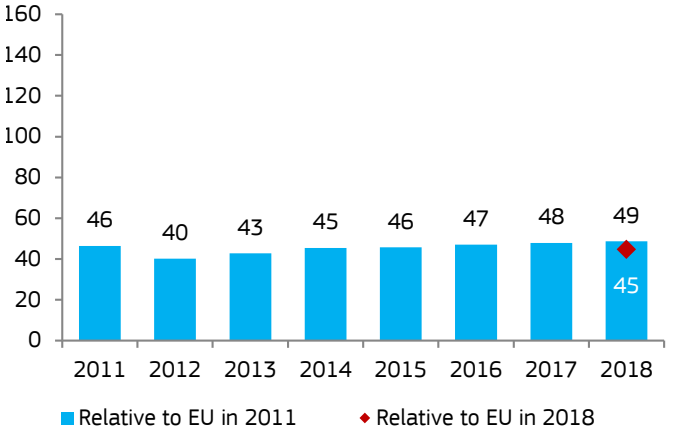
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Bulgaria is a **Modest Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Employment impacts and *Intellectual assets* are the strongest innovation dimensions. Employment 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 expenditure in the public sector, Most cited publications, and Lifelong learning.

Structural differences with the EU are shown in the table below. GDP per capita, the employment share of high and medium high-tech manufacturing, the turnover share of large enterprises, and top R&D spending enterprises per 10 million population are well below the EU average. Average annual GDP growth, the turnover share of SMEs, and enterprise births are well above the EU average.

Bulgaria	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**44.8**		**46.3**	**48.7**
Human resources	**52.7**		**31.5**	**64.5**
New doctorate graduates	69.8		30.8	101.3
Population with tertiary education	65.0		56.0	77.6
Lifelong learning	12.2		5.2	12.5
Attractive research systems	**20.5**		**18.4**	**23.1**
International scientific co-publications	25.5		23.4	37.1
Most cited publications	11.5		10.8	12.6
Foreign doctorate students	31.8		26.8	30.5
Innovation-friendly environment	**53.8**		**48.1**	**85.1**
Broadband penetration	77.8		77.8	155.6
Opportunity-driven entrepreneurship	28.7		27.9	37.1
Finance and support	**15.5**		**44.0**	**17.0**
R&D expenditure in the public sector	5.1		17.8	4.8
Venture capital expenditures	24.4		75.0	31.5
Firm investments	**41.5**		**70.8**	**49.4**
R&D expenditure in the business sector	37.8		21.9	43.4
Non-R&D innovation expenditures	59.7		126.3	69.7
Enterprises providing ICT training	26.3		60.0	33.3
Innovators	**27.0**		**36.8**	**24.5**
SMEs product/process innovations	31.9		47.2	31.0
SMEs marketing/organizational innovations	20.7		23.3	17.7
SMEs innovating in-house	27.7		40.0	24.9
Linkages	**30.1**		**36.9**	**31.3**
Innovative SMEs collaborating with others	23.0		23.1	24.5
Public-private co-publications	17.5		10.0	20.5
Private co-funding of public R&D exp.	42.6		58.5	40.9
Intellectual assets	**81.0**		**49.9**	**78.8**
PCT patent applications	12.9		9.0	11.8
Trademark applications	111.0		112.2	123.7
Design applications	120.7		41.1	111.3
Employment impacts	**108.7**		**86.6**	**113.5**
Employment in knowledge-intensive activities	52.9		35.9	57.7
Employment fast-growing enterprises	152.0		123.3	153.8
Sales impacts	**37.9**		**47.0**	**39.0**
Medium and high-tech product exports	43.3		21.8	46.7
Knowledge-intensive services exports	39.3		18.7	40.5
Sales of new-to-market/firm innovations	28.9		109.3	28.1

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	14,200	29,500
Average annual GDP growth (%)	3.5	2.2
Employment share manufacturing (NACE C) (%)	19.5	15.5
of which High and medium high-tech (%)	19.9	37.5
Employment share services (NACE G-N) (%)	41.6	41.8
of which Knowledge-intensive services (%)	27.6	35.0
Turnover share SMEs (%)	47.3	37.9
Turnover share large enterprises (%)	30.5	44.4
Foreign-controlled enterprises – share of value added (%)	16.3	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	2.1	1.5
Total Entrepreneurial Activity (TEA) (%)	4.8	6.7
FDI net inflows (% GDP)	4.0	4.3
Top R&D spending enterprises per 10 million population	0.0	19.6
Buyer sophistication (1 to 7 best)	3.2	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	71.4	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.8	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.3	3.5
Rule of law (-2.5 to 2.5 best)	-0.1	1.2
Demography		
Population size (millions)	7.1	511.3
Average annual population growth (%)	-0.7	0.2
Population density (inhabitants/km2)	65.1	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.79	0.75	1.50
Tertiary educational attainment (% of population aged 30-34)	30.9	33.7	36.0

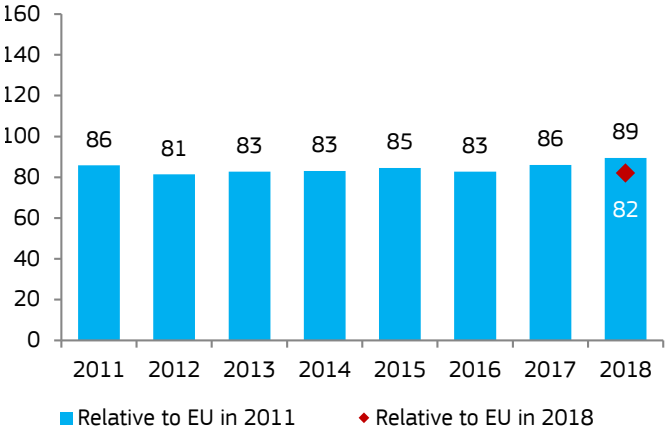
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Czechia is a **Moderate Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Employment impacts, *Innovators* and *Firm investments*, are the strongest innovation dimensions. Czechia scores high on Employment fast-growing enterprises of innovative sectors, Medium and high-tech product exports, and SMEs innovating in-house. *Finance and support*, *Intellectual assets* and *Attractive research systems*, are the weakest innovation dimensions. Low-scoring indicators include Venture capital expenditures, PCT patent applications, and Most cited publications.

Structural differences with the EU are shown in the table below. Average annual GDP growth, the employment share in manufacturing, and the value-added share of foreign-controlled enterprises are well above the EU average. Enterprise births and top R&D spending enterprises per 10 million population are well below the EU average.

Czechia	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**82.2**		**85.9**	**89.4**
Human resources	**75.0**		**73.4**	**91.7**
New doctorate graduates	77.8		84.6	112.9
Population with tertiary education	61.3		45.5	73.1
Lifelong learning	88.8		92.7	90.6
Attractive research systems	**65.3**		**48.8**	**73.6**
International scientific co-publications	91.0		73.8	132.3
Most cited publications	43.8		37.3	48.0
Foreign doctorate students	78.1		50.2	74.7
Innovation-friendly environment	**75.1**		**84.3**	**118.6**
Broadband penetration	72.2		88.9	144.4
Opportunity-driven entrepreneurship	78.1		81.2	101.1
Finance and support	**46.7**		**84.6**	**51.1**
R&D expenditure in the public sector	96.0		70.1	88.8
Venture capital expenditures	5.0		101.7	6.5
Firm investments	**94.4**		**104.6**	**112.6**
R&D expenditure in the business sector	82.8		64.0	94.9
Non-R&D innovation expenditures	89.3		134.6	104.3
Enterprises providing ICT training	110.5		113.3	140.0
Innovators	**96.9**		**105.4**	**88.0**
SMEs product/process innovations	94.9		99.0	92.1
SMEs marketing/organizational innovations	82.9		120.1	70.7
SMEs innovating in-house	112.6		97.0	101.4
Linkages	**84.1**		**71.5**	**87.3**
Innovative SMEs collaborating with others	107.1		101.1	114.4
Public-private co-publications	73.0		71.4	85.6
Private co-funding of public R&D exp.	71.2		49.8	68.3
Intellectual assets	**63.8**		**50.7**	**62.1**
PCT patent applications	23.2		21.1	21.1
Trademark applications	69.1		71.4	76.9
Design applications	100.0		64.3	92.2
Employment impacts	**118.4**		**114.6**	**123.6**
Employment in knowledge-intensive activities	84.7		84.6	92.3
Employment fast-growing enterprises	144.6		136.3	146.3
Sales impacts	**93.0**		**105.4**	**95.8**
Medium and high-tech product exports	128.2		127.2	138.3
Knowledge-intensive services exports	49.3		41.1	50.9
Sales of new-to-market/firm innovations	100.0		153.4	97.0

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	25,900	29,500
Average annual GDP growth (%)	3.7	2.2
Employment share manufacturing (NACE C) (%)	27.7	15.5
of which High and medium high-tech (%)	41.1	37.5
Employment share services (NACE G-N) (%)	35.6	41.8
of which Knowledge-intensive services (%)	34.6	35.0
Turnover share SMEs (%)	39.6	37.9
Turnover share large enterprises (%)	42.7	44.4
Foreign-controlled enterprises – share of value added (%)	22.7	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.5	1.5
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	3.6	4.3
Top R&D spending enterprises per 10 million population	2.5	19.6
Buyer sophistication (1 to 7 best)	3.0	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	75.9	76.8
Basic-school entrepren. education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.1	3.5
Rule of law (-2.5 to 2.5 best)	1.1	1.2
Demography		
Population size (millions)	10.6	511.3
Average annual population growth (%)	0.3	0.2
Population density (inhabitants/km2)	136.9	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.97	1.79	1.00
Tertiary educational attainment (% of population aged 30-34)	28.2	33.7	32.0

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

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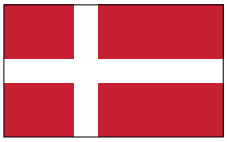
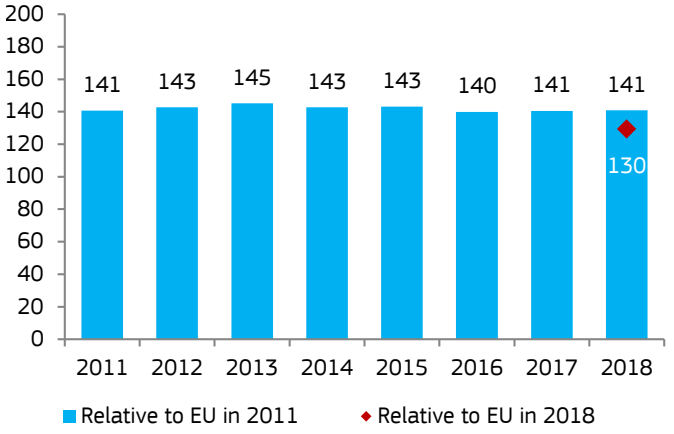


Denmark is an **Innovation Leader.** Over time, performance has remained the same compared to that of the EU in 2011.



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, and Lifelong learning. *Sales impacts* and *Innovators* are the weakest innovation dimensions. Overall, Denmark's lowest indicator scores comprise Sales of new-to-market and new-to-firm product innovations, Non-R&D innovation expenditures, and Venture capital expenditures.

Structural differences with the EU are shown in the table below. GDP per capita and top R&D spending enterprises per 10 million population are well above the EU average. Enterprise births and FDI net inflows are well below the EU average.

Denmark	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	2018
SUMMARY INNOVATION INDEX	**129.5**		**140.7**	**140.9**
Human resources	**180.4**		**192.5**	**220.6**
New doctorate graduates	157.2		146.2	228.3
Population with tertiary education	143.1		167.2	170.9
Lifelong learning	262.2		267.7	267.7
Attractive research systems	**183.8**		**160.0**	**207.0**
International scientific co-publications	265.1		257.0	385.6
Most cited publications	143.5		144.1	157.1
Foreign doctorate students	174.0		120.2	166.4
Innovation-friendly environment	**182.3**		**244.6**	**288.1**
Broadband penetration	177.8		266.7	355.6
Opportunity-driven entrepreneurship	187.0		229.6	242.2
Finance and support	**106.7**		**128.2**	**116.7**
R&D expenditure in the public sector	174.7		141.1	161.6
Venture capital expenditures	49.1		112.9	63.5
Firm investments	**104.5**		**119.7**	**124.6**
R&D expenditure in the business sector	145.7		166.1	166.9
Non-R&D innovation expenditures	45.3		45.9	52.9
Enterprises providing ICT training	126.3		153.3	160.0
Innovators	**95.7**		**103.4**	**86.9**
SMEs product/process innovations	96.1		109.1	93.3
SMEs marketing/organizational innovations	114.2		100.2	97.5
SMEs innovating in-house	77.5		100.9	69.8
Linkages	**139.2**		**175.5**	**144.6**
Innovative SMEs collaborating with others	109.8		215.5	117.2
Public-private co-publications	315.1		349.3	369.7
Private co-funding of public R&D exp.	70.5		71.5	67.7
Intellectual assets	**163.8**		**152.4**	**159.3**
PCT patent applications	175.1		171.7	159.3
Trademark applications	142.6		135.2	158.9
Design applications	173.2		146.5	159.7
Employment impacts	**100.7**		**127.3**	**105.1**
Employment in knowledge-intensive activities	110.6		120.5	120.5
Employment fast-growing enterprises	93.0		132.1	94.0
Sales impacts	**75.3**		**91.2**	**77.6**
Medium and high-tech product exports	79.8		68.1	86.1
Knowledge-intensive services exports	112.8		123.1	116.4
Sales of new-to-market/firm innovations	23.7		82.0	22.9

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	37,400	29,500
Average annual GDP growth (%)	1.8	2.2
Employment share manufacturing (NACE C) (%)	11.8	15.5
of which High and medium high-tech (%)	42.9	37.5
Employment share services (NACE G-N) (%)	41.4	41.8
of which Knowledge-intensive services (%)	34.8	35.0
Turnover share SMEs (%)	40.7	37.9
Turnover share large enterprises (%)	40.7	44.4
Foreign-controlled enterprises – share of value added (%)	10.6	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.5	1.5
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	1.3	4.3
Top R&D spending enterprises per 10 million population	63.1	19.6
Buyer sophistication (1 to 7 best)	3.7	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	84.0	76.8
Basic-school entrepreneurial education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.5	3.5
Rule of law (-2.5 to 2.5 best)	1.9	1.2
Demography		
Population size (millions)	5.7	511.3
Average annual population growth (%)	0.6	0.2
Population density (inhabitants/km2)	135.4	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	2.91	3.05	3.00
Tertiary educational attainment (% of population aged 30-34)	44.9	49.1	40.0

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

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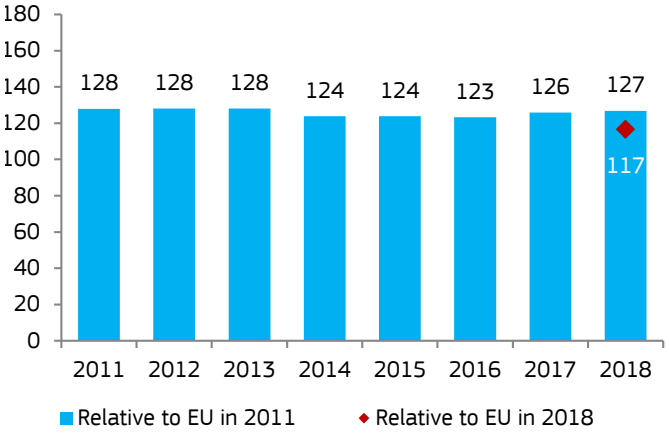
https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Germany is a **Strong Innovator**. Over time, performance has remained the same compared to that of the EU in 2011.



Intellectual assets, *Firm investments* and *Innovators*, are the strongest innovation dimensions. Germany performs particularly well on PCT patent applications, Public-private co-publications, and Private co-funding of public R&D expenditures. *Attractive research systems* and *Human resources* are the weakest innovation dimensions. Germany's lowest indicator scores are on Foreign doctorate students, Population with tertiary education, and Venture capital expenditures.

Structural differences with the EU are shown in the table below. Germany scores high on various economic indicators. GDP per capita, the employment shares in high and medium high-tech manufacturing and in total manufacturing, the turnover share of large enterprises, and top R&D spending enterprises per 10 million population are all above the EU average. However, enterprise births and FDI net inflows are well below the EU average.

Germany	Relative to EU 2018 in 2018	Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**116.6**	**127.8**	**126.9**
Human resources	**88.7**	**97.2**	**108.5**
New doctorate graduates	131.5	192.3	191.0
Population with tertiary education	51.9	34.3	61.9
Lifelong learning	74.5	69.8	76.0
Attractive research systems	**85.9**	**89.2**	**96.8**
International scientific co-publications	92.5	105.0	134.5
Most cited publications	103.8	105.8	113.7
Foreign doctorate students	47.2	52.4	45.1
Innovation-friendly environment	**98.8**	**95.6**	**156.2**
Broadband penetration	94.4	100.0	188.9
Opportunity-driven entrepreneurship	103.4	92.6	133.9
Finance and support	**100.2**	**98.3**	**109.6**
R&D expenditure in the public sector	150.5	131.7	139.2
Venture capital expenditures	57.6	58.7	74.5
Firm investments	**142.8**	**132.9**	**170.2**
R&D expenditure in the business sector	154.7	154.1	177.2
Non-R&D innovation expenditures	137.7	118.8	160.8
Enterprises providing ICT training	136.8	126.7	173.3
Innovators	**136.0**	**169.9**	**123.5**
SMEs product/process innovations	125.3	167.6	121.6
SMEs marketing/organizational innovations	139.6	170.0	119.1
SMEs innovating in-house	144.3	172.1	130.0
Linkages	**132.9**	**138.0**	**138.0**
Innovative SMEs collaborating with others	69.0	106.1	73.7
Public-private co-publications	170.3	162.8	199.8
Private co-funding of public R&D exp.	165.1	150.8	158.5
Intellectual assets	**148.7**	**164.5**	**144.6**
PCT patent applications	177.8	193.4	161.7
Trademark applications	115.5	135.9	128.7
Design applications	151.7	158.1	139.9
Employment impacts	**97.7**	**120.0**	**102.1**
Employment in knowledge-intensive activities	107.1	124.4	116.7
Employment fast-growing enterprises	90.5	116.8	91.6
Sales impacts	**119.6**	**130.8**	**123.2**
Medium and high-tech product exports	131.4	133.8	141.7
Knowledge-intensive services exports	114.0	119.1	117.6
Sales of new-to-market/firm innovations	111.0	140.7	107.6

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	36,500	29,500
Average annual GDP growth (%)	1.8	2.2
Employment share manufacturing (NACE C) (%)	19.2	15.5
of which High and medium high-tech (%)	51.3	37.5
Employment share services (NACE G-N) (%)	40.6	41.8
of which Knowledge-intensive services (%)	33.9	35.0
Turnover share SMEs (%)	36.0	37.9
Turnover share large enterprises (%)	52.5	44.4
Foreign-controlled enterprises – share of value added (%)	11.6	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.7	1.5
Total Entrepreneurial Activity (TEA) (%)	4.9	6.7
FDI net inflows (% GDP)	1.8	4.3
Top R&D spending enterprises per 10 million population	26.8	19.6
Buyer sophistication (1 to 7 best)	4.3	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	79.0	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.7	1.9
Govt. procurement of advanced tech products (1 to 7 best)	4.6	3.5
Rule of law (-2.5 to 2.5 best)	1.7	1.2
Demography		
Population size (millions)	82.5	511.3
Average annual population growth (%)	0.4	0.2
Population density (inhabitants/km2)	232.8	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	2.87	3.02	3.00
Tertiary educational attainment (% of population aged 30-34)	31.4	34.9	42.0

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

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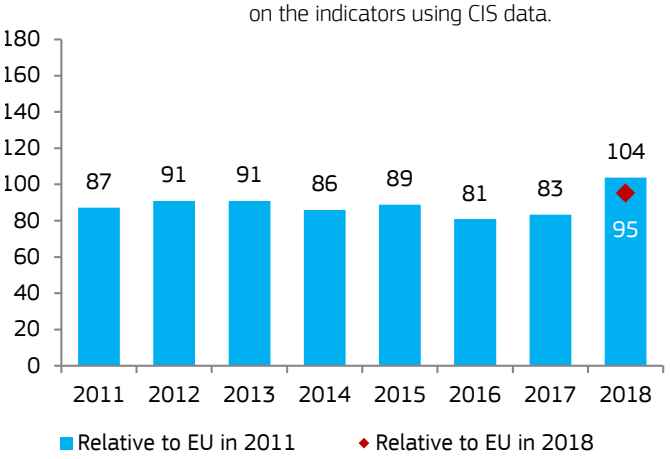
Estonia is a **Strong Innovator**. Over time, performance has increased relative to that of the EU in 2011. The strong increase in 2018 is largely explained by improved performance on the indicators using CIS data.



Intellectual assets, *Linkages* and *Human resources*, are the strongest innovation dimensions. Estonia scores high on Innovative SMEs collaborating with others, Trademark applications, and Non-R&D innovation expenditures. *Sales impacts* and *Employment impacts* are the weakest innovation dimensions. Low-scoring indicators include PCT patent applications, SMEs with marketing or organizational innovations, and R&D expenditures in the business sector.

Structural differences with the EU are shown in the table below. The turnover share of SMEs and total entrepreneurial activity are well above the EU average. The employment share in high and medium high-tech manufacturing, FDI net inflows, and top R&D spending enterprises per 10 million population are well below the EU average.

Estonia	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**95.3**		**87.2**	**103.7**
Human resources	**109.7**		**94.9**	**134.2**
New doctorate graduates	59.0		53.8	85.7
Population with tertiary education	124.4		125.4	148.5
Lifelong learning	164.3		103.1	167.7
Attractive research systems	**94.4**		**60.8**	**106.3**
International scientific co-publications	141.7		106.4	206.1
Most cited publications	85.2		61.6	93.3
Foreign doctorate students	63.0		29.2	60.2
Innovation-friendly environment	**87.9**		**92.6**	**138.9**
Broadband penetration	88.9		77.8	177.8
Opportunity-driven entrepreneurship	86.9		102.7	112.5
Finance and support	**88.5**		**92.7**	**96.8**
R&D expenditure in the public sector	96.0		109.3	88.8
Venture capital expenditures	82.1		73.0	106.2
Firm investments	**90.6**		**107.3**	**108.0**
R&D expenditure in the business sector	43.8		65.7	50.2
Non-R&D innovation expenditures	176.1		195.1	205.6
Enterprises providing ICT training	47.4		53.3	60.0
Innovators	**107.6**		**109.7**	**97.7**
SMEs product/process innovations	126.5		132.1	122.8
SMEs marketing/organizational innovations	39.3		80.2	33.5
SMEs innovating in-house	152.4		117.0	137.2
Linkages	**121.2**		**111.1**	**125.9**
Innovative SMEs collaborating with others	203.6		211.5	217.4
Public-private co-publications	63.8		40.8	74.8
Private co-funding of public R&D exp.	84.2		67.8	80.8
Intellectual assets	**127.8**		**84.7**	**124.3**
PCT patent applications	36.6		62.5	33.3
Trademark applications	196.2		129.6	218.6
Design applications	153.0		71.0	141.1
Employment impacts	**66.4**		**51.9**	**69.3**
Employment in knowledge-intensive activities	91.8		52.6	100.0
Employment fast-growing enterprises	46.6		51.4	47.1
Sales impacts	**65.6**		**64.2**	**67.6**
Medium and high-tech product exports	55.3		60.5	59.6
Knowledge-intensive services exports	63.7		62.9	65.8
Sales of new-to-market/firm innovations	81.6		70.0	79.2

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	22,700	29,500
Average annual GDP growth (%)	4.4	2.2
Employment share manufacturing (NACE C) (%)	18.9	15.5
of which High and medium high-tech (%)	20.2	37.5
Employment share services (NACE G-N) (%)	40.1	41.8
of which Knowledge-intensive services (%)	31.3	35.0
Turnover share SMEs (%)	48.2	37.9
Turnover share large enterprises (%)	22.3	44.4
Foreign-controlled enterprises – share of value added (%)	13.5	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.9	1.5
Total Entrepreneurial Activity (TEA) (%)	17.8	6.7
FDI net inflows (% GDP)	2.3	4.3
Top R&D spending enterprises per 10 million population	0.0	19.6
Buyer sophistication (1 to 7 best)	3.5	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	80.4	76.8
Basic-school entrepren. education and training (1 to 5 best)	2.9	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.7	3.5
Rule of law (-2.5 to 2.5 best)	1.3	1.2
Demography		
Population size (millions)	1.3	511.3
Average annual population growth (%)	0.1	0.2
Population density (inhabitants/km2)	30.3	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.43	1.29	3.00
Tertiary educational attainment (% of population aged 30-34)	43.2	47.2	40.0

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

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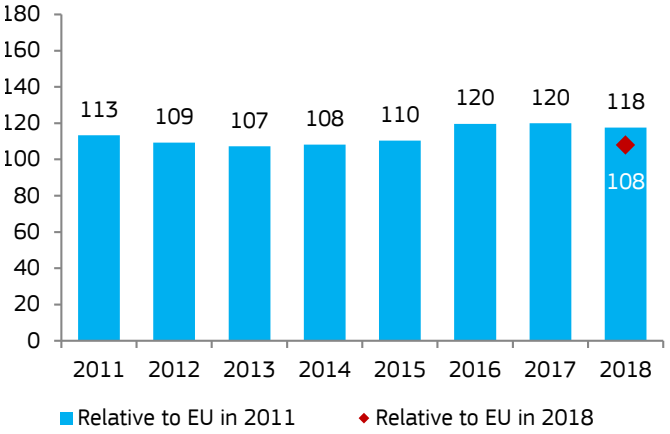
https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Ireland is a **Strong Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Employment impacts, *Innovators* and *Human resources* are the strongest innovation dimensions. Ireland scores particularly well on Population with tertiary education, Employment in knowledge-intensive activities, and International scientific co-publication. *Intellectual assets*, *Finance and support*, and *Linkages* are the weakest innovation dimensions. Overall, Ireland's lowest indicator scores comprise R&D expenditure in the public sector, Private co-funding of public R&D expenditure, and Design applications.

Structural differences with the EU are shown in the table below. Ireland scores high on various economic indicators. GDP per capita, the value-added share of foreign-controlled enterprises, FDI net inflows, and top R&D spending enterprises per 10 million population are well above the EU average. However, the turnover share of large enterprises and enterprise births are below the EU average.

