European Commission

European **Innovation Scoreboard** 2016

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This report was prepared by:
Hugo Hollanders, Nordine Es-Sadki, and Minna Kanerva
Maastricht University (Maastricht Economic and Social Research Institute on Innovation and Technology – MERIT)

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

Coordinated and guided by:
Mark Nicklas, Acting Head of Unit, Daniel Bloemers, Alberto Licciardello, and Marshall Hsia
Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

Directorate F – Innovation and Advanced Manufacturing
Unit F1 – Innovation Policy and Investment for Growth

in close co-operation with
Román Arjona, Chief Economist, Marnix Surgeon, Deputy Head of Unit, and Richard Deiss
Directorate-General for Research and Innovation
Unit A4 – Analysis and monitoring of national research policies

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European **Innovation** Scoreboard 2016

Foreword

Innovation grows the EU's knowledge economy, it enhances our competitiveness and it creates a prosperous future for all Member States. This is why innovation features prominently in the ten priorities of the Juncker Commission.

The *European Innovation Scoreboard 2016* gives an assessment of the EU and Member States' innovation performance, as well as that of key international competitors. Its 25 indicators give a detailed analysis of the strengths and weaknesses of Member States on the basis of important innovation drivers – from research systems and public and private investment, to the economic effects of innovation. Also, for the first time, we include a chapter on expected short-term changes in EU innovation performance to help anticipate future trends.

This edition of the Scoreboard reveals several interesting developments. The EU has a lead in innovation performance over many other countries, while China is making swift progress. In addition, the EU is catching up with Japan and the United States, but is still losing ground to South Korea.

The report shows positive trends in human resources, and the attractiveness, openness and quality of research systems, but negative trends both in research investment and in the framework conditions for business engagement in venture capital and SME innovation.

While performance varies considerably, many Member States are top innovators worldwide. Reforms are crucial to maintaining and improving the performance of national research and innovation systems. The EU supports Member States in achieving reform through the Horizon 2020 Policy Support Facility and, through initiatives such as the Investment Plan for Europe and the Single Market Agenda, the Commission is improving the business environment for SMEs and start-ups.

In short, Europe's future depends on becoming a place where innovation flourishes and where businesses develop new products and services. We need market-creating innovation for sustainable economic growth, more and better jobs, an improved quality of life and economic opportunities for all citizens.

We believe *the European Innovation Scoreboard 2016* provides important insights into the challenges and opportunities that lie ahead and we hope it will be a useful tool for everyone interested in innovation, in particular, decision-makers designing innovation policies and strategies.

Elżbieta Bieńkowska
Member of the European Commission
Responsible for Internal Market, Industry,
Entrepreneurship and SMEs

Carlos Moedas
Member of the European Commission
Responsible for Research,
Science and Innovation

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Executive summary

European Innovation Scoreboard 2016: a new name

Using again its original name, the report is now called European Innovation Scoreboard, and not Innovation Union Scoreboard, as it was called from 2010 to 2015.

The EU is doing better compared to Japan and the United States, while it is losing ground vis-à-vis South Korea

At global level, the EU continues to be less innovative than South Korea, the United States and Japan, but performance differences with the last two countries have become smaller. However, South Korea has managed to improve its performance at a much faster pace than the EU over the last eight years. The EU still has a considerable performance lead over many other countries, including China. However, China is catching up, with a performance growth rate five times that of the EU.

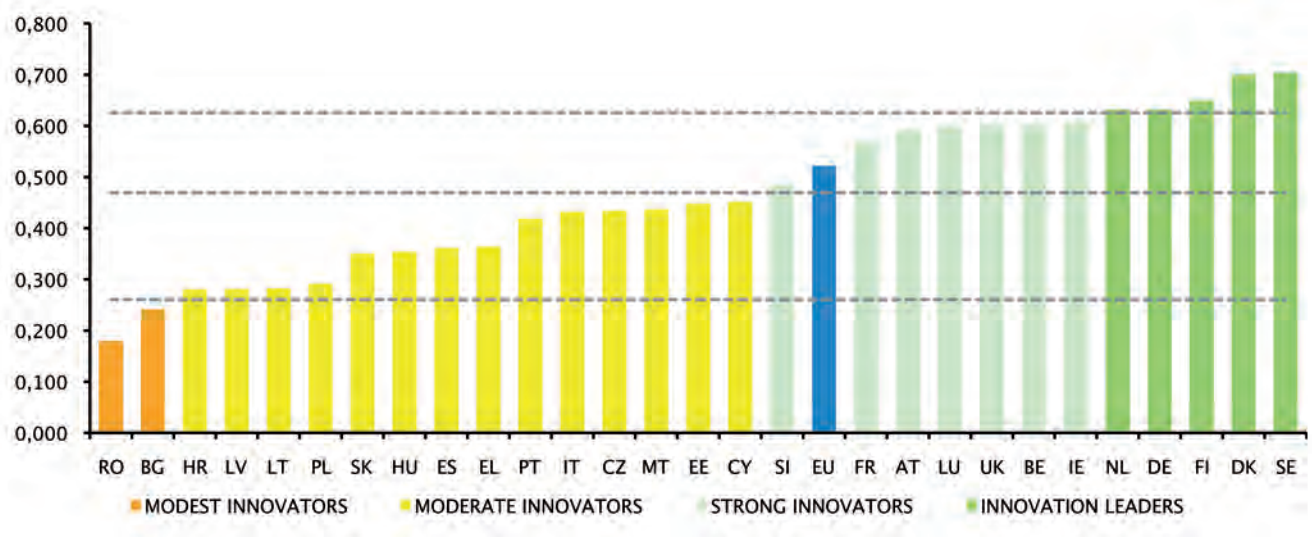
Innovation performance is measured by average performance on 25 indicators

The measurement framework used in the European Innovation Scoreboard distinguishes between three main types of indicators and eight innovation dimensions, capturing in total 25 different indicators. The Enablers capture the main drivers of innovation performance external to the firm and cover three innovation dimensions: *Human resources, Open, excellent and attractive research systems,* as well as *Finance and support*. Firm activities capture the innovation efforts at the level of the firm, grouped in three innovation dimensions: *Firm investments, Linkages & entrepreneurship*, and *Intellectual assets*. Outputs cover the effects of firms' innovation activities in two innovation dimensions: *Innovators* and *Economic effects*.

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

Based on their average innovation performance as calculated by a composite indicator, the Summary Innovation Index, Member States fall into four different performance groups (Figure 1). Denmark, Finland, Germany, the Netherlands, and Sweden are *Innovation Leaders* with innovation performance well above that of the EU average. Austria, Belgium, France, Ireland, Luxembourg, Slovenia, and the UK are *Strong Innovators* with innovation performance above or close to that of the EU average. The performance of Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, and Spain is below that of the EU average. These countries are *Moderate Innovators*. Bulgaria and Romania are *Modest Innovators* with innovation performance well below that of the EU average.

Figure 1: EU Member States' innovation performance



There have been two changes in performance group memberships compared to last year's report: Latvia has moved up to the Moderate Innovators, and the Netherlands has moved up to the Innovation Leaders.

Date timeliness has improved

The improved timeliness of the data for this year's report originates from two changes. Firstly, the postponement of the report's publication has allowed data updates until April 2016 to be included. Secondly, timeliness has improved due to changes in several data sources, e.g. data on trademarks and designs have now been acquired directly from the European Union Intellectual Property Office (EUIPO), and data on venture capital investments from Invest Europe, instead of acquiring these data indirectly from Eurostat.

Growth has been positive over a period of eight years ...

Over an eight-year period (2008-2015), performance has been improving for the EU as a whole, and for as many as 21 Member States, with growth having been highest for Latvia and Malta. However, for seven Member States, long-term performance growth has been negative, with the most negative growth rate observed for Romania.

... but more recently, performance has declined for many Member States

Despite the positive performance growth for many Member States for 2008-2015, there has been a trend reversal when comparing the years before and after 2012, with many Member States experiencing negative performance growth for 2012-2015. Most recently (2014-2015), as many as 17 Member States have experienced negative growth. The process of convergence in performance differences between Member States – as observed in previous reports since 2012 – appears to have come to a halt.

More innovative countries have balanced innovation systems

The country ranking order in overall innovation performance is similar to the ranking order for each of the eight innovation dimensions. Performance differences across the dimensions are smallest for the Innovation Leaders, suggesting that a balanced innovation system is essential for achieving a high level of performance.

Switzerland remains the most innovative country in Europe

Comparing the EU Member States to other European and neighbouring countries, Switzerland remains the most innovative European country. New inclusions this year to this comparison are Israel, a Strong Innovator, and Ukraine, a Modest Innovator. As regards other changes since last year, recent performance growth for Turkey has been strong, and this has moved the country from Modest to Moderate Innovators.

In two years' time, EU innovation performance is expected to increase by about 2.5%

For the first time, this year's report includes a forward-looking analysis of EU innovation performance discussing more recent developments, trends, and expected changes. The purpose of this exercise is to address the need for more recent information, since available statistical data for the EIS innovation indicators are, on average, two to three years old. The analysis explores the EU trend performance for 20 indicators, for which a robust calculation of expected short-term changes proved possible. Increasing performance is expected for 15 of these indicators, and decreasing performance for only three indicators. Projections for six indicators are based on provisional 'fast track' Community Innovation Survey 2014 data made available by 18 Member States. Overall, the EU innovation index is expected to increase relatively strongly by about 2.5% in two years' time. The exercise also includes a trend comparison of the EU with its main competitors. At the global level, the trends observed in recent years can be expected to continue, with the EU performance gap towards Japan and the US narrowing further, the gap towards South Korea increasing, and the EU lead over China shrinking.

1. Introduction

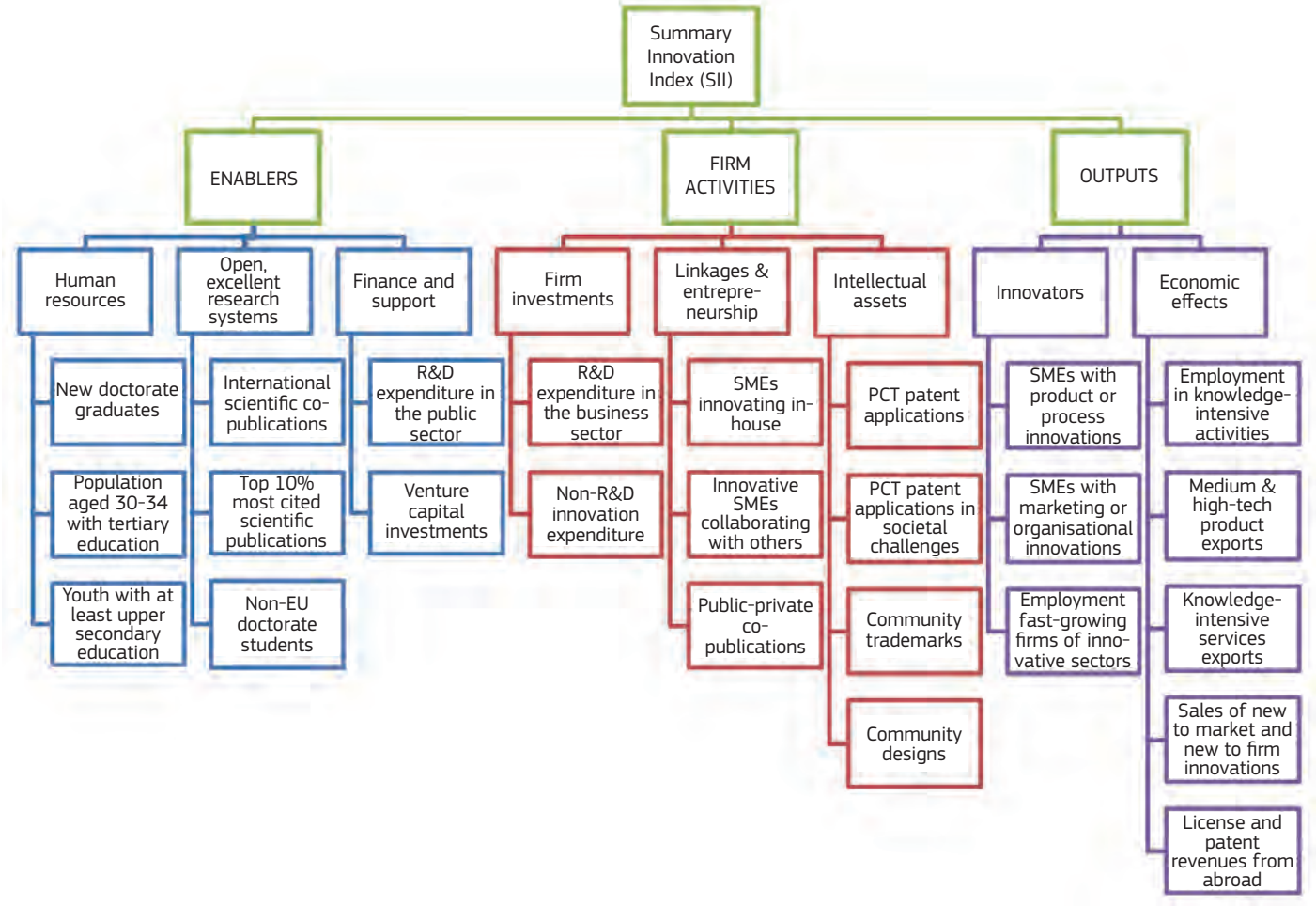
The annual European Innovation Scoreboard (EIS) provides a comparative assessment of the research and innovation performance of the EU Member States and the relative strengths and weaknesses of their research and innovation systems. It helps Member States assess areas in which they need to concentrate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

Measurement framework

The European Innovation Scoreboard 2016[1], the 15th edition since the introduction of the EIS in 2001, follows the methodology of previous editions. Innovation performance is measured using a composite indicator – the Summary Innovation Index – which summarizes the performance of a range of different indicators. The EIS distinguishes between three main types of indicators – Enablers, Firm activities, and Outputs – and eight innovation dimensions, capturing in total 25 indicators. The measurement framework is presented in Figure 2 and Table 1.

The Enablers capture the main drivers of innovation performance external to the firm and differentiate 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 30-34 with completed tertiary education, and Population aged 20-24 having completed at least upper secondary education. *Open, excellent and 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 Non-EU doctorate students. *Finance and support* includes two indicators and measures the availability of finance for innovation projects by Venture capital investments and the support of governments for research and innovation activities by R&D expenditures by universities and government research organisations.

Figure 2: Measurement framework of the European Innovation Scoreboard



[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.*

Firm activities capture the innovation efforts at the level of the firm and differentiate between three innovation dimensions. *Firm investments* include two indicators of both R&D and Non-R&D investments that firms make in order to generate innovations. *Linkages & entrepreneurship* includes three indicators measuring innovation capabilities by looking at SMEs that innovate in-house, collaboration efforts between innovating firms, and research collaboration between the private and public sector. *Intellectual assets* captures different forms of Intellectual Property Rights (IPR) generated in the innovation process, including PCT patent applications, Community trademarks and Community designs.

Outputs capture the effects of firms' innovation activities and differentiate between two innovation dimensions. *Innovators* include three indicators measuring the share of firms that have introduced innovations onto the market or within their organisations, covering both technological and non-technological innovations, and Employment in fast-growing firms in innovative sectors. *Economic effects* includes five indicators and captures the economic impact of innovation in Employment in knowledge-intensive activities, Exports of medium and high tech products, Exports of knowledge-intensive services, Sales due to innovation activities, and License and patent revenues from selling technologies abroad.

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 1 April 2016. International sources have been used wherever possible in order to improve comparability between countries. The data relates to actual performance in 2015 for seven indicators, 2014 for seven indicators, 2013 for four indicators, and 2012 for seven indicators (these are the most recent years for which data are available, as highlighted by the underlined years in the last column in Table 1).