Ireland	Relative to EU 2018 in		Performance relative to EU 2011 in	
	2018		2011	2018
SUMMARY INNOVATION INDEX	**108.1**		**113.4**	**117.6**
Human resources	**131.4**		**143.1**	**160.7**
New doctorate graduates	108.1		107.7	156.9
Population with tertiary education	196.9		230.6	235.1
Lifelong learning	80.6		82.3	82.3
Attractive research systems	**130.8**		**143.6**	**147.3**
International scientific co-publications	161.4		166.8	234.8
Most cited publications	112.3		113.4	123.0
Foreign doctorate students	133.1		175.6	127.2
Innovation-friendly environment	**97.8**		**68.9**	**154.5**
Broadband penetration	116.7		100.0	233.3
Opportunity-driven entrepreneurship	77.9		47.8	100.9
Finance and support	**72.0**		**119.6**	**78.7**
R&D expenditure in the public sector	25.3		58.9	23.4
Venture capital expenditures	111.5		191.6	144.2
Firm investments	**85.1**		**125.5**	**101.5**
R&D expenditure in the business sector	53.6		91.4	61.4
Non-R&D innovation expenditures	63.2		132.2	73.8
Enterprises providing ICT training	136.8		153.3	173.3
Innovators	**131.5**		**127.4**	**119.4**
SMEs product/process innovations	112.8		126.3	109.5
SMEs marketing/organizational innovations	151.5		105.5	129.3
SMEs innovating in-house	132.6		150.6	119.4
Linkages	**79.1**		**66.7**	**82.1**
Innovative SMEs collaborating with others	97.8		86.5	104.4
Public-private co-publications	137.3		91.9	161.0
Private co-funding of public R&D exp.	33.2		41.3	31.9
Intellectual assets	**51.7**		**63.1**	**50.3**
PCT patent applications	54.9		68.5	49.9
Trademark applications	66.5		88.7	74.1
Design applications	33.9		36.7	31.3
Employment impacts	**166.3**		**158.2**	**173.6**
Employment in knowledge-intensive activities	177.6		193.6	193.6
Employment fast-growing enterprises	157.4		132.6	159.2
Sales impacts	**127.6**		**108.5**	**131.5**
Medium and high-tech product exports	99.6		92.3	107.4
Knowledge-intensive services exports	147.2		151.8	151.8
Sales of new-to-market/firm innovations	140.7		77.8	136.5

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	52,600	29,500
Average annual GDP growth (%)	6.9	2.2
Employment share manufacturing (NACE C) (%)	11.6	15.5
of which High and medium high-tech (%)	44.2	37.5
Employment share services (NACE G-N) (%)	46.6	41.8
of which Knowledge-intensive services (%)	39.8	35.0
Turnover share SMEs (%)	45.3	37.9
Turnover share large enterprises (%)	35.5	44.4
Foreign-controlled enterprises – share of value added (%)	33.8	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.8	1.5
Total Entrepreneurial Activity (TEA) (%)	9.8	6.7
FDI net inflows (% GDP)	53.5	4.3
Top R&D spending enterprises per 10 million population	55.0	19.6
Buyer sophistication (1 to 7 best)	4.4	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	79.5	76.8
Basic-school entrepren. education and training (1 to 5 best)	2.1	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.5	3.5
Rule of law (-2.5 to 2.5 best)	1.6	1.2
Demography		
Population size (millions)	4.8	511.3
Average annual population growth (%)	1.1	0.2
Population density (inhabitants/km2)	69.3	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.50	1.05	2.00
Tertiary educational attainment (% of population aged 30-34)	54.6	56.3	60.0

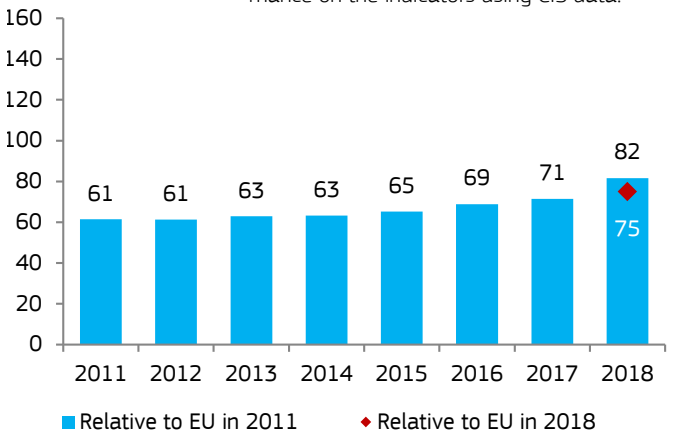
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

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



Innovators, *Linkages*, and *Employment impacts* are the strongest innovation dimensions. Greece performs particularly well on Innovative SMEs collaborating with others, SMEs innovating in-house, and SMEs with marketing or organizational innovations. *Intellectual assets*, *Innovation-friendly environment* and *Finance and support* are the weakest innovation dimensions. Greece's lowest indicator scores are for Foreign doctorate students, Medium and high-tech product exports, and Venture capital expenditures.

Structural differences with the EU are shown in the table below. Many economic indicators are well below the EU average, including GDP per capita, the employment share in high and medium high-tech manufacturing, the turnover share of large enterprises, the value-added share of foreign-controlled enterprises, FDI net inflows, and top R&D spending enterprises per 10 million population. The employment share of services and enterprise births are above the EU average.

Greece	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**75.0**		**61.4**	**81.6**
Human resources	**78.2**		**69.3**	**95.6**
New doctorate graduates	70.9		69.2	103.0
Population with tertiary education	120.0		111.2	143.3
Lifelong learning	34.7		22.9	35.4
Attractive research systems	**59.2**		**55.5**	**66.6**
International scientific co-publications	77.6		78.0	112.8
Most cited publications	78.4		76.4	85.9
Foreign doctorate students	5.9		7.7	5.7
Innovation-friendly environment	**40.9**		**38.7**	**64.6**
Broadband penetration	22.2		22.2	44.4
Opportunity-driven entrepreneurship	60.5		49.9	78.4
Finance and support	**44.4**		**20.7**	**48.5**
R&D expenditure in the public sector	77.8		30.9	72.0
Venture capital expenditures	16.0		8.5	20.7
Firm investments	**66.0**		**69.1**	**78.7**
R&D expenditure in the business sector	39.3		18.5	45.1
Non-R&D innovation expenditures	103.6		118.5	121.0
Enterprises providing ICT training	52.6		66.7	66.7
Innovators	**145.7**		**93.6**	**132.4**
SMEs product/process innovations	137.8		79.9	133.8
SMEs marketing/organizational innovations	142.5		117.2	121.6
SMEs innovating in-house	157.5		83.5	141.8
Linkages	**111.5**		**80.2**	**115.9**
Innovative SMEs collaborating with others	201.6		112.6	215.3
Public-private co-publications	41.1		31.3	48.2
Private co-funding of public R&D exp.	75.3		77.5	72.2
Intellectual assets	**36.0**		**14.6**	**35.0**
PCT patent applications	16.1		11.0	14.6
Trademark applications	67.6		24.8	75.3
Design applications	25.0		10.1	23.0
Employment impacts	**84.2**		**92.0**	**87.9**
Employment in knowledge-intensive activities	75.3		67.9	82.1
Employment fast-growing enterprises	91.0		109.4	92.1
Sales impacts	**66.3**		**59.4**	**68.2**
Medium and high-tech product exports	8.3		9.4	9.0
Knowledge-intensive services exports	69.4		88.5	71.6
Sales of new-to-market/firm innovations	138.8		85.1	134.6

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	20,100	29,500
Average annual GDP growth (%)	1.7	2.2
Employment share manufacturing (NACE C) (%)	9.4	15.5
of which High and medium high-tech (%)	14.3	37.5
Employment share services (NACE G-N) (%)	46.1	41.8
of which Knowledge-intensive services (%)	28.7	35.0
Turnover share SMEs (%)	39.8	37.9
Turnover share large enterprises (%)	28.3	44.4
Foreign-controlled enterprises – share of value added (%)	3.7	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	2.3	1.5
Total Entrepreneurial Activity (TEA) (%)	5.6	6.7
FDI net inflows (% GDP)	1.3	4.3
Top R&D spending enterprises per 10 million population	4.0	19.6
Buyer sophistication (1 to 7 best)	3.3	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	68.1	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.8	1.9
Govt. procurement of advanced tech products (1 to 7 best)	2.6	3.5
Rule of law (-2.5 to 2.5 best)	0.2	1.2
Demography		
Population size (millions)	10.8	511.3
Average annual population growth (%)	-0.2	0.2
Population density (inhabitants/km^2)	82.4	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.83	1.13	1.20
Tertiary educational attainment (% of population aged 30-34)	37.2	44.3	32.0

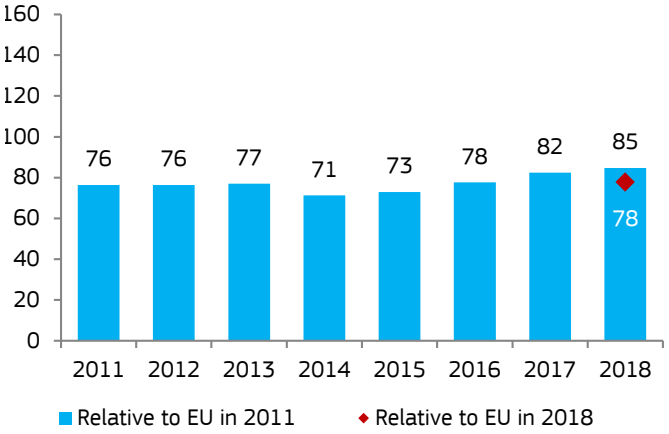
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Spain is a **Moderate Innovator**. Over time, performance has increased relative to that of the EU in 2011, with a temporary decline in 2014.



Human resources and *Innovation-friendly environment* are the strongest innovation dimensions. Spain scores high on Sales of new-to-market and new-to-firm product innovations, Broadband penetration, and New doctorate graduates. *Innovators*, *Linkages* and *Firm investments* are the weakest innovation dimensions. Low-scoring indicators include SMEs innovating in-house, Knowledge-intensive service exports, and SMEs with product or process innovations.

Structural differences with the EU are shown in the table below. Most of Spain's economic indicators are closely above or below the EU average. A notable exception is the indicator measuring top R&D spending enterprises per 10 million population, which is well below the EU average.

Spain	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**77.9**		**76.3**	**84.8**
Human resources	**115.9**		**101.8**	**141.7**
New doctorate graduates	126.8		76.9	184.2
Population with tertiary education	123.8		132.1	147.8
Lifelong learning	89.8		93.8	91.7
Attractive research systems	**76.8**		**93.8**	**86.5**
International scientific co-publications	84.4		82.4	122.7
Most cited publications	82.5		90.4	90.3
Foreign doctorate students	58.9		106.8	56.3
Innovation-friendly environment	**107.1**		**74.9**	**169.3**
Broadband penetration	155.6		100.0	311.1
Opportunity-driven entrepreneurship	56.2		57.8	72.8
Finance and support	**75.2**		**80.7**	**82.3**
R&D expenditure in the public sector	71.7		86.9	66.4
Venture capital expenditures	78.2		73.3	101.1
Firm investments	**64.0**		**66.3**	**76.3**
R&D expenditure in the business sector	47.6		57.1	54.5
Non-R&D innovation expenditures	54.0		68.4	63.0
Enterprises providing ICT training	89.5		73.3	113.3
Innovators	**45.1**		**67.4**	**40.9**
SMEs product/process innovations	39.0		72.1	37.9
SMEs marketing/organizational innovations	66.3		67.4	56.6
SMEs innovating in-house	31.3		62.6	28.2
Linkages	**58.2**		**67.9**	**60.5**
Innovative SMEs collaborating with others	49.1		41.5	52.4
Public-private co-publications	45.4		45.5	53.3
Private co-funding of public R&D exp.	72.4		96.8	69.4
Intellectual assets	**71.2**		**72.7**	**69.3**
PCT patent applications	39.8		40.1	36.2
Trademark applications	110.2		110.8	122.8
Design applications	64.8		75.3	59.7
Employment impacts	**93.3**		**65.5**	**97.5**
Employment in knowledge-intensive activities	80.0		78.2	87.2
Employment fast-growing enterprises	103.7		56.3	104.9
Sales impacts	**85.0**		**77.6**	**87.5**
Medium and high-tech product exports	73.7		82.0	79.6
Knowledge-intensive services exports	31.8		30.8	32.8
Sales of new-to-market/firm innovations	164.8		126.2	159.9

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	26,900	29,500
Average annual GDP growth (%)	2.8	2.2
Employment share manufacturing (NACE C) (%)	12.5	15.5
of which High and medium high-tech (%)	31.8	37.5
Employment share services (NACE G-N) (%)	49.4	41.8
of which Knowledge-intensive services (%)	31.5	35.0
Turnover share SMEs (%)	38.6	37.9
Turnover share large enterprises (%)	38.1	44.4
Foreign-controlled enterprises – share of value added (%)	9.2	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.5	1.5
Total Entrepreneurial Activity (TEA) (%)	5.9	6.7
FDI net inflows (% GDP)	1.9	4.3
Top R&D spending enterprises per 10 million population	4.5	19.6
Buyer sophistication (1 to 7 best)	3.3	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	77.0	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.9	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.2	3.5
Rule of law (-2.5 to 2.5 best)	1.0	1.2
Demography		
Population size (millions)	46.5	511.3
Average annual population growth (%)	0.2	0.2
Population density (inhabitants/km2)	92.6	117.5

EU targets for 2020

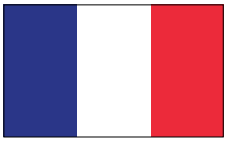
Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.24	1.20	2.00
Tertiary educational attainment (% of population aged 30-34)	42.3	42.4	44.0

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

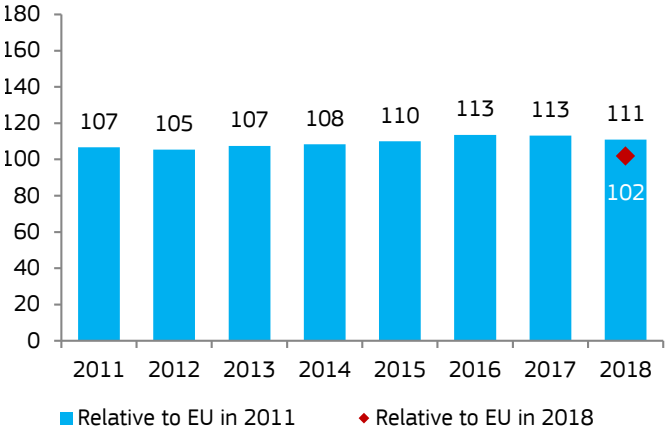
European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis



France is a **Strong Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Finance and support, *Human resources* and *Innovators* are the strongest innovation dimensions. France scores particularly well on Foreign doctorate students, Lifelong learning, and Venture capital expenditures. *Firm investments*, *Intellectual assets* and *Innovation-friendly environment* are the weakest innovation dimensions. Overall, France's lowest indicator scores comprise Non-R&D innovation expenditures, Broadband penetration, and Sales of new-to-market and new-to-firm product innovations.

Structural differences with the EU are shown in the table below. In general, economic indicators tend to be close to the EU average. However, the value-added share of foreign-controlled enterprises, enterprise births, and FDI net inflows are well below the EU average.

France	Relative to EU 2018 in 2018	Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**102.0**	**106.8**	**111.0**
Human resources	**127.6**	**146.9**	**156.0**
New doctorate graduates	80.1	107.7	116.3
Population with tertiary education	140.6	153.0	167.9
Lifelong learning	179.6	180.2	183.3
Attractive research systems	**114.4**	**128.1**	**128.9**
International scientific co-publications	84.4	97.7	122.7
Most cited publications	86.2	96.0	94.4
Foreign doctorate students	195.7	198.9	187.1
Innovation-friendly environment	**87.4**	**114.4**	**138.2**
Broadband penetration	66.7	100.0	133.3
Opportunity-driven entrepreneurship	109.2	124.2	141.5
Finance and support	**127.8**	**116.5**	**139.8**
R&D expenditure in the public sector	110.1	111.2	101.9
Venture capital expenditures	142.9	122.8	184.8
Firm investments	**82.1**	**94.7**	**97.8**
R&D expenditure in the business sector	104.5	116.3	119.7
Non-R&D innovation expenditures	64.6	69.7	75.4
Enterprises providing ICT training	78.9	100.0	100.0
Innovators	**126.5**	**94.2**	**114.9**
SMEs product/process innovations	113.8	88.8	110.4
SMEs marketing/organizational innovations	138.3	95.1	118.0
SMEs innovating in-house	129.0	98.7	116.2
Linkages	**92.4**	**96.9**	**96.0**
Innovative SMEs collaborating with others	114.4	123.5	122.1
Public-private co-publications	78.0	99.2	91.5
Private co-funding of public R&D exp.	82.2	76.3	78.8
Intellectual assets	**85.8**	**92.5**	**83.4**
PCT patent applications	106.3	105.9	96.7
Trademark applications	81.1	89.4	90.3
Design applications	69.5	81.3	64.1
Employment impacts	**88.5**	**102.2**	**92.4**
Employment in knowledge-intensive activities	103.5	106.4	112.8
Employment fast-growing enterprises	76.8	99.2	77.7
Sales impacts	**88.6**	**99.9**	**91.2**
Medium and high-tech product exports	105.1	107.6	113.4
Knowledge-intensive services exports	87.4	92.0	90.1
Sales of new-to-market/firm innovations	68.3	99.9	66.3

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	30,800	29,500
Average annual GDP growth (%)	1.8	2.2
Employment share manufacturing (NACE C) (%)	12.4	15.5
of which High and medium high-tech (%)	36.4	37.5
Employment share services (NACE G-N) (%)	41.0	41.8
of which Knowledge-intensive services (%)	37.1	35.0
Turnover share SMEs (%)	34.5	37.9
Turnover share large enterprises (%)	45.2	44.4
Foreign-controlled enterprises – share of value added (%)	6.8	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.6	1.5
Total Entrepreneurial Activity (TEA) (%)	5.1	6.7
FDI net inflows (% GDP)	1.8	4.3
Top R&D spending enterprises per 10 million population	16.8	19.6
Buyer sophistication (1 to 7 best)	4.0	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	76.3	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.8	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.8	3.5
Rule of law (-2.5 to 2.5 best)	1.4	1.2
Demography		
Population size (millions)	66.8	511.3
Average annual population growth (%)	0.2	0.2
Population density (inhabitants/km2)	105.3	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	2.23	2.19	3.00
Tertiary educational attainment (% of population aged 30-34)	43.7	46.2	50.0

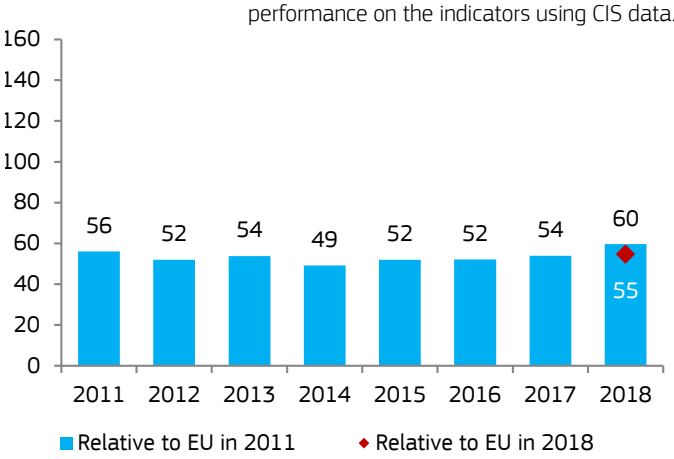
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

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.



Innovators and *Firm investments* are the strongest innovation dimensions. Croatia scores well on Non-R&D innovation expenditures, SMEs with marketing or organisational innovations, and Enterprises providing ICT training. *Intellectual assets*, *Finance and support* and *Attractive research systems* are the weakest innovation dimensions. Croatia's lowest indicator scores are for Knowledge-intensive service exports, Venture capital expenditure and Lifelong learning.

Structural differences with the EU are shown in the table below. GDP per capita, the employment share in high and medium high-tech manufacturing, FDI net inflows, and top R&D spending enterprises per 10 million population are well below the EU average. Enterprise births and total entrepreneurial activity are above the EU average.

Croatia	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**54.8**		**56.1**	**59.6**
Human resources	**49.9**		**57.8**	**61.0**
New doctorate graduates	60.7		92.3	88.1
Population with tertiary education	66.9		60.4	79.9
Lifelong learning	12.2		19.8	12.5
Attractive research systems	**33.7**		**21.1**	**38.0**
International scientific co-publications	63.3		52.8	92.1
Most cited publications	25.5		15.1	27.9
Foreign doctorate students	18.5		9.6	17.7
Innovation-friendly environment	**41.3**		**29.6**	**65.3**
Broadband penetration	44.4		11.1	88.9
Opportunity-driven entrepreneurship	38.0		42.1	49.2
Finance and support	**30.3**		**28.8**	**33.1**
R&D expenditure in the public sector	51.6		42.1	47.7
Venture capital expenditures	12.2		13.1	15.7
Firm investments	**93.6**		**101.1**	**111.6**
R&D expenditure in the business sector	29.6		26.2	33.9
Non-R&D innovation expenditures	140.9		117.6	164.6
Enterprises providing ICT training	105.3		160.0	133.3
Innovators	**95.4**		**80.0**	**86.6**
SMEs product/process innovations	86.8		86.6	84.2
SMEs marketing/organizational innovations	107.9		74.5	92.1
SMEs innovating in-house	92.7		78.8	83.4
Linkages	**62.9**		**92.8**	**65.3**
Innovative SMEs collaborating with others	81.0		107.1	86.5
Public-private co-publications	55.8		86.0	65.5
Private co-funding of public R&D exp.	51.8		85.2	49.7
Intellectual assets	**30.0**		**21.2**	**29.2**
PCT patent applications	18.2		17.3	16.6
Trademark applications	51.7		50.9	57.6
Design applications	20.7		1.0	19.1
Employment impacts	**64.6**		**32.1**	**67.5**
Employment in knowledge-intensive activities	69.4		55.1	75.6
Employment fast-growing enterprises	60.8		15.5	61.5
Sales impacts	**35.3**		**60.7**	**36.3**
Medium and high-tech product exports	54.5		71.0	58.8
Knowledge-intensive services exports	2.7		6.1	2.8
Sales of new-to-market/firm innovations	49.9		111.3	48.4

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	17,900	29,500
Average annual GDP growth (%)	2.8	2.2
Employment share manufacturing (NACE C) (%)	16.9	15.5
of which High and medium high-tech (%)	20.3	37.5
Employment share services (NACE G-N) (%)	40.5	41.8
of which Knowledge-intensive services (%)	29.9	35.0
Turnover share SMEs (%)	41.5	37.9
Turnover share large enterprises (%)	39.7	44.4
Foreign-controlled enterprises – share of value added (%)	11.6	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.9	1.5
Total Entrepreneurial Activity (TEA) (%)	9.0	6.7
FDI net inflows (% GDP)	2.5	4.3
Top R&D spending enterprises per 10 million population	0.0	19.6
Buyer sophistication (1 to 7 best)	2.7	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	70.9	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.6	1.9
Govt. procurement of advanced tech products (1 to 7 best)	2.5	3.5
Rule of law (-2.5 to 2.5 best)	0.3	1.2
Demography		
Population size (millions)	4.2	511.3
Average annual population growth (%)	-1.0	0.2
Population density (inhabitants/km2)	74.3	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.78	0.86	1.40
Tertiary educational attainment (% of population aged 30-34)	32.1	34.1	35.0

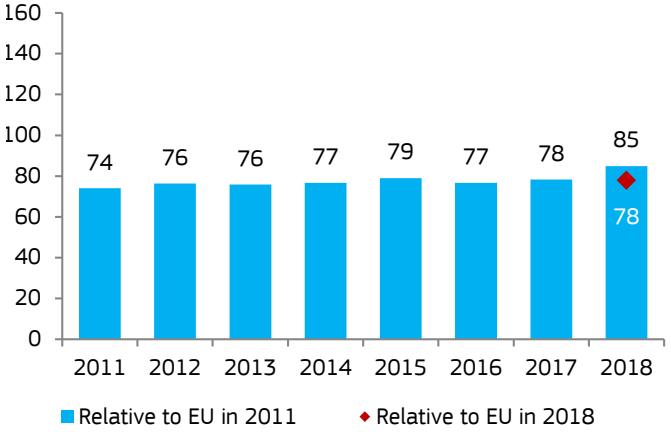
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

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



Innovators, *Intellectual assets* and *Attractive research systems* are the strongest innovation dimensions. Italy scores high on SMEs innovating in-house, Design applications, and SMEs with product or process innovations. *Linkages*, *Human resources*, and *Finance and support* are the weakest innovation dimensions. Low-scoring indicators include Population with tertiary education, Private co-funding of public R&D expenditure, and Innovative SMEs collaborating with others.

Structural differences with the EU are shown in the table below. Italy scores low on various economic indicators. Average annual GDP growth, the turnover share of large enterprises, the value-added share of foreign-controlled enterprises, FDI net inflows, and top R&D spending enterprises per 10 million population are well below the EU average. The employment share in manufacturing and the turnover share of SMEs are above the EU average.

Italy	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**78.1**		**74.1**	**84.9**
Human resources	**52.4**		**53.2**	**64.1**
New doctorate graduates	65.8		107.7	95.5
Population with tertiary education	24.4		3.0	29.1
Lifelong learning	69.4		53.1	70.8
Attractive research systems	**90.1**		**73.3**	**101.5**
International scientific co-publications	76.0		71.1	110.6
Most cited publications	109.5		93.5	119.9
Foreign doctorate students	69.4		43.1	66.4
Innovation-friendly environment	**67.6**		**84.5**	**106.9**
Broadband penetration	50.0		55.6	100.0
Opportunity-driven entrepreneurship	86.1		104.3	111.5
Finance and support	**52.9**		**53.7**	**57.8**
R&D expenditure in the public sector	63.7		62.6	58.9
Venture capital expenditures	43.7		43.1	56.5
Firm investments	**71.2**		**66.8**	**84.8**
R&D expenditure in the business sector	60.3		69.1	69.1
Non-R&D innovation expenditures	83.8		89.0	97.9
Enterprises providing ICT training	68.4		40.0	86.7
Innovators	**130.5**		**102.1**	**118.5**
SMEs product/process innovations	124.1		86.6	120.4
SMEs marketing/organizational innovations	113.0		102.3	96.5
SMEs innovating in-house	154.3		117.6	138.9
Linkages	**47.8**		**46.7**	**49.6**
Innovative SMEs collaborating with others	42.7		48.0	45.6
Public-private co-publications	76.8		63.2	90.1
Private co-funding of public R&D exp.	36.6		38.7	35.1
Intellectual assets	**100.7**		**95.4**	**97.9**
PCT patent applications	60.1		52.1	54.7
Trademark applications	107.2		95.4	119.4
Design applications	135.5		140.1	124.9
Employment impacts	**73.3**		**71.4**	**76.5**
Employment in knowledge-intensive activities	94.1		102.6	102.6
Employment fast-growing enterprises	57.0		48.9	57.7
Sales impacts	**82.5**		**81.2**	**85.0**
Medium and high-tech product exports	89.1		90.3	96.2
Knowledge-intensive services exports	65.7		68.3	67.8
Sales of new-to-market/firm innovations	94.3		85.5	91.5

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	28,300	29,500
Average annual GDP growth (%)	1.3	2.2
Employment share manufacturing (NACE C) (%)	18.3	15.5
of which High and medium high-tech (%)	33.2	37.5
Employment share services (NACE G-N) (%)	45.0	41.8
of which Knowledge-intensive services (%)	37.1	35.0
Turnover share SMEs (%)	43.9	37.9
Turnover share large enterprises (%)	31.6	44.4
Foreign-controlled enterprises – share of value added (%)	6.2	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.2	1.5
Total Entrepreneurial Activity (TEA) (%)	4.3	6.7
FDI net inflows (% GDP)	0.8	4.3
Top R&D spending enterprises per 10 million population	6.7	19.6
Buyer sophistication (1 to 7 best)	3.7	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	71.8	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.8	1.9
Govt. procurement of advanced tech products (1 to 7 best)	2.9	3.5
Rule of law (-2.5 to 2.5 best)	0.3	1.2
Demography		
Population size (millions)	60.6	511.3
Average annual population growth (%)	-0.1	0.2
Population density (inhabitants/km2)	204.8	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.34	1.35	1.53
Tertiary educational attainment (% of population aged 30-34)	23..9	27.8	26.0

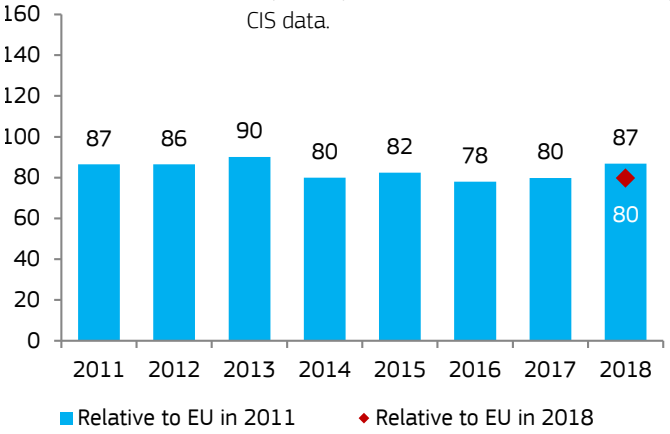
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

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



Attractive research systems, *Intellectual assets*, and *Sales impacts* are the strongest innovation dimensions. Cyprus scores particularly well on Trademark applications, Population with tertiary education, and International scientific co-publications. *Finance and support* and *Linkages* are the weakest innovation dimensions. Overall, Cyprus' lowest indicator scores comprise Private co-funding of public R&D expenditure, R&D expenditure in the business sector, and PCT patent applications.

Structural differences with the EU are shown in the table below. Cyprus has many economic indicators well below or above the EU average. Indicators well above EU average include average annual GDP growth, the employment share in services, the turnover share of SMEs, and FDI net inflows. Indicators well below the EU average include the employment shares in manufacturing and in high and medium high-tech manufacturing, the turnover share of large enterprises, the value-added share of foreign-controlled enterprises, and top R&D spending enterprises per 10 million population.

Cyprus	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**79.7**		**86.6**	**86.8**
Human resources	**96.7**		**103.1**	**118.3**
New doctorate graduates	23.7		0.0	34.4
Population with tertiary education	207.5		225.4	247.8
Lifelong learning	59.2		72.9	60.4
Attractive research systems	**109.6**		**72.7**	**123.4**
International scientific co-publications	196.7		151.2	286.1
Most cited publications	82.5		60.9	90.3
Foreign doctorate students	70.2		39.1	67.1
Innovation-friendly environment	**71.9**		**46.8**	**113.7**
Broadband penetration	55.6		0.0	111.1
Opportunity-driven entrepreneurship	89.2		78.6	115.4
Finance and support	**24.7**		**17.5**	**27.0**
R&D expenditure in the public sector	21.3		23.4	19.7
Venture capital expenditures	27.6		10.4	35.7
Firm investments	**71.0**		**120.3**	**84.7**
R&D expenditure in the business sector	13.1		4.7	15.0
Non-R&D innovation expenditures	80.0		192.1	93.5
Enterprises providing ICT training	115.8		160.0	146.7
Innovators	**82.4**		**134.2**	**74.8**
SMEs product/process innovations	78.2		126.0	75.9
SMEs marketing/organizational innovations	67.9		125.1	57.9
SMEs innovating in-house	100.8		151.7	90.8
Linkages	**48.9**		**86.3**	**50.8**
Innovative SMEs collaborating with others	74.8		201.6	79.9
Public-private co-publications	99.1		54.4	116.3
Private co-funding of public R&D exp.	1.3		15.7	1.3
Intellectual assets	**104.9**		**83.0**	**102.0**
PCT patent applications	15.7		14.9	14.3
Trademark applications	241.4		216.4	269.0
Design applications	60.8		44.3	56.0
Employment impacts	**71.8**		**53.6**	**75.0**
Employment in knowledge-intensive activities	132.9		111.5	144.9
Employment fast-growing enterprises	24.2		11.8	24.5
Sales impacts	**101.2**		**94.5**	**104.3**
Medium and high-tech product exports	108.2		56.3	116.7
Knowledge-intensive services exports	100.7		104.9	103.9
Sales of new-to-market/firm innovations	92.8		127.7	90.0

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	24,600	29,500
Average annual GDP growth (%)	4.1	2.2
Employment share manufacturing (NACE C) (%)	7.4	15.5
of which High and medium high-tech (%)	11.2	37.5
Employment share services (NACE G-N) (%)	53.6	41.8
of which Knowledge-intensive services (%)	37.5	35.0
Turnover share SMEs (%)	54.1	37.9
Turnover share large enterprises (%)	21.7	44.4
Foreign-controlled enterprises – share of value added (%)	5.1	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.2	1.5
Total Entrepreneurial Activity (TEA) (%)	7.7	6.7
FDI net inflows (% GDP)	43.8	4.3
Top R&D spending enterprises per 10 million population	0.0	19.6
Buyer sophistication (1 to 7 best)	3.8	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	71.5	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.9	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.1	3.5
Rule of law (-2.5 to 2.5 best)	0.9	1.2
Demography		
Population size (millions)	0.9	511.3
Average annual population growth (%)	0.9	0.2
Population density (inhabitants/km^2)	92.6	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.51	0.56	0.50
Tertiary educational attainment (% of population aged 30-34)	52.5	57.1	46.0

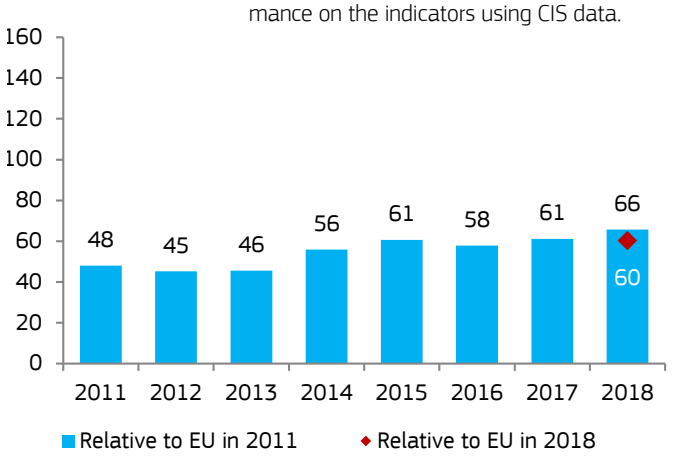
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Latvia 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.



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, and Employment fast-growing enterprises of innovative sectors. *Innovators*, *Attractive research systems* and *Firm investments* are the weakest innovation dimensions. Latvia's lowest indicator scores are on R&D expenditure in the business sector, PCT patent applications, and New doctorate graduates.

Structural differences with the EU are shown in the table below. Many economic indicators tend to be either well below or well above the EU average. Average annual GDP growth, the turnover share of SMEs, and total entrepreneurial activity are all well above the EU average. Indicators well below the EU average include GDP per capita, the employment share in high and medium high-tech manufacturing,

Latvia	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	2018
SUMMARY INNOVATION INDEX	**60.3**		**48.0**	**65.7**
Human resources	**63.0**		**63.1**	**77.1**
New doctorate graduates	18.4		23.1	26.7
Population with tertiary education	111.3		116.4	132.8
Lifelong learning	65.3		44.8	66.7
Attractive research systems	**41.0**		**10.0**	**46.1**
International scientific co-publications	39.9		22.1	58.0
Most cited publications	37.8		8.1	41.4
Foreign doctorate students	47.8		5.0	45.8
Innovation-friendly environment	**90.9**		**124.0**	**143.7**
Broadband penetration	94.4		200.0	188.9
Opportunity-driven entrepreneurship	87.2		72.3	112.9
Finance and support	**97.4**		**26.7**	**106.5**
R&D expenditure in the public sector	37.4		36.5	34.6
Venture capital expenditures	148.2		15.0	191.6
Firm investments	**46.4**		**69.0**	**55.3**
R&D expenditure in the business sector	8.6		17.6	9.9
Non-R&D innovation expenditures	90.4		149.4	105.6
Enterprises providing ICT training	36.8		33.3	46.7
Innovators	**39.7**		**24.7**	**36.1**
SMEs product/process innovations	41.0		34.4	39.8
SMEs marketing/organizational innovations	43.4		11.6	37.0
SMEs innovating in-house	34.8		27.9	31.4
Linkages	**48.0**		**40.7**	**49.8**
Innovative SMEs collaborating with others	41.3		20.9	44.1
Public-private co-publications	26.8		6.9	31.4
Private co-funding of public R&D exp.	64.5		69.8	61.9
Intellectual assets	**53.5**		**65.1**	**52.0**
PCT patent applications	17.4		29.5	15.9
Trademark applications	101.7		108.2	113.3
Design applications	42.6		66.6	39.3
Employment impacts	**94.4**		**53.4**	**98.6**
Employment in knowledge-intensive activities	75.3		48.7	82.1
Employment fast-growing enterprises	109.2		56.8	110.5
Sales impacts	**53.9**		**46.0**	**55.5**
Medium and high-tech product exports	45.4		34.6	48.9
Knowledge-intensive services exports	66.8		74.1	68.9
Sales of new-to-market/firm innovations	49.5		27.1	48.1

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	19,100	29,500
Average annual GDP growth (%)	4.7	2.2
Employment share manufacturing (NACE C) (%)	13.4	15.5
of which High and medium high-tech (%)	12.4	37.5
Employment share services (NACE G-N) (%)	41.7	41.8
of which Knowledge-intensive services (%)	29.3	35.0
Turnover share SMEs (%)	51.6	37.9
Turnover share large enterprises (%)	22.3	44.4
Foreign-controlled enterprises – share of value added (%)	14.1	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.8	1.5
Total Entrepreneurial Activity (TEA) (%)	14.2	6.7
FDI net inflows (% GDP)	2.6	4.3
Top R&D spending enterprises per 10 million population	0.0	19.6
Buyer sophistication (1 to 7 best)	2.9	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	79.3	76.8
Basic-school entrepren. education and training (1 to 5 best)	2.5	1.9
Govt. procurement of advanced tech products (1 to 7 best)	2.9	3.5
Rule of law (-2.5 to 2.5 best)	0.9	1.2
Demography		
Population size (millions)	2.0	511.3
Average annual population growth (%)	-0.9	0.2
Population density (inhabitants/km2)	31.2	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.69	0.51	1.50
Tertiary educational attainment (% of population aged 30-34)	39.9	42.7	34.0

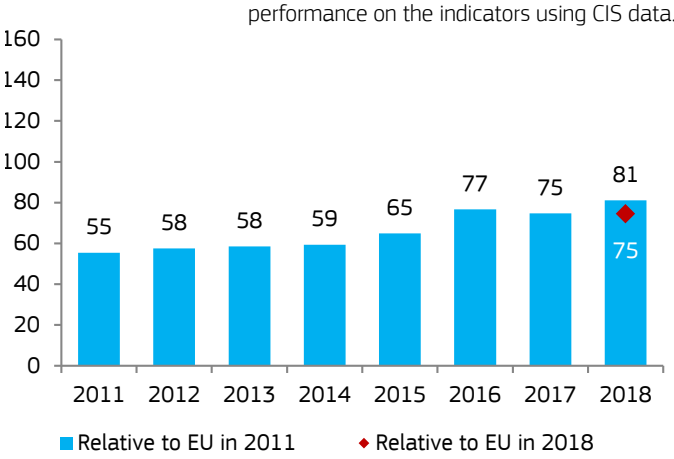
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

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



Innovation-friendly environment, *Innovators* and *Linkages* are the strongest innovation dimensions. Lithuania scores high on Population with tertiary education, Non-R&D innovation expenditures and Broadband penetration. *Attractive research systems*, *Employment impacts* and *Intellectual assets* are the weakest innovation dimensions. Low-scoring indicators include Knowledge-intensive services exports, PCT patent applications and Public-private co-publications.

Structural differences with the EU are shown in the table below. Average annual GDP growth, the turnover share of SMEs, and enterprise births are well above the EU average. Many economic indicators are well below the EU average, including the employment share in high and medium high-tech manufacturing, the employment share in knowledge-intensive services, the turnover share of large enterprises, FDI net inflows, and top R&D spending enterprises per 10 million population.

Lithuania	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**74.5**		**55.4**	**81.1**
Human resources	**94.6**		**107.1**	**115.6**
New doctorate graduates	35.2		61.5	51.1
Population with tertiary education	196.3		214.9	234.3
Lifelong learning	49.0		34.4	50.0
Attractive research systems	**37.3**		**16.2**	**42.0**
International scientific co-publications	56.4		35.6	82.1
Most cited publications	35.0		17.3	38.3
Foreign doctorate students	21.9		1.5	20.9
Innovation-friendly environment	**121.0**		**116.0**	**191.3**
Broadband penetration	172.2		177.8	344.4
Opportunity-driven entrepreneurship	67.1		73.9	86.9
Finance and support	**51.4**		**44.9**	**56.2**
R&D expenditure in the public sector	77.8		70.1	72.0
Venture capital expenditures	29.0		15.0	37.5
Firm investments	**76.6**		**53.8**	**91.3**
R&D expenditure in the business sector	22.1		17.6	25.3
Non-R&D innovation expenditures	176.1		106.2	205.6
Enterprises providing ICT training	26.3		33.3	33.3
Innovators	**110.4**		**46.4**	**100.3**
SMEs product/process innovations	113.4		51.7	110.0
SMEs marketing/organizational innovations	91.0		37.0	77.7
SMEs innovating in-house	125.9		50.5	113.4
Linkages	**106.9**		**92.0**	**111.0**
Innovative SMEs collaborating with others	145.7		68.5	155.6
Public-private co-publications	17.4		15.1	20.4
Private co-funding of public R&D exp.	122.4		142.3	117.4
Intellectual assets	**51.3**		**24.5**	**49.9**
PCT patent applications	16.0		8.5	14.5
Trademark applications	100.2		54.0	111.6
Design applications	38.9		17.0	35.9
Employment impacts	**42.5**		**65.1**	**44.4**
Employment in knowledge-intensive activities	47.1		38.5	51.3
Employment fast-growing enterprises	38.9		84.3	39.4
Sales impacts	**55.0**		**33.4**	**56.6**
Medium and high tech product exports	48.3		40.1	52.1
Knowledge-intensive services exports	10.7		0.2	11.0
Sales of new-to-market/firm innovations	117.9		63.7	114.4

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	22,400	29,500
Average annual GDP growth (%)	3.8	2.2
Employment share manufacturing (NACE C) (%)	15.4	15.5
of which High and medium high-tech (%)	13.8	37.5
Employment share services (NACE G-N) (%)	39.6	41.8
of which Knowledge-intensive services (%)	24.3	35.0
Turnover share SMEs (%)	48.9	37.9
Turnover share large enterprises (%)	32.8	44.4
Foreign-controlled enterprises – share of value added (%)	11.5	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	2.4	1.5
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	2.4	4.3
Top R&D spending enterprises per 10 million population	0.0	19.6
Buyer sophistication (1 to 7 best)	3.2	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	79.5	76.8
Basic-school entrepren. education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.0	3.5
Rule of law (-2.5 to 2.5 best)	1.0	1.2
Demography		
Population size (millions)	2.8	511.3
Average annual population growth (%)	-1.4	0.2
Population density (inhabitants/km2)	45.8	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.03	0.89	1.90
Tertiary educational attainment (% of population aged 30-34)	53.3	57.6	48.7

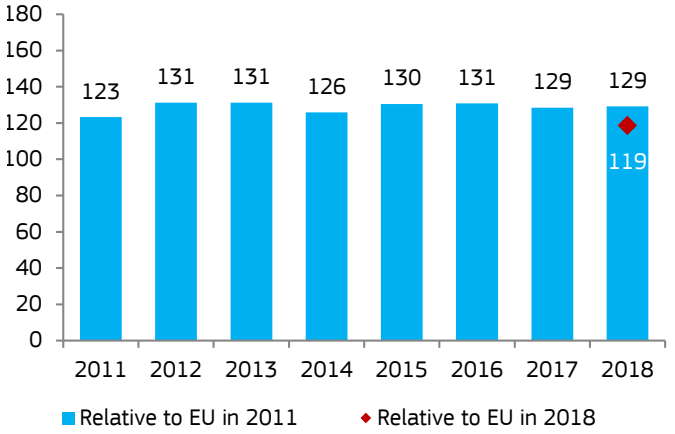
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Luxembourg is a **Strong Innovator.** Over time, performance has increased relative to that of the EU in 2011.



Luxembourg	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**118.7**		**123.2**	**129.2**
Human resources	**127.5**		**141.4**	**155.8**
New doctorate graduates	55.1		46.2	80.0
Population with tertiary education	180.0		197.8	214.9
Lifelong learning	164.3		176.0	167.7
Attractive research systems	**192.7**		**179.1**	**217.0**
International scientific co-publications	237.9		221.2	346.1
Most cited publications	124.9		111.5	136.8
Foreign doctorate students	268.8		257.1	257.1
Innovation-friendly environment	**134.6**		**202.6**	**212.7**
Broadband penetration	150.0		144.4	300.0
Opportunity-driven entrepreneurship	118.3		242.2	153.2
Finance and support	**116.8**		**120.6**	**127.7**
R&D expenditure in the public sector	79.8		60.8	73.9
Venture capital expenditures	148.2		191.6	191.6
Firm investments	**65.3**		**65.3**	**77.9**
R&D expenditure in the business sector	49.1		57.9	56.2
Non-R&D innovation expenditures	25.4		34.6	29.7
Enterprises providing ICT training	121.1		106.7	153.3
Innovators	**140.4**		**133.3**	**127.5**
SMEs product/process innovations	122.7		123.2	119.1
SMEs marketing/organizational innovations	165.3		144.2	141.1
SMEs innovating in-house	135.8		132.6	122.3
Linkages	**67.9**		**69.7**	**70.5**
Innovative SMEs collaborating with others	81.0		111.7	86.4
Public-private co-publications	129.0		88.9	151.4
Private co-funding of public R&D exp.	25.1		30.7	24.1
Intellectual assets	**157.6**		**152.9**	**153.3**
PCT patent applications	63.4		45.4	57.6
Trademark applications	241.4		269.0	269.0
Design applications	170.9		168.9	157.6
Employment impacts	**134.5**		**123.7**	**140.5**
Employment in knowledge-intensive activities	191.8		220.5	209.0
Employment fast-growing enterprises	89.9		53.7	91.0
Sales impacts	**81.2**		**98.7**	**83.6**
Medium and high-tech product exports	68.6		88.1	74.0
Knowledge-intensive services exports	147.2		146.1	151.8
Sales of new-to-market/firm innovations	17.1		56.6	16.6

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

Attractive research systems, *Intellectual assets* and *Innovators* are the strongest innovation dimensions. Luxembourg scores particularly well on Foreign doctorate students, Trademark applications, and International scientific co-publications. *Firm investments*, *Linkages* and *Sales impacts* are the weakest innovation dimensions. Overall, Luxembourg's lowest indicator scores comprise Sales of new-to-market and new-to-firm product innovations, Private co-funding of public R&D expenditures, and Non-R&D innovation expenditures.

Structural differences with the EU are shown in the table below. Most of Luxembourg's economic indicators are well above the EU average, including GDP per capita, the employment share in knowledge-intensive services, the turnover share of SMEs, the value-added share of foreign-controlled enterprises, FDI net inflows, and top R&D spending enterprises per 10 million population. The employment shares in manufacturing and in high and medium high-tech manufacturing, and the turnover share of large enterprises are well below the EU average.

	LU	EU
Performance and structure of the economy		
GDP per capita (PPS)	76,500	29,500
Average annual GDP growth (%)	2.1	2.2
Employment share manufacturing (NACE C) (%)	4.6	15.5
of which High and medium high-tech (%)	18.6	37.5
Employment share services (NACE G-N) (%)	46.5	41.8
of which Knowledge-intensive services (%)	58.6	35.0
Turnover share SMEs (%)	54.2	37.9
Turnover share large enterprises (%)	30.7	44.4
Foreign-controlled enterprises – share of value added (%)	20.3	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.1	1.5
Total Entrepreneurial Activity (TEA) (%)	9.7	6.7
FDI net inflows (% GDP)	35.7	4.3
Top R&D spending enterprises per 10 million population	277.5	19.6
Buyer sophistication (1 to 7 best)	4.9	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	68.8	76.9
Basic-school entrepren. education and training (1 to 5 best)	2.0	1.9
Govt. procurement of advanced tech products (1 to 7 best)	4.6	3.5
Rule of law (-2.5 to 2.5 best)	1.8	1.2
Demography		
Population size (millions)	0.6	511.3
Average annual population growth (%)	2.2	0.2
Population density (inhabitants/km2)	225.3	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.26	1.26	2.30
Tertiary educational attainment (% of population aged 30-34)	52.7	56.2	66.0

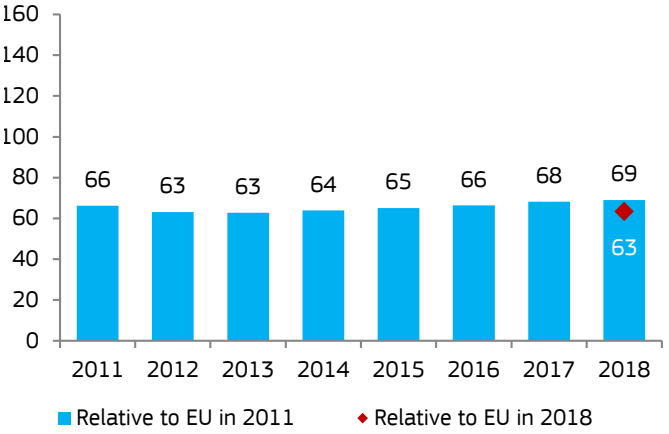
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Hungary is a **Moderate Innovator**. Over time, performance has increased relative to that of the EU in 2011.



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

Structural differences with the EU are shown in the table below. Average annual GDP growth, the value-added share of foreign-controlled enterprises, and FDI net inflows are well above the EU average. GDP per capita and top R&D spending enterprises per 10 million population are well below the EU average.

Hungary	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**63.4**		**66.2**	**69.0**
Human resources	**43.9**		**57.0**	**53.7**
New doctorate graduates	40.1		46.2	58.2
Population with tertiary education	41.9		61.9	50.0
Lifelong learning	52.0		62.5	53.1
Attractive research systems	**49.7**		**37.1**	**55.9**
International scientific co-publications	49.4		51.2	71.8
Most cited publications	45.8		35.2	50.2
Foreign doctorate students	56.9		30.5	54.4
Innovation-friendly environment	**91.5**		**68.8**	**144.7**
Broadband penetration	105.6		88.9	211.1
Opportunity-driven entrepreneurship	76.8		55.0	99.5
Finance and support	**42.2**		**36.5**	**46.2**
R&D expenditure in the public sector	33.4		47.7	30.9
Venture capital expenditures	49.7		23.2	64.2
Firm investments	**82.2**		**74.3**	**98.0**
R&D expenditure in the business sector	72.3		56.2	82.8
Non-R&D innovation expenditures	104.9		104.2	122.5
Enterprises providing ICT training	68.4		60.0	86.7
Innovators	**34.0**		**28.9**	**30.9**
SMEs product/process innovations	38.3		33.0	37.2
SMEs marketing/organizational innovations	31.7		34.0	27.1
SMEs innovating in-house	31.5		19.5	28.3
Linkages	**54.9**		**81.6**	**57.1**
Innovative SMEs collaborating with others	43.8		59.7	46.7
Public-private co-publications	59.9		45.6	70.3
Private co-funding of public R&D exp.	61.4		113.2	58.9
Intellectual assets	**41.2**		**36.6**	**40.1**
PCT patent applications	38.6		38.4	35.1
Trademark applications	57.0		51.9	63.5
Design applications	28.3		22.1	26.1
Employment impacts	**118.9**		**127.1**	**124.2**
Employment in knowledge-intensive activities	69.4		89.7	75.6
Employment fast-growing enterprises	157.4		154.0	159.2
Sales impacts	**81.6**		**111.1**	**84.1**
Medium and high-tech product exports	129.5		142.3	139.7
Knowledge-intensive services exports	59.2		61.4	61.1
Sales of new-to-market/firm innovations	46.0		131.4	44.6

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	19,900	29,500
Average annual GDP growth (%)	4.5	2.2
Employment share manufacturing (NACE C) (%)	21.9	15.5
of which High and medium high-tech (%)	43.4	37.5
Employment share services (NACE G-N) (%)	36.2	41.8
of which Knowledge-intensive services (%)	29.6	35.0
Turnover share SMEs (%)	37.8	37.9
Turnover share large enterprises (%)	43.3	44.4
Foreign-controlled enterprises – share of value added (%)	25.8	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.9	1.5
Total Entrepreneurial Activity (TEA) (%)	7.9	6.7
FDI net inflows (% GDP)	25.2	4.3
Top R&D spending enterprises per 10 million population	1.0	19.6
Buyer sophistication (1 to 7 best)	3.0	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	71.3	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.5	1.9
Govt. procurement of advanced tech products (1 to 7 best)	2.8	3.5
Rule of law (-2.5 to 2.5 best)	0.5	1.2
Demography		
Population size (millions)	9.8	511.3
Average annual population growth (%)	-0.3	0.2
Population density (inhabitants/km2)	107.6	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.35	1.35	1.80
Tertiary educational attainment (% of population aged 30-34)	34.1	33.7	34.0

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

European Semester country report and country specific recommendations:

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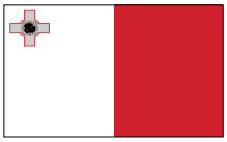
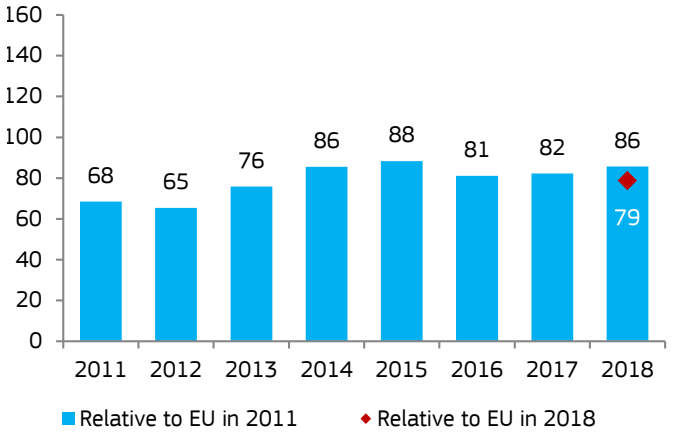
https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis



Malta is a **Moderate Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Intellectual assets, *Employment impacts* and *Innovation-friendly environment* are the strongest innovation dimensions. Malta scores high on Trademark applications, Design applications, and Employment in knowledge-intensive activities. Finance and support and Linkages are the weakest innovation dimensions. Low-scoring indicators include R&D expenditure in the public sector, Private co-funding of public R&D expenditures, and New doctorate graduates.