Data availability is complete for 27 Member States, with data being available for all 25 indicators. For Greece, data is missing for only one indicator (Non-EU doctorate students as percentage of all doctorate students). Compared to last year, data availability has improved significantly for Venture capital investments, as data for ten more countries have been made available by Invest Europe[2].

Changes to the measurement framework

Although the general methodology of the EIS 2016 has remained unchanged, there have been several changes in indicator definitions, data sources or data revisions as compared to the IUS 2015 report. Due to these changes, results in this year's report are not comparable to those in last year's report:

1. **Change in data source for International scientific co-publications**
   Data on International scientific co-publications are calculated by the Centre for Science and Technology Studies (CWTS) using data from Web of Science[3]. For the IUS 2015 report, the indicator was calculated using data from Scopus[4]. Web of Science is an online subscription-based scientific citation indexing service maintained by Thomson Reuters. Scopus is a bibliographic database containing abstracts and citations for academic journal articles maintained by Elsevier. The impact of switching data sources is significant, as the indicator values for the Member States for International scientific co-publications for 2008-2012 (for which data are available from the IUS 2015 and EIS 2016) are on average about 23% higher using Web of Science data.

2. **Change in data source for Most-cited scientific publications**
   Data on Most-cited scientific publications are calculated CWTS using data from Web of Science. For the IUS 2015 report, the indicator was calculated using data from Scopus. The impact of switching data sources is significant as the indicator values for the Member States for Most-cited scientific publications for 2006-2009 (for which data are available from the IUS 2015 and EIS 2016) are on average about 16% lower using Web of Science data.

3. **Change in definition and calculation method for Venture capital investments**
   The definition of Venture capital investments has changed, using market instead of industry statistics. Industry statistics measure how much venture capital funding originates from a particular country, whereas market statistics measure how much venture capital is invested in a particular country. Market statistics provide more relevant information about the importance of venture capital for the domestic market. Another change is that for Venture capital investments three-year averages have been used, whereas in the IUS 2015 two-year averages were used. Venture capital statistics are obtained directly from Invest Europe, which has provided data for all Member States, including data for those countries for which data had not been available in any of the previous EIS/IUS reports: Croatia, Cyprus, Estonia, Latvia, Lithuania, Malta, Slovakia, and Slovenia.[5] The indicator values for the Member States for Venture capital investments for 2008-2013 (for which data are available from the IUS 2015 and EIS 2016) are on average about 190% higher in the EIS 2016 as compared to the IUS 2015.

4. **Data revision for Public-private co-publications**
   Data on Public-private co-publications are calculated by CWTS using data from Web of Science. Data are not comparable to those used in the 2015 report due to a revised calculation method by CWTS. The indicator values for the Member States for Public-private co-publications for 2007-2012 (for which data are available from the IUS 2015 and EIS 2016) are on average about 20% lower in the EIS 2016 as compared to the IUS 2015.

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[2] *Invest Europe, formerly known as EVCA, European Private Equity & Venture Capital Association, is the association representing Europe's private equity, venture capital and infrastructure sectors, as well as their investors (http://www.investeurope.eu/).*

[3] *http://ipscience.thomsonreuters.com/product/web-of-science/*

[4] *https://www.elsevier.com/solutions/scopus*

[5] *In addition to these eight Member States, Invest Europe has also made data available for the Former Yugoslav Republic of Macedonia and Serbia.*

5. Change in definition for PCT patent applications in societal challenges

For the IUS 2015, the indicator was calculated using data from the OECD aggregating PCT patent applications in Environment-related technologies and Health. Patents in Environment-related technologies include applications in the following technology domains: 1) General Environmental Management (air, water, waste), 2) Energy generation from renewable and non-fossil sources, 3) Combustion technologies with mitigation potential (e.g. using fossil fuels, biomass, waste, etc.), 4) Technologies specific to climate change mitigation, 5) Technologies with potential or indirect contribution to emissions mitigation, 6) Emissions abatement and fuel efficiency in transportation, and 7) Energy efficiency in buildings and lighting. Patents in Health-related technologies include applications in Medical technology and Pharmaceuticals technology domains. For the EIS 2016, similar data for Environment-related technologies are no longer available from the OECD. Environment-related technologies for the EIS 2016 include applications in the following technology domains: 1) Climate change mitigation technologies related to buildings, 2) Climate change mitigation technologies related to energy generation, transmission or distribution, 3) Capture, storage, sequestration or disposal of greenhouse gases, 4) Environmental management, 5) Climate change mitigation technologies related to transportation, and 6) Water-related adaptation technologies. The indicator values for the Member States for PCT patent applications in societal challenges for 2006-2011 (for which data are available from the IUS 2015 and EIS 2016) are on average about 11% higher in the EIS 2016 as compared to the IUS 2015.

6. Change in data source for Community trademarks

Data are obtained directly from the European Union Intellectual Property Office (EUIPO)[6]. Previously, data were extracted from Eurostat who also use EUIPO as their source. The advantage of receiving the data directly from EUIPO is that more timely 2015 data could be used. There is no impact as such on the indicator values for the Member States for Community trademarks.

7. Change in definition and data source for Community designs

For the indicator measuring Community designs, following a recommendation from EUIPO, data on individual designs have been used instead of using the number of applications, as one application can include multiple individual designs. Data are obtained directly from EUIPO. Previously, data were extracted from Eurostat who also use EUIPO as their source, but Eurostat data are for number of applications only. The advantage of receiving the data directly from EUIPO is also that more timely 2015 data could be used. The impact of changing the definition is significant, as the indicator values for the Member States for Community designs for 2007-2012 (for which data are available from the IUS 2015 and EIS 2016) are on average about 250% higher in the EIS 2016 as compared to the IUS 2015.

8. Change in the methodology for calculating Balance of Payments statistics for Exports of knowledge-intensive services

The production of statistics on international trade in services uses as reference the International Monetary Fund (IMF)'s Balance Of Payments and International Investment Position Manual (BPM) and the United Nations' Manual on Statistics of International Trade in Services (MSITS). The indicator measuring Exports of knowledge-intensive services was first introduced in the EIS 2008. It followed the fifth edition of the BPM and matched NACE industries to EBOPS (Extended Balance of Payments Services Classification) using the correspondence table in the 2002 MSITS[7]. BMP5 and MSITS 2002 have meanwhile been replaced by newer editions, BMP6 (the sixth edition) and MSITS 2010. As a result of these revisions, the EBOPS classification has been revised, requiring an update of the definition of knowledge-intensive services exports. As work is still ongoing at the United Nations Statistics Division on the concordance tables that would allow for an 'automatic' selection of knowledge-intensive services, a task force involving experts from various European Commission services decided to select a list of services that – given the details in BPM6 – are potentially associated with knowledge-intensive business activities[8]. Full details are reported in the Methodology report for the 2016 Innovation Output Indicator[9]. Data using the new definition have been estimated by the European Commission's Joint Research Centre. The impact of changing the definition is significant, as the indicator values for the Member States for Exports of knowledge-intensive services for 2010-2012 (for which data are available from the IUS 2015 and EIS 2016) are on average about 34% higher in the EIS 2016 as compared to the IUS 2015.

9. Change in the methodology for calculating Balance of Payments statistics for License and patent revenues from abroad

As for the indicator measuring Exports of knowledge-intensive services, the indicator on License and patent revenues from abroad is also affected by the introduction of new international standards for compiling Balance of Payments statistics under the BPM6 methodology. The impact of changing the definition is significant, as the indicator values for the Member States for License and patent revenues from abroad for 2007-2013 (for which data are available from the IUS 2015 and EIS 2016) are on average about 57% higher in the EIS 2016 as compared to the IUS 2015.

Of the above-mentioned changes, several had to be introduced because of changes in the primary data sources. These include changes in the values for the three indicators using bibliometric data (items 1, 2 and 4 above), in the values for the two indicators using Balance of Payment statistics (items 8 and 9 above), and the value for PCT patent applications in societal challenges as OECD data for the definition used up until last year are no longer available (item 5 above). Changes to the indicators on Venture capital investments (item 3) and Community designs (item 7) were introduced, as these are perceived to improve the measurement framework. Changes on the normalized scores used for calculating the Summary Innovation Index are much smaller, as the normalized scores are always between 0 and 1 (for respectively the lowest and highest performing country).

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[6] *The European Union Intellectual Property Office, or EUIPO, is the trademark and designs registry for the internal market of the European Union. Until 23 March 2016, it was named Office for Harmonization in the Internal Market (Trade Marks and Designs), or OHIM: https://euipo.europa.eu/ohimportal/en/*

[7] *Table A.IV.1 in United Nations, Manual on Statistics of International Trade in Services, Statistical Papers Series M. No. 86, 2002*

[8] *The revised list of Knowledge-intensive services includes the following items: SC1 Sea transport, SC2 Air transport, SC3A Space transport, SF Insurance and pension services, SG Financial services, SI Telecommunications, computer and information services, SJ Other business services and SK1 Audio-visual and related services.*

[9] *Vertesy, D., (2016), The Innovation Output Indicator 2016: Methodology update, European Commission, DG JRC, COIN.*

Table 1: European Innovation Scoreboard indicators

MAIN TYPE / Innovation dimension / Indicator	Data source	Years included
ENABLERS		
Human resources		
1.1.1 New doctorate graduates (ISCED 6) per 1000 population aged 25-34	Eurostat	2007 - 2014
1.1.2 Percentage population aged 30-34 having completed tertiary education	Eurostat	2008 - 2015
1.1.3 Percentage youth aged 20-24 having attained at least upper secondary level education	Eurostat	2008 - 2015
Open, excellent and attractive research systems		
1.2.1 International scientific co-publications per million population	Web of Science (data provided by CWTS as part of a contract to DG Research and Innovation)	2008 - 2015
1.2.2 Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	Web of Science (data provided by CWTS as part of a contract to DG Research and Innovation)	2006 - 2013
1.2.3 Non-EU doctorate students as percentage of all doctorate students[10]	Eurostat	2007 - 2014
Finance and support		
1.3.1 R&D expenditure in the public sector as percentage of GDP	Eurostat	2007 - 2014
1.3.2 Venture capital investment as percentage of GDP	Venture capital: Invest Europe; GDP: Eurostat	2008 - 2015
FIRM ACTIVITIES		
Firm investments		
2.1.1 R&D expenditure in the business sector as percentage of GDP	Eurostat	2007 - 2014
2.1.2 Non-R&D innovation expenditures as percentage of turnover	Eurostat	2006, 2008, 2010, 2012
Linkages & entrepreneurship		
2.2.1 SMEs innovating in-house as percentage of SMEs	Eurostat	2006, 2008, 2010, 2012
2.2.2 Innovative SMEs collaborating with others as percentage of SMEs	Eurostat	2006, 2008, 2010, 2012
2.2.3 Public-private co-publications per million population	Web of Science (data provided by CWTS as part of a contract to DG Research and Innovation)	2008 - 2014
Intellectual assets		
2.3.1 PCT patents applications per billion GDP (in Purchasing Power Standard €)	Patents: OECD; GDP: Eurostat	2006 - 2013
2.3.2 PCT patent applications in societal challenges (environment-related technologies; health) per billion GDP (in Purchasing Power Standard €)	Patents: OECD; GDP: Eurostat	2005 - 2012
2.3.3 Community trademarks per billion GDP (in Purchasing Power Standard €)	Trademarks: EUIPO; GDP: Eurostat	2008 - 2015
2.3.4 Community designs per billion GDP (in Purchasing Power Standard €)	Designs: EUIPO; GDP: Eurostat	2008 - 2015
OUTPUTS		
Innovators		
3.1.1 SMEs introducing product or process innovations as percentage of SMEs	Eurostat	2006, 2008, 2010, 2012
3.1.2 SMEs introducing marketing or organisational innovations as percentage of SMEs	Eurostat	2006, 2008, 2010, 2012
3.1.3 Employment in fast-growing enterprises (average innovativeness scores),	Joint Research Centre	2010 - 2013
Economic effects		
3.2.1 Employment in knowledge-intensive activities (manufacturing and services) as percentage of total employment	Eurostat	2008 - 2014
3.2.2 Medium and high tech product exports as percentage of total product exports	Eurostat	2008 - 2015
3.2.3 Knowledge-intensive services exports as percentage of total service exports	Joint Research Centre	2010 - 2013
3.2.4 Sales of new-to-market and new-to-firm innovations as percentage of turnover	Eurostat	2006, 2008, 2010, 2012
3.2.5 License and patent revenues from abroad as percentage of GDP	Eurostat	2007 - 2014

Underlined years in the last column show the data used to measure countries' most recent innovation performance.

[10] *For non-EU countries, the indicator measures the share of non-domestic doctoral students.*

2. Innovation performance and trends

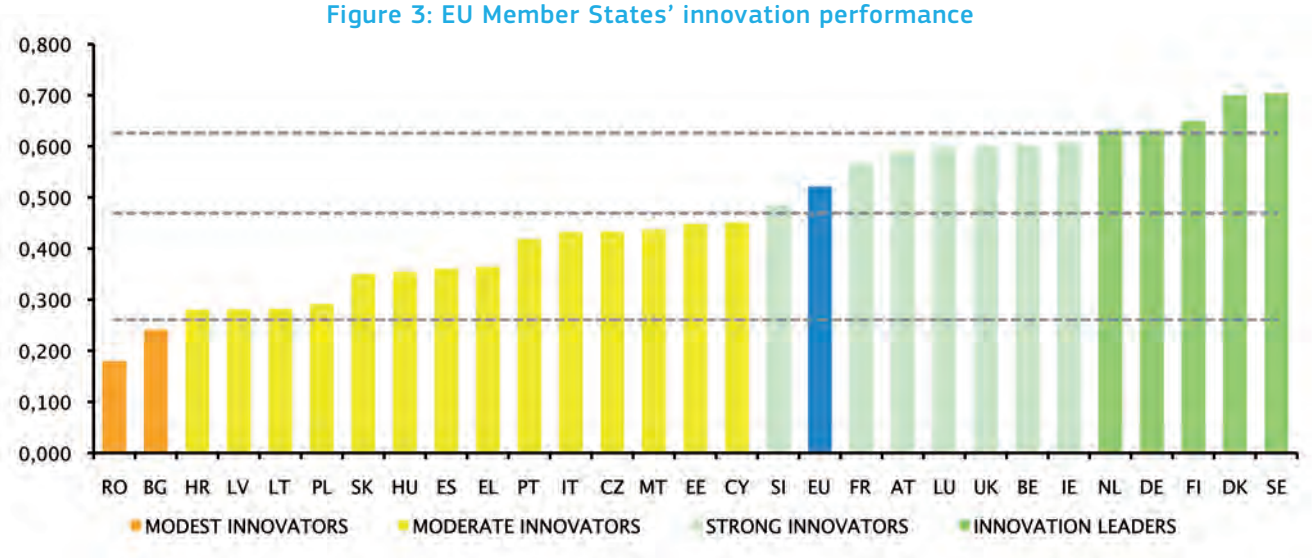
2.1 Most recent innovation performance

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 25 indicators[11]. Figure 3 shows the performance results for all EU Member States.

Based on this year's Summary Innovation Index, the Member States fall into the following four performance groups[12]:

- The first group of Innovation Leaders includes Member States in which innovation performance is more than 20% above the EU average. These are Denmark, Finland, Germany, the Netherlands, and Sweden, which confirms its top position. The Netherlands has improved from being a Strong Innovator to an Innovation Leader.
- The second group of Strong Innovators includes Member States with a performance between 90% and 120% of the EU average. Austria, Belgium, France, Ireland, Luxembourg, Slovenia, and the UK are Strong Innovators.
- The third group of Moderate Innovators includes Member States where the innovation performance is between 50% and 90% of the EU average. Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, and Spain belong to this group. Latvia has improved from being a Modest Innovator to a Moderate Innovator.
- The fourth group of Modest Innovators includes Member States that show an innovation performance level well below that of the EU average, i.e. less than 50% of the EU average. This group comprises Bulgaria and Romania.