Structural differences with the EU are shown in the table below. The employment share in high and medium high-tech manufacturing and the turnover share of large enterprises are well below the EU average. Average annual GDP growth and FDI net inflows are well above the EU average

Malta	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	2018
SUMMARY INNOVATION INDEX	**78.7**		**68.4**	**85.7**
Human resources	**64.0**		**51.5**	**78.2**
New doctorate graduates	17.4		0.0	25.3
Population with tertiary education	90.6		56.0	108.2
Lifelong learning	96.9		99.0	99.0
Attractive research systems	**53.4**		**25.6**	**60.2**
International scientific co-publications	91.1		46.3	132.6
Most cited publications	30.3		25.5	33.2
Foreign doctorate students	56.8		12.1	54.3
Innovation-friendly environment §	**131.0**		**108.0**	**207.1**
Broadband penetration	127.8		133.3	255.6
Opportunity-driven entrepreneurship	N/A		N/A	N/A
Finance and support §	**4.7**		**11.2**	**5.2**
R&D expenditure in the public sector	5.1		10.4	4.8
Venture capital expenditures	N/A		N/A	N/A
Firm investments	**83.9**		**98.3**	**100.0**
R&D expenditure in the business sector	23.6		29.6	27.0
Non-R&D innovation expenditures	107.7		136.7	125.8
Enterprises providing ICT training	115.8		126.7	146.7
Innovators	**59.3**		**59.4**	**53.8**
SMEs product/process innovations	55.5		66.4	53.9
SMEs marketing/organizational innovations	61.1		51.4	52.2
SMEs innovating in-house	61.6		60.4	55.4
Linkages	**16.0**		**24.7**	**16.6**
Innovative SMEs collaborating with others	19.9		40.0	21.2
Public-private co-publications	25.9		31.9	30.4
Private co-funding of public R&D exp.	7.6		10.5	7.3
Intellectual assets	**174.5**		**70.0**	**169.7**
PCT patent applications	46.8		7.0	42.6
Trademark applications	241.4		211.1	269.0
Design applications	238.4		19.8	219.8
Employment impacts	**151.0**		**123.4**	**157.7**
Employment in knowledge-intensive activities	156.5		132.1	170.5
Employment fast-growing enterprises	146.7		117.2	148.4
Sales impacts	**74.9**		**100.6**	**77.2**
Medium and high-tech product exports	96.0		88.2	103.6
Knowledge-intensive services exports	71.3		97.1	73.5
Sales of new-to-market/firm innovations	51.6		119.3	50.1

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	28,100	29,500
Average annual GDP growth (%)	6.6	2.2
Employment share manufacturing (NACE C) (%)	12.0	15.5
of which High and medium high-tech (%)	29.6	37.5
Employment share services (NACE G-N) (%)	47.3	41.8
of which Knowledge-intensive services (%)	37.3	35.0
Turnover share SMEs (%)	45.8	37.9
Turnover share large enterprises (%)	16.8	44.4
Foreign-controlled enterprises – share of value added (%)	11.7	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	2.0	1.5
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	25.9	4.3
Top R&D spending enterprises per 10 million population	22.2	19.6
Buyer sophistication (1 to 7 best)	3.5	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	64.0	76.8
Basic-school entrepren. education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.7	3.5
Rule of law (-2.5 to 2.5 best)	1.1	1.2
Demography		
Population size (millions)	0.5	511.3
Average annual population growth (%)	2.8	0.2
Population density (inhabitants/km2)	1451.3	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.71	0.54	2.00
Tertiary educational attainment (% of population aged 30-34)	28.6	34.2	33.0

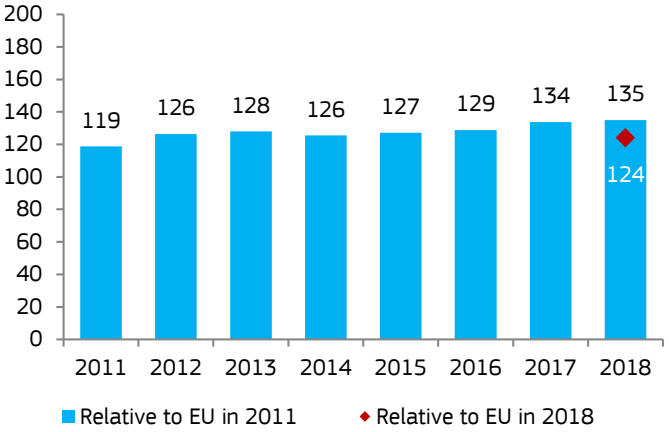
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

The Netherlands is an **Innovation Leader**. Over time, performance has increased relative to that of the EU in 2011.



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, and Public-private co-publications. *Firm investments* and *Sales impacts* 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, and Medium and high-tech product exports.

Structural differences with the EU are shown in the table below. The Netherlands scores high on various economic indicators. GDP per capita, the turnover share of SMEs, total entrepreneurial activity, FDI net inflows, and top R&D spending enterprises per 10 million population are well above the EU average. The employment share in high and medium high-tech manufacturing and enterprise births are well below the EU average.

Netherlands	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**124.0**		**118.9**	**135.0**
Human resources	**142.1**		**152.8**	**173.7**
New doctorate graduates	107.9		130.8	156.7
Population with tertiary education	148.1		153.0	176.9
Lifelong learning	183.7		175.0	187.5
Attractive research systems	**170.0**		**172.4**	**191.4**
International scientific co-publications	191.8		198.4	279.0
Most cited publications	142.5		154.5	156.0
Foreign doctorate students	197.4		183.1	188.7
Innovation-friendly environment	**166.6**		**196.4**	**263.4**
Broadband penetration	172.2		166.7	344.4
Opportunity-driven entrepreneurship	160.7		216.7	208.2
Finance and support	**118.4**		**107.2**	**129.4**
R&D expenditure in the public sector	128.3		122.4	118.7
Venture capital expenditures	110.0		89.2	142.2
Firm investments	**71.2**		**81.9**	**84.9**
R&D expenditure in the business sector	85.8		88.8	98.3
Non-R&D innovation expenditures	13.9		77.0	16.2
Enterprises providing ICT training	115.8		80.0	146.7
Innovators	**125.7**		**76.8**	**114.1**
SMEs product/process innovations	153.3		87.0	148.8
SMEs marketing/organizational innovations	84.0		61.5	71.7
SMEs innovating in-house	135.4		81.9	122.0
Linkages	**143.5**		**149.0**	**149.1**
Innovative SMEs collaborating with others	124.5		118.0	132.9
Public-private co-publications	187.1		227.8	219.5
Private co-funding of public R&D exp.	136.1		137.8	130.6
Intellectual assets	**124.3**		**120.2**	**120.8**
PCT patent applications	156.5		149.5	142.3
Trademark applications	117.4		124.0	130.8
Design applications	98.2		86.7	90.5
Employment impacts	**113.8**		**120.5**	**118.8**
Employment in knowledge-intensive activities	134.1		146.2	146.2
Employment fast-growing enterprises	98.0		102.0	99.1
Sales impacts	**92.7**		**84.3**	**95.5**
Medium and high-tech product exports	82.6		71.2	89.1
Knowledge-intensive services exports	118.9		122.0	122.7
Sales of new-to-market/firm innovations	74.0		56.4	71.8

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	37,900	29,500
Average annual GDP growth (%)	2.7	2.2
Employment share manufacturing (NACE C) (%)	10.3	15.5
of which High and medium high-tech (%)	30.3	37.5
Employment share services (NACE G-N) (%)	46.5	41.8
of which Knowledge-intensive services (%)	39.6	35.0
Turnover share SMEs (%)	47.7	37.9
Turnover share large enterprises (%)	37.3	44.4
Foreign-controlled enterprises – share of value added (%)	13.5	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.9	1.5
Total Entrepreneurial Activity (TEA) (%)	11.1	6.7
FDI net inflows (% GDP)	27.7	4.3
Top R&D spending enterprises per 10 million population	29.0	19.6
Buyer sophistication (1 to 7 best)	4.4	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	75.7	76.8
Basic-school entrepren. education and training (1 to 5 best)	3.3	1.9
Govt. procurement of advanced tech products (1 to 7 best)	4.0	3.5
Rule of law (-2.5 to 2.5 best)	1.9	1.2
Demography		
Population size (millions)	17.1	511.3
Average annual population growth (%)	0.6	0.2
Population density (inhabitants/km2)	500.8	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.98	1.99	2.50
Tertiary educational attainment (% of population aged 30-34)	44.8	49.4	40.0

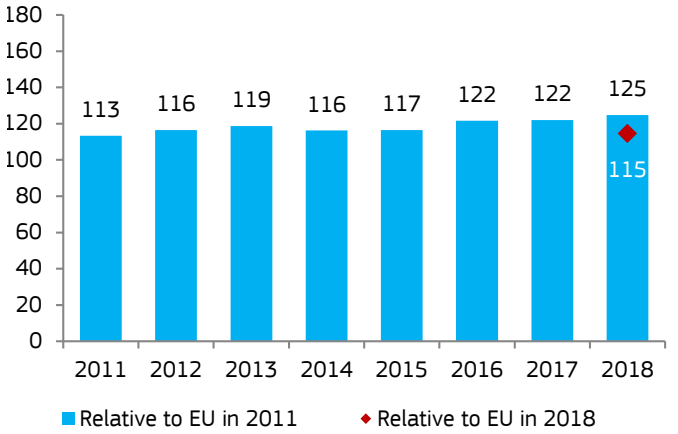
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Austria is a **Strong Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Linkages, Innovators and *Intellectual assets* are the strongest innovation dimensions. Austria scores particularly well on Public-private co-publications, Innovative SMEs collaborating with others, and International scientific co-publications. *Employment impacts*, *Innovation-friendly-environment* and *Sales impacts* are the weakest innovation dimensions. Austria's lowest indicator scores are on Venture capital expenditures, Employment fast-growing enterprises of innovative sectors, and Knowledge-intensive services exports.

Structural differences with the EU are shown in the table below. GDP per capita, the turnover share of SMEs, total entrepreneurial activity, and top R&D spending enterprises per 10 million population are well above the EU average. The turnover share of large enterprises, enterprise births, and FDI net inflows are well below the EU average.

Austria	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	2018
SUMMARY INNOVATION INDEX	**114.7**		**113.4**	**124.8**
Human resources	**116.7**		**133.6**	**142.6**
New doctorate graduates	105.7		161.5	153.5
Population with tertiary education	103.1		109.0	123.1
Lifelong learning	150.0		132.3	153.1
Attractive research systems	**131.0**		**121.5**	**147.5**
International scientific co-publications	166.4		178.6	242.0
Most cited publications	100.5		101.6	110.1
Foreign doctorate students	149.9		114.6	143.3
Innovation-friendly environment	**78.5**		**129.9**	**124.0**
Broadband penetration	77.8		133.3	155.6
Opportunity-driven entrepreneurship	79.2		127.5	102.5
Finance and support	**84.4**		**86.6**	**92.3**
R&D expenditure in the public sector	148.4		122.4	137.4
Venture capital expenditures	30.1		44.1	38.9
Firm investments	**116.2**		**130.0**	**138.6**
R&D expenditure in the business sector	164.4		158.4	188.4
Non-R&D innovation expenditures	67.3		70.3	78.6
Enterprises providing ICT training	121.1		166.7	153.3
Innovators	**149.9**		**114.9**	**136.2**
SMEs product/process innovations	140.3		116.2	136.2
SMEs marketing/organizational innovations	158.9		109.6	135.6
SMEs innovating in-house	151.8		118.9	136.7
Linkages	**165.7**		**132.1**	**172.1**
Innovative SMEs collaborating with others	196.2		135.4	209.5
Public-private co-publications	250.2		226.2	293.6
Private co-funding of public R&D exp.	96.4		89.1	92.5
Intellectual assets	**145.8**		**157.1**	**141.8**
PCT patent applications	133.5		127.4	121.4
Trademark applications	148.4		170.2	165.3
Design applications	155.9		177.0	143.8
Employment impacts	**65.0**		**75.0**	**67.9**
Employment in knowledge-intensive activities	109.4		111.5	119.2
Employment fast-growing enterprises	30.5		48.6	30.8
Sales impacts	**83.1**		**71.2**	**85.6**
Medium and high-tech product exports	102.8		100.9	110.9
Knowledge-intensive services exports	51.2		32.9	52.8
Sales of new-to-market/firm innovations	96.2		80.1	93.3

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	37,700	29,500
Average annual GDP growth (%)	2.6	2.2
Employment share manufacturing (NACE C) (%)	15.9	15.5
of which High and medium high-tech (%)	38.1	37.5
Employment share services (NACE G-N) (%)	41.8	41.8
of which Knowledge-intensive services (%)	32.1	35.0
Turnover share SMEs (%)	48.4	37.9
Turnover share large enterprises (%)	34.3	44.4
Foreign-controlled enterprises – share of value added (%)	13.9	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.3	1.5
Total Entrepreneurial Activity (TEA) (%)	10.3	6.7
FDI net inflows (% GDP)	-1.9	4.3
Top R&D spending enterprises per 10 million population	34.2	19.6
Buyer sophistication (1 to 7 best)	3.8	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	78.6	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.5	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.4	3.5
Rule of law (-2.5 to 2.5 best)	1.8	1.2
Demography		
Population size (millions)	8.8	511.3
Average annual population growth (%)	0.7	0.2
Population density (inhabitants/km2)	105.9	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	3.08	3.16	3.76
Tertiary educational attainment (% of population aged 30-34)	40.0	40.7	38.0

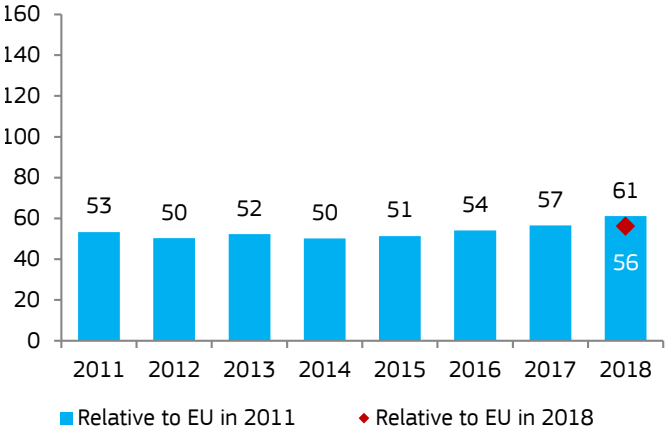
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Poland is a **Moderate Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Innovation-friendly environment and *Employment impacts* are the strongest innovation dimensions. Poland scores high on Opportunity-driven entrepreneurship, Design applications, and Population with tertiary education. *Innovators*, *Attractive research systems* and *Linkages* are the weakest innovation dimensions. Low-scoring indicators include SMEs with marketing or organizational innovations, Foreign doctorate students, and PCT patent applications.

Structural differences with the EU are shown in the table below. Average annual GDP growth, the employment share in manufacturing, and enterprise births are well above the EU average. GDP per capita, the employment share in high and medium high-tech manufacturing, FDI net inflows, and top R&D spending enterprises per 10 million population are well below the EU average.

Poland	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**56.1**		**53.3**	**61.1**
Human resources	**57.6**		**67.9**	**70.4**
New doctorate graduates	18.3		23.1	26.5
Population with tertiary education	123.1		140.3	147.0
Lifelong learning	29.6		33.3	30.2
Attractive research systems	**30.7**		**17.2**	**34.6**
International scientific co-publications	32.3		23.7	47.0
Most cited publications	42.1		19.0	46.1
Foreign doctorate students	8.7		10.1	8.3
Innovation-friendly environment	**125.2**		**42.1**	**197.9**
Broadband penetration	116.7		77.8	233.3
Opportunity-driven entrepreneurship	134.1		17.8	173.7
Finance and support	**35.7**		**50.9**	**39.1**
R&D expenditure in the public sector	35.4		64.5	32.8
Venture capital expenditures	36.0		34.7	46.6
Firm investments	**73.2**		**71.6**	**87.3**
R&D expenditure in the business sector	48.3		14.2	55.4
Non-R&D innovation expenditures	121.5		153.8	141.9
Enterprises providing ICT training	47.4		40.0	60.0
Innovators	**16.5**		**29.4**	**15.0**
SMEs product/process innovations	26.3		35.7	25.5
SMEs marketing/organizational innovations	2.5		27.7	2.1
SMEs innovating in-house	19.1		24.8	17.2
Linkages	**31.2**		**46.7**	**32.4**
Innovative SMEs collaborating with others	30.8		52.1	32.8
Public-private co-publications	23.1		9.4	27.1
Private co-funding of public R&D exp.	35.8		58.7	34.3
Intellectual assets	**69.3**		**51.6**	**67.4**
PCT patent applications	14.7		11.8	13.4
Trademark applications	70.6		51.6	78.7
Design applications	123.6		92.8	114.0
Employment impacts	**92.4**		**91.1**	**96.5**
Employment in knowledge-intensive activities	54.1		42.3	59.0
Employment fast-growing enterprises	122.2		126.3	123.6
Sales impacts	**54.5**		**66.9**	**56.1**
Medium and high-tech product exports	79.8		88.7	86.0
Knowledge-intensive services exports	45.6		45.2	47.1
Sales of new-to-market/firm innovations	32.0		66.2	31.0

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	20,200	29,500
Average annual GDP growth (%)	5.0	2.2
Employment share manufacturing (NACE C) (%)	20.2	15.5
of which High and medium high-tech (%)	28.0	37.5
Employment share services (NACE G-N) (%)	34.9	41.8
of which Knowledge-intensive services (%)	29.7	35.0
Turnover share SMEs (%)	34.8	37.9
Turnover share large enterprises (%)	44.1	44.4
Foreign-controlled enterprises – share of value added (%)	13.3	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.9	1.5
Total Entrepreneurial Activity (TEA) (%)	8.3	6.7
FDI net inflows (% GDP)	3.0	4.3
Top R&D spending enterprises per 10 million population	0.6	19.6
Buyer sophistication (1 to 7 best)	3.3	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	76.9	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.6	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.0	3.5
Rule of law (-2.5 to 2.5 best)	0.6	1.2
Demography		
Population size (millions)	38.0	511.3
Average annual population growth (%)	0.0	0.2
Population density (inhabitants/km2)	123.6	117.5

EU targets for 2020

Indicator	2013	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.94	1.03	1.70
Tertiary educational attainment (% of population aged 30-34)	42.1	45.7	45.0

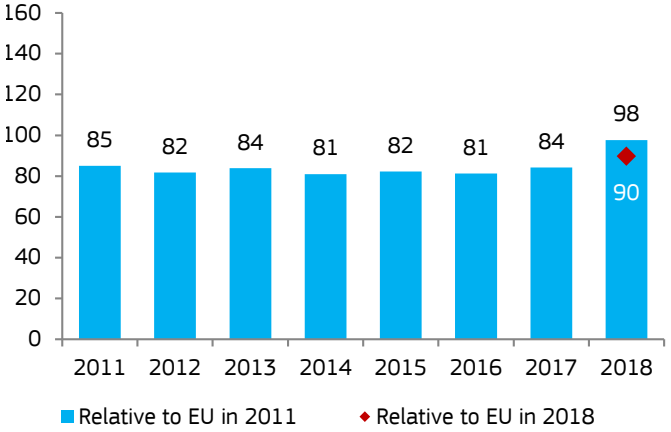
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

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



Innovators, *Innovation-friendly environment* and *Attractive research systems* are the strongest innovation dimensions. Portugal scores particularly well on SMEs innovating in-house, Broadband penetration, and SMEs with product or process innovations. *Sales impacts* and *Linkages* are the weakest innovation dimensions. Portugal's lowest indicator scores comprise PCT patent applications, Public-private co-publications, and Knowledge-intensive services exports.

Structural differences with the EU are shown in the table below. In general, economic indicators tend to be close to the EU average. Notable exceptions are the employment share in high and medium high-tech manufacturing and top R&D spending enterprises per 10 million population, which are well below the EU average.

Portugal	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	2018
SUMMARY INNOVATION INDEX	**89.7**		**85.0**	**97.6**
Human resources	**80.3**		**97.4**	**98.1**
New doctorate graduates	86.4		130.8	125.4
Population with tertiary education	66.9		56.7	79.9
Lifelong learning	88.8		108.3	90.6
Attractive research systems	**103.2**		**87.8**	**116.2**
International scientific co-publications	116.4		98.2	169.3
Most cited publications	84.7		100.0	92.8
Foreign doctorate students	123.1		61.6	117.7
Innovation-friendly environment	**129.8**		**122.4**	**205.1**
Broadband penetration	177.8		144.4	355.6
Opportunity-driven entrepreneurship	79.3		107.3	102.7
Finance and support	**75.8**		**84.8**	**82.9**
R&D expenditure in the public sector	91.9		92.5	85.1
Venture capital expenditures	62.1		75.6	80.2
Firm investments	**81.4**		**91.5**	**97.0**
R&D expenditure in the business sector	48.3		57.9	55.4
Non-R&D innovation expenditures	114.1		97.0	133.2
Enterprises providing ICT training	78.9		120.0	100.0
Innovators	**171.4**		**125.2**	**155.6**
SMEs product/process innovations	174.9		146.1	169.8
SMEs marketing/organizational innovations	146.8		113.2	125.2
SMEs innovating in-house	191.1		116.2	172.1
Linkages	**55.6**		**65.3**	**57.7**
Innovative SMEs collaborating with others	80.1		121.4	85.5
Public-private co-publications	38.3		37.4	45.0
Private co-funding of public R&D exp.	44.6		36.3	42.8
Intellectual assets	**74.8**		**60.1**	**72.7**
PCT patent applications	25.7		16.9	23.4
Trademark applications	108.3		76.5	120.7
Design applications	91.6		91.4	84.4
Employment impacts	**78.2**		**48.9**	**81.7**
Employment in knowledge-intensive activities	57.6		43.6	62.8
Employment fast-growing enterprises	94.3		52.8	95.3
Sales impacts	**54.5**		**71.8**	**56.2**
Medium and high-tech product exports	57.3		52.5	61.8
Knowledge-intensive services exports	41.0		47.4	42.3
Sales of new-to-market/firm innovations	67.5		122.8	65.5

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	22,600	29,500
Average annual GDP growth (%)	2.5	2.2
Employment share manufacturing (NACE C) (%)	17.1	15.5
of which High and medium high-tech (%)	18.4	37.5
Employment share services (NACE G-N) (%)	41.3	41.8
of which Knowledge-intensive services (%)	30.8	35.0
Turnover share SMEs (%)	n/a	37.9
Turnover share large enterprises (%)	n/a	44.4
Foreign-controlled enterprises – share of value added (%)	9.5	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.6	1.5
Total Entrepreneurial Activity (TEA) (%)	8.2	6.7
FDI net inflows (% GDP)	3.5	4.3
Top R&D spending enterprises per 10 million population	4.2	19.6
Buyer sophistication (1 to 7 best)	3.6	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	76.6	76.8
Basic-school entrepren. education and training (1 to 5 best)	2.1	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.5	3.5
Rule of law (-2.5 to 2.5 best)	1.1	1.2
Demography		
Population size (millions)	10.3	511.3
Average annual population growth (%)	-0.2	0.2
Population density (inhabitants/km2)	113.0	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.29	1.33	2.70
Tertiary educational attainment (% of population aged 30-34)	31.3	33.5	40.0

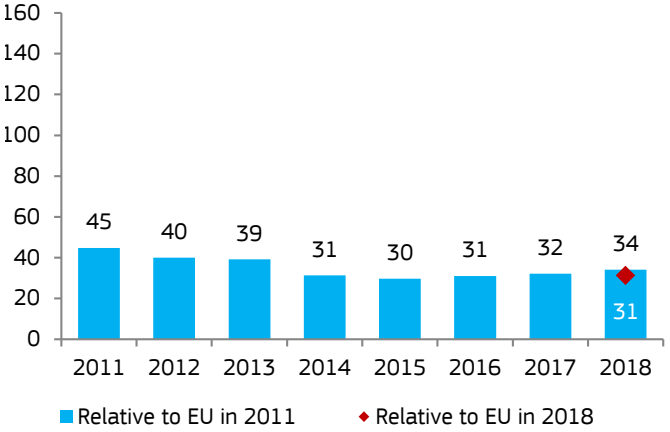
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Romania is a **Modest Innovator**. Over time, performance has declined relative to that of the EU in 2011, but after a strong decline between 2011 and 2015, performance has started to increase after 2015.



Innovation-friendly environment and *Sales impacts* are the strongest innovation dimensions. Broadband penetration scores high above the EU average, Medium and high-tech product exports is the only other indicator showing above 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 in 2018 across all countries resulting in a relative score to the EU of 0.

Romania	Relative to EU 2018 in	Performance relative to EU 2011 in	
	2018	2011	2018
SUMMARY INNOVATION INDEX	**31.4**	**44.8**	**34.1**
Human resources	**13.7**	**40.3**	**16.7**
New doctorate graduates	28.1	107.7	40.8
Population with tertiary education	8.1	11.9	9.7
Lifelong learning	0.0	3.1	0.0
Attractive research systems	**24.2**	**14.3**	**27.2**
International scientific co-publications	18.8	15.7	27.3
Most cited publications	29.1	14.7	31.9
Foreign doctorate students	20.7	12.8	19.8
Innovation-friendly environment	**76.9**	**75.4**	**121.6**
Broadband penetration	116.7	111.1	233.3
Opportunity-driven entrepreneurship	35.2	51.0	45.5
Finance and support	**26.9**	**31.7**	**29.4**
R&D expenditure in the public sector	5.1	23.4	4.8
Venture capital expenditures	45.4	41.6	58.7
Firm investments	**9.1**	**61.9**	**10.9**
R&D expenditure in the business sector	19.9	13.3	22.8
Non-R&D innovation expenditures	3.1	163.3	3.6
Enterprises providing ICT training	5.3	0.0	6.7
Innovators	**0.0**	**42.5**	**0.0**
SMEs product/process innovations	0.0	37.4	0.0
SMEs marketing/organizational innovations	0.0	52.0	0.0
SMEs innovating in-house	0.0	38.0	0.0
Linkages	**39.3**	**53.7**	**40.8**
Innovative SMEs collaborating with others	4.8	10.7	5.1
Public-private co-publications	20.8	19.9	24.5
Private co-funding of public R&D exp.	77.0	99.7	73.9
Intellectual assets	**23.0**	**13.2**	**22.3**
PCT patent applications	6.5	4.2	5.9
Trademark applications	31.2	27.1	34.8
Design applications	31.6	11.2	29.1
Employment impacts	**46.3**	**18.7**	**48.4**
Employment in knowledge-intensive activities	23.5	3.8	25.6
Employment fast-growing enterprises	64.1	29.4	64.8
Sales impacts	**61.6**	**84.0**	**63.5**
Medium and high-tech product exports	102.2	91.1	110.3
Knowledge-intensive services exports	54.9	48.9	56.6
Sales of new-to-market/firm innovations	16.3	115.9	15.8

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; orange: below 50%. Normalised performance uses the data after a possible imputation of missing data and transformation of the data.

Structural differences with the EU are shown in the table below. Many of the economic indicators in Romania tend to be closely above or beneath the EU value. However, GDP per capita, the employment share in services and top R&D spending enterprises per 10 million population are well below the EU average. Average annual GDP growth, enterprise births, and total entrepreneurial activity are well above the EU average.

	RO	EU
Performance and structure of the economy		
GDP per capita (PPS)	17,500	29,500
Average annual GDP growth (%)	5.5	2.2
Employment share manufacturing (NACE C) (%)	18.8	15.5
of which High and medium high-tech (%)	30.7	37.5
Employment share services (NACE G-N) (%)	30.6	41.8
of which Knowledge-intensive services (%)	27.6	35.0
Turnover share SMEs (%)	42.6	37.9
Turnover share large enterprises (%)	41.5	44.4
Foreign-controlled enterprises – share of value added (%)	15.6	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	2.8	1.5
Total Entrepreneurial Activity (TEA) (%)	10.8	6.7
FDI net inflows (% GDP)	2.9	4.3
Top R&D spending enterprises per 10 million population	0.2	19.6
Buyer sophistication (1 to 7 best)	2.8	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	72.7	76.8
Basic-school entrepren. education and training (1 to 5 best)	2.4	1.9
Govt. procurement of advanced tech products (1 to 7 best)	2.5	3.5
Rule of law (-2.5 to 2.5 best)	0.3	1.2
Demography		
Population size (millions)	19.6	511.3
Average annual population growth (%)	-0.6	0.2
Population density (inhabitants/km2)	85.1	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.38	0.50	2.00
Tertiary educational attainment (% of population aged 30-34)	25.0	24.6	26.7

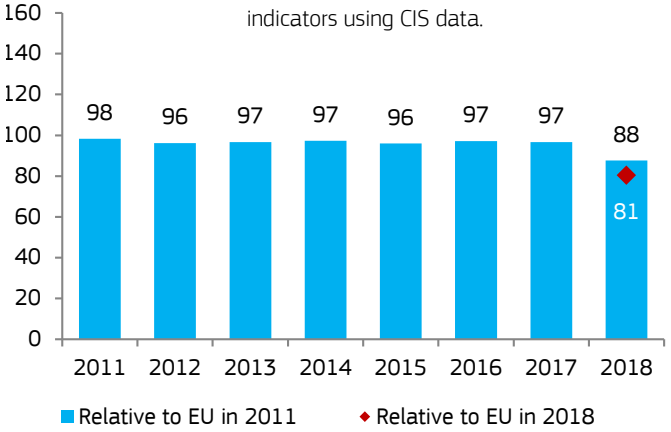
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Slovenia is a **Moderate Innovator.** Over time, performance has declined relative to that of the EU in 2011. The strong decrease in 2018 is explained by worsened performance for New doctorate graduates and the indicators using CIS data.