Figure 3: EU Member States' innovation performance



Note: Average performance is measured using a composite indicator building on data for 25 indicators going from a lowest possible performance of 0 to a maximum possible performance of 1.

2.2 Performance changes over time

This section will discuss performance changes over time for each of the innovation performance groups and the Member States included in each of the groups.

Innovation Leaders

Innovation performance for the Innovation Leaders has been improving up to about two years ago, when average performance for the group started to decline. During the last two years, performance relative to the EU dropped by 1.3 percentage points (Figure 4). For Finland, performance started to decline in 2010, for Denmark and Germany in 2012, for Sweden in 2013, and for the Netherlands in 2014. Sweden has been the most innovative Member State over the whole period, but Denmark has managed to close a significant part of its performance gap with Sweden.

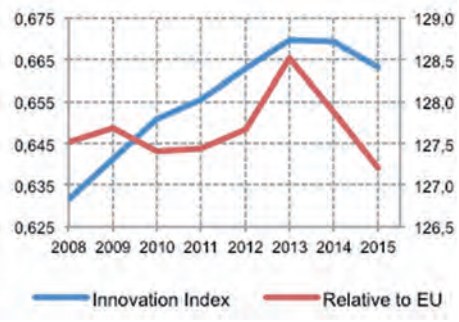
Performance has improved most for the Netherlands. The Dutch innovation index has grown at an average annual growth rate for 2008-2015 of 2.0%, followed by Denmark (1.7%), Germany (0.2%) and Sweden (0.1%) (cf. Figure 8). For Finland, the innovation index has decreased at an average annual rate of -0.3%. For both Denmark and the Netherlands, innovation performance has been improving more rapidly than that of the EU. The other Innovation

[11] *Section 8.1 gives a brief explanation of the calculation methodology. The EIS 2016 Methodology report provides a more detailed explanation.*

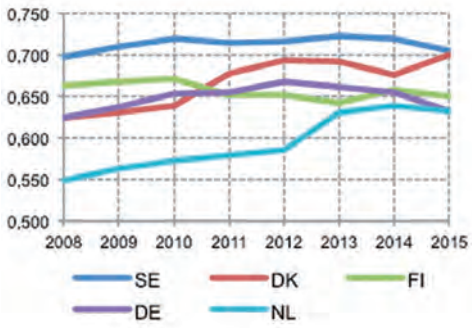
[12] *The EIS performance groups are relative performance groups with countries' group membership depending on their performance relative to that of the EU. With a growing EU innovation performance, the absolute thresholds between these groups will also be increasing over time.*

Leaders have not been able to match the performance increase of the EU, resulting in declining performance leads over the EU average. For example, the Swedish performance lead over the EU has declined from an average of 41% in 2008-2010 to 35% in 2015, the most recent reference year.

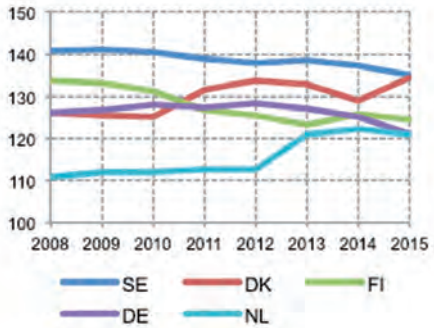
Figure 4: Innovation Leaders



Group performance



Innovation index



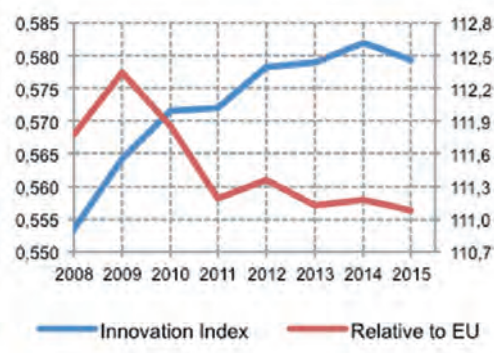
Relative to EU (EU=100)

Strong Innovators

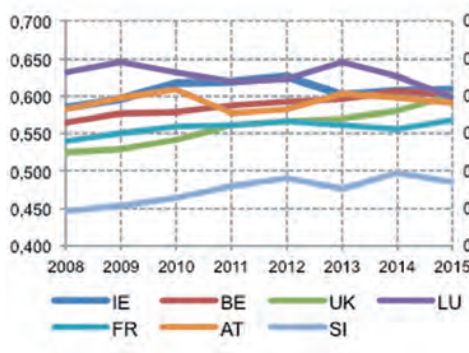
Innovation performance for the Strong Innovators has been improving until last year, when average performance for the group declined. Performance relative to the EU has been declining for most of the period, in particular between 2009 and 2011, after which the rate of decline decreased (Figure 5). Within the group of Strong Innovators, Ireland and Luxembourg have been swapping group leadership over time. Luxembourg was the best performing country for 2008-2010 and 2013-2014, Ireland was the best performing country for 2011-2012 and 2015.

Innovation performance has been improving for most Strong Innovators. Performance has improved strongest for the UK (2.0% average annual growth rate for 2008-2015, cf. Figure 8), Slovenia (1.2%), Belgium (0.9%), and France (0.8%). These four Strong Innovators have been growing at a higher rate than the EU, and relative performance to the EU has improved. Growth performance of Ireland (0.6%) and Austria (0.2%) is at or below that of the EU, and for both countries, relative performance to the EU has declined. For Luxembourg, the innovation index has decreased at an average annual rate of -0.8%, leading to a strong decline of 13 percentage points between 2008 and 2015 in the relative performance to the EU.

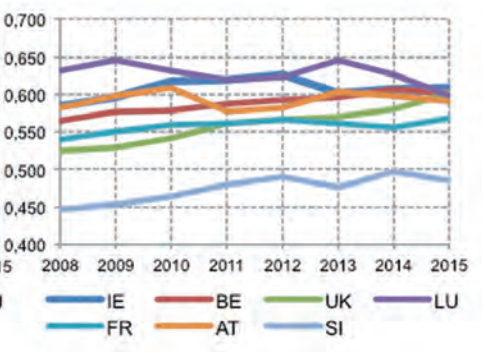
Figure 5: Strong Innovators



Group performance



Innovation index



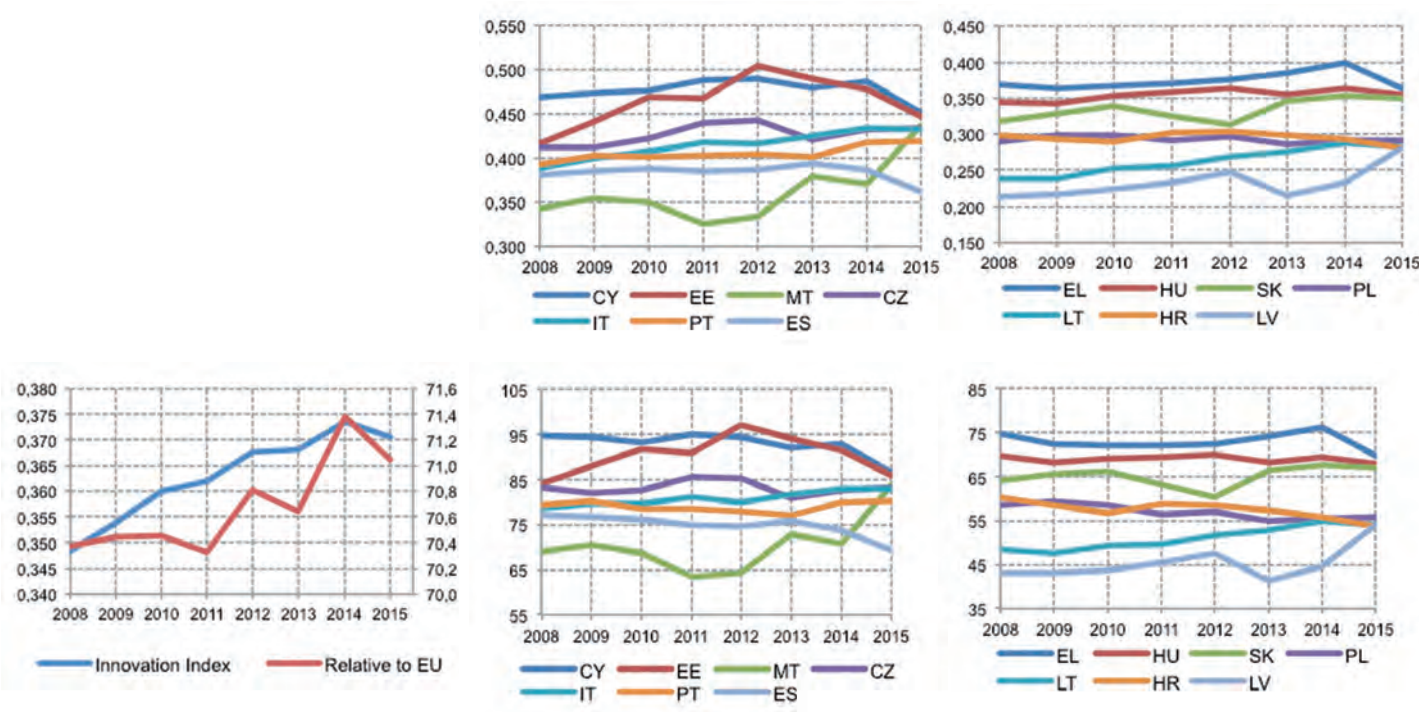
Relative to EU (EU=100)

Moderate Innovators

Innovation performance for the Moderate Innovators has been consistently improving over time until last year. Performance relative to the EU has improved from 70.4% in 2008 to 71% in 2015 (Figure 6). Cyprus and Estonia are among the best performing countries, with both countries belonging to the group of Strong Innovators until last year. Latvia, a Modest Innovator in the IUS 2015, is the weakest performing Moderate Innovator, but its gap with other countries has decreased significantly as shown by an increase in the performance level relative to that of the EU from as low as 43% in 2008 to almost 54% in 2015.

Performance between 2008 and 2015 has improved for ten countries and was strongest for Latvia (4.0% average annual growth rate for 2008-2015, cf. Figure 8), followed by Malta (3.6%), Lithuania (2.4%), Italy (1.5%), Slovakia (1.4%), Estonia (1.1%), and Portugal (0.9%). All of these Moderate Innovators have been growing at a higher rate than the EU, resulting in an improved relative performance to the EU. For the Czech Republic (0.7%), innovation performance has improved at almost the same rate as that of the EU. For Poland (0.1%) and Hungary (0.4%), innovation performance has improved but at a rate below that of the EU, and for both countries, relative performance to the EU has decreased. For Greece (-0.2%), Cyprus (-0.6%), Spain (-0.8%), and Croatia (-0.9%), growth of their innovation index has been negative, and relative performance to the EU has declined. Malta's strong performance growth has resulted in an increase of six rank positions over time to the third best Moderate Innovator in 2015.

Figure 6: Moderate Innovators

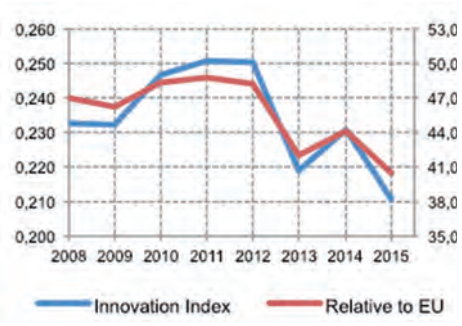


Group performance ***Innovation index*** ***Relative to EU (EU=100)***

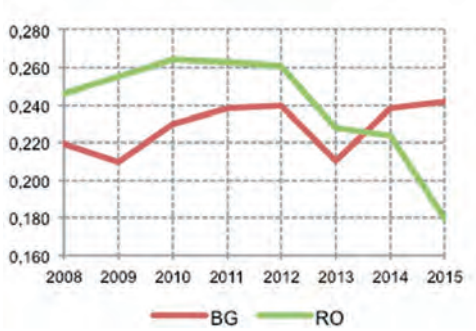
Modest Innovators

There are only two Member States currently included in this group, Bulgaria and Romania. Over time, innovation performance for the Modest Innovators has been declining, and performance relative to the EU has dropped from more than 48% in 2010-2012 to 40.3% in 2015 (Figure 7). Innovation performance has increased for Bulgaria and has declined strongly for Romania. For Bulgaria (1.4% average annual growth rate for 2008-2015, cf. Figure 8) performance declined strongly in 2013, but was followed by a strong recovery in 2014 and 2015. Romania's performance has declined the most of all countries (-4.4%), in particular since 2012. Until 2010, Romania's innovation index had improved, even raising its relative performance level above 50%. During the last three years, performance has declined sharply, in particular due to performance drops of 75% or more in Non-R&D innovation expenditures and Sales of new product innovations.

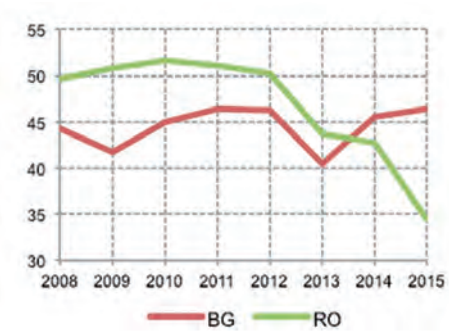
Figure 7: Modest Innovators



Group performance



Innovation index



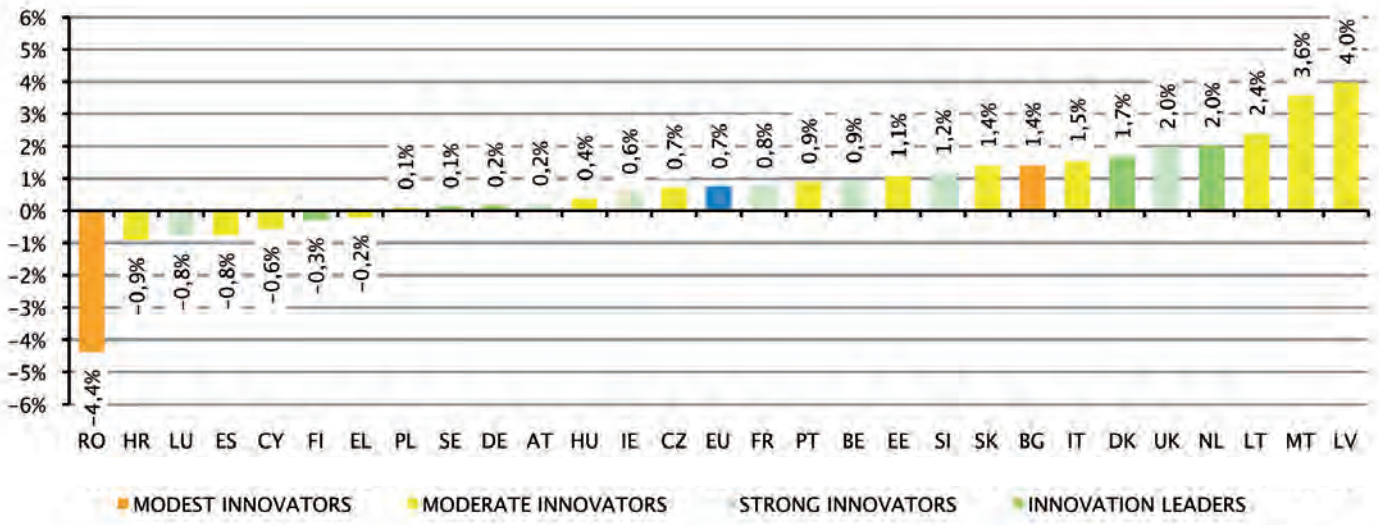
Relative to EU (EU=100)

Performance growth and growth leaders

For 21 Member States, performance growth has been positive over the eight-year period considered (Figure 8). Average annual growth has been close to or at 4% for both Latvia and Malta, the two growth leaders. For 14 Member States, growth has been faster than that of the EU, for 14 Member States it has been slower. Growth has been negative for seven Member States (in descending order of performance): Greece, Finland, Cyprus, Spain, Luxembourg, Croatia, and Romania. Innovation performance for half of the Member States has been growing faster than that of the EU, where the group of Moderate Innovators has performed best, with seven out of 14 countries growing faster than the EU.

Within the four country groups, growth performance is very different. Within the Innovation Leaders, the Netherlands is the growth leader closely followed by Denmark, whereas performance growth for Finland is negative. The UK is the growth leader of the Strong Innovators. Performance growth is also relatively strong for Slovenia and Belgium, and negative for Luxembourg. Latvia and Malta are the growth leaders amongst the Moderate Innovators. Performance growth is negative for Croatia, Cyprus, Greece and Spain. Bulgaria is the growth leader of the Modest Innovators.

Figure 8: EU Member States' performance growth



Average annual growth rates of the innovation index have been calculated over an eight-year period (2008-2015).

For most Member States, performance has improved over time, but for many countries this has not been a consistent process. Figure 9 shows on a year-to-year basis whether performance has improved (green circle), remained the same (yellow circle) or declined (red circle). One clearly sees that performance growth for 2008-2015 relies mostly on performance improvements between 2008 and 2012, during which time declines in performance were observed for only one out of seven Member States on average.

Between 2012 and 2013, performance declined for 15 Member States, and between 2014 and 2015, performance declined for 17 Member States. Although the number of Member States for which performance declined between 2013 and 2014 was lower than in the surrounding years, this number was still much higher than for the years 2008-2012.

The large number of Member States for which performance declined in 2013 and 2015 can mostly be attributed to a relatively small number of indicators. In 2013, performance declined for a large number of Member States in Public-private co-publications (25 Member States), Non-R&D innovation expenditures (23), Venture capital investments (19), Sales of new-to-market and new-to-firm innovations (19), SMEs with product or process innovations (16), and PCT patent applications in societal challenges (15). In 2015, performance declined for a large number of Member States in PCT patent applications in societal challenges (24), SMEs with product or process innovations (22), Sales of new-to-market and new-to-firm innovations (21), SMEs with marketing or organizational innovations (20), SMEs innovating in-house (19), PCT patent applications (19), Innovative SMEs collaborating with others (18), and Public-private co-publications (17). In particular, using more recent CIS data (CIS 2010 instead of CIS 2008 data in 2013, and CIS 2012 instead of CIS 2010 data in 2015) had a significant negative impact on Member States' innovation performance. In addition, PCT patent applications and Public-private co-publications contribute negatively to Member States' innovation performance in 2013-2015, with declines in performance for more than half of the Member States.

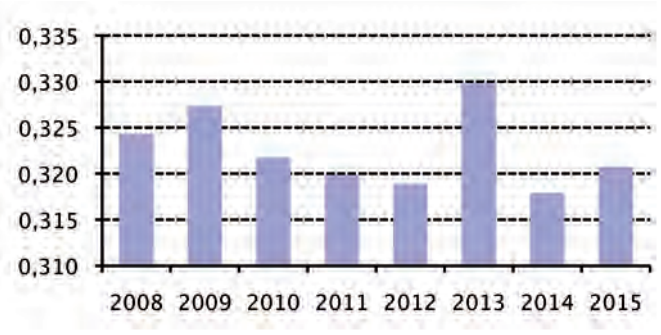
Figure 9: Performance changes over time

	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2008-2015
EU	●	●	●	●	●	●	●	●
Innovation Leaders	●	●	●	●	●	●	●	●
SE	●	●	●	●	●	●	●	●
DK	●	●	●	●	●	●	●	●
FI	●	●	●	●	●	●	●	●
DE	●	●	●	●	●	●	●	●
NL	●	●	●	●	●	●	●	●
Strong Innovators	●	●	●	●	●	●	●	●
IE	●	●	●	●	●	●	●	●
BE	●	●	●	●	●	●	●	●
UK	●	●	●	●	●	●	●	●
LU	●	●	●	●	●	●	●	●
FR	●	●	●	●	●	●	●	●
AT	●	●	●	●	●	●	●	●
SI	●	●	●	●	●	●	●	●
Moderate Innovators	●	●	●	●	●	●	●	●
CY	●	●	●	●	●	●	●	●
EE	●	●	●	●	●	●	●	●
MT	●	●	●	●	●	●	●	●
CZ	●	●	●	●	●	●	●	●
IT	●	●	●	●	●	●	●	●
PT	●	●	●	●	●	●	●	●
ES	●	●	●	●	●	●	●	●
EL	●	●	●	●	●	●	●	●
HU	●	●	●	●	●	●	●	●
SK	●	●	●	●	●	●	●	●
PL	●	●	●	●	●	●	●	●
LT	●	●	●	●	●	●	●	●
HR	●	●	●	●	●	●	●	●
LV	●	●	●	●	●	●	●	●
Modest Innovators	●	●	●	●	●	●	●	●
BG	●	●	●	●	●	●	●	●
RO	●	●	●	●	●	●	●	●
Increasing performance	22	22	17	20	12	17	7	21
Stable performance	2	3	3	5	1	0	4	0
Decreasing performance	4	3	8	3	15	11	17	7

2.3 Convergence in innovation performance

The differences in innovation performance between Member States can become smaller (*convergence*) or larger (*divergence*) over time.[13] Until 2012, differences in innovation performance became smaller. In 2013, the process of convergence reversed, and differences in countries' innovation performance became more pronounced (Figure 10). Between 2013 and 2014, differences in innovation performance decreased strongly, but between 2014 and 2015 differences again increased. These increases in performance differences in 2013 and 2015 are directly linked to the increase in the number of Member States in both years for which performance declined (cf. Section 2.2). The increase in performance differences in 2013 and 2015 is partly due to a declining performance of those Member States with the lowest performance (-12.3% for Bulgaria between 2012 and 2013, and -19.6% for Romania

Figure 10: Convergence in Member States innovation performance



The bars show the degree of sigma-convergence (cf. footnote 13). Lower (higher) degrees of sigma-convergence reveal higher (lower) convergence.

[13] *The change in performance differences over time can be measured by sigma-convergence. Sigma-convergence occurs when the spread in innovation performance across a group of economies falls over time. This spread in convergence is measured by the ratio of the standard deviation and the average performance of all EU Member States. Figures 11 to 14 show an additional measure for changes in performance differences using the performance gap ratio between the best and worst performing country in each performance group.*

between 2014 and 2015) increasing the distance between the highest and lowest performing Member States in 2013 and 2015.

Differences between the four performance groups

Among the Innovation Leaders, performance converged until 2014, but in 2015 performance differences have increased slightly. The performance gap between the best and worst performing country has almost halved due to the strong performance increase for the Netherlands, the lowest performing Innovation Leader (2.0% average annual growth), and stagnating performance for the best Innovation leader Sweden (0.1% average annual growth) (Figure 11). Among the Strong Innovators, we see a similar pattern as observed for all countries: a process of convergence until 2012, followed by increasing performance differences in 2013, after which performance differences became smaller again in 2014 and 2015 (Figure 12).

Among the Moderate Innovators, performance differences were stable over time, but in 2015 performance differences have become smaller, mainly due to a strong decline in performance for Cyprus, the highest performing Moderate Innovator, and a strong increase in performance for Latvia, the lowest performing Moderate Innovator (Figure 13). For the two Modest Innovators, we see a mixed pattern over time, but performance differences for this group are expected to be more volatile with only two Member States belonging to the group of Modest Innovators (Figure 14).

The results for the different performance groups show that the difference in convergence patterns over time for all Member States is also observed within the Strong Innovators and to a certain extent the Moderate Innovators. However, this is not the case for the Modest Innovators, where differences between countries have rather increased strongly over time, and the Innovation leaders, where differences have become consistently smaller after 2012.

Figure 11: Innovation Leaders

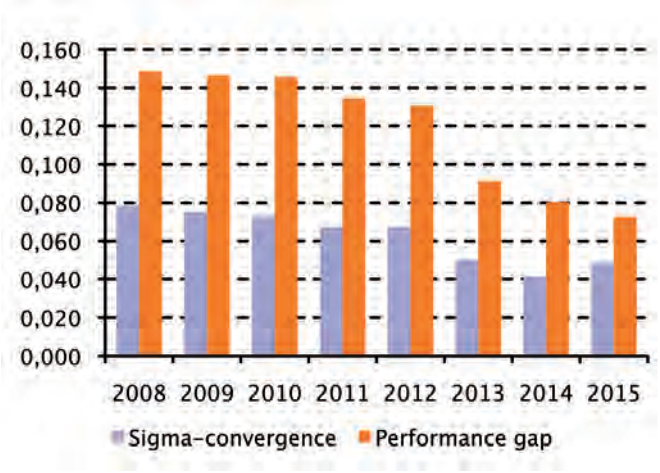


Figure 12: Strong Innovators

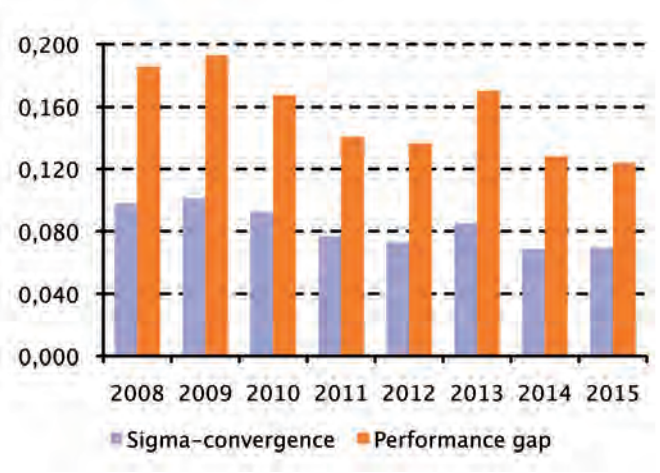


Figure 13: Moderate Innovators

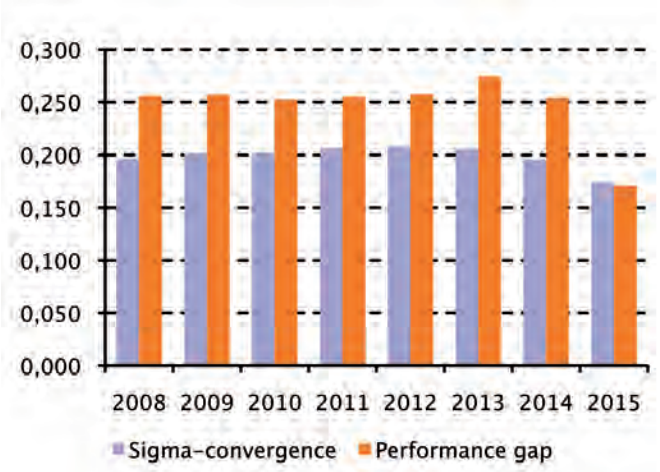
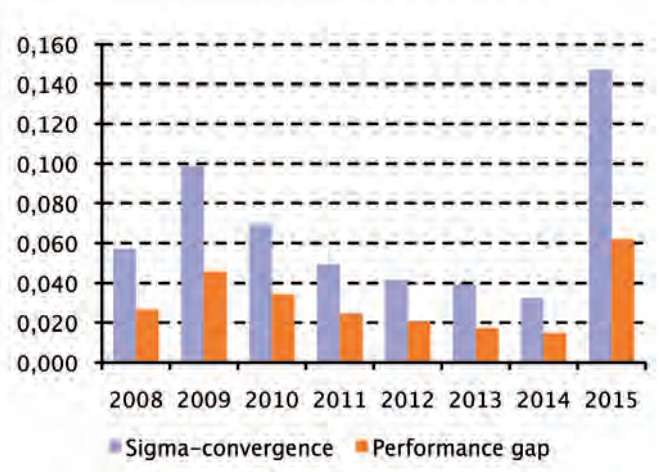


Figure 14: Modest Innovators



3. Innovation dimensions

Where Section 2.1 introduced four performance groups based on the average performance of countries for 25 innovation indicators, a different pattern emerges when a comparison in performance is made across the eight innovation dimensions (Figure 15).

The performance order for overall innovation performance is also observed for the individual dimensions. The Innovation Leaders perform best on all dimensions, followed by the Strong Innovators, the Moderate Innovators and the Modest Innovators. Performance differences, however, can be small between the different performance groups, in particular for Human resources, Open, excellent and attractive research systems, Innovators, and Economic effects between the Innovation Leaders and Strong Innovators, for Firm investments between the Strong and Moderate Innovators, and for Human resources and Intellectual assets between the Moderate and Modest innovators.

Variance in performance is a measure for the spread in performance across different countries[14] and it shows how large differences are between Member States when looking at individual strengths and weaknesses. Performance differences across the eight dimensions are smallest among the Innovation Leaders (variance of 0.37%) and largest among the Modest Innovators (variance of 1.53%) (Table 2), confirming that to achieve a high level of performance, countries need a balanced innovation system performing well across all dimensions. Performance differences within the Strong Innovators are larger than those within the Moderate Innovators. The high variation within the Strong Innovators is mostly the result of a relatively weak performance in Firm investments.

Figure 15: Country groups: innovation performance per dimension

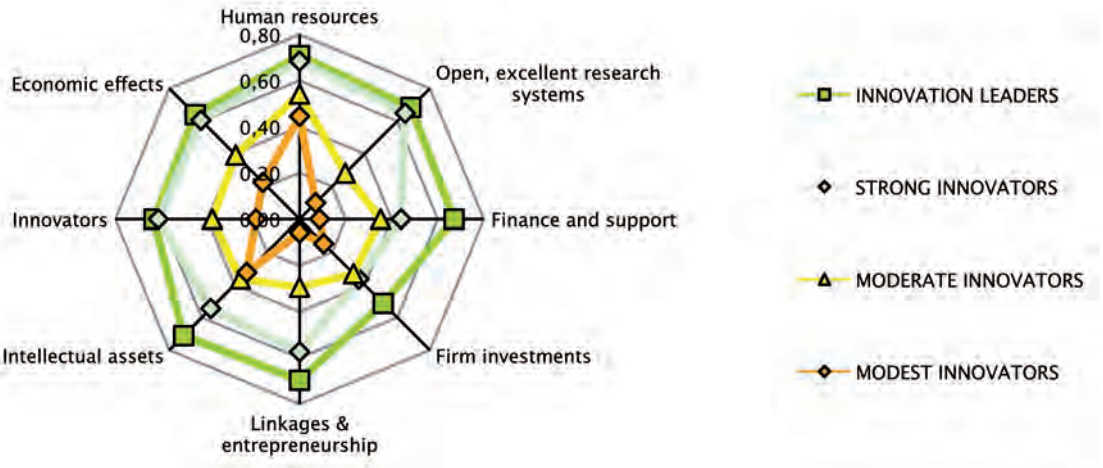


Table 2: Average performance and variance in performance across the innovation dimensions for four performance groups

	INNOVATION LEADERS	STRONG INNOVATORS	MODERATE INNOVATORS	MODEST INNOVATORS
Average performance by dimension				
Human resources	0.709	0.685	0.542	0.445
Open, excellent research systems	0.684	0.649	0.281	0.099
Finance and support	0.671	0.441	0.352	0.087
Firm investments	0.514	0.365	0.331	0.148
Linkages & entrepreneurship	0.697	0.573	0.293	0.058
Intellectual assets	0.712	0.545	0.364	0.324
Innovators	0.632	0.613	0.379	0.189
Economic effects	0.641	0.606	0.392	0.225
Variance across all eight dimensions	**0.37%**	**1.01%**	**0.57%**	**1.53%**

The remainder of this section will discuss for each of the innovation dimensions the performance ranking for the Member States and the increase (or decrease) in performance over time.