Firm investments, *Human resources* and *Linkages*, are the strongest innovation dimensions. Slovenia scores high on International scientific co-publications, Enterprises providing ICT training, and Trademark applications. *Finance and support*, *Sales impacts* and *Innovators* are the weakest innovation dimensions. Low-scoring indicators include Venture capital expenditures, Knowledge-intensive services exports, and Foreign doctorate students.

Structural differences with the EU are shown in the table below. Average annual GDP growth, the employment share in manufacturing and the turnover share of SMEs are well above the EU average. The turnover share of large enterprises, enterprise births, FDI net inflows, and top R&D spending enterprises per 10 million population are well below the EU average.

Slovenia	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**80.5**		**98.2**	**87.6**
Human resources	**103.0**		**121.1**	**126.0**
New doctorate graduates	92.3		100.0	134.0
Population with tertiary education	108.8		106.0	129.9
Lifelong learning	111.2		159.4	113.5
Attractive research systems	**78.7**		**65.6**	**88.7**
International scientific co-publications	142.1		139.9	206.7
Most cited publications	62.7		50.8	68.7
Foreign doctorate students	43.3		39.4	41.4
Innovation-friendly environment	**88.7**		**162.5**	**140.3**
Broadband penetration	105.6		144.4	211.1
Opportunity-driven entrepreneurship	71.0		174.7	92.0
Finance and support	**28.5**		**51.5**	**31.2**
R&D expenditure in the public sector	57.6		85.1	53.3
Venture capital expenditures	3.9		11.8	5.0
Firm investments	**106.1**		**137.4**	**126.4**
R&D expenditure in the business sector	102.2		151.5	117.2
Non-R&D innovation expenditures	84.5		109.8	98.6
Enterprises providing ICT training	131.6		153.3	166.7
Innovators	**68.4**		**87.6**	**62.1**
SMEs product/process innovations	68.2		84.9	66.2
SMEs marketing/organizational innovations	65.7		98.1	56.0
SMEs innovating in-house	71.3		79.7	64.2
Linkages	**100.6**		**133.6**	**104.5**
Innovative SMEs collaborating with others	103.1		130.8	110.1
Public-private co-publications	117.2		198.7	137.5
Private co-funding of public R&D exp.	89.8		107.6	86.2
Intellectual assets	**81.4**		**93.8**	**79.2**
PCT patent applications	52.9		79.1	48.1
Trademark applications	127.8		129.8	142.4
Design applications	64.6		79.5	59.5
Employment impacts	**81.7**		**69.1**	**85.3**
Employment in knowledge-intensive activities	94.1		98.7	102.6
Employment fast-growing enterprises	72.0		47.7	72.8
Sales impacts	**66.9**		**86.3**	**68.9**
Medium and high-tech product exports	102.6		102.2	110.7
Knowledge-intensive services exports	37.1		31.8	38.3
Sales of new-to-market/firm innovations	56.4		130.1	54.7

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	24,500	29,500
Average annual GDP growth (%)	4.7	2.2
Employment share manufacturing (NACE C) (%)	24.9	15.5
of which High and medium high-tech (%)	39.0	37.5
Employment share services (NACE G-N) (%)	35.9	41.8
of which Knowledge-intensive services (%)	34.5	35.0
Turnover share SMEs (%)	46.7	37.9
Turnover share large enterprises (%)	31.9	44.4
Foreign-controlled enterprises – share of value added (%)	13.0	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.0	1.5
Total Entrepreneurial Activity (TEA) (%)	7.1	6.7
FDI net inflows (% GDP)	3.2	4.3
Top R&D spending enterprises per 10 million population	11.3	19.6
Buyer sophistication (1 to 7 best)	3.3	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	74.7	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.9	1.9
Govt. procurement of advanced tech products (1 to 7 best)	2.6	3.5
Rule of law (-2.5 to 2.5 best)	1.0	1.2
Demography		
Population size (millions)	2.1	511.3
Average annual population growth (%)	0.1	0.2
Population density (inhabitants/km2)	102.5	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	2.37	1.86	3.00
Tertiary educational attainment (% of population aged 30-34)	41.0	42.7	40.0

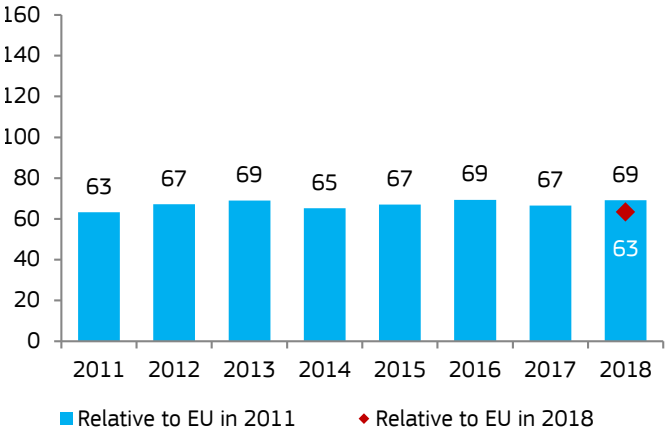
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Slovakia is a **Moderate Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Sales impacts and *Employment impacts* are the strongest innovation dimensions. Slovakia scores particularly well on Sales of new-to-market and new-to-firm product innovations, Employment fast-growing enterprises of innovative sectors, and Medium and high-tech product exports. *Finance and support*, *Intellectual assets* and *Attractive research systems* are the weakest innovation dimensions. Overall, Slovakia's lowest indicator scores comprise Venture capital expenditures, PCT patent applications, and Lifelong learning.

Structural differences with the EU are shown in the table below. Average annual GDP growth, the employment share in manufacturing, the value-added share of foreign-controlled enterprises, and total entrepreneurial activity are well above the EU average. The employment shares in services and in knowledge-intensive services, and top R&D spending enterprises per 10 million population are well below the EU average.

Slovakia	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**63.5**		**63.3**	**69.1**
Human resources	**70.4**		**101.0**	**86.1**
New doctorate graduates	95.4		230.8	138.5
Population with tertiary education	78.8		44.8	94.0
Lifelong learning	23.5		31.3	24.0
Attractive research systems	**41.5**		**28.7**	**46.7**
International scientific co-publications	57.8		52.1	84.1
Most cited publications	31.8		15.5	34.9
Foreign doctorate students	42.4		34.0	40.5
Innovation-friendly environment	**57.5**		**63.4**	**90.9**
Broadband penetration	72.2		88.9	144.4
Opportunity-driven entrepreneurship	42.0		46.0	54.4
Finance and support	**23.8**		**21.4**	**26.1**
R&D expenditure in the public sector	43.5		30.9	40.2
Venture capital expenditures	7.2		10.1	9.3
Firm investments	**66.9**		**84.9**	**79.7**
R&D expenditure in the business sector	34.1		20.2	39.1
Non-R&D innovation expenditures	90.2		101.5	105.4
Enterprises providing ICT training	73.7		133.3	93.3
Innovators	**41.7**		**44.1**	**37.9**
SMEs product/process innovations	44.1		41.1	42.8
SMEs marketing/organizational innovations	37.8		60.6	32.3
SMEs innovating in-house	42.7		30.3	38.4
Linkages	**57.9**		**51.1**	**60.1**
Innovative SMEs collaborating with others	65.6		45.8	70.1
Public-private co-publications	32.7		30.8	38.4
Private co-funding of public R&D exp.	64.8		63.6	62.2
Intellectual assets	**39.8**		**28.2**	**38.7**
PCT patent applications	17.9		9.9	16.3
Trademark applications	59.8		49.2	66.6
Design applications	42.2		30.0	38.9
Employment impacts	**108.5**		**117.7**	**113.3**
Employment in knowledge-intensive activities	57.6		60.3	62.8
Employment fast-growing enterprises	148.1		159.2	149.8
Sales impacts	**111.2**		**92.2**	**114.5**
Medium and high-tech product exports	128.6		119.1	138.7
Knowledge-intensive services exports	40.6		35.9	41.9
Sales of new-to-market/firm innovations	174.5		125.0	169.3

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	22,600	29,500
Average annual GDP growth (%)	3.6	2.2
Employment share manufacturing (NACE C) (%)	24.6	15.5
of which High and medium high-tech (%)	44.1	37.5
Employment share services (NACE G-N) (%)	34.1	41.8
of which Knowledge-intensive services (%)	28.6	35.0
Turnover share SMEs (%)	35.5	37.9
Turnover share large enterprises (%)	43.6	44.4
Foreign-controlled enterprises – share of value added (%)	19.4	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.7	1.5
Total Entrepreneurial Activity (TEA) (%)	11.1	6.7
FDI net inflows (% GDP)	n/a	4.3
Top R&D spending enterprises per 10 million population	0.0	19.6
Buyer sophistication (1 to 7 best)	2.9	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	74.7	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.9	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.1	3.5
Rule of law (-2.5 to 2.5 best)	n/a	1.2
Demography		
Population size (millions)	5.4	511.3
Average annual population growth (%)	0.2	0.2
Population density (inhabitants/km2)	111.3	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	0.88	0.88	1.20
Tertiary educational attainment (% of population aged 30-34)	26.9	37.7	40.0

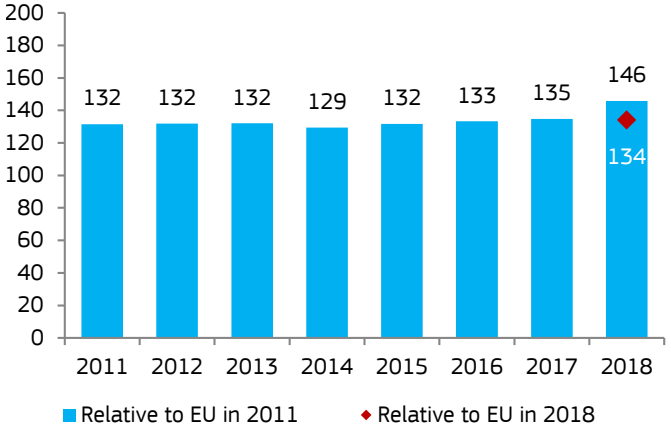
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Finland is an **Innovation Leader**. Over time, performance has increased relative to that of the EU in 2011. The strong increase in 2018 is almost entirely explained by improved performance on the indicators using CIS data.



Innovation-friendly environment, *Innovators* and *Human resources* are the strongest innovation dimensions. Performance on Lifelong learning, PCT patent applications, and International scientific co-publications is well above the EU average. *Employment impacts* and *Sales impacts* are the weakest innovation dimensions. Finland's lowest indicator scores are on Employment fast-growing enterprises of innovative sectors, Medium and high-tech product exports, and Venture capital expenditures.

Structural differences with the EU are shown in the table below. All indicators are close to the EU average, except for the share of enterprise births, which is well below the EU average, and top R&D spending enterprises per 10 million population, which is well above the EU average.

Finland	Relative to EU 2018 in 2018	Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**134.0**	**131.6**	**145.9**
Human resources	**157.0**	**176.8**	**192.0**
New doctorate graduates	128.8	184.6	187.0
Population with tertiary education	102.5	123.1	122.4
Lifelong learning	268.4	228.1	274.0
Attractive research systems	**135.4**	**108.6**	**152.5**
International scientific co-publications	202.8	199.4	295.0
Most cited publications	112.8	107.9	123.5
Foreign doctorate students	107.8	49.0	103.1
Innovation-friendly environment	**182.3**	**161.2**	**288.1**
Broadband penetration	177.8	222.2	355.6
Opportunity-driven entrepreneurship	187.0	119.6	242.2
Finance and support	**113.6**	**158.5**	**124.2**
R&D expenditure in the public sector	152.5	161.6	141.1
Venture capital expenditures	80.6	154.8	104.3
Firm investments	**129.8**	**174.1**	**154.7**
R&D expenditure in the business sector	133.0	220.2	152.4
Non-R&D innovation expenditures	88.9	83.5	103.8
Enterprises providing ICT training	168.4	226.7	213.3
Innovators	**168.2**	**111.2**	**152.7**
SMEs product/process innovations	174.9	124.5	169.8
SMEs marketing/organizational innovations	136.6	71.3	116.6
SMEs innovating in-house	191.1	138.2	172.1
Linkages	**152.0**	**158.1**	**157.9**
Innovative SMEs collaborating with others	189.1	141.4	201.9
Public-private co-publications	202.2	234.6	237.2
Private co-funding of public R&D exp.	95.3	137.3	91.5
Intellectual assets	**151.8**	**142.4**	**147.6**
PCT patent applications	219.4	212.8	199.5
Trademark applications	137.1	115.4	152.7
Design applications	97.5	91.8	89.9
Employment impacts	**80.2**	**86.4**	**83.7**
Employment in knowledge-intensive activities	123.5	121.8	134.6
Employment fast-growing enterprises	46.5	60.8	47.0
Sales impacts	**85.4**	**80.2**	**88.0**
Medium and high-tech product exports	67.5	67.2	72.9
Knowledge-intensive services exports	106.6	56.4	109.9
Sales of new-to-market/firm innovations	83.1	123.1	80.6

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	32,100	29,500
Average annual GDP growth (%)	2.5	2.2
Employment share manufacturing (NACE C) (%)	13.4	15.5
of which High and medium high-tech (%)	36.1	37.5
Employment share services (NACE G-N) (%)	40.0	41.8
of which Knowledge-intensive services (%)	39.3	35.0
Turnover share SMEs (%)	40.1	37.9
Turnover share large enterprises (%)	44.3	44.4
Foreign-controlled enterprises – share of value added (%)	9.5	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.4	1.5
Total Entrepreneurial Activity (TEA) (%)	6.7	6.7
FDI net inflows (% GDP)	4.9	4.3
Top R&D spending enterprises per 10 million population	67.4	19.6
Buyer sophistication (1 to 7 best)	4.6	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	80.4	76.8
Basic-school entrepren. education and training (1 to 5 best)	2.4	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.9	3.5
Rule of law (-2.5 to 2.5 best)	2.0	1.2
Demography		
Population size (millions)	5.5	511.3
Average annual population growth (%)	0.2	0.2
Population density (inhabitants/km2)	18.1	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	3.17	2.76	4.00
Tertiary educational attainment (% of population aged 30-34)	45.3	44.2	42.0

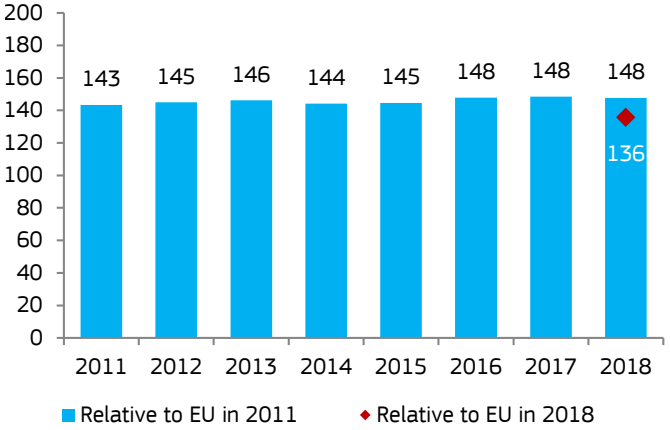
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Sweden is an **Innovation Leader.** Over time, performance has increased relative to that of the EU in 2011.



Human resources, *Innovation-friendly environment* and *Attractive research systems* are the strongest innovation dimensions. Sweden scores high on Public-private co-publications, Lifelong learning, and International scientific co-publications. *Sales impacts* is the weakest innovation dimension. Low-scoring indicators include Sales of new-to-market and new-to-firm product innovations, Venture capital expenditures, and Private co-funding of public R&D expenditure.

Structural differences with the EU are shown in the table below. GDP per capita and top R&D spending enterprises per 10 million population are well above the EU average. The employment share in manufacturing, enterprise births, and FDI net inflows are well below the EU average.

Sweden	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	2018
SUMMARY INNOVATION INDEX	**135.8**		**143.4**	**147.7**
Human resources	**174.9**		**205.0**	**213.9**
New doctorate graduates	133.2		207.7	193.4
Population with tertiary education	149.4		165.7	178.4
Lifelong learning	268.4		245.8	274.0
Attractive research systems	**166.2**		**151.5**	**187.2**
International scientific co-publications	239.2		241.4	347.9
Most cited publications	121.0		125.3	132.5
Foreign doctorate students	173.7		132.7	166.1
Innovation-friendly environment	**172.3**		**232.7**	**272.4**
Broadband penetration	177.8		244.4	355.6
Opportunity-driven entrepreneurship	166.6		224.7	215.7
Finance and support	**109.3**		**141.8**	**119.5**
R&D expenditure in the public sector	158.5		154.2	146.7
Venture capital expenditures	67.5		127.2	87.3
Firm investments	**124.3**		**138.7**	**148.1**
R&D expenditure in the business sector	179.4		187.5	205.6
Non-R&D innovation expenditures	92.4		104.0	107.9
Enterprises providing ICT training	105.3		126.7	133.3
Innovators	**115.4**		**113.3**	**104.8**
SMEs product/process innovations	115.1		119.9	111.7
SMEs marketing/organizational innovations	102.8		89.1	87.7
SMEs innovating in-house	127.8		131.0	115.0
Linkages	**147.3**		**155.5**	**153.0**
Innovative SMEs collaborating with others	112.8		153.5	120.4
Public-private co-publications	314.5		306.5	369.0
Private co-funding of public R&D exp.	87.4		92.0	83.8
Intellectual assets	**156.2**		**149.8**	**151.9**
PCT patent applications	234.0		212.8	212.8
Trademark applications	132.5		126.3	147.6
Design applications	100.4		103.7	92.6
Employment impacts	**134.5**		**136.9**	**140.5**
Employment in knowledge-intensive activities	150.6		143.6	164.1
Employment fast-growing enterprises	122.0		132.0	123.4
Sales impacts	**88.0**		**91.7**	**90.6**
Medium and high-tech product exports	94.9		100.1	102.4
Knowledge-intensive services exports	106.2		111.1	109.6
Sales of new-to-market/firm innovations	56.6		59.5	54.9

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	36,100	29,500
Average annual GDP growth (%)	2.2	2.2
Employment share manufacturing (NACE C) (%)	10.3	15.5
of which High and medium high-tech (%)	42.5	37.5
Employment share services (NACE G-N) (%)	41.3	41.8
of which Knowledge-intensive services (%)	44.0	35.0
Turnover share SMEs (%)	38.4	37.9
Turnover share large enterprises (%)	43.0	44.4
Foreign-controlled enterprises – share of value added (%)	13.5	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.4	1.5
Total Entrepreneurial Activity (TEA) (%)	7.2	6.7
FDI net inflows (% GDP)	3.0	4.3
Top R&D spending enterprises per 10 million population	81.8	19.6
Buyer sophistication (1 to 7 best)	4.6	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	81.1	76.8
Basic-school entrepren. education and training (1 to 5 best)	2.4	1.9
Govt. procurement of advanced tech products (1 to 7 best)	4.0	3.5
Rule of law (-2.5 to 2.5 best)	2.0	1.2
Demography		
Population size (millions)	10.0	511.3
Average annual population growth (%)	1.4	0.2
Population density (inhabitants/km2)	24.4	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	3.14	3.40	4.00
Tertiary educational attainment (% of population aged 30-34)	49.9	52.0	45.0

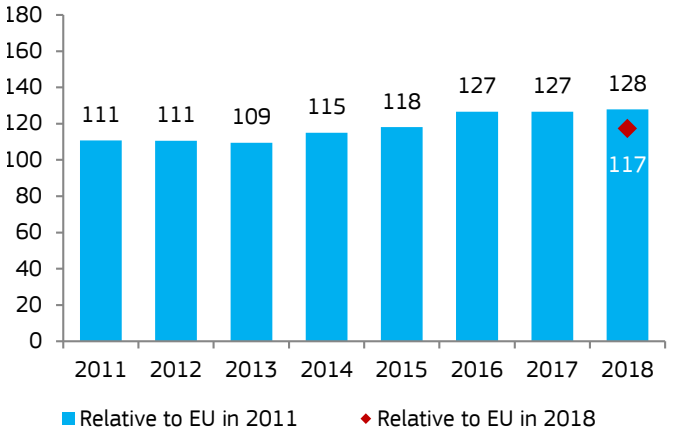
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

The **United Kingdom** is a **Strong Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Attractive research systems, *Human resources* and *Employment impacts* are the strongest innovation dimensions. The United Kingdom scores particularly well on Foreign doctorate students, Innovative SMEs collaborating with others, and New doctorate graduates. *Intellectual assets*, *Firm investments* and *Innovation-friendly environment* are the weakest innovation dimensions. Overall, the United Kingdom's lowest indicator scores comprise Private co-funding of public R&D expenditure, R&D expenditure in the public sector, and Design applications.

Structural differences with the EU are shown in the table below. Many economic indicators of the United Kingdom are well above the EU average, including the turnover share of large enterprises, the value-added share of foreign-controlled enterprises, enterprise births, and top R&D spending enterprises per 10 million population. However, the employment share in manufacturing and the turnover share of SMEs are well below the EU average.

United Kingdom	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	2018
SUMMARY INNOVATION INDEX	**117.5**		**110.8**	**127.8**
Human resources	**147.9**		**174.1**	**180.8**
New doctorate graduates	152.8		161.5	221.9
Population with tertiary education	152.5		164.2	182.1
Lifelong learning	134.7		197.9	137.5
Attractive research systems	**157.5**		**160.4**	**177.3**
International scientific co-publications	147.1		144.3	214.0
Most cited publications	132.0		126.5	144.6
Foreign doctorate students	213.7		224.6	204.3
Innovation-friendly environment	**98.4**		**98.6**	**155.5**
Broadband penetration	88.9		77.8	177.8
Opportunity-driven entrepreneurship	108.4		112.8	140.3
Finance and support	**102.8**		**101.9**	**112.4**
R&D expenditure in the public sector	63.7		79.5	58.9
Venture capital expenditures	136.0		128.5	175.8
Firm investments	**97.3**		**95.9**	**116.0**
R&D expenditure in the business sector	82.0		88.8	94.0
Non-R&D innovation expenditures	82.8		44.3	96.6
Enterprises providing ICT training	126.3		160.0	160.0
Innovators	**103.9**		**63.0**	**94.3**
SMEs product/process innovations	113.9		70.2	110.5
SMEs marketing/organizational innovations	118.2		69.8	100.9
SMEs innovating in-house	79.2		48.8	71.3
Linkages	**127.4**		**136.6**	**132.3**
Innovative SMEs collaborating with others	203.6		217.4	217.4
Public-private co-publications	144.3		150.6	169.3
Private co-funding of public R&D exp.	56.4		71.4	54.1
Intellectual assets	**81.6**		**81.2**	**79.4**
PCT patent applications	86.3		89.0	78.5
Trademark applications	88.3		91.4	98.4
Design applications	70.2		64.7	64.8
Employment impacts	**146.7**		**138.9**	**153.2**
Employment in knowledge-intensive activities	150.6		147.4	164.1
Employment fast-growing enterprises	143.7		132.7	145.4
Sales impacts	**114.0**		**90.9**	**117.4**
Medium and high-tech product exports	92.5		91.4	99.8
Knowledge-intensive services exports	127.0		133.8	131.1
Sales of new-to-market/firm innovations	126.2		41.1	122.4

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	31,500	29,500
Average annual GDP growth (%)	1.6	2.2
Employment share manufacturing (NACE C) (%)	9.5	15.5
of which High and medium high-tech (%)	38.6	37.5
Employment share services (NACE G-N) (%)	45.0	41.8
of which Knowledge-intensive services (%)	39.7	35.0
Turnover share SMEs (%)	30.9	37.9
Turnover share large enterprises (%)	55.0	44.4
Foreign-controlled enterprises – share of value added (%)	15.7	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	4.0	1.5
Total Entrepreneurial Activity (TEA) (%)	8.5	6.7
FDI net inflows (% GDP)	4.7	4.3
Top R&D spending enterprises per 10 million population	42.9	19.6
Buyer sophistication (1 to 7 best)	4.7	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	82.4	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.8	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.8	3.5
Rule of law (-2.5 to 2.5 best)	1.7	1.2
Demography		
Population size (millions)	65.8	511.3
Average annual population growth (%)	0.7	0.2
Population density (inhabitants/km2)	270.5	117.5

EU targets for 2020

Indicator	2014	Latest	Target[1]
Gross domestic expenditure on R&D (% of GDP)	1.66	1.66	n/a
Tertiary educational attainment (% of population aged 30-34)	47.7	48.8	n/a

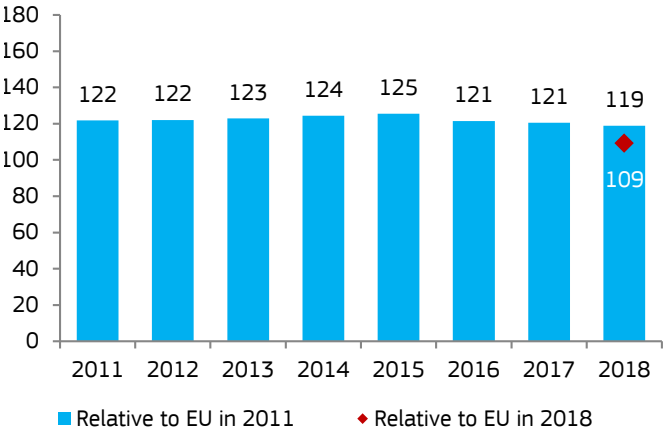
1 Sources are provided in the introduction to the country profiles.

European Semester country report and country specific recommendations:

https://rio.jrc.ec.europa.eu/en/library/research-and-innovation-analysis-european-semester-2019-country-reports

https://rio.jrc.ec.europa.eu/en/library/country-specific-recommendations-2019-research-and-innovation-analysis

Iceland is a **Strong Innovator**. Over time, performance has declined relative to that of the EU in 2011.



Innovation-friendly environment, *Linkages* and *Attractive research systems* are the strongest innovation dimensions. Iceland scores particularly well on Public-private co-publications, International scientific co-publications, 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 Design applications.

Structural differences with the EU are shown in the table below. For several indicators data are not available. GDP per capita, average annual GDP growth and top R&D spending enterprises per 10 million population are well above the EU average. The employment shares in manufacturing and in high and medium high-tech manufacturing, and FDI net inflows are well below the EU average.

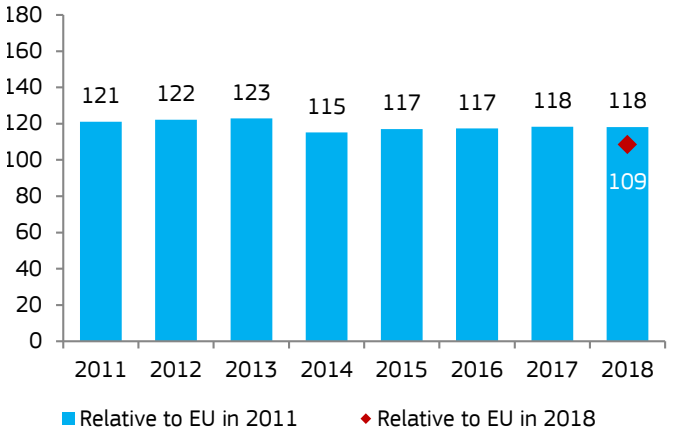
Iceland	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**109.3**		**121.8**	**118.9**
Human resources	**126.5**		**141.0**	**154.7**
New doctorate graduates	37.1		46.2	53.8
Population with tertiary education	146.9		126.9	175.4
Lifelong learning	229.6		253.1	234.4
Attractive research systems	**155.0**		**146.9**	**174.5**
International scientific co-publications	265.1		353.0	385.6
Most cited publications	81.0		90.6	88.7
Foreign doctorate students	176.6		97.8	168.8
Innovation-friendly environment §	**182.3**		**288.1**	**288.1**
Broadband penetration	N/A		N/A	N/A
Opportunity-driven entrepreneurship	187.0		242.2	242.2
Finance and support §	**104.8**		**116.6**	**114.6**
R&D expenditure in the public sector	114.1		107.5	105.6
Venture capital expenditures	N/A		N/A	N/A
Firm investments §	**100.6**		**119.0**	**119.9**
R&D expenditure in the business sector	99.3		79.4	113.7
Non-R&D innovation expenditures	N/A		N/A	N/A
Enterprises providing ICT training	105.3		166.7	133.3
Innovators §	**127.8**		**145.7**	**116.1**
SMEs product/process innovations	138.2		169.6	134.1
SMEs marketing/organizational innovations	113.7		120.4	97.0
SMEs innovating in-house	N/A		N/A	N/A
Linkages	**166.0**		**172.0**	**172.4**
Innovative SMEs collaborating with others	203.5		163.1	217.3
Public-private co-publications	290.6		369.7	340.9
Private co-funding of public R&D exp.	69.8		93.5	67.0
Intellectual assets	**61.8**		**68.3**	**60.1**
PCT patent applications	66.9		90.5	60.8
Trademark applications	86.2		93.0	96.1
Design applications	32.5		25.1	29.9
Employment impacts §	**140.0**		**133.3**	**146.2**
Employment in knowledge-intensive activities	160.0		159.0	174.4
Employment fast-growing enterprises	N/A		N/A	N/A
Sales impacts	**31.6**		**55.2**	**32.5**
Medium and high-tech product exports	0.0		0.0	0.0
Knowledge-intensive services exports	67.1		84.9	69.3
Sales of new-to-market/firm innovations	29.8		86.4	28.9

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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..

	IS	EU
Performance and structure of the economy		
GDP per capita (PPS)	38,000	29,500
Average annual GDP growth (%)	4.6	2.2
Employment share manufacturing (NACE C) (%)	10.0	15.5
of which High and medium high-tech (%)	15.3	37.5
Employment share services (NACE G-N) (%)	44.6	41.8
of which Knowledge-intensive services (%)	39.8	35.0
Turnover share SMEs (%)	n/a	37.9
Turnover share large enterprises (%)	n/a	44.4
Foreign-controlled enterprises – share of value added (%)	n/a	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	1.5	1.5
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	0.8	4.3
Top R&D spending enterprises per 10 million population	30.0	19.6
Buyer sophistication (1 to 7 best)	4.1	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	79.3	76.8
Basic-school entrepren. education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.6	3.5
Rule of law (-2.5 to 2.5 best)	1.6	1.2
Demography		
Population size (millions)	0.3	511.3
Average annual population growth (%)	2.4	0.2
Population density (inhabitants/km2)	3.3	117.5

Israel is a **Strong Innovator.** Over time, performance has declined relative to that of the EU in 2011.



Firm investments and *Employment impacts* are the strongest innovation dimensions. Israel scores high on PCT patent applications, Employment in knowledge-intensive activities, and R&D expenditure in the business sector, *Finance and support*, *Innovation-friendly environment* 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. For several indicators data are not available. Average annual GDP growth and total entrepreneurial activity are well above the EU average. The employment share in manufacturing is well below the EU average.

Israel	Relative to EU 2018 in	Performance relative to EU 2011 in	
	2018	2011	2018
SUMMARY INNOVATION INDEX	**108.6**	**121.1**	**118.1**
Human resources §	**129.8**	**135.0**	**158.7**
New doctorate graduates	88.3	96.2	128.2
Population with tertiary education	151.4	165.7	180.8
Lifelong learning	N/A	N/A	N/A
Attractive research systems §	**101.6**	**111.1**	**114.4**
International scientific co-publications	104.4	131.8	151.9
Most cited publications	84.6	96.7	92.7
Foreign doctorate students	N/A	N/A	N/A
Innovation-friendly environment §	**75.8**	**107.4**	**119.9**
Broadband penetration	N/A	N/A	N/A
Opportunity-driven entrepreneurship	77.8	90.2	100.8
Finance and support §	**71.4**	**88.5**	**78.1**
R&D expenditure in the public sector	77.8	81.6	72.0
Venture capital expenditures	N/A	N/A	N/A
Firm investments §	**182.1**	**217.1**	**217.1**
R&D expenditure in the business sector	192.1	220.2	220.2
Non-R&D innovation expenditures	N/A	N/A	N/A
Enterprises providing ICT training	N/A	N/A	N/A
Innovators	**84.5**	**116.2**	**76.7**
SMEs product/process innovations	54.3	84.9	52.7
SMEs marketing/organizational innovations	136.9	170.0	116.8
SMEs innovating in-house	67.3	93.4	60.6
Linkages	**124.5**	**147.2**	**129.3**
Innovative SMEs collaborating with others	109.9	159.5	117.3
Public-private co-publications	68.4	98.5	80.2
Private co-funding of public R&D exp.	165.8	159.1	159.1
Intellectual assets	**104.7**	**91.3**	**101.8**
PCT patent applications	234.0	212.8	212.8
Trademark applications	46.0	16.9	51.2
Design applications	31.0	26.7	28.6
Employment impacts §	**177.1**	**184.9**	**184.9**
Employment in knowledge-intensive activities	202.4	220.5	220.5
Employment fast-growing enterprises	N/A	N/A	N/A
Sales impacts	**98.7**	**84.5**	**101.6**
Medium and high-tech product exports	101.3	93.8	109.2
Knowledge-intensive services exports	103.7	82.7	106.9
Sales of new-to-market/firm innovations	89.2	75.7	86.5

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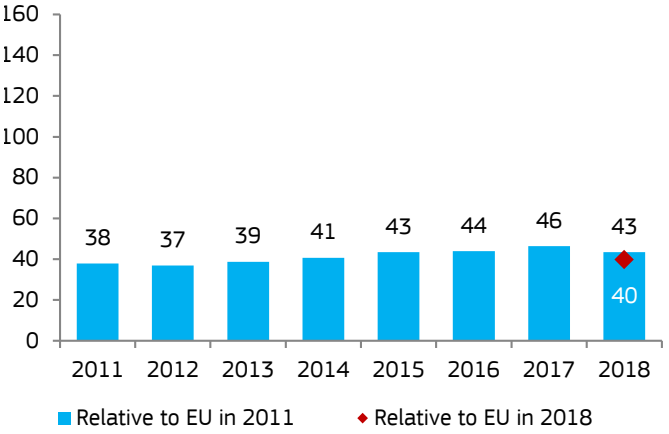
§ Due to missing data, the relative dimension score does not necessarily reflect that of the indicators.

	IL	EU
Performance and structure of the economy		
GDP per capita (PPS)	29,400	29,500
Average annual GDP growth (%)	3.7	2.2
Employment share manufacturing (NACE C) (%)	10.0	15.5
of which High and medium high-tech (%)	n/a	37.5
Employment share services (NACE G-N) (%)	44.4	41.8
of which Knowledge-intensive services (%)	n/a	35.0
Turnover share SMEs (%)	n/a	37.9
Turnover share large enterprises (%)	n/a	44.4
Foreign-controlled enterprises – share of value added (%)	n/a	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	n/a	1.5
Total Entrepreneurial Activity (TEA) (%)	12.3	6.7
FDI net inflows (% GDP)	4.2	4.3
Top R&D spending enterprises per 10 million population	24.6	19.6
Buyer sophistication (1 to 7 best)	4.1	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	72.5	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.8	1.9
Govt. procurement of advanced tech products (1 to 7 best)	4.4	3.5
Rule of law (-2.5 to 2.5 best)	1.1	1.2
Demography		
Population size (millions)	8.5	511.3
Average annual population growth (%)	1.6	0.2
Population density (inhabitants/km2)	394.9	117.5

North Macedonia is a **Modest Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Firm investments, *Attractive research systems* and *Innovators* are the strongest innovation dimensions. North Macedonia scores particularly well on Foreign doctorate students, Non-R&D innovation expenditures, and Medium and high-tech product exports. *Employment impacts*, *Finance and support* and *Intellectual assets* are the weakest innovation dimensions. Overall, North Macedonia's lowest indicator scores comprise PCT patent applications, Design applications, and Public-private co-publications.

Structural differences with the EU are shown in the table below. For several indicators data are not available. Many economic indicators are well below the EU average, including GDP per capita, average annual GDP growth, the employment share in high and medium high-tech manufacturing, the employment shares in services and knowledge-intensive sectors, the turnover share of large enterprises and top R&D spending enterprises per 10 million population. The employment share in manufacturing is above the EU average.

North Macedonia	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**39.9**		**37.9**	**43.4**
Human resources	**33.2**		**26.9**	**40.6**
New doctorate graduates	21.5		23.1	31.2
Population with tertiary education	62.5		32.1	74.6
Lifelong learning	12.2		25.0	12.5
Attractive research systems	**53.4**		**22.9**	**60.2**
International scientific co-publications	16.4		11.6	23.8
Most cited publications	12.2		21.6	13.4
Foreign doctorate students	165.2		32.5	157.9
Innovation-friendly environment	**35.2**		**32.9**	**55.6**
Broadband penetration	55.6		77.8	111.1
Opportunity-driven entrepreneurship	13.8		2.3	17.8
Finance and support §	**14.0**		**1.4**	**15.3**
R&D expenditure in the public sector	15.2		1.3	14.1
Venture capital expenditures	N/A		N/A	N/A
Firm investments	**62.1**		**61.8**	**74.0**
R&D expenditure in the business sector	4.9		0.0	5.6
Non-R&D innovation expenditures	113.5		121.3	132.5
Enterprises providing ICT training	63.2		60.0	80.0
Innovators	**53.0**		**66.0**	**48.1**
SMEs product/process innovations	71.8		114.9	69.7
SMEs marketing/organizational innovations	71.0		68.9	60.6
SMEs innovating in-house	15.0		13.5	13.5
Linkages §	**25.1**		**43.3**	**26.0**
Innovative SMEs collaborating with others	46.6		84.2	49.8
Public-private co-publications	2.2		1.9	2.6
Private co-funding of public R&D exp.	N/A		N/A	N/A
Intellectual assets	**16.3**		**5.6**	**15.8**
PCT patent applications	0.9		4.5	0.8
Trademark applications	47.1		13.8	52.5
Design applications	1.5		0.0	1.4
Employment impacts §	**6.2**		**16.1**	**6.5**
Employment in knowledge-intensive activities	7.1		19.2	7.7
Employment fast-growing enterprises	N/A		N/A	N/A
Sales impacts	**50.1**		**51.6**	**51.6**
Medium and high-tech product exports	111.1		58.1	119.9
Knowledge-intensive services exports	22.1		31.8	22.8
Sales of new-to-market/firm innovations	3.9		66.8	3.8

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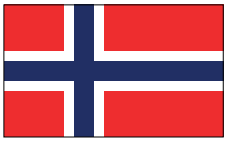
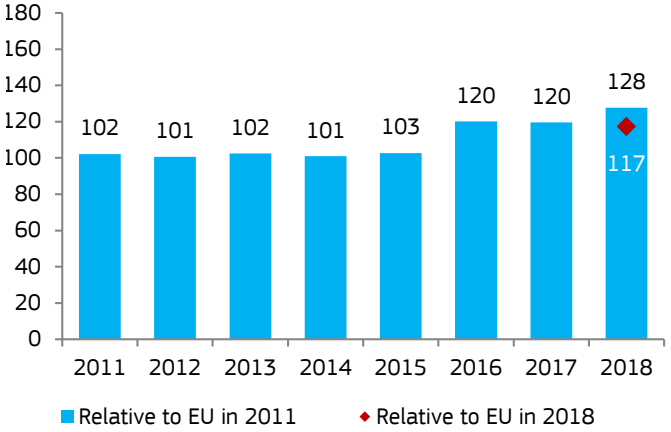
§ Due to missing data, the relative dimension score does not necessarily reflect that of the indicators.

	MK	EU
Performance and structure of the economy		
GDP per capita (PPS)	11,700	29,500
Average annual GDP growth (%)	1.4	2.2
Employment share manufacturing (NACE C) (%)	19.3	15.5
of which High and medium high-tech (%)	16.2	37.5
Employment share services (NACE G-N) (%)	30.3	41.8
of which Knowledge-intensive services (%)	21.1	35.0
Turnover share SMEs (%)	43.9	37.9
Turnover share large enterprises (%)	31.7	44.4
Foreign-controlled enterprises – share of value added (%)	n/a	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	n/a	1.5
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	3.8	4.3
Top R&D spending enterprises per 10 million population	0.0	19.6
Buyer sophistication (1 to 7 best)	2.8	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	80.3	76.8
Basic-school entrepren. education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced tech products (1 to 7 best)	2.7	3.5
Rule of law (-2.5 to 2.5 best)	-0.2	1.2
Demography		
Population size (millions)	2.1	511.3
Average annual population growth (%)	0.1	0.2
Population density (inhabitants/km2)	82.5	117.5



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



Innovators, *Linkages* and *Innovation-friendly environment* are the strongest innovation dimensions. Norway performs well on International scientific co-publications, Public-private co-publications, and Innovative SMEs collaborating with others. *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, and Sales of new-to-market and new-to-firm product innovations.

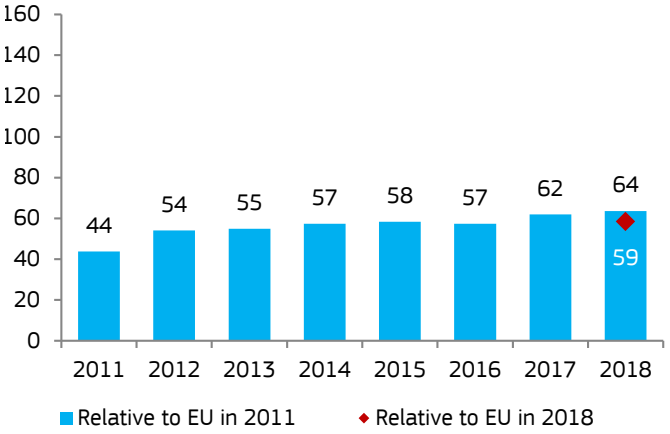
Structural differences with the EU are shown in the table below. Most of Norway's economic indicators tend to be close to the EU average. Notable exceptions are GDP per capita, which is well above the EU average, and enterprise births and FDI net inflows, which are well below the EU average.

Norway	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**117.4**		**102.1**	**127.7**
Human resources	**143.0**		**169.4**	**174.8**
New doctorate graduates	98.5		130.8	143.1
Population with tertiary education	155.0		197.0	185.1
Lifelong learning	191.8		178.1	195.8
Attractive research systems	**139.9**		**146.5**	**157.5**
International scientific co-publications	238.3		223.6	346.6
Most cited publications	105.9		114.0	116.0
Foreign doctorate students	101.3		146.2	96.8
Innovation-friendly environment	**143.8**		**202.6**	**227.4**
Broadband penetration	138.9		144.4	277.8
Opportunity-driven entrepreneurship	149.1		242.2	193.0
Finance and support	**116.1**		**99.0**	**127.0**
R&D expenditure in the public sector	164.6		114.9	152.3
Venture capital expenditures	75.0		80.2	97.0
Firm investments	**114.9**		**95.4**	**137.0**
R&D expenditure in the business sector	80.5		70.0	92.3
Non-R&D innovation expenditures	83.3		0.0	97.3
Enterprises providing ICT training	178.9		226.7	226.7
Innovators	**179.7**		**74.7**	**163.2**
SMEs product/process innovations	174.9		77.2	169.8
SMEs marketing/organizational innovations	173.3		69.0	147.9
SMEs innovating in-house	191.1		78.0	172.1
Linkages	**157.5**		**134.3**	**163.6**
Innovative SMEs collaborating with others	192.2		119.0	205.2
Public-private co-publications	227.3		247.9	266.7
Private co-funding of public R&D exp.	92.5		96.7	88.8
Intellectual assets	**58.0**		**50.9**	**56.4**
PCT patent applications	102.2		94.8	93.0
Trademark applications	57.0		41.0	63.5
Design applications	13.9		13.6	12.8
Employment impacts	**79.0**		**92.4**	**82.5**
Employment in knowledge-intensive activities	114.1		111.5	124.4
Employment fast-growing enterprises	51.8		78.7	52.4
Sales impacts	**51.7**		**45.4**	**53.2**
Medium and high-tech product exports	0.0		0.0	0.0
Knowledge-intensive services exports	115.4		118.9	119.0
Sales of new-to-market/firm innovations	41.9		14.7	40.6

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	43,900	29,500
Average annual GDP growth (%)	1.7	2.2
Employment share manufacturing (NACE C) (%)	8.3	15.5
of which High and medium high-tech (%)	34.2	37.5
Employment share services (NACE G-N) (%)	38.7	41.8
of which Knowledge-intensive services (%)	38.4	35.0
Turnover share SMEs (%)	38.2	37.9
Turnover share large enterprises (%)	39.2	44.4
Foreign-controlled enterprises – share of value added (%)	13.7	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.9	1.5
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	-0.9	4.3
Top R&D spending enterprises per 10 million population	21.1	19.6
Buyer sophistication (1 to 7 best)	4.5	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	82.3	76.8
Basic-school entrepren. education and training (1 to 5 best)	2.4	1.9
Govt. procurement of advanced tech products (1 to 7 best)	4.1	3.5
Rule of law (-2.5 to 2.5 best)	2.0	1.2
Demography		
Population size (millions)	5.3	511.3
Average annual population growth (%)	0.8	0.2
Population density (inhabitants/km2)	17.0	117.5

Serbia is a **Moderate Innovator**. Over time, performance has increased relative to that of the EU in 2011.



Innovators, *Firm investments* and *Sales impacts* are the strongest innovation dimensions. Serbia scores high on Enterprises providing ICT training, SMEs innovating in-house, and Non-R&D innovation expenditures. *Intellectual assets*, *Attractive research systems* and *Finance and support* are the weakest innovation dimensions. Low-scoring indicators include Design applications, Venture capital expenditures, and R&D expenditure in the business sector.

Structural differences with the EU are shown in the table below. For several indicators data are not available. GDP per capita, the employment share in high and medium high-tech manufacturing, the employment share in services, and buyer sophistication are well below the EU average. Average annual GDP growth and FDI net inflows are well above the EU average.

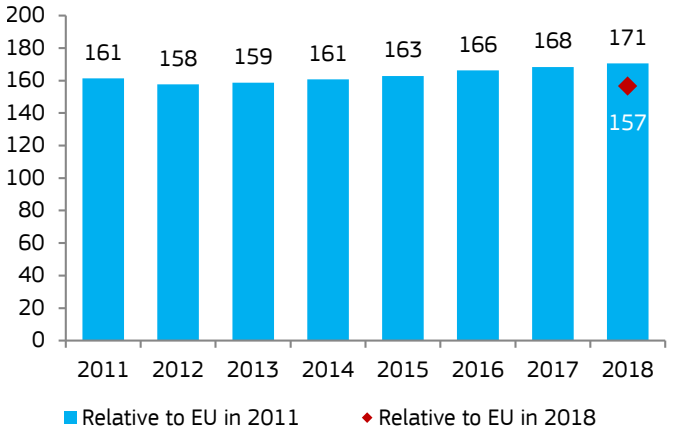
Serbia	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**58.5**		**43.7**	**63.7**
Human resources	**54.7**		**29.2**	**66.8**
New doctorate graduates	71.7		29.2	104.1
Population with tertiary education	51.9		24.6	61.9
Lifelong learning	33.7		34.4	34.4
Attractive research systems	**31.3**		**31.7**	**35.2**
International scientific co-publications	41.0		31.1	59.6
Most cited publications	25.8		37.9	28.3
Foreign doctorate students	31.4		22.4	30.0
Innovation-friendly environment §	**39.9**		**27.0**	**63.0**
Broadband penetration	38.9		33.3	77.8
Opportunity-driven entrepreneurship	N/A		N/A	N/A
Finance and support	**36.7**		**38.5**	**40.1**
R&D expenditure in the public sector	75.8		60.8	70.1
Venture capital expenditures	3.5		12.1	4.6
Firm investments	**79.7**		**80.4**	**95.0**
R&D expenditure in the business sector	22.1		15.9	25.3
Non-R&D innovation expenditures	102.1		110.8	119.2
Enterprises providing ICT training	110.5		113.3	140.0
Innovators	**96.3**		**50.9**	**87.4**
SMEs product/process innovations	97.1		38.5	94.2
SMEs marketing/organizational innovations	82.7		25.6	70.5
SMEs innovating in-house	108.5		89.0	97.7
Linkages	**63.2**		**35.3**	**65.6**
Innovative SMEs collaborating with others	70.4		23.1	75.2
Public-private co-publications	23.1		26.6	27.1
Private co-funding of public R&D exp.	78.3		48.1	75.2
Intellectual assets §	**24.5**		**25.1**	**23.8**
PCT patent applications	N/A		N/A	N/A
Trademark applications	47.3		58.3	52.7
Design applications	2.3		0.1	2.2
Employment impacts §	**38.1**		**36.6**	**39.8**
Employment in knowledge-intensive activities	43.5		43.6	47.4
Employment fast-growing enterprises	N/A		N/A	N/A
Sales impacts	**67.3**		**46.9**	**69.3**
Medium and high-tech product exports	53.0		23.7	57.2
Knowledge-intensive services exports	65.4		52.7	67.5
Sales of new-to-market/firm innovations	88.5		67.9	85.9

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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.

	RS	EU
Performance and structure of the economy		
GDP per capita (PPS)	11,400	29,500
Average annual GDP growth (%)	3.2	2.2
Employment share manufacturing (NACE C) (%)	16.6	15.5
of which High and medium high-tech (%)	21.7	37.5
Employment share services (NACE G-N) (%)	31.3	41.8
of which Knowledge-intensive services (%)	35.9	35.0
Turnover share SMEs (%)	n/a	37.9
Turnover share large enterprises (%)	n/a	44.4
Foreign-controlled enterprises – share of value added (%)	n/a	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	n/a	1.5
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	6.5	4.3
Top R&D spending enterprises per 10 million population	0.0	19.6
Buyer sophistication (1 to 7 best)	2.3	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	71.9	76.8
Basic-school entrepren. education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced tech products (1 to 7 best)	2.8	3.5
Rule of law (-2.5 to 2.5 best)	-0.2	1.2
Demography		
Population size (millions)	7.0	511.3
Average annual population growth (%)	-0.5	0.3
Population density (inhabitants/km^2)	80.7	117.5

Switzerland is an **Innovation Leader**. Over time, performance has increased relative to that of the EU in 2011.



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, and Lifelong learning. *Employment impacts* and *Sales impacts* are the weakest innovation dimensions. Overall, Switzerland's lowest indicator scores comprise Employment fast-growing enterprises of innovative sectors, Innovative SMEs collaborating with others, and Medium and high-tech product exports.

Structural differences with the EU are shown in the table below. For several indicators data are not available. Many economic indicators are well above the EU average, including GDP per capita, the employment share in knowledge-intensive services, FDI net inflows, top R&D spending enterprises per 10 million population, and buyer sophistication. However, enterprise births is well below the EU average.

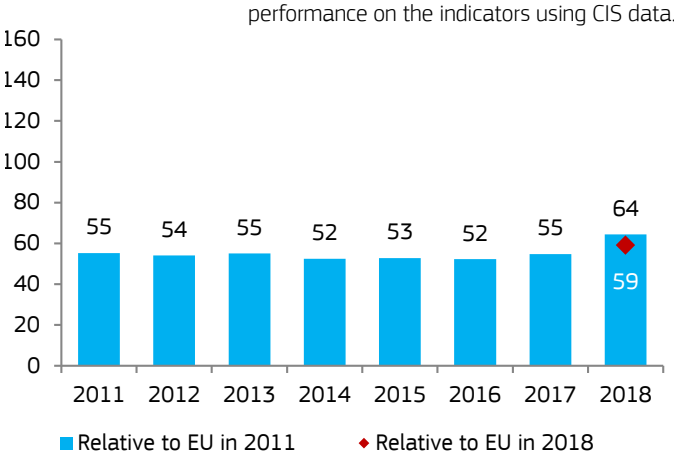
Switzerland	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**156.7**		**161.4**	**170.6**
Human resources	**195.5**		**229.3**	**239.0**
New doctorate graduates	170.7		269.2	247.9
Population with tertiary education	166.9		152.2	199.3
Lifelong learning	268.4		274.0	274.0
Attractive research systems	**207.9**		**226.1**	**234.2**
International scientific co-publications	265.1		385.6	385.6
Most cited publications	141.9		157.1	155.4
Foreign doctorate students	268.8		228.4	257.1
Innovation-friendly environment §	**147.0**		**175.4**	**232.4**
Broadband penetration	N/A		N/A	N/A
Opportunity-driven entrepreneurship	150.8		147.5	195.3
Finance and support	**134.9**		**84.7**	**147.6**
R&D expenditure in the public sector	150.5		105.6	139.2
Venture capital expenditures	121.8		60.0	157.5
Firm investments §	**175.0**		**172.6**	**208.7**
R&D expenditure in the business sector	177.1		193.6	203.0
Non-R&D innovation expenditures	176.1		146.1	205.6
Enterprises providing ICT training	N/A		N/A	N/A
Innovators	**157.2**		**143.7**	**142.8**
SMEs product/process innovations	139.3		169.8	135.2
SMEs marketing/organizational innovations	190.5		170.0	162.6
SMEs innovating in-house	144.7		90.7	130.3
Linkages	**158.6**		**163.8**	**164.7**
Innovative SMEs collaborating with others	79.6		82.2	85.0
Public-private co-publications	315.1		369.7	369.7
Private co-funding of public R&D exp.	140.5		134.8	134.8
Intellectual assets	**173.4**		**187.5**	**168.6**
PCT patent applications	191.1		188.6	173.8
Trademark applications	186.4		223.8	207.6
Design applications	142.4		156.7	131.3
Employment impacts	**112.3**		**106.9**	**117.2**
Employment in knowledge-intensive activities	184.7		175.6	201.3
Employment fast-growing enterprises	55.9		57.3	56.6
Sales impacts	**115.8**		**130.6**	**119.2**
Medium and high-tech product exports	88.5		125.7	95.5
Knowledge-intensive services exports	102.5		97.5	105.7
Sales of new-to-market/firm innovations	167.9		174.5	162.9

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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.