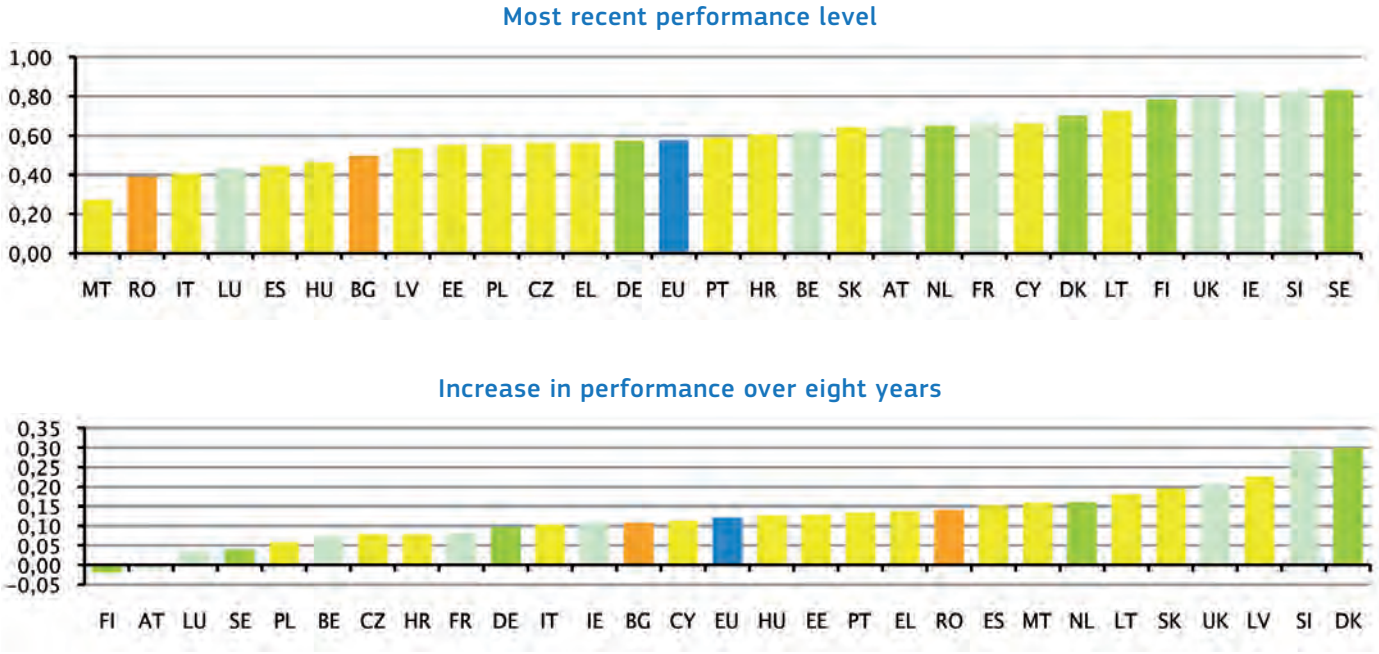
[14] *The variance of a data set is the arithmetic average of the squared differences between the values and the mean or average value, and it is a measure of the spread of the distribution about the mean. If all countries had the same performance level, variance would be 0%. Variance would be highest (25%) if half of all countries shared the highest possible normalised score of 1, and the other half shared the lowest possible normalised score of 0. High levels of variance signal large differences in performance across countries, whereas low levels of variance signal small differences in performance across countries. There are no statistical rules for identifying high versus low levels of variance, as variance also depends on, for example, the number of countries included in the sample (i.e., a higher spread in performance is more likely for a larger group of countries).*

Performance in Human resources

Two Innovation Leaders (Sweden and Finland) and three Strong Innovators (Ireland, Slovenia, and the United Kingdom) are in the top-5 performers in *Human resources*, with Sweden leading the dimension (Figure 16). A high share of the workforce in these countries has the skills needed to participate in and further develop the knowledge-based economy. Germany, another Innovation Leader, only manages to perform at the EU average for this dimension. Germany performs very well in doctoral education, but not so well in other tertiary and in upper secondary-level education. Most Strong Innovators perform above the EU average, except for Luxembourg which can be found close to the bottom of the range. Most Moderate Innovators perform below the EU average, except Lithuania, Cyprus, Slovakia, Croatia and Portugal.

All countries, except Finland and Austria, have improved their performance on *Human resources* over the last eight years. Average performance has improved slightly more for the less innovative countries than for the more innovative countries, but two Innovation Leaders, Denmark and the Netherlands, and two Strong Innovators, Slovenia and the United Kingdom, have improved their performance well above the EU average. Performance differences in *Human resources* have become smaller over time contributing to the overall process of convergence in innovation performance; however, performance in this dimension has stagnated recently.

Figure 16: Human resources



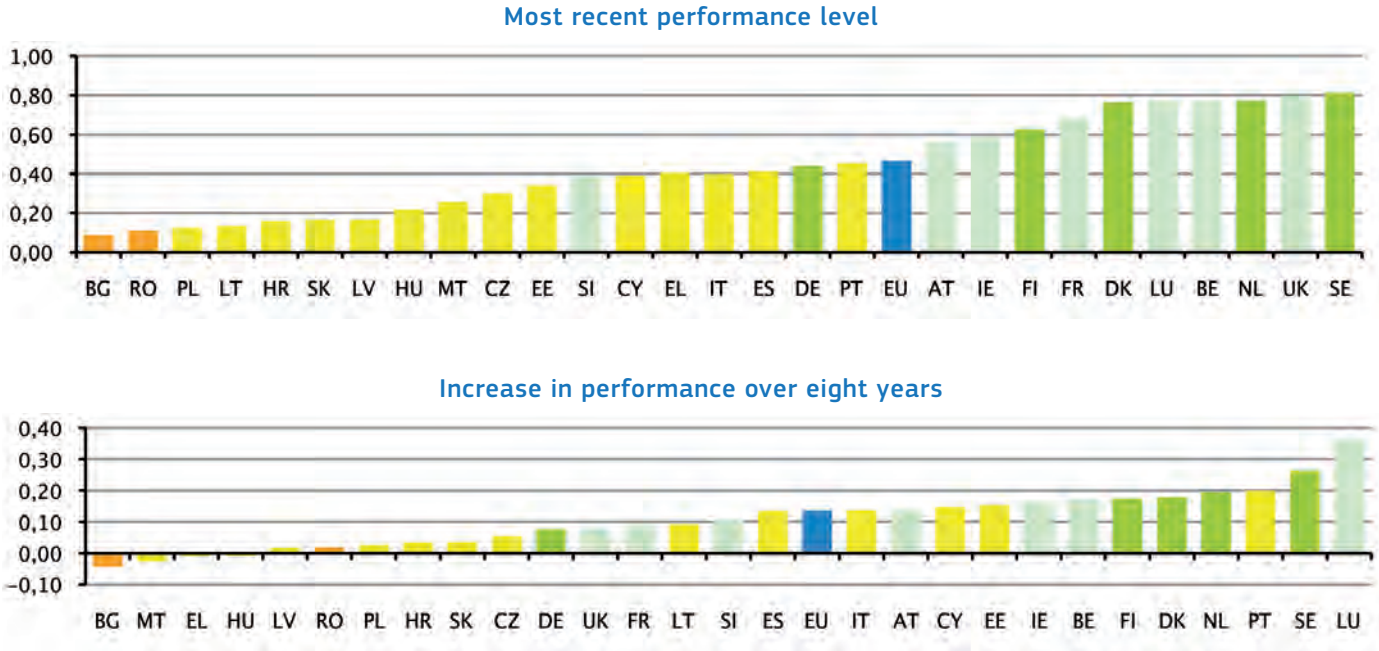
Colour coding matches the groups of countries identified in Section 2.1.

Performance in Open, excellent and attractive research systems

The Innovation Leaders and Strong Innovators are performing best in this dimension (Figure 17), and all of them, except Germany and Slovenia, are above the EU average. Sweden is the overall leader, followed very closely by five other countries, the United Kingdom, the Netherlands, Belgium, Luxembourg and Denmark. The innovation systems in these countries are open for cooperation with partners from abroad, researchers are well networked at international level, and the quality of research output is very high. Germany, one of the Innovation Leaders, performs below average due to a low share of non-EU doctorate students at only 42% of the EU average. All the Modest and Moderate Innovators perform below the EU average, only Portugal manages to get very close to the EU average.

All countries, except Bulgaria, Malta, Hungary and Greece, have improved their performance over time, with Luxembourg and Sweden being the top performers. Performance of the more innovative countries in this dimension has improved more than that of the less innovative countries, whereas there has been practically no improvement for the Modest Innovators. Moderate and Modest Innovators will need to further intensify their efforts to increase the performance of their research systems, if they want to close the performance gap with the Innovation Leaders and Strong Innovators. Performance differences have been slowly but steadily increasing, creating more divergence among the countries.

Figure 17: Open, excellent and effective research system



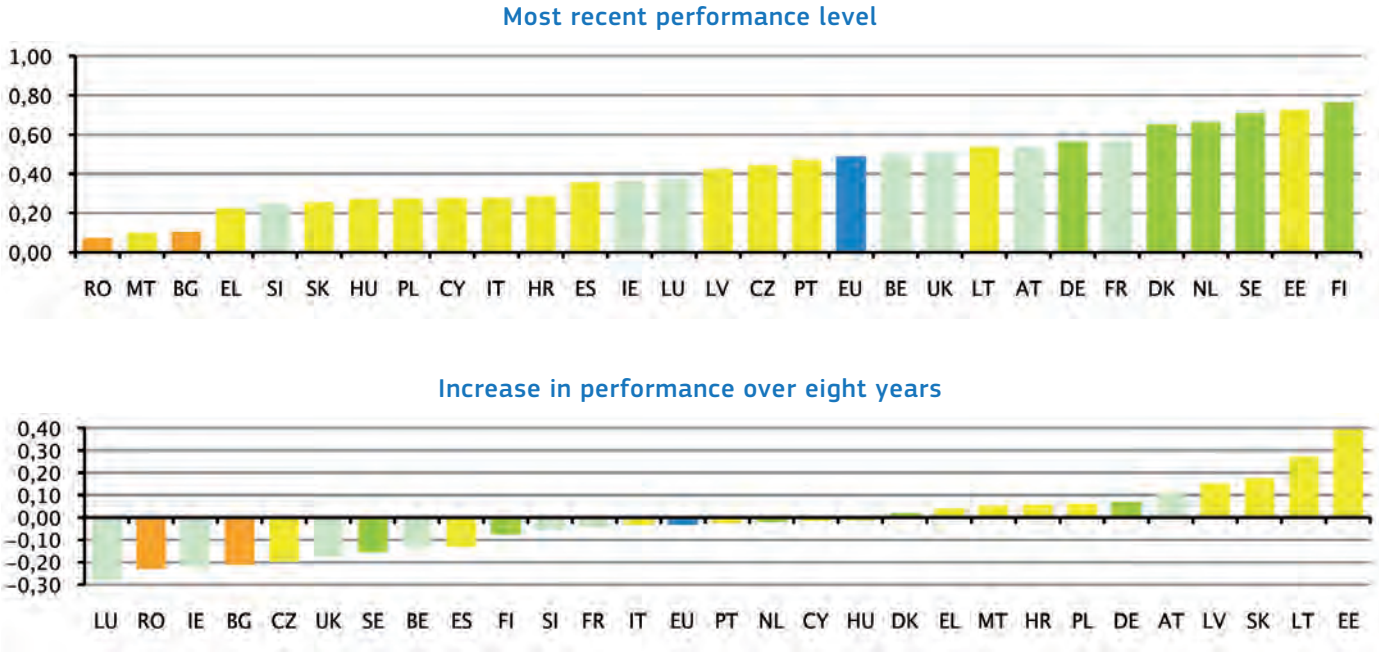
Colour coding matches the groups of countries identified in Section 2.1.

Performance in Finance and support

The Innovation Leaders and Strong Innovators are performing best in *Finance and support* (Figure 18), although Estonia, a Moderate Innovator, comes second in this dimension. The other top-5 performers are Finland (leading the dimension), Sweden, the Netherlands and Denmark. These countries are characterised by a public sector which is well endowed to perform R&D activities and by the availability of risk capital for private firms to develop new technologies. Almost all Modest and Moderate Innovators perform below the EU average. Apart from Estonia, the only other Moderate Innovator performing above the EU average is Lithuania.

Large differences can be observed in the eight-year performance development. For more than half of the Member States, as well as for the EU average, performance has not improved over time, in particular due to declining Venture capital investments. There has, however, been a gradual process of convergence in performance since 2011.

Figure 18: Finance and support



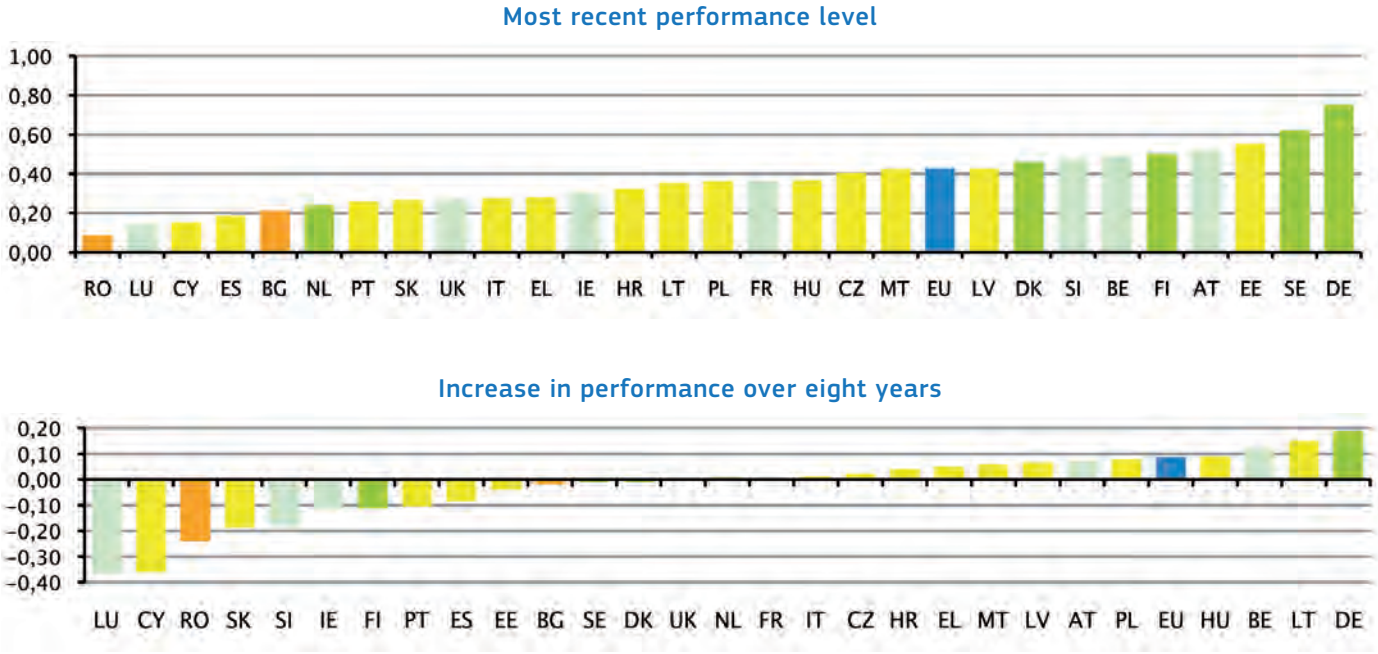
Colour coding matches the groups of countries identified in Section 2.1.

Performance in Firm investments

In terms of *Firm investments*, the Innovation Leaders and Strong Innovators are performing best (Figure 19). Germany and Sweden are the overall leaders, followed by Estonia, Austria and Finland. In these countries, companies invest more in innovation activities, both for science-based R&D activities and non-R&D innovation activities, including investments in advanced equipment and machinery. The performances of Luxembourg, one of the Strong Innovators, and the Netherlands, an Innovation Leader, are relatively weak, in particular due to low shares of Non-R&D innovation expenditures in these countries. Except for Estonia and Latvia, all the Modest and Moderate Innovators perform below the EU average, with Romania being at the bottom of the performance scale.

There are large differences in performance development over time, with performance having worsened for nearly half of the Member States, in particular for Luxembourg, Cyprus, Romania, Slovakia and Slovenia. Performance has improved most notably for Germany and Lithuania. The performance improvement of the EU is higher than that for 24 Member States, which is a direct result of the fact that Germany contributes more than one-third to the EU's overall business R&D expenditures and non-R&D innovation expenditures. A process of convergence has taken place until last year with performance differences increasing in 2015.

Figure 19: Firm investments



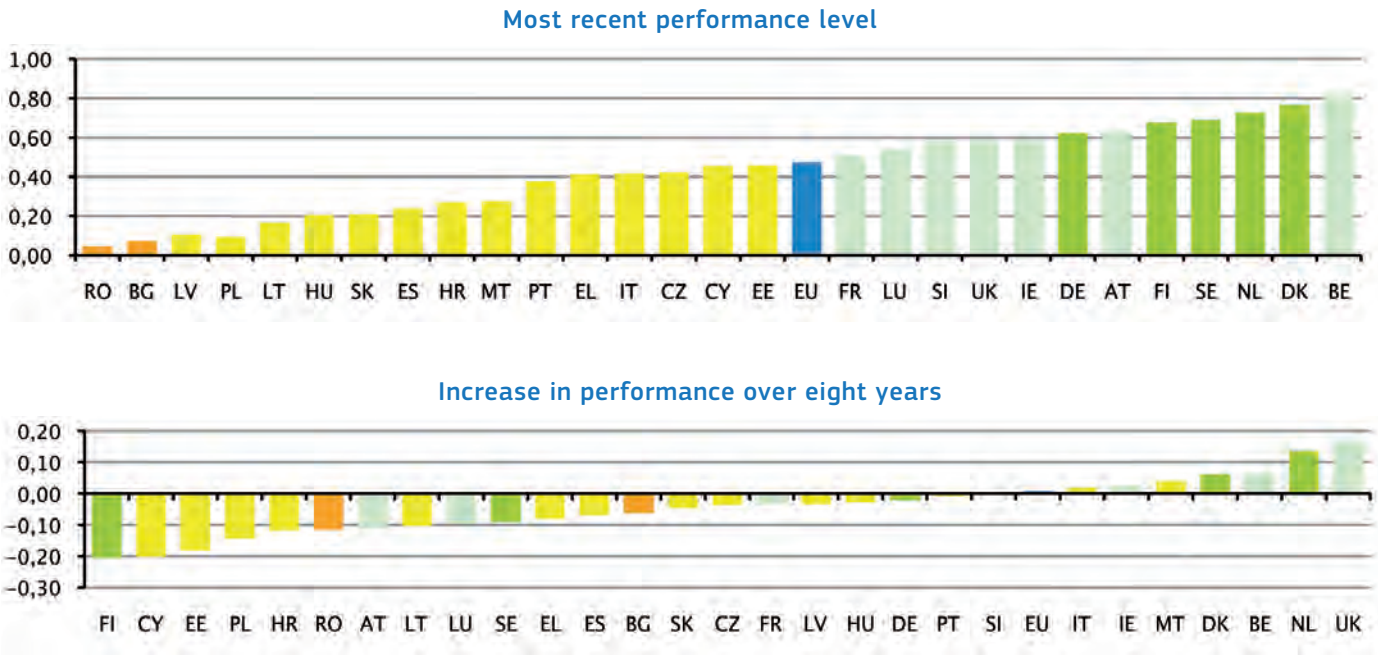
Colour coding matches the groups of countries identified in Section 2.1.

Performance in Linkages & entrepreneurship

In *Linkages & entrepreneurship*, the Innovation Leaders and Strong Innovators have performed particularly strongly. Belgium, Denmark, the Netherlands, Sweden and Finland are the overall leaders (Figure 20). SMEs in these countries have more versatile innovation capabilities as they combine in-house innovation activities with joint innovation activities with other companies or public-sector organisations. The research systems in these countries are also geared towards meeting the demand from companies, as highlighted by high co-publication activities. All Innovation Leaders and Strong Innovators perform above the EU average. All Modest and Moderate Innovators perform below the EU average.

For 20 Member States, average performance has not improved over time. For Finland, performance has decreased most over time, and the strongest performer in terms of growth is the United Kingdom. Over the eight-year period, the differences in country performances have mostly grown larger, but in 2015 there was some convergence.

Figure 20: Linkages & entrepreneurship



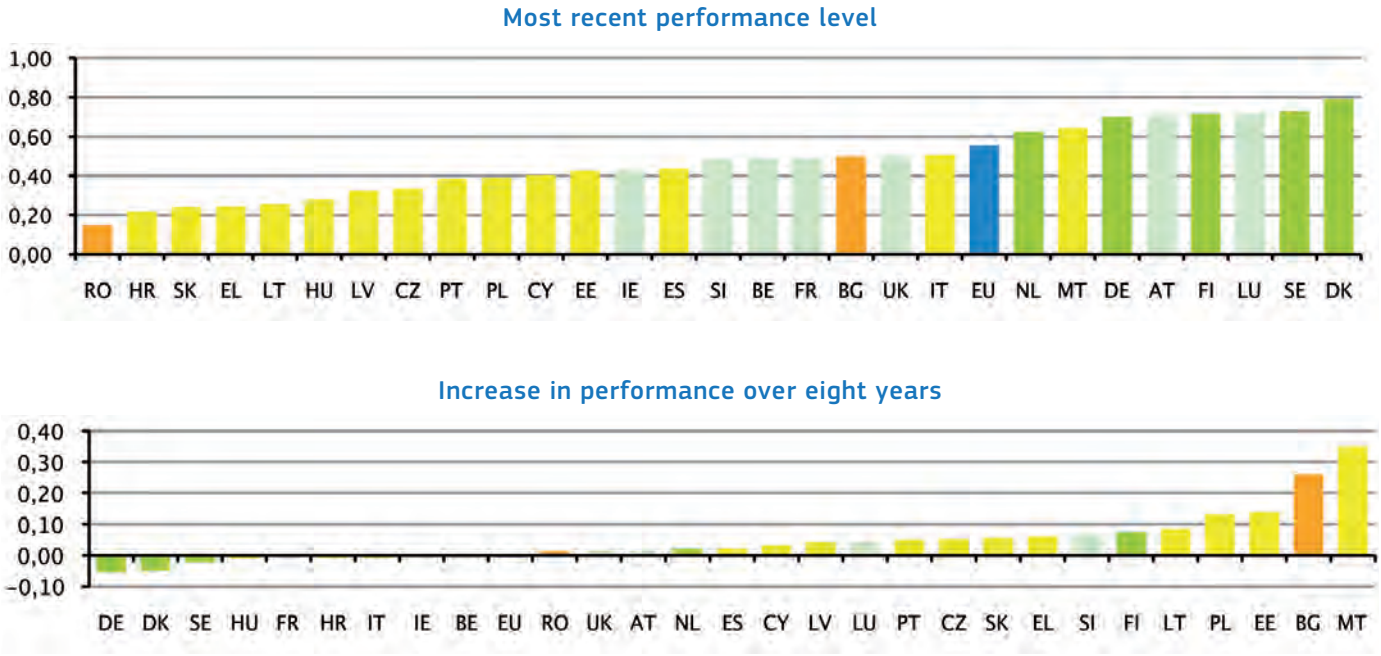
Colour coding matches the groups of countries identified in Section 2.1.

Performance in Intellectual assets

In *Intellectual assets*, the Innovation Leaders all perform above the EU average, with three of them, Denmark, Sweden and Finland in the top-5 (Figure 21). More than half of the Strong Innovators perform below average, as do nearly all of the Modest and Moderate Innovators. Only Malta, as a Moderate Innovator, is above the EU average. Bulgaria is performing at close to an average level, mostly due to its very strong performance in Community designs. The average EU performance is higher than that of most Member States due to the very good performance of the leading countries.

Many less innovative countries have improved their performance over time in this dimension, in particular Malta, Bulgaria, Estonia and Poland. There has been a process of convergence among countries during most of the eight-year period. However, performance has decreased for three Innovation Leaders, Germany, Denmark, and Sweden.

Figure 21: Intellectual assets



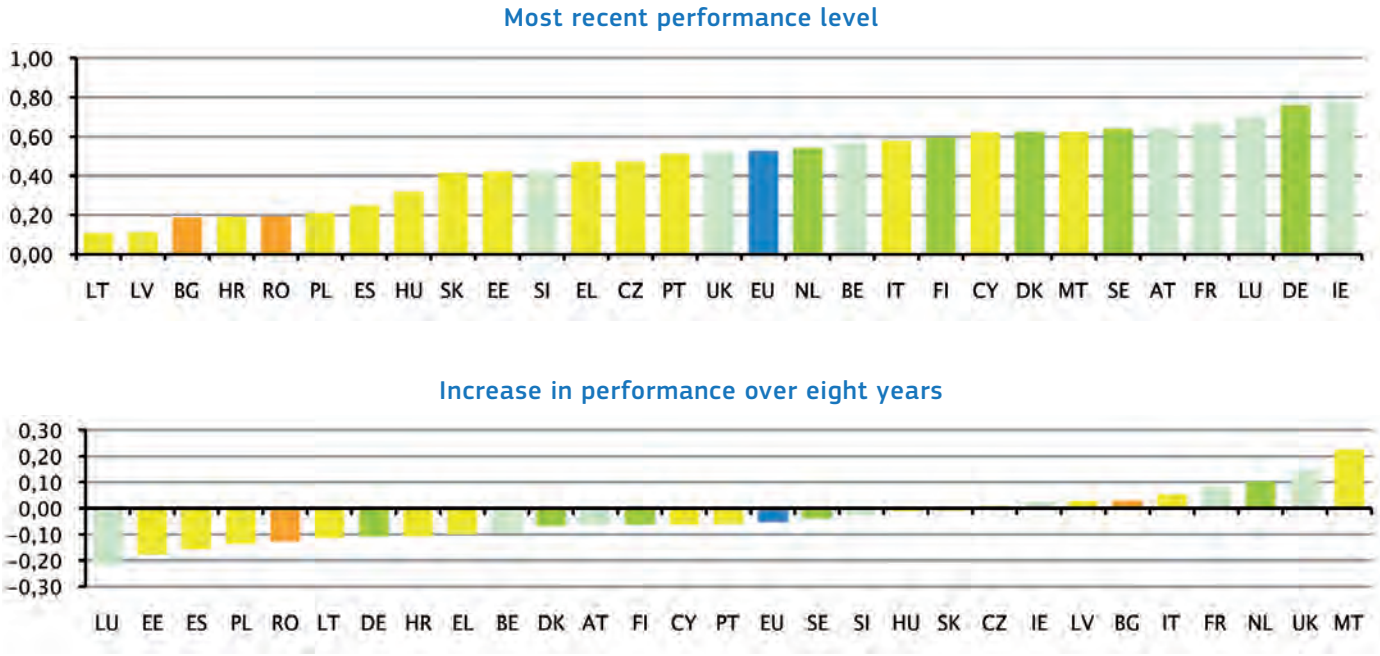
Colour coding matches the groups of countries identified in Section 2.1.

Performance in Innovators

In the *Innovators* dimension, the Strong Innovators and Innovation Leaders are performing best, with all of them except Slovenia and the United Kingdom above the EU average. Ireland is the overall leader, followed by Germany, Luxembourg, France, and Austria (Figure 22). Innovation systems in these countries are characterised by high shares of firms involved in innovation activities: innovation seems a natural strategy for firms to meet their customers' demands and to face competitive pressures. This also results in faster employment growth linked to innovation activities. Malta, Cyprus, and Italy are the strongest performing Moderate Innovators. The performance of Lithuania and Latvia is overall the weakest.

Over time, performance has worsened for 19 Member States and the EU at large. Malta, the United Kingdom, the Netherlands, and France have been the only countries where performance has increased significantly over time, and for four Innovation Leaders – Germany, Denmark, Finland, and Sweden – performance has decreased. Over time, a process of convergence among the EU countries has been taking place.

Figure 22: Innovators



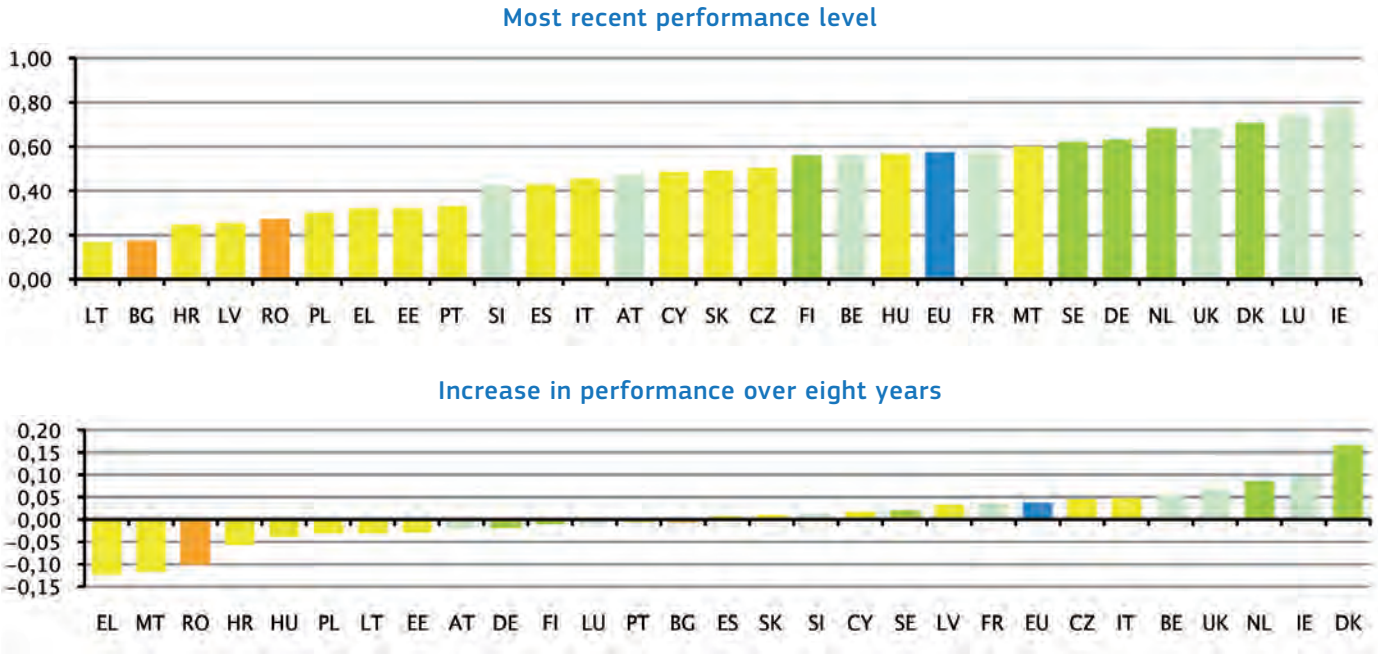
Colour coding matches the groups of countries identified in Section 2.1.

Performance in Economic effects

In *Economic effects*, most of the Innovation Leaders and Strong Innovators are performing above the EU average (Figure 23). Ireland is the overall leader in this dimension, followed by Luxembourg, Denmark, the United Kingdom and the Netherlands. All the Modest and Moderate Innovators perform below the EU average, with the exception of Malta, mainly because of its very strong performance in License and patent revenues from abroad.

Over time, performance has decreased for half of the Member States, in particular for Greece, Malta and Romania. Performance of the more innovative countries on average has been better than that of the less innovative countries, but since 2011, there has been a process of divergence in this dimension.

Figure 23: Economic effects



Colour coding matches the groups of countries identified in Section 2.1.