	CH	EU
Performance and structure of the economy		
GDP per capita (PPS)	47,200	29,500
Average annual GDP growth (%)	2.1	2.2
Employment share manufacturing (NACE C) (%)	12.9	15.5
of which High and medium high-tech (%)	44.6	37.5
Employment share services (NACE G-N) (%)	45.1	41.8
of which Knowledge-intensive services (%)	45.7	35.0
Turnover share SMEs (%)	n/a	37.9
Turnover share large enterprises (%)	n/a	44.4
Foreign-controlled enterprises – share of value added (%)	n/a	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	0.2	1.5
Total Entrepreneurial Activity (TEA) (%)	8.0	6.7
FDI net inflows (% GDP)	10.6	4.3
Top R&D spending enterprises per 10 million population	67.6	19.6
Buyer sophistication (1 to 7 best)	5.0	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	75.6	76.8
Basic-school entrepren. education and training (1 to 5 best)	2.2	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.8	3.5
Rule of law (-2.5 to 2.5 best)	1.9	1.2
Demography		
Population size (millions)	8.4	511.3
Average annual population growth (%)	0.9	0.2
Population density (inhabitants/km2)	209.7	117.5

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



Innovators, *Firm investments* and *Innovation-friendly environment* are the strongest innovation dimensions. Turkey performs relatively well on Non-R&D innovation expenditures, SMEs innovating in-house, and SMEs with marketing or organisational innovations. *Intellectual assets*, *Employment impacts* and *Attractive research systems* are the weakest innovation dimensions. Turkey's lowest indicator scores are on Design applications, Trademark applications, and International scientific co-publications.

Structural differences with the EU are shown in the table below. For several indicators data are not available. Average annual GDP growth, enterprise births, and total entrepreneurial activity are well above the EU average. The employment share in high and medium high-tech manufacturing, the employment share in knowledge-intensive services, FDI net inflows, and top R&D spending enterprises per 10 million population are well below the EU average.

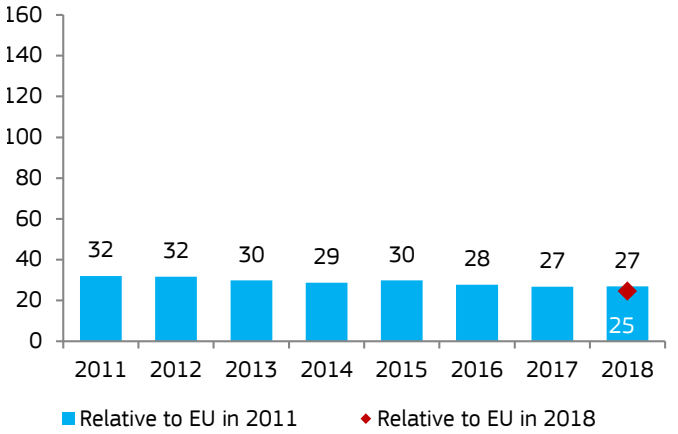
Turkey	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**59.2**		**55.3**	**64.4**
Human resources	**35.8**		**20.4**	**43.7**
New doctorate graduates	14.7		15.4	21.3
Population with tertiary education	50.0		0.0	59.7
Lifelong learning	48.0		47.9	49.0
Attractive research systems	**27.1**		**28.1**	**30.5**
International scientific co-publications	5.2		1.1	7.5
Most cited publications	35.7		50.4	39.1
Foreign doctorate students	33.8		11.0	32.4
Innovation-friendly environment	**78.2**		**97.4**	**123.6**
Broadband penetration	100.0		155.6	200.0
Opportunity-driven entrepreneurship	55.3		57.8	71.6
Finance and support §	**41.8**		**55.8**	**45.7**
R&D expenditure in the public sector	45.5		51.4	42.1
Venture capital expenditures	N/A		N/A	N/A
Firm investments	**92.8**		**104.7**	**110.6**
R&D expenditure in the business sector	39.3		27.0	45.1
Non-R&D innovation expenditures	176.1		205.6	205.6
Enterprises providing ICT training	57.9		73.3	73.3
Innovators	**150.0**		**93.4**	**136.2**
SMEs product/process innovations	127.8		90.5	124.0
SMEs marketing/organizational innovations	158.7		107.0	135.5
SMEs innovating in-house	165.9		82.4	149.3
Linkages	**41.6**		**31.1**	**43.2**
Innovative SMEs collaborating with others	86.9		49.7	92.8
Public-private co-publications	7.6		2.8	8.9
Private co-funding of public R&D exp.	22.6		29.6	21.7
Intellectual assets	**8.5**		**6.9**	**8.3**
PCT patent applications	18.9		14.2	17.2
Trademark applications	3.6		0.0	4.0
Design applications	2.7		5.1	2.5
Employment impacts §	**10.3**		**0.0**	**10.8**
Employment in knowledge-intensive activities	11.8		0.0	12.8
Employment fast-growing enterprises	N/A		N/A	N/A
Sales impacts	**55.3**		**77.8**	**56.9**
Medium and high-tech product exports	55.4		55.3	59.8
Knowledge-intensive services exports	38.9		16.9	40.2
Sales of new-to-market/firm innovations	75.1		174.5	72.8

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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)	21,700	29,500
Average annual GDP growth (%)	5.3	2.2
Employment share manufacturing (NACE C) (%)	18.2	15.5
of which High and medium high-tech (%)	18.0	37.5
Employment share services (NACE G-N) (%)	35.4	41.8
of which Knowledge-intensive services (%)	20.2	35.0
Turnover share SMEs (%)	n/a	37.9
Turnover share large enterprises (%)	n/a	44.4
Foreign-controlled enterprises – share of value added (%)	n/a	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	5.6	1.5
Total Entrepreneurial Activity (TEA) (%)	15.2	6.7
FDI net inflows (% GDP)	1.6	4.3
Top R&D spending enterprises per 10 million population	0.7	19.6
Buyer sophistication (1 to 7 best)	3.5	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	69.0	76.8
Basic-school entrepren. education and training (1 to 5 best)	1.7	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.5	3.5
Rule of law (-2.5 to 2.5 best)	-0.2	1.2
Demography		
Population size (millions)	79.8	511.3
Average annual population growth (%)	1.3	0.2
Population density (inhabitants/km2)	103.3	117.5

Ukraine is a **Modest Innovator.** Over time, performance has declined relative to that of the EU in 2011.



Human resources and *Employment impacts* are the strongest innovation dimensions. Ukraine scores high on Employment in knowledge-intensive activities, New doctorate graduates and Non-R&D innovation expenditures. *Linkages*, *Innovation-friendly environment*, and *Finance and support* are the weakest innovation dimensions. Low-scoring indicators include SMEs with product or process innovations, SMEs with marketing or organizational innovations, and R&D expenditure in the public sector.

Structural differences with the EU are shown in the table below. For several indicators data are not available. Various economic indicators are well below the EU average, including GDP per capita, the employment share in manufacturing, the employment share in services, and top R&D spending enterprises per 10 million population. Average annual GDP growth is above the EU average.

Ukraine	Relative to EU 2018 in 2018		Performance relative to EU 2011 in 2011	Performance relative to EU 2011 in 2018
SUMMARY INNOVATION INDEX	**24.7**		**32.0**	**26.8**
Human resources §	**82.4**		**114.1**	**100.8**
New doctorate graduates	71.0		116.7	103.1
Population with tertiary education	N/A		N/A	N/A
Lifelong learning	N/A		N/A	N/A
Attractive research systems	**13.3**		**9.0**	**15.0**
International scientific co-publications	3.9		0.0	5.7
Most cited publications	7.2		1.2	7.9
Foreign doctorate students	33.9		27.2	32.4
Innovation-friendly environment §	**3.8**		**6.1**	**6.0**
Broadband penetration	3.7		7.6	7.4
Opportunity-driven entrepreneurship	N/A		N/A	N/A
Finance and support	**6.9**		**37.1**	**7.6**
R&D expenditure in the public sector	0.6		32.0	0.5
Venture capital expenditures	12.3		43.1	15.9
Firm investments §	**44.3**		**65.4**	**52.9**
R&D expenditure in the business sector	17.7		38.9	20.3
Non-R&D innovation expenditures	69.5		87.6	81.2
Enterprises providing ICT training	N/A		N/A	N/A
Innovators	**17.2**		**17.8**	**15.6**
SMEs product/process innovations	0.0		0.0	0.0
SMEs marketing/organizational innovations	0.0		2.4	0.0
SMEs innovating in-house	52.5		51.4	47.3
Linkages §	**2.8**		**2.5**	**3.0**
Innovative SMEs collaborating with others	2.8		5.0	3.0
Public-private co-publications	4.1		0.0	4.8
Private co-funding of public R&D exp.	N/A		N/A	N/A
Intellectual assets	**13.4**		**11.3**	**13.1**
PCT patent applications	16.6		10.5	15.1
Trademark applications	22.2		26.0	24.7
Design applications	1.6		0.2	1.4
Employment impacts §	**74.1**		**68.8**	**77.4**
Employment in knowledge-intensive activities	84.7		82.1	92.3
Employment fast-growing enterprises	N/A		N/A	N/A
Sales impacts	**33.6**		**41.7**	**34.7**
Medium and high-tech product exports	22.3		57.8	24.1
Knowledge-intensive services exports	57.5		55.8	59.3
Sales of new-to-market/firm innovations	19.4		6.5	18.8

The colours show normalised performance in 2018 relative to that of the EU in 2018: dark green: above 120%; light green: between 90% and 120%; yellow: between 50% and 90%; 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.

	UA	EU
Performance and structure of the economy		
GDP per capita (PPS)	6,900	29,500
Average annual GDP growth (%)	2.5	2.2
Employment share manufacturing (NACE C) (%)	12.4	15.5
of which High and medium high-tech (%)	n/a	37.5
Employment share services (NACE G-N) (%)	33.8	41.8
of which Knowledge-intensive services (%)	n/a	35.0
Turnover share SMEs (%)	n/a	37.9
Turnover share large enterprises (%)	n/a	44.4
Foreign-controlled enterprises – share of value added (%)	n/a	12.6
Business and entrepreneurship		
Enterprise births (10+ employees) (%)	n/a	1.5
Total Entrepreneurial Activity (TEA) (%)	n/a	6.7
FDI net inflows (% GDP)	3.2	4.3
Top R&D spending enterprises per 10 million population	0.0	19.6
Buyer sophistication (1 to 7 best)	3.2	3.7
Governance and policy framework		
Ease of starting a business (0 to 100 best)	65.2	76.8
Basic-school entrepren. education and training (1 to 5 best)	n/a	1.9
Govt. procurement of advanced tech products (1 to 7 best)	3.0	3.5
Rule of law (-2.5 to 2.5 best)	-0.8	1.2
Demography		
Population size (millions)	42.4	511.3
Average annual population growth (%)	-0.4	0.2
Population density (inhabitants/km2)	77.7	117.5

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 2019 Methodology Report[21]. 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.

European benchmark

Step 1: Identifying and replacing outliers

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

Step 2: 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 3: Imputing for missing values

Reference year data are then used for "2018", 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	"2018"	"2017"	"2016"	"2015"	"2014"
Available data	N/A	45	40	35	30
Use most recent year	45	45	40	35	30
Year-in-between missing	"2018"	"2017"	"2016"	"2015"	"2014"
Available data	50	N/A	40	35	30
Substitute with previous year	50	40	40	35	30
Beginning-of-period missing	"2018"	"2017"	"2016"	"2015"	"2014"
Available data	50	45	40	35	N/A
Substitute with next available year	50	45	40	35	35

Step 4: 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 5: 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, Public-private co-publications, Private co-funding of public R&D expenditures, and Trademark applications. A square root transformation means using the square root of the indicator value instead of the original value.

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 2011 and for the latest year also to that of the EU in 2018. For the definition of the performance groups, only the performance scores relative to the EU in 2018 have been used.

[21] https://ec.europa.eu/docsroom/documents/35644

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

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

- Innovation Leaders are all countries with a relative performance in 2018 more than 20% above the EU average in 2018;
- Strong Innovators are all countries with a relative performance in 2018 between 90% and 120% of the EU average in 2018;
- Moderate Innovators are all countries with a relative performance in 2018 between 50% and 90% of the EU average in 2018;
- Modest Innovators are all countries with a relative performance in 2018 below 50% of the EU average in 2018.

Annex A: Country abbreviations

AT	Austria	IT	Italy
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	NL	Netherlands
CZ	Czechia	NO	Norway
DE	Germany	PL	Poland
DK	Denmark	PT	Portugal
EL	Greece	RO	Romania
EE	Estonia	RS	Serbia
ES	Spain	RU	Russia
FI	Finland	SA	South Africa
FR	France	SE	Sweden
HR	Croatia	SI	Slovenia
HU	Hungary	SK	Slovakia
IE	Ireland	TR	Turkey
IL	Israel	UA	Ukraine
IN	India	UK	United Kingdom
IS	Iceland	US	United States

Annex B: Performance per indicator

Available on the EIS website: https://ec.europa.eu/docsroom/documents/35645

Annex C: Current performance

	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)	2.1	2.0	1.5	1.7	3.2	2.7	1.3	2.2	1.5	2.6	1.7	1.3	1.4	0.6	0.5	0.9	1.2	1.0	0.5
1.1.2 Population completed tertiary education (2018)	39.8	46.7	34.2	33.6	46.7	32.1	43.7	55.3	43.0	43.6	46.3	34.5	27.7	58.2	41.6	55.2	52.6	30.5	38.3
1.1.3 Lifelong learning (2017)	10.9	8.5	2.3	9.8	26.8	8.4	17.2	9.0	4.5	9.9	18.7	2.3	7.9	6.9	7.5	5.9	17.2	6.2	10.6
Attractive research systems																			
1.2.1 International scientific co-publications (2018)	1070	1835	324	980	2929	995	1488	1686	846	914	914	703	831	2039	468	634	2452	564	982
1.2.2 Scientific publications among top 10% most cited (2016)	11.5	13.1	2.7	5.9	15.8	11.8	10.0	12.7	9.3	9.7	10.1	4.1	12.4	9.7	5.3	5.0	13.9	6.1	4.5
1.2.3 Foreign doctorate students (2017)	20.3	37.9	6.6	15.9	35.2	9.7	12.9	27.0	1.4	12.0	39.5	3.9	14.2	14.3	9.8	4.6	80.8	11.6	11.6
Innovation-friendly environment																			
1.3.1 Broadband penetration (2018)	18.0	29.0	14.0	13.0	46.0	17.0	16.0	21.0	4.0	28.0	12.0	8.0	9.0	10.0	17.0	31.0	27.0	19.0	23.0
1.3.2 Opportunity-driven entrepreneurship (2018)	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 (2017)	0.68	0.83	0.21	0.66	1.07	0.93	0.66	0.31	0.57	0.54	0.73	0.44	0.50	0.29	0.37	0.57	0.58	0.35	0.21
2.1.2 Venture capital expenditures (2018)	0.149	0.133	0.036	0.007	0.073	0.086	0.122	0.166	0.024	0.116	0.212	0.018	0.065	0.041	0.231	0.043	0.324	0.074	n/a
Firm investments																			
2.2.1 R&D expenditure in the business sector (2017)	1.36	1.76	0.53	1.13	1.97	2.09	0.61	0.74	0.55	0.66	1.42	0.42	0.83	0.20	0.14	0.32	0.68	0.99	0.34
2.2.2 Non-R&D innovation expenditures (2016)	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 (2018)	23.0	36.0	9.0	25.0	28.0	30.0	13.0	30.0	14.0	21.0	19.0	24.0	17.0	26.0	11.0	9.0	27.0	17.0	26.0
INNOVATION ACTIVITIES																			
Innovators																			
3.1.1 SMEs with product or process innovations (2016)	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)	35.6	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)	28.1	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)	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 (2018)	81.7	120.0	16.5	60.3	267.6	137.3	53.1	111.2	35.1	38.5	64.3	46.8	63.3	81.0	23.8	16.4	104.7	50.0	23.1
3.2.3 Private co-funding of public R&D expenditures (2016)	0.05	0.08	0.01	0.03	0.03	0.12	0.04	0.01	0.03	0.03	0.04	0.02	0.01	0.00	0.02	0.07	0.01	0.02	0.00
Intellectual assets																			
3.3.1 PCT patent applications (2016)	3.53	3.46	0.46	0.82	6.17	6.27	1.29	1.94	0.57	1.40	3.75	0.64	2.12	0.56	0.61	0.56	2.23	1.36	1.65
3.3.2 Trademark applications (2018)	7.85	8.31	8.96	5.13	12.55	9.44	20.02	4.93	5.01	8.88	6.12	3.86	8.57	39.48	8.02	7.87	35.49	4.23	46.48
3.3.3 Design applications (2018)	4.17	2.76	5.03	4.17	7.22	6.32	6.38	1.41	1.04	2.70	2.89	0.86	5.65	2.53	1.78	1.62	7.12	1.18	9.93
IMPACTS																			
Employment impacts																			
4.1.1 Employment in knowledge-intensive activities (2017)	14.2	15.6	10.2	12.9	15.1	14.8	13.5	20.8	12.1	12.5	14.5	11.6	13.7	17.0	12.1	9.7	22.0	11.6	19.0
4.1.2 Employment fast-growing firms in innovative sectors (2016)	5.2	2.8	7.5	7.2	4.9	4.8	2.8	8.5	4.8	5.3	4.2	3.5	3.3	1.8	5.6	2.5	4.7	8.5	7.2
Sales impacts																			
4.2.1 Medium & high-tech product exports (2018)	56.3	48.4	34.7	67.1	48.6	68.3	39.3	56.2	21.4	46.3	58.3	39.0	52.2	59.5	35.5	36.6	44.4	67.6	54.8
4.2.2 Knowledge-intensive services exports (2017)	68.4	68.7	37.6	42.7	74.9	75.5	50.0	94.0	52.9	33.8	62.0	19.1	51.0	68.7	51.5	23.1	92.3	47.7	53.8
4.2.3 Sales of new-to-market and new-to-firm innovations (2016)	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

	EU28	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK	IS	IL	MK	NO	RS	CH	TR	UA
FRAMEWORK CONDITIONS																			
Human resources																			
1.1.1 New doctorate graduates (2017)	2.1	2.2	2.2	0.5	1.8	0.7	1.9	2.0	2.6	2.7	3.1	0.9	1.9	0.6	2.1	1.6	3.4	0.5	1.5
1.1.2 Population completed tertiary education (2018)	39.8	47.5	40.3	43.5	34.5	25.1	41.2	36.4	40.2	47.7	48.2	47.3	48.0	33.8	48.6	32.1	50.5	31.8	n/a
1.1.3 Lifelong learning (2017)	10.9	19.1	15.8	4.0	9.8	1.1	12.0	3.4	27.4	30.4	14.3	23.6	n/a	2.3	19.9	4.4	31.2	5.8	n/a
Attractive research systems																			
1.2.1 International scientific co-publications (2018)	1070	1990	1735	393	1235	257	1492	648	2100	2464	1542	3507	1115	233	2455	479	3492	121	108
1.2.2 Scientific publications among top 10% most cited (2016)	11.5	15.7	11.5	5.7	9.9	4.4	7.8	4.7	12.7	13.5	14.6	9.6	9.9	2.8	12.0	4.1	15.6	5.1	2.3
1.2.3 Foreign doctorate students (2017)	20.3	39.9	30.3	2.0	25.0	4.4	8.9	8.7	21.9	35.1	43.2	35.7	n/a	33.4	20.6	6.5	55.3	7.0	7.0
Innovation-friendly environment																			
1.3.1 Broadband penetration (2018)	18.0	31.0	14.0	21.0	37.0	21.0	19.0	13.0	32.0	45.0	16.0	n/a	n/a	10.0	25.0	7.0	n/a	18.0	0.7
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	4.0	10.0	2.6	0.7	6.3	n/a	6.4	1.8	n/a
INVESTMENTS																			
Finance and support																			
2.1.1 R&D expenditure in the public sector (2017)	0.68	0.82	0.92	0.36	0.64	0.21	0.47	0.40	0.94	0.97	0.50	0.75	0.57	0.26	1.00	0.56	0.93	0.41	0.19
2.1.2 Venture capital expenditures (2018)	0.149	0.163	0.045	0.054	0.092	0.067	0.006	0.011	0.120	0.100	0.202	n/a	n/a	n/a	0.111	0.005	0.181	n/a	0.018
Firm investments																			
2.2.1 R&D expenditure in the business sector (2017)	1.36	1.17	2.22	0.67	0.67	0.29	1.39	0.48	1.80	2.42	1.12	1.35	3.64	0.09	1.10	0.32	2.39	0.55	0.26
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	0.67	n/a	n/a	1.01	0.68	0.88	2.01	2.70	0.55
2.2.3 Enterprises providing ICT training (2018)	23.0	26.0	27.0	13.0	19.0	5.0	29.0	18.0	36.0	24.0	28.0	24.0	n/a	16.0	42.0	25.0	n/a	15.0	n/a
INNOVATION ACTIVITIES																			
Innovators																			
3.1.1 SMEs with product or process innovations (2016)	34.3	48.5	45.0	14.8	56.0	4.6	25.9	19.5	54.2	38.3	38.0	44.5	22.2	26.8	55.6	33.6	44.8	41.7	7.4
3.1.2 SMEs with marketing or organisational innovations (2016)	35.6	31.6	50.4	11.1	47.4	7.4	27.0	20.0	44.8	36.3	40.2	39.1	44.9	28.3	54.0	31.3	58.4	50.4	10.5
3.1.3 SMEs innovating in-house (2016)	28.1	35.0	38.3	12.1	51.2	4.2	22.4	16.8	48.5	33.5	24.0	n/a	21.6	11.3	47.9	29.7	36.9	41.0	18.7
Linkages																			
3.2.1 Innovative SMEs collaborating with others (2016)	11.8	14.5	22.1	4.5	9.7	1.7	12.2	8.2	21.3	13.2	30.6	22.9	12.9	6.2	21.7	8.7	9.7	10.5	1.5
3.2.2 Public-private co-publications (2018)	81.7	150.6	200.5	20.9	32.9	19.1	95.3	28.5	162.5	251.4	116.7	232.5	56.7	4.3	182.4	20.9	388.5	8.6	5.8
3.2.3 Private co-funding of public R&D expenditures (2016)	0.05	0.08	0.05	0.01	0.01	0.03	0.04	0.02	0.05	0.04	0.02	0.03	0.59	n/a	0.04	0.03	0.09	0.01	n/a
Intellectual assets																			
3.3.1 PCT patent applications (2016)	3.53	5.52	4.71	0.52	0.91	0.23	1.86	0.63	7.73	9.57	3.04	2.36	9.36	0.03	3.60	n/a	6.74	0.67	0.59
3.3.2 Trademark applications (2018)	7.85	9.64	13.27	5.25	8.68	2.58	10.79	4.43	11.88	11.33	6.76	6.57	3.47	3.55	4.23	3.56	18.51	1.27	2.10
3.3.3 Design applications (2018)	4.17	4.09	6.50	5.15	3.82	1.32	2.69	1.76	4.06	4.18	2.93	1.35	1.29	0.06	0.58	0.10	5.94	0.11	0.07
IMPACTS																			
Employment impacts																			
4.1.1 Employment in knowledge-intensive activities (2017)	14.2	17.1	15.0	10.3	10.6	7.7	13.7	10.6	16.2	18.5	18.5	19.3	33.9	6.3	15.4	9.4	21.4	6.7	12.9
4.1.2 Employment fast-growing firms in innovative sectors (2016)	5.2	5.1	2.1	6.2	4.9	3.6	3.9	7.3	2.8	6.2	7.1	n/a	n/a	n/a	3.1	n/a	3.2	n/a	n/a
Sales impacts																			
4.2.1 Medium & high-tech product exports (2018)	56.3	49.7	57.4	48.6	40.1	57.2	57.3	67.3	44.0	54.4	53.5	8.7	56.8	60.6	14.3	38.4	52.0	39.3	26.7
4.2.2 Knowledge-intensive services exports (2017)	68.4	78.0	43.7	40.8	38.5	45.5	36.5	38.3	71.7	71.5	82.1	51.7	70.3	28.9	76.2	50.9	69.7	37.4	46.8
4.2.3 Sales of new-to-market and new-to-firm innovations (2016)	12.96	10.41	12.59	6.28	9.77	4.74	8.68	20.27	11.30	8.70	15.53	6.07	11.90	3.52	7.25	11.83	19.62	10.51	5.05

Annex D: Performance change

Performance change is measured as the difference between performance in 2018 relative to the EU average in 2011 and performance in 2011 relative to the EU average in 2011 (the relative performance scores in both years are shown in the first table on the Country profiles).

	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	45.2	36.7	70.5	28.3	82.1	-1.3	31.8	49.2	33.7	107.2	8.6	-4.2	-12.2	34.4	3.7	-10.4	33.8	12.0	25.3
1.1.2 Population completed tertiary education	19.4	7.5	21.6	27.6	3.7	27.6	23.1	4.5	32.1	15.7	14.9	19.4	26.1	22.4	16.4	19.4	17.2	-11.9	52.2
1.1.3 Lifelong learning	2.1	0.0	7.3	-2.1	0.0	6.3	64.6	0.0	12.5	-2.1	3.1	-7.3	17.7	-12.5	21.9	15.6	-8.3	-9.4	0.0
Attractive research systems																			
1.2.1 International scientific co-publications	45.4	66.6	13.6	58.6	128.6	29.5	99.7	68.0	34.8	40.3	25.0	39.3	39.5	134.9	35.9	46.5	124.8	20.6	86.2
1.2.2 Scientific publications among top 10% most cited	9.5	0.4	1.8	10.7	13.0	7.9	31.7	9.5	9.5	-0.1	-1.5	12.8	26.5	29.4	33.3	21.0	25.3	14.9	7.7
1.2.3 Foreign doctorate students	-4.4	26.6	3.6	24.5	46.2	-7.3	31.1	-48.4	-2.1	-50.5	-11.8	8.2	23.3	28.0	40.7	19.5	0.0	23.9	42.3
Innovation-friendly environment																			
1.3.1 Broadband penetration	100.0	144.4	77.8	55.6	88.9	88.9	100.0	133.3	22.2	211.1	33.3	77.8	44.4	111.1	-11.1	166.7	155.6	122.2	122.2
1.3.2 Opportunity-driven entrepreneurship	29.5	-106.5	9.2	19.9	12.6	41.3	9.8	53.1	28.4	15.0	17.3	7.0	7.3	36.8	40.7	13.0	-88.9	44.4	n/a
INVESTMENTS																			
Finance and support																			
2.1.1 R&D expenditure in the public sector	-7.5	29.9	-13.1	18.7	20.5	7.5	-20.5	-35.5	41.1	-20.5	-9.3	5.6	-3.7	-3.7	-1.9	1.9	13.1	-16.8	-5.6
2.1.2 Venture capital expenditures	29.3	14.8	-43.5	-95.3	-49.4	15.9	33.2	-47.4	12.2	27.8	62.0	2.6	13.5	25.4	176.6	22.5	0.0	41.1	n/a
Firm investments																			
2.2.1 R&D expenditure in the business sector	14.6	32.6	21.5	30.9	0.9	23.2	-15.4	-30.0	26.6	-2.6	3.4	7.7	0.0	10.3	-7.7	7.7	-1.7	26.6	-2.6
2.2.2 Non-R&D innovation expenditures	16.8	-10.9	-56.6	-30.3	6.9	42.0	10.5	-58.4	2.5	-5.4	5.8	47.0	8.9	-98.7	-43.8	99.4	-4.9	18.3	-10.9
2.2.3 Enterprises providing ICT training	26.7	40.0	-26.7	26.7	6.7	46.7	6.7	20.0	0.0	40.0	0.0	-26.7	46.7	-13.3	13.3	0.0	46.7	26.7	20.0
INNOVATION ACTIVITIES																			
Innovators																			
3.1.1 SMEs with product or process innovations	-2.9	12.1	-16.3	-6.9	-15.9	-46.0	-9.3	-16.7	53.9	-34.2	21.6	-2.4	33.8	-50.1	5.4	58.4	-4.2	4.2	-12.4
3.1.2 SMEs with marketing or organisational innovations	-14.7	3.4	-5.6	-49.4	-2.8	-50.8	-46.6	23.8	4.4	-10.8	22.8	17.6	-5.8	-67.2	25.4	40.6	-3.1	-7.0	0.8
3.1.3 SMEs innovating in-house	-10.0	-2.2	-15.1	4.4	-31.1	-42.2	20.2	-31.2	58.2	-34.5	17.5	4.6	21.3	-60.9	3.5	62.9	-10.3	8.9	-4.9
Linkages																			
3.2.1 Innovative SMEs collaborating with others	6.8	-1.1	1.4	13.3	-98.2	-32.4	5.9	17.9	102.7	10.9	-1.4	-20.6	-2.4	-121.8	23.2	87.1	-25.2	-12.9	-18.8
3.2.2 Public-private co-publications	17.3	32.0	10.5	14.2	20.4	36.9	34.1	69.2	16.9	7.8	-7.7	-20.5	26.8	61.9	24.5	5.3	62.5	24.7	-1.4
3.2.3 Private co-funding of public R&D expenditures	-4.0	13.5	-17.6	18.5	-3.8	7.7	13.0	-9.5	-5.2	-27.4	2.5	-35.5	-3.6	-14.4	-7.8	-24.9	-6.6	-54.2	-3.2
Intellectual assets																			
3.3.1 PCT patent applications	-9.1	-5.2	2.8	0.1	-12.4	-31.7	-29.2	-18.6	3.7	-3.9	-9.3	-0.7	2.5	-0.6	-13.6	6.0	12.2	-3.3	35.6
3.3.2 Trademark applications	11.4	7.8	11.5	5.5	23.7	-7.2	89.1	-14.6	50.5	12.0	0.9	6.7	24.1	52.6	5.1	57.7	0.0	11.6	57.9
3.3.3 Design applications	-7.8	-31.1	70.2	27.9	13.2	-18.2	70.1	-5.5	12.9	-15.6	-17.2	18.1	-15.2	11.7	-27.3	18.9	-11.3	4.0	200.0
IMPACTS																			
Employment impacts																			
4.1.1 Employment in knowledge-intensive activities	9.0	0.0	21.8	7.7	0.0	-7.7	47.4	0.0	14.1	9.0	6.4	20.5	0.0	33.3	33.3	12.8	-11.5	-14.1	38.5
4.1.2 Employment fast-growing firms in innovative sectors	1.2	8.8	30.5	10.0	-38.1	-25.3	-4.3	26.6	-17.3	48.7	-21.5	46.1	8.8	12.6	53.7	-45.0	37.3	5.2	31.2
Sales impacts																			
4.2.1 Medium & high-tech product exports	7.9	4.6	24.9	11.1	18.0	7.9	-0.9	15.1	-0.4	-2.5	5.8	-12.3	5.9	60.4	14.3	12.0	-14.1	-2.6	15.3
4.2.2 Knowledge-intensive services exports	3.2	6.3	21.9	9.8	-6.7	-1.4	2.9	0.0	-16.8	2.0	-1.9	-3.3	-0.5	-1.0	-5.3	10.9	5.7	-0.3	-23.6
4.2.3 Sales of new-to-market and new-to-firm innovations	-3.0	60.4	-81.2	-56.4	-59.0	-33.0	9.1	58.7	49.5	33.7	-33.6	-62.9	6.0	-37.8	21.0	50.7	-40.0	-86.8	-69.3

Performance change is measured as the difference between performance in 2018 relative to the EU average in 2011 and performance in 2011 relative to the EU average in 2011 (the relative performance scores in both years are shown in the first table on the Country profiles).

	EU28	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK	IS	IL	MK	NO	RS	CH	TR	UA
FRAMEWORK CONDITIONS																			
Human resources																			
1.1.1 New doctorate graduates	45.2	25.9	-8.1	3.5	-5.4	-66.9	34.0	-92.2	2.4	-14.3	60.4	7.7	32.0	8.1	12.3	74.8	-21.4	5.9	-13.6
1.1.2 Population completed tertiary education	19.4	23.9	14.2	6.7	23.1	-2.2	23.9	49.3	-0.7	12.7	17.9	48.5	15.1	42.5	-11.9	37.3	47.0	59.7	n/a
1.1.3 Lifelong learning	2.1	12.5	20.8	-3.1	-17.7	-3.1	-45.8	-7.3	45.8	28.1	-60.4	-18.8	n/a	-12.5	17.7	0.0	0.0	1.0	n/a
Attractive research systems																			
1.2.1 International scientific co-publications	45.4	80.6	63.3	23.3	71.1	11.6	66.7	32.0	95.6	106.4	69.7	32.6	20.1	12.2	123.0	28.5	0.0	6.5	5.7
1.2.2 Scientific publications among top 10% most cited	9.5	1.6	8.5	27.0	-7.2	17.2	17.8	19.4	15.6	7.2	18.1	-2.0	-4.0	-8.2	1.9	-9.6	-1.7	-11.3	6.7
1.2.3 Foreign doctorate students	-4.4	5.6	28.7	-1.7	56.1	7.0	2.1	6.6	54.1	33.4	-20.3	71.0	n/a	125.4	-49.3	7.6	28.7	21.3	5.2
Innovation-friendly environment																			
1.3.1 Broadband penetration	100.0	177.8	22.2	155.6	211.1	122.2	66.7	55.6	133.3	111.1	100.0	n/a	n/a	33.3	133.3	44.4	n/a	44.4	-0.1
1.3.2 Opportunity-driven entrepreneurship	29.5	-8.6	-25.0	155.8	-4.6	-5.5	-82.7	8.4	122.6	-9.0	27.5	0.0	10.5	15.5	-49.1	n/a	47.9	13.7	n/a
INVESTMENTS																			
Finance and support																			
2.1.1 R&D expenditure in the public sector	-7.5	-3.7	14.9	-31.7	-7.5	-18.7	-31.7	9.3	-20.5	-7.5	-20.5	-1.9	-9.6	12.8	37.4	9.3	33.6	-9.3	-31.4
2.1.2 Venture capital expenditures	29.3	53.0	-5.2	11.9	4.7	17.1	-6.8	-0.8	-50.5	-39.9	47.3	n/a	n/a	n/a	16.8	-7.6	97.5	n/a	-27.2
Firm investments																			
2.2.1 R&D expenditure in the business sector	14.6	9.4	30.0	41.2	-2.6	9.4	-34.3	18.9	-67.8	18.0	5.1	34.3	0.0	5.6	22.3	9.4	9.4	18.0	-18.6
2.2.2 Non-R&D innovation expenditures	16.8	-60.8	8.4	-11.9	36.3	-159.7	-11.1	3.9	20.3	3.9	52.4	n/a	n/a	11.3	97.3	8.4	59.6	0.0	-6.4
2.2.3 Enterprises providing ICT training	26.7	66.7	-13.3	20.0	-20.0	6.7	13.3	-40.0	-13.3	6.7	0.0	-33.3	n/a	20.0	0.0	26.7	n/a	0.0	n/a
INNOVATION ACTIVITIES																			
Innovators																			
3.1.1 SMEs with product or process innovations	-2.9	61.8	20.0	-10.1	23.7	-37.4	-18.7	1.7	45.3	-8.2	40.3	-35.5	-32.2	-45.2	92.5	55.7	-34.5	33.5	0.0
3.1.2 SMEs with marketing or organisational innovations	-14.7	10.1	26.0	-25.6	12.0	-52.0	-42.1	-28.3	45.3	-1.4	31.1	-23.4	-53.1	-8.3	78.9	44.9	-7.4	28.4	-2.4
3.1.3 SMEs innovating in-house	-10.0	40.1	17.8	-7.5	56.0	-38.0	-15.5	8.1	34.0	-15.9	22.5	n/a	-32.9	0.0	94.1	8.7	39.6	67.0	-4.1
Linkages																			
3.2.1 Innovative SMEs collaborating with others	6.8	14.9	74.1	-19.3	-35.9	-5.6	-20.7	24.3	60.5	-33.1	0.0	54.2	-42.1	-34.5	86.2	52.1	2.8	43.1	-2.0
3.2.2 Public-private co-publications	17.3	-8.3	67.4	17.7	7.6	4.5	-61.2	7.6	2.6	62.5	18.6	-28.8	-18.3	0.7	18.9	0.5	0.0	6.1	4.8
3.2.3 Private co-funding of public R&D expenditures	-4.0	-7.2	3.4	-24.4	6.5	-25.8	-21.4	-1.5	-45.9	-8.2	-17.3	-26.5	0.0	n/a	-7.9	27.1	0.0	-7.9	n/a
Intellectual assets																			
3.3.1 PCT patent applications	-9.1	-7.2	-6.0	1.5	6.5	1.7	-31.0	6.4	-13.3	0.0	-10.5	-29.7	0.0	-3.7	-1.9	n/a	-14.7	3.0	4.6
3.3.2 Trademark applications	11.4	6.8	-4.9	27.1	44.1	7.7	12.6	17.5	37.3	21.2	7.0	3.1	34.3	38.7	22.6	-5.6	-16.2	4.0	-1.3
3.3.3 Design applications	-7.8	3.8	-33.2	21.2	-6.9	17.9	-19.9	8.9	-1.8	-11.2	0.0	4.8	1.9	1.4	-0.8	2.0	-25.4	-2.6	1.2
IMPACTS																			
Employment impacts																			
4.1.1 Employment in knowledge-intensive activities	9.0	0.0	7.7	16.7	19.2	21.8	3.8	2.6	12.8	20.5	16.7	15.4	0.0	-11.5	12.8	3.8	25.6	12.8	10.3
4.1.2 Employment fast-growing firms in innovative sectors	1.2	-2.9	-17.8	-2.6	42.5	35.4	25.1	-9.4	-13.8	-8.6	12.6	n/a	n/a	n/a	-26.3	n/a	-0.8	n/a	n/a
Sales impacts																			
4.2.1 Medium & high-tech product exports	7.9	17.9	10.0	-2.6	9.3	19.2	8.4	19.7	5.7	2.3	8.4	0.0	15.4	61.8	0.0	33.5	-30.2	4.5	-33.7
4.2.2 Knowledge-intensive services exports	3.2	0.6	19.9	1.8	-5.1	7.7	6.5	6.0	53.5	-1.5	-2.7	-15.6	24.3	-8.9	0.2	14.8	8.2	23.2	3.5
4.2.3 Sales of new-to-market and new-to-firm innovations	-3.0	15.4	13.3	-35.1	-57.4	-100.1	-75.4	44.3	-42.5	-4.5	81.3	-57.6	10.9	-63.0	25.8	18.0	-11.7	-101.7	12.4

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	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	2018 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 informa¬tion 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	2017 Lifelong learning encompasses all purposeful learning activity, whether formal, non-formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills and competence. The intention or aim to learn is the critical point that distinguishes these activities from non-learning activities, such as cultural or sporting activities.
1.2.1 International scientific co-publications per million population	Number of scientific publications with at least one co-author based abroad (where abroad is non-EU for the EU28) Scopus *	Total population Eurostat	2018 International scientific co-publications are a proxy for the quality of scientific research as collaboration increases scientific productivity.
1.2.2 Scientific publications among the top-10% most cited publications worldwide as percentage of total scientific publications of the country	Number of scientific publications among the top-10% most cited publications worldwide Scopus *	Total number of scientific publications Scopus *	2016 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	2018 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	2017 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	2018 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	2017 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	2018 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	2018 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	2016 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	2016 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	2018 Trademarks are an important innovation indicator, especially for the service sector. The Community trademark gives its proprietor a uniform right applicable in all Member States of the European Union through a single procedure which simplifies trademark policies at European level. It fulfils the three essential functions of a trademark: it identifies the origin of goods and services, guarantees consistent quality through evidence of the company's commitment vis-à-vis the consumer, and it is a form of communication, a basis for publicity and advertising.
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	2017 Knowledge-intensive activities provide services directly to consumers, such as telecommunications, and provide inputs to the innovative activities of other firms in all sectors of the economy.

INDICATOR	DEFINITION NUMERATOR Source	DEFINITION DENOMINATOR Source	MOST RECENT YEAR FOR WHICH DATA ARE AVAILABLE INTERPRETATION
4.1.2 Employment in 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	2016 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	2018 The indicator measures the technological compe¬titiveness 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	2017 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) time series

	SUMMARY INNOVATION INDEX								RELATIVE TO EU IN 2011								... IN 2018
	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018	2018
EU28	0.482	0.478	0.483	0.482	0.490	0.503	0.513	0.525	100.0	99.2	100.2	99.9	101.6	104.4	106.3	108.8	100.0
BE	0.561	0.562	0.561	0.558	0.564	0.583	0.599	0.618	116.3	116.5	116.3	115.7	116.9	120.9	124.2	128.1	117.7
BG	0.223	0.194	0.206	0.219	0.220	0.227	0.231	0.235	46.3	40.2	42.7	45.5	45.7	47.0	47.9	48.7	44.8
CZ	0.414	0.392	0.399	0.401	0.408	0.399	0.415	0.431	85.9	81.4	82.7	83.1	84.5	82.7	86.1	89.4	82.2
DK	0.679	0.688	0.700	0.688	0.691	0.675	0.678	0.680	140.7	142.7	145.2	142.7	143.2	140.0	140.5	140.9	129.5
DE	0.616	0.618	0.618	0.597	0.597	0.594	0.607	0.612	127.8	128.1	128.1	123.8	123.8	123.2	125.9	126.9	116.6
EE	0.421	0.439	0.438	0.414	0.428	0.390	0.402	0.500	87.2	90.9	90.9	85.9	88.8	80.9	83.3	103.7	95.3
IE	0.547	0.527	0.518	0.522	0.533	0.577	0.579	0.567	113.4	109.2	107.3	108.1	110.5	119.6	120.0	117.6	108.1
EL	0.296	0.296	0.303	0.305	0.315	0.332	0.345	0.394	61.4	61.3	62.9	63.3	65.3	68.9	71.5	81.6	75.0
ES	0.368	0.368	0.371	0.344	0.352	0.375	0.398	0.409	76.3	76.3	77.0	71.3	72.9	77.7	82.5	84.8	77.9
FR	0.515	0.509	0.518	0.523	0.531	0.547	0.546	0.535	106.8	105.4	107.4	108.4	110.1	113.5	113.1	111.0	102.0
HR	0.271	0.251	0.260	0.237	0.251	0.251	0.260	0.287	56.1	52.0	53.8	49.1	52.0	52.1	54.0	59.6	54.8
IT	0.357	0.368	0.366	0.370	0.381	0.369	0.378	0.410	74.1	76.4	75.9	76.7	79.0	76.6	78.3	84.9	78.1
CY	0.417	0.417	0.434	0.385	0.398	0.376	0.385	0.419	86.6	86.4	90.1	79.9	82.4	78.1	79.8	86.8	79.7
LV	0.232	0.218	0.220	0.269	0.292	0.279	0.295	0.317	48.0	45.3	45.5	55.8	60.6	57.8	61.1	65.7	60.3
LT	0.267	0.278	0.282	0.286	0.313	0.370	0.360	0.391	55.4	57.6	58.5	59.3	64.9	76.7	74.7	81.1	74.5
LU	0.594	0.633	0.633	0.607	0.629	0.631	0.620	0.623	123.2	131.2	131.2	125.9	130.5	130.8	128.5	129.2	118.7
HU	0.319	0.304	0.303	0.308	0.314	0.320	0.328	0.333	66.2	63.1	62.8	63.9	65.1	66.4	68.1	69.0	63.4
MT	0.330	0.315	0.366	0.413	0.426	0.391	0.397	0.413	68.4	65.3	75.9	85.6	88.4	81.1	82.3	85.7	78.7
NL	0.573	0.610	0.617	0.606	0.614	0.621	0.645	0.651	118.9	126.4	127.9	125.6	127.2	128.9	133.8	135.0	124.0
AT	0.547	0.562	0.573	0.561	0.562	0.587	0.588	0.602	113.4	116.5	118.8	116.4	116.6	121.7	122.0	124.8	114.7
PL	0.257	0.242	0.252	0.242	0.248	0.260	0.273	0.295	53.3	50.2	52.2	50.2	51.4	54.0	56.6	61.1	56.1
PT	0.410	0.395	0.405	0.391	0.397	0.392	0.407	0.471	85.0	81.8	83.9	81.0	82.2	81.3	84.3	97.6	89.7
RO	0.216	0.193	0.189	0.151	0.144	0.150	0.155	0.165	44.8	40.0	39.1	31.3	29.8	31.1	32.2	34.1	31.4
SI	0.474	0.464	0.466	0.469	0.463	0.469	0.467	0.423	98.2	96.2	96.7	97.3	96.0	97.2	96.7	87.6	80.5
SK	0.305	0.324	0.332	0.315	0.323	0.334	0.321	0.333	63.3	67.1	68.9	65.3	67.0	69.3	66.5	69.1	63.5
FI	0.635	0.636	0.638	0.624	0.635	0.643	0.650	0.704	131.6	131.8	132.2	129.4	131.7	133.4	134.8	145.9	134.0
SE	0.692	0.699	0.705	0.695	0.698	0.713	0.716	0.713	143.4	145.0	146.1	144.1	144.6	147.8	148.5	147.7	135.8
UK	0.535	0.533	0.528	0.554	0.569	0.611	0.611	0.616	110.8	110.6	109.4	114.9	118.1	126.6	126.7	127.8	117.5
IS	0.587	0.589	0.593	0.600	0.605	0.586	0.581	0.573	121.8	122.1	123.0	124.4	125.5	121.4	120.5	118.9	109.3
IL	0.584	0.589	0.593	0.555	0.564	0.567	0.571	0.570	121.1	122.2	123.0	115.1	117.0	117.5	118.3	118.1	108.6
MK	0.183	0.178	0.187	0.196	0.209	0.212	0.223	0.209	37.9	36.9	38.8	40.7	43.4	43.9	46.3	43.4	39.9
NO	0.492	0.486	0.494	0.487	0.496	0.579	0.577	0.616	102.1	100.7	102.4	100.9	102.8	120.1	119.7	127.7	117.4
RS	0.211	0.261	0.265	0.277	0.282	0.276	0.299	0.307	43.7	54.1	55.0	57.4	58.4	57.3	61.9	63.7	58.5
CH	0.779	0.760	0.765	0.775	0.785	0.802	0.812	0.823	161.4	157.6	158.7	160.7	162.8	166.2	168.4	170.6	156.7
TR	0.155	0.152	0.144	0.138	0.144	0.134	0.129	0.129	32.0	31.6	29.9	28.7	29.9	27.7	26.7	26.8	24.7
UA	0.267	0.261	0.265	0.253	0.255	0.252	0.264	0.311	55.3	54.1	55.0	52.4	52.8	52.2	54.8	64.4	59.2

Annex G: Performance scores per dimension

Performance is measured relative to that of the EU in 2018.

	HUMAN RESOURCES	RESEARCH SYSTEMS	INNOVATION-FRIENDLY ENVIRONMENT	FINANCE AND SUPPORT	FIRM INVESTMENTS	INNOVATORS	LINKAGES	INTELLECTUAL ASSETS	EMPLOYMENT IMPACTS	SALES IMPACTS
	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018
EU28	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
BE	106.1	151.0	106.4	108.3	119.6	148.8	157.7	89.7	76.4	100.1
BG	52.7	20.5	53.8	15.5	41.5	27.0	30.1	81.0	108.7	37.9
CZ	75.0	65.3	75.1	46.7	94.4	96.9	84.1	63.8	118.4	93.0
DK	180.4	183.8	182.3	106.7	104.5	95.7	139.2	163.8	100.7	75.3
DE	88.7	85.9	98.8	100.2	142.8	136.0	132.9	148.7	97.7	119.6
EE	109.7	94.4	87.9	88.5	90.6	107.6	121.2	127.8	66.4	65.6
IE	131.4	130.8	97.8	72.0	85.1	131.5	79.1	51.7	166.3	127.6
EL	78.2	59.2	40.9	44.4	66.0	145.7	111.5	36.0	84.2	66.3
ES	115.9	76.8	107.1	75.2	64.0	45.1	58.2	71.2	93.3	85.0
FR	127.6	114.4	87.4	127.8	82.1	126.5	92.4	85.8	88.5	88.6
HR	49.9	33.7	41.3	30.3	93.6	95.4	62.9	30.0	64.6	35.3
IT	52.4	90.1	67.6	52.9	71.2	130.5	47.8	100.7	73.3	82.5
CY	96.7	109.6	71.9	24.7	71.0	82.4	48.9	104.9	71.8	101.2
LV	63.0	41.0	90.9	97.4	46.4	39.7	48.0	53.5	94.4	53.9
LT	94.6	37.3	121.0	51.4	76.6	110.4	106.9	51.3	42.5	55.0
LU	127.5	192.7	134.6	116.8	65.3	140.4	67.9	157.6	134.5	81.2
HU	43.9	49.7	91.5	42.2	82.2	34.0	54.9	41.2	118.9	81.6
MT	64.0	53.4	131.0	4.7	83.9	59.3	16.0	174.5	151.0	74.9
NL	142.1	170.0	166.6	118.4	71.2	125.7	143.5	124.3	113.8	92.7
AT	116.7	131.0	78.5	84.4	116.2	149.9	165.7	145.8	65.0	83.1
PL	57.6	30.7	125.2	35.7	73.2	16.5	31.2	69.3	92.4	54.5
PT	80.3	103.2	129.8	75.8	81.4	171.4	55.6	74.8	78.2	54.5
RO	13.7	24.2	76.9	26.9	9.1	0.0	39.3	23.0	46.3	61.6
SI	103.0	78.7	88.7	28.5	106.1	68.4	100.6	81.4	81.7	66.9
SK	70.4	41.5	57.5	23.8	66.9	41.7	57.9	39.8	108.5	111.2
FI	157.0	135.4	182.3	113.6	129.8	168.2	152.0	151.8	80.2	85.4
SE	174.9	166.2	172.3	109.3	124.3	115.4	147.3	156.2	134.5	88.0
UK	147.9	157.5	98.4	102.8	97.3	103.9	127.4	81.6	146.7	114.0
IS	126.5	155.0	182.3	104.8	100.6	127.8	166.0	61.8	140.0	31.6
IL	129.8	101.6	75.8	71.4	182.1	84.5	124.5	104.7	177.1	98.7
NO	54.7	31.3	39.9	36.7	79.7	96.3	63.2	24.5	38.1	67.3
MK	143.0	139.9	143.8	116.1	114.9	179.7	157.5	58.0	79.0	51.7
RS	33.2	53.4	35.2	14.0	62.1	53.0	25.1	16.3	6.2	50.1
CH	195.5	207.9	147.0	134.9	175.0	157.2	158.6	173.4	112.3	115.8
TR	82.4	13.3	3.8	6.9	44.3	17.2	2.8	13.4	74.1	33.6
UA	35.8	27.1	78.2	41.8	92.8	150.0	41.6	8.5	10.3	55.3

Annex H: International data

Performance in 2018 relative to EU in 2011	AU	BR	CA	CN	IN	JP	KR	RU	SA	US
	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018
1.1.1 New doctorate graduates	126.7	23.4	79.6	11.0	5.6	63.6	90.3	57.7	11.0	80.6
1.1.2 Population completed tertiary education	132.0	43.1	165.1	40.4	n/a	149.8	139.0	161.9	21.7	135.0
1.2.1 International scientific co-publications	171.7	47.7	165.2	43.0	19.6	74.2	92.9	53.6	62.6	113.6
1.2.2 Scientific publications among top 10% most cited	118.7	46.2	104.1	79.6	47.2	55.3	64.1	28.2	64.2	123.2
2.1.1 R&D expenditure in the public sector	122.0	95.8	115.8	72.6	53.2	96.6	132.9	66.5	69.5	96.6
2.2.1 R&D expenditure in the business sector	77.7	40.3	63.9	126.7	21.0	195.9	238.1	51.7	26.5	158.1
3.1.1 SMEs with product or process innovations	145.0	102.3	153.5	n/a	52.0	71.4	100.8	13.0	n/a	64.7
3.1.2 SMEs with marketing or organisational innovations	93.8	184.6	157.2	n/a	136.6	96.7	98.3	2.9	n/a	n/a
3.2.1 Innovative SMEs collaborating with others	184.4	41.2	n/a	n/a	n/a	143.0	134.9	9.1	n/a	n/a
3.2.2 Public-private co-publications	96.2	7.2	106.5	106.5	2.9	104.4	112.7	17.2	5.3	144.9
3.2.3 Private co-funding of public R&D expenditures	155.1	n/a	161.0	5.4	n/a	55.8	212.2	98.3	165.2	60.6
3.3.1 PCT patent applications	78.9	29.2	83.8	91.7	33.2	172.4	171.8	32.9	38.5	103.4
3.3.2 Trademark applications	222.5	111.9	210.7	296.6	57.9	205.7	225.8	151.0	67.0	61.7
3.3.3 Design applications	98.4	53.0	76.4	202.6	42.0	96.3	226.8	54.6	65.0	59.9
4.2.1 Medium & high-tech product exports	13.6	40.6	59.9	91.9	47.6	118.5	119.4	21.5	50.0	80.9
4.2.2 Knowledge-intensive services exports	36.0	114.8	82.9	72.4	120.1	110.2	87.8	95.8	36.7	86.3

Change in performance (2011-2018)

Performance change is measured as the difference between performance in 2018 relative to the EU average in 2011 and performance in 2011 relative to the EU average in 2011 (the results are the same as those shown in the final column in the performance tables in the country profiles in Section 5.3).

	AU	BR	CA	CN	IN	JP	KR	RU	SA	US
1.1.1 New doctorate graduates	9.7	-0.2	2.7	-2.0	-1.3	-2.2	11.2	30.8	2.5	-19.4
1.1.2 Population completed tertiary education	-2.3	-8.8	-14.8	5.1	n/a	-12.7	-2.6	-25.6	-17.5	-13.8
1.2.1 International scientific co-publications	-19.5	5.1	-8.5	7.0	1.3	-4.9	-4.4	5.7	5.9	-4.4
1.2.2 Scientific publications among top 10% most cited	-1.2	0.1	-15.1	17.2	-2.8	-4.3	-8.5	12.6	-4.7	-15.5
2.1.1 R&D expenditure in the public sector	1.0	3.9	-5.4	9.7	-24.3	-5.6	13.6	9.1	12.9	-13.7
2.2.1 R&D expenditure in the business sector	-26.7	-4.1	-17.7	11.8	-4.0	-17.6	-6.8	-1.0	-3.1	-3.6
3.1.1 SMEs with product or process innovations	-16.6	-2.3	-18.0	n/a	-1.2	-7.5	48.6	0.1	n/a	-3.7
3.1.2 SMEs with marketing or organisational innovations	-32.9	18.5	0.5	n/a	14.2	2.2	48.3	0.3	n/a	n/a
3.2.1 Innovative SMEs collaborating with others	38.1	-19.9	n/a	n/a	n/a	25.0	-44.8	0.1	n/a	n/a
3.2.2 Public-private co-publications	7.3	-0.5	-10.4	-10.4	0.2	-17.4	-13.4	8.9	-0.3	-27.9
3.2.3 Private co-funding of public R&D expenditures	9.5	n/a	-17.5	-3.1	n/a	4.9	44.3	-60.1	78.9	-33.6
3.3.1 PCT patent applications	-4.0	1.5	-3.0	24.8	-2.7	6.5	20.4	0.4	-5.7	1.0
3.3.2 Trademark applications	-51.2	-6.7	-6.2	62.3	-21.5	110.3	-28.8	13.2	-55.2	0.6
3.3.3 Design applications	8.1	-1.2	8.0	-10.0	-0.6	3.5	14.1	7.3	0.8	9.9
4.2.1 Medium & high-tech product exports	-1.7	-4.6	-3.5	-4.6	3.2	-2.0	-7.2	3.4	1.1	-5.4
4.2.2 Knowledge-intensive services exports	7.0	10.9	-4.2	-19.4	0.6	-13.2	-3.8	1.7	-1.0	3.8

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