4. Innovation performance of the European Union

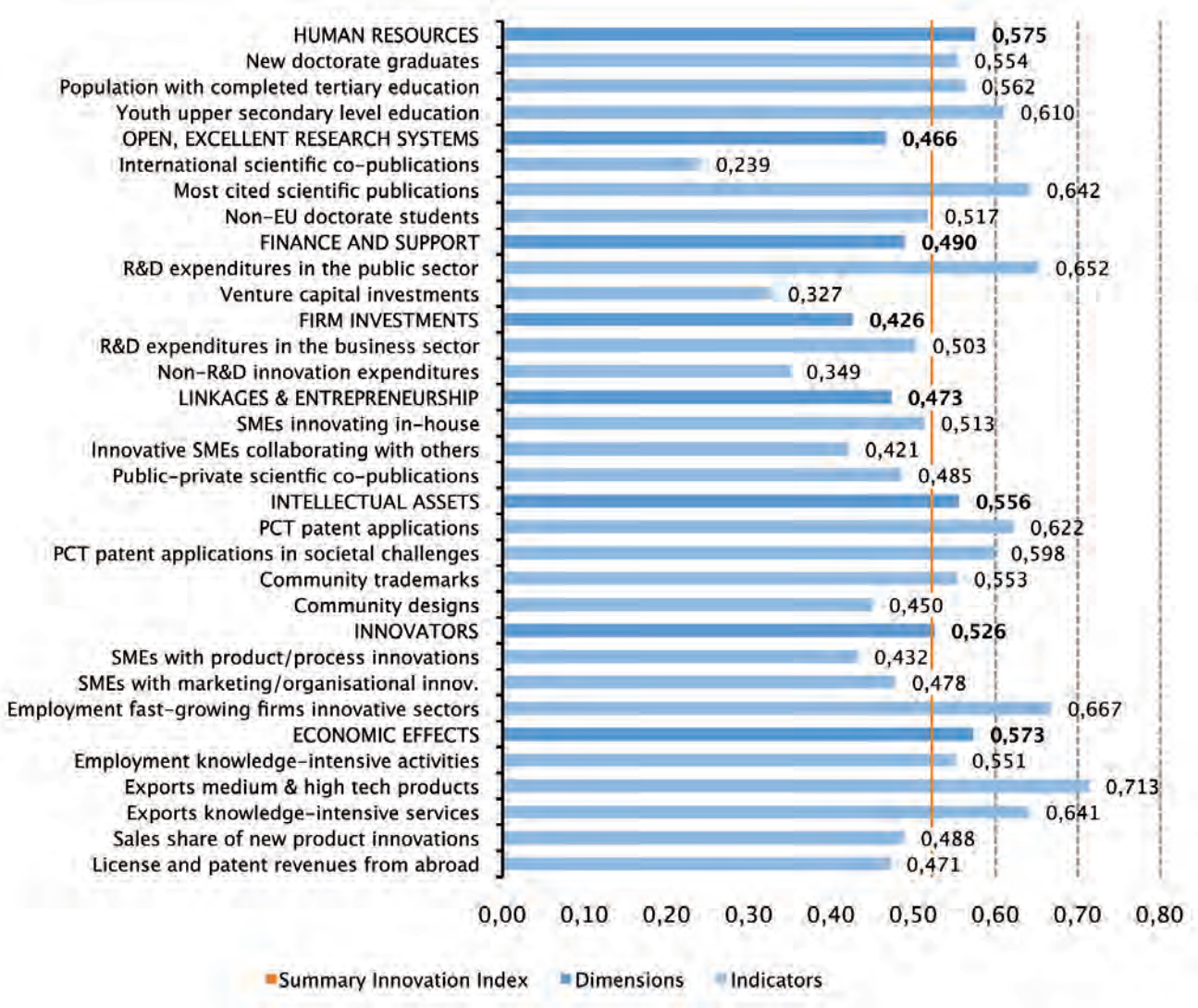
4.1 EU innovation performance

Average innovation performance for the EU depends on the performance of each of the Member States but also on the average performance of the Member States on each of the innovation dimensions and indicators. A comparison of the normalised performance scores by dimension and indicator to the average performance measured by the Summary Innovation Index reveals relative strengths and weaknesses of the EU as a whole (Figure 24).

For the innovation dimensions, relative strengths for the EU, as compared to average performance, are in *Human resources* (in particular in Population with completed tertiary education and Youth with upper secondary level education), in *Economic effects* (in particular in Exports of medium and high tech products and Exports of knowledge-intensive services), and in *Intellectual assets* (in particular in PCT patent applications). Relative weaknesses are in *Firm investments* (in particular due to a weak relative performance in Non-R&D innovation expenditures), *Open, excellent and attractive research systems* (in particular in International scientific co-publications), and *Linkages & entrepreneurship* (most notably due to a low share of Innovative SMEs collaborating with others).

Performance in *Open, excellent and attractive research systems* is below average because above-average performance in Most-cited scientific publications is negatively offset by a well below-average performance in International scientific co-publications. Performance in International scientific co-publications for the EU, however, is very low and below that of most Member States for a "technical" reason: for the EU, co-publications between co-authors in different Member States are excluded from the indicator, whereas these co-publications are included in the indicator scores for the individual Member States.

Figure 24: EU innovation performance by dimension

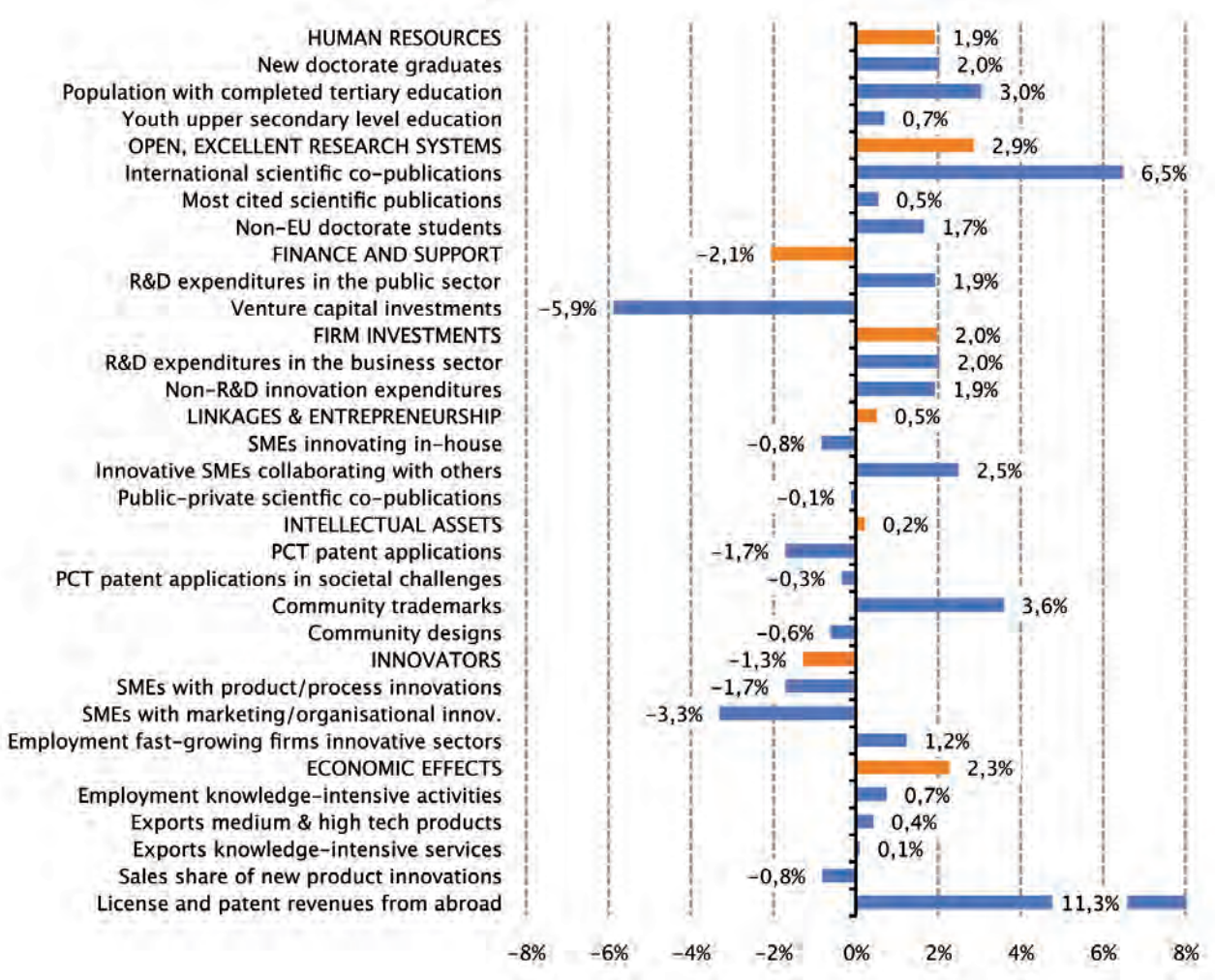


4.2 EU performance growth

EU innovation performance has been increasing at an average annual rate of 0.7% between 2008 and 2015, but growth has not been equally strong across all dimensions and indicators (Figure 25). Growth has been particularly strong in *Open, excellent and attractive research systems* (2.9%), driven by high growth in International scientific co-publications (6.5%). The EU innovation system is becoming more networked both between Member States and at the global scale.

Also performance growth in *Economic effects* (2.3%), *Firm investments* (2.0%), and *Human resources* (1.9%) has been relatively strong. In *Economic effects*, performance has increased very strongly for License and patent revenues from abroad (11.3%). In *Human resources*, performance has increased most for Population aged 30-34 with completed tertiary education (3.0%). The EU has been strengthening its educational knowledge base turning Europe into a more knowledge-based economy. Growth in *Firm investments* is driven by about equal growth performance for both R&D expenditures in the business sector and Non-R&D innovation expenditures (2.0% and 1.9% respectively). Growth in *Linkages & entrepreneurship* has been modest (0.5%), even with strongly improving performance in Innovative SMEs collaborating with others. Growth in *Intellectual assets* is positive but small (0.2%) with decreasing performance in both indicators measuring PCT patent application and Industrial designs matched by a strong increase in Community trademarks (3.6%). Growth in *Finance and support* has been very negative (-2.1%), due to a strong decline in Venture capital investments (-5.9%). Negative growth is also observed in *Innovators* (-1.3%) due to declining performance in SMEs that introduced product or process innovations, and SMEs that introduced marketing or organisational innovations.

Figure 25: EU average annual performance growth over 2008-2015



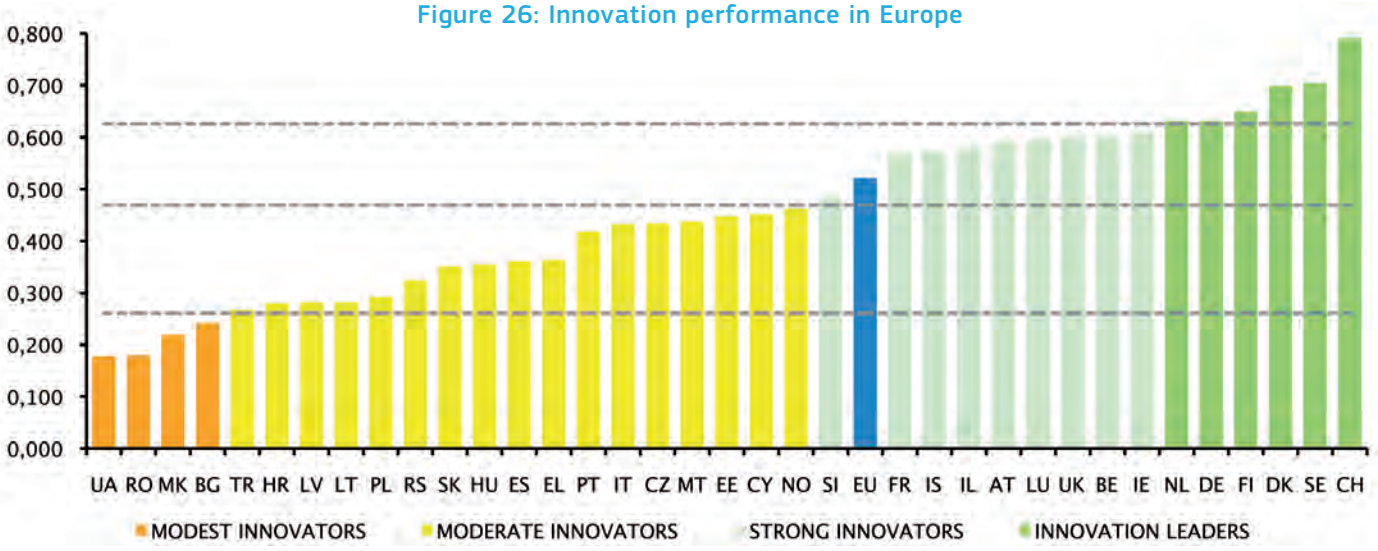
5. Benchmarking innovation performance with non-EU countries

5.1 Benchmarking against other European countries and regional neighbours

Compared to last year's report, two more countries are included in this year's benchmarking: Israel and Ukraine. For Israel, it is the second appearance after its first (and only) inclusion in the EIS 2007. As discussed in the Introduction, there have been several changes in indicator definitions, data sources or data revisions, and due to these changes, results in this year's report are not comparable to those in last year's report.[15]

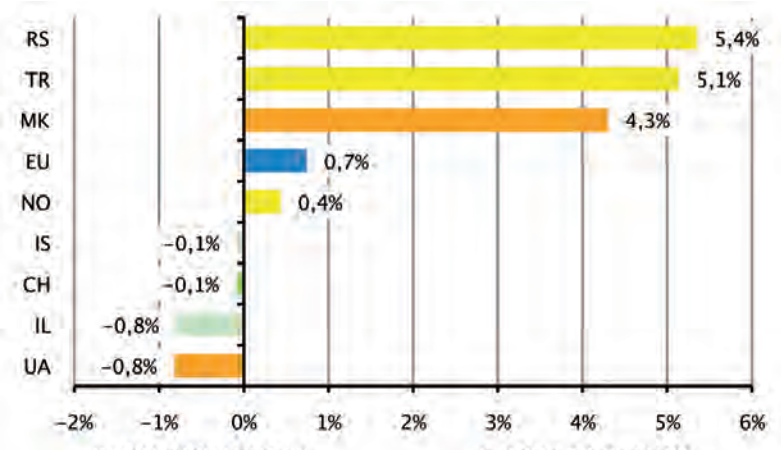
Switzerland is the overall Innovation Leader in Europe, outperforming all EU Member States (Figure 26). Switzerland's strong performance is linked to being the best performer on as many as nine indicators, in particular in *Open, excellent and attractive research systems* where it has the best performance in all three indicators, *Linkages and entrepreneurship* where it has best performance in two indicators (SMEs innovating in-house and Public-private co-publications), and *Economic effects* (best performance in Employment in knowledge-intensive activities and License and patent revenues from abroad). Switzerland's relative weaknesses with below EU average scores are in Venture capital investments, SMEs collaborating with others, and Exports of knowledge-intensive services. Switzerland's performance growth over the last eight years has been slightly negative at -0.1% (Figure 27).

Figure 26: Innovation performance in Europe



Non-EU countries include (in descending order of performance): Switzerland (CH), Israel (IL), Iceland (IS), Norway (NO), Serbia (RS), Turkey (TR), the Former Yugoslav Republic of Macedonia (MK), and Ukraine (UA).

Figure 27: Performance growth



Both Iceland and Israel are Strong Innovators. Iceland has the highest performance of all countries in International scientific co-publications, Public-private co-publications, and the Share of SMEs that introduced product or process innovators. Iceland is among the lowest performers in Youth education and Exports of medium and high tech products. Iceland's performance growth has been slightly negative at -0.1%. Israel has the highest performance of all countries on four indicators: Business R&D expenditures, PCT patent applications, PCT patent applications in societal challenges, and Employment in knowledge-intensive activities. Performance growth over time has been negative at -0.8%.

[15] *Average data availability for this year's report is good with data available for 25 indicators for Norway, for 24 indicators for Switzerland, for 23 indicators for Israel and Turkey, for 22 indicators for Iceland, Former Yugoslav Republic of Macedonia and Ukraine, and for 21 indicators for Serbia.*

Norway, Serbia, and Turkey are Moderate Innovators. Norway's relative performance score of 88.7% compared to the EU average is just below the threshold of becoming a Strong Innovator. Serbia has best overall performance in Non-R&D innovation expenditures, and Serbia's innovation performance has been improving rapidly at an average annual growth rate of 5.4%. Turkey has overall best performance in Sales of new-to-market and new-to-firm product innovations. Turkey's growth rate at 5.1% is significantly above that of the EU and, compared to last year's report, Turkey has progressed from the Modest to the Moderate Innovators.

The Former Yugoslav Republic of Macedonia (FYROM) and Ukraine are Modest Innovators. FYROM is performing well above average on Non-R&D innovation expenditures and SMEs with product or process innovations, and its growth performance (4.3%) has been well above that of the EU. Innovation performance for FYROM is improving rapidly, and performance relative to the EU has improved from 33% in 2008 to 42.1% in 2015, an increase of 9.1 percentage points. Ukraine, a country in Eastern Europe, is the latest addition to the EIS. On almost all indicators the country is performing below the EU average, except for Non-R&D innovation expenditures (2% above average) and Population with completed tertiary education (33% above average). Performance growth is negative at -0.8%[16].

5.2 Benchmarking against global competitors

This section provides a comparison of the EU to some of its main global economic competitors including Australia, the BRICS countries (Brazil, Russia, India, China, and South Africa), Canada, Japan, South Korea and the United States.

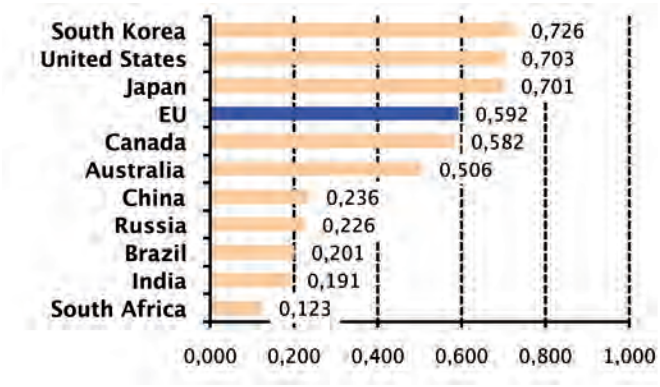
South Korea, the US, and Japan have a performance lead over the EU (Figure 28). The performance lead has been increasing for South Korea as its growth rate has been more than twice that of the EU (Figure 29). Innovation performance for the EU, however, has been improving at a higher rate than that for the US and Japan. As a consequence, the EU has been able to close part of its performance gap with the US and Japan over the last eight years. The three global top innovators are dominating the EU particularly on indicators capturing business activity as measured by R&D expenditures in the business sector, Public-private co-publications and PCT patents, especially in societal challenges, but also in educational attainment as measured by the Share of population having completed tertiary education. Enterprises in these countries invest more in research and innovation, and collaborative knowledge creation between public and private sectors is better developed. The skilled workforce in these countries is also relatively larger than in the EU.

The EU continues to have a performance lead over Australia, Canada, and all BRICS countries. Of these countries, only China has managed to grow at a (much) higher rate than the EU. Performance growth for Canada, Brazil, and South Africa has been close to zero.

Methodology

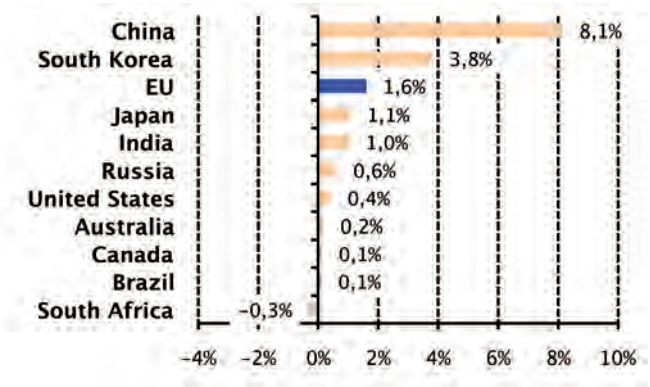
The economic and/or population size of most global competitors outweighs that of many of the individual Member States, and innovation performance is therefore compared to the aggregate of the Member States or the EU. Data availability is more limited for global competitors than for the European countries. Therefore, a more restricted set of 12 indicators (Table 3) has been used for the international comparison of the EU with its global competitors. These indicators focus mainly on performance related to R&D activities (R&D expenditures, scientific publications, patents), as innovation survey data are not available for most of the global competitors or are not directly comparable with data from the Community Innovation

Figure 28: Global innovation performance



Average performance is measured using a composite indicator - the innovation index - building on data for 12 indicators ranging from a lowest possible performance of 0 to a maximum possible performance of 1.

Figure 29: Global innovation growth rates



Average annual growth rates of the innovation index have been calculated over an eight-year period. Due to a smaller set of indicators the EU growth rate shown in this figure is not comparable to that in Sections 2 and 4.

[16] *This result has to be interpreted with care as for several indicators time series data are available for only a small number of years.*
[17] *The methodology for calculating average innovation performance is explained in Section 8.3.*

Survey (CIS). Most of the indicators used here are nearly identical to indicators used in the measurement framework for the EU Member States (cf. Table 1).[17] Only the indicator measuring the Percentage of population aged 30 to 34 having completed tertiary education has been replaced by the same indicator for a larger age group, namely 25 to 64, as data for the age group 30 to 34 are not available for most countries.

For some indicators, slightly different definitions have been used for the EU as compared to the previous chapters. For Medium and high tech product exports and Knowledge-intensive services exports, the data for the EU will exclude trade between Member States (so-called intra-EU trade) and will only include exports to non-Member States (so-called extra-EU trade). Indicator values in the international comparison using only extra-EU trade will be higher for the EU compared to those used for the EU in the comparison between Member States. For License and patent revenues from abroad, for the EU data will be used from the World Bank's World Development Indicators to ensure full comparability with the other countries. World Bank data, however, give different results than Eurostat (e.g., in 2013 the value was 0.498 using Eurostat data and 0.585 using World Bank data).

As discussed in the Introduction, there have been several changes in indicator definitions, data sources or data revisions. Some of these changes are also relevant here, in particular the change in data source for International scientific co-publications and Most–cited publications, the revised data for Public-private co-publications, and the change in definition for PCT patent applications in societal challenges. Due to these changes, results in this year's report are not comparable to those in the IUS 2015. For the first time, data on International scientific co-publications and Most–cited publications are available for Australia, Canada, and South Africa, adding to the fact that the results this year may be very different from those in the IUS 2015.

For each of the international competitors, the following pages discuss their performance relative to the EU and relative strengths and weaknesses for the different indicators. Indicator values, performance leads and changes in performance leads are shown in Annex H Data have been extracted from various sources including Eurostat, OECD, UNESCO Institute for Statistics, United Nations, Web of Science, and World Bank.

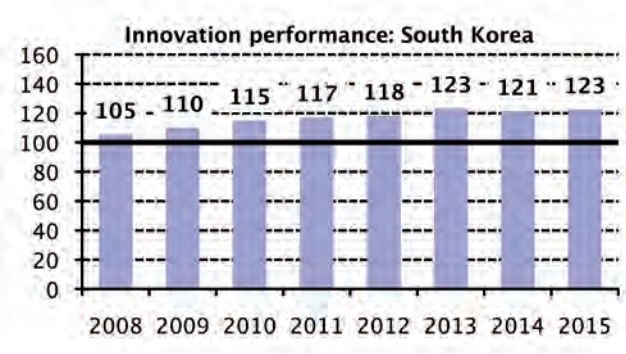
Table 3: Indicators used in the international comparison

MAIN TYPE / Innovation dimension / Indicator	Data source	Years included
ENABLERS		
Human resources		
1.1.1 New doctorate graduates (ISCED 6) per 1000 population aged 25-34	OECD	2006 - 2013
1.1.2 Percentage population aged 25-64 having completed tertiary education	OECD, World Bank, Eurostat	2007 - 2014
Open, excellent and attractive research systems		
1.2.1 International scientific co-publications per million population	Web of Science (data provided by CWTS as part of a contract to DG Research and Innovation)	2008 - 2015
1.2.2 Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	Web of Science (data provided by CWTS as part of a contract to DG Research and Innovation)	2006 - 2013
Finance and support		
1.3.1 R&D expenditure in the public sector as % of GDP	OECD, UNESCO Institute for Statistics	2007 - 2014
FIRM ACTIVITIES		
Firm investments		
2.1.1 R&D expenditure in the business sector as % of GDP	OECD, UNESCO Institute for Statistics	2007 - 2014
Linkages & entrepreneurship		
2.2.3 Public-private co-publications per million population	Web of Science (data provided by CWTS as part of a contract to DG Research and Innovation)	2008 - 2014
Intellectual assets		
2.3.1 PCT patents applications per billion GDP (Purchasing Power Parity in international dollars (PPP$))	OECD, World Bank	2006 - 2013
2.3.2 PCT patents applications in societal challenges per billion GDP (Purchasing Power Parity in international dollars (PPP$)) (environment-related technologies; health)	OECD, World Bank	2005 - 2012
OUTPUTS		
Economic effects		
3.2.2 Medium and high tech product exports as a % of total product exports	United Nations	2007 - 2014
3.2.3 Knowledge-intensive services exports as % total service exports	United Nations	2007 - 2014
3.2.5 License and patent revenues from abroad as % of GDP	World Bank	2007 - 2014

Underlined years in the last column show the data used to measure countries' most recent innovation performance. For the EU28, data sources are similar to those in Table 1 except for Knowledge-intensive services exports and License and patent revenues from abroad, where data from the United Nations and World Bank have been used also for the EU. For India data are not available for New doctorate graduates, for South Africa data are not available for Knowledge-intensive services exports.

South Korea

South Korea is more innovative than the EU, and the innovation lead has been increasing over the last eight years. In 2008, the lead was relatively small at 5%, but in 2015 it has increased to 23%, being even higher than the current US-EU or Japan-EU performance lead.



Scores are calculated by dividing the innovation index by that of the EU and multiplying by 100.

South Korea is performing better than the EU on seven indicators. A 41% higher share of the population has completed tertiary education. South Korea is much more active in Public-private co-publications, in applying for patents and, in particular, the country spends more than twice as much on business R&D as a share of GDP. South Korea has relative weaknesses in Doctorate graduates, License and patent revenues from abroad, Exports of knowledge-intensive services, and in sharing its knowledge base, with considerably weaker performance compared to the EU on Most-cited publications.

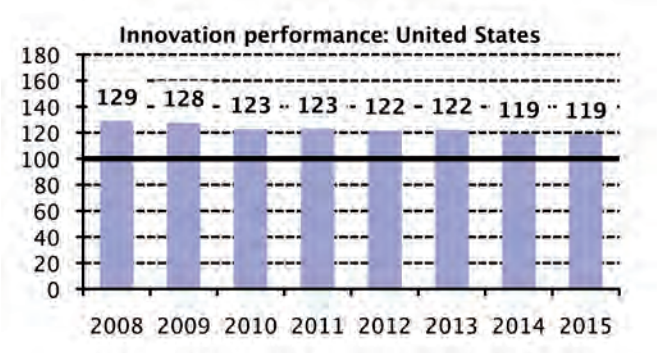
Relative performance of South Korea has improved for nine indicators. This has led to performance lead increases for six indicators, particularly in Patent applications. South Korea is narrowing the performance gap with faster growth in Doctorate graduates and Licence and patent revenues from abroad. South Korea is experiencing a widening in its performance gap in Exports of knowledge-intensive services.

	RELATIVE PERFORMANCE	DIFFERENCE IN PERFORMANCE GROWTH
Doctorate graduates	86.1	3.4%
Tertiary education	140.6	0.2%
International co-publ.	98.1	0.7%
Most cited publications	59.3	0.0%
R&D exp. public sector	120.8	1.8%
R&D exp. business sector	242.1	1.8%
Public-private co-publ.	172.4	2.2%
PCT patents	163.6	3.8%
PCT patents societal ch.	216.0	14.1%
Exports med&high tech prods	118.9	-0.3%
Exports knowledge-int serv	80.3	-3.4%
License and patent rev.	62.4	7.4%

*Performance scores equal 100 * the country's indicator values divided by those of the EU. Growth differences are calculated by subtracting EU growth rates from those of the country.*

The United States

The United States has been more innovative than the EU, but the performance lead is steadily decreasing. Between 2008 and 2013, the US innovation index was more than 20% higher than that of the EU, but since 2014 the US lead has dropped below 20%.



Scores are calculated by dividing the innovation index by that of the EU and multiplying by 100.

The US is performing better on eight indicators compared to the EU. A much higher share of the US population has completed tertiary education, creating a performance lead of the US of almost 40%. The US is also performing much better on all three indicators using data on scientific publications. US businesses spend about 58% more on R&D, and the US is more successful in commercializing new technologies as measured by a 26% higher score for License and patent revenues. The US has relative weaknesses in Exports of medium and high tech products and Exports of knowledge-intensive services, as well as in the number of doctorate graduates.

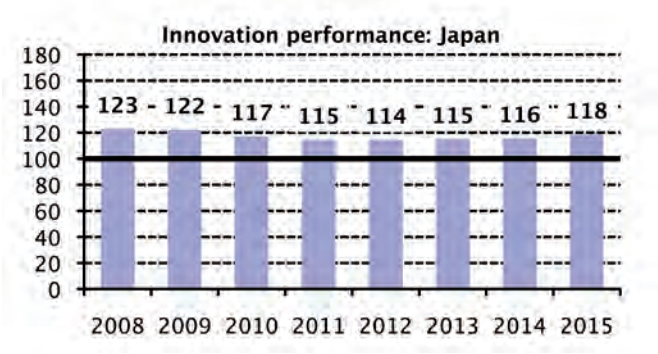
For most indicators, relative performance of the US has worsened. Only for PCT patent applications and Exports of knowledge-intensive services, the US has managed to improve its performance at a faster rate. For all other indicators, either the performance lead has declined or the performance gap with the EU has widened.

	RELATIVE PERFORMANCE	DIFFERENCE IN PERFORMANCE GROWTH
Doctorate graduates	82.5	-1.8%
Tertiary education	139.6	-2.1%
International co-publ.	117.2	-0.4%
Most cited publications	133.4	-0.8%
R&D exp. public sector	100.0	0.0%
R&D exp. business sector	158.1	-1.3%
Public-private co-publ.	183.2	-0.7%
PCT patents	117.7	1.3%
PCT patents societal ch.	131.2	-1.9%
Exports med&high tech prods	83.2	-3.0%
Exports knowledge-int serv	83.1	1.7%
License and patent rev.	126.0	-3.1%

*Performance scores equal 100 * the country's indicator values divided by those of the EU. Growth differences are calculated by subtracting EU growth rates from those of the country.*

Japan

Japan has been consistently more innovative than the EU. In 2008-2009, the Japanese innovation index was more than 20% above that of the EU. The performance lead started to decline from 2010, but has climbed up again in the last years to 18% in 2015.



Scores are calculated by dividing the innovation index by that of the EU and multiplying by 100.

A closer look at the individual indicators reveals that Japan is performing better on eight indicators. A 47% higher share of population has completed tertiary education (46.6% in Japan compared to 31.7% in the EU). Japanese businesses spend more than twice as much on R&D as a share of GDP, and Japan is also much more active in applying for patents. Japan also outperforms the EU on Public-private co-publications, Exports of medium and high tech products, and License and patent revenues from abroad. Japan has relative weaknesses in Doctorate graduates, International scientific co-publications, Most-cited publications, and Exports of knowledge-intensive services.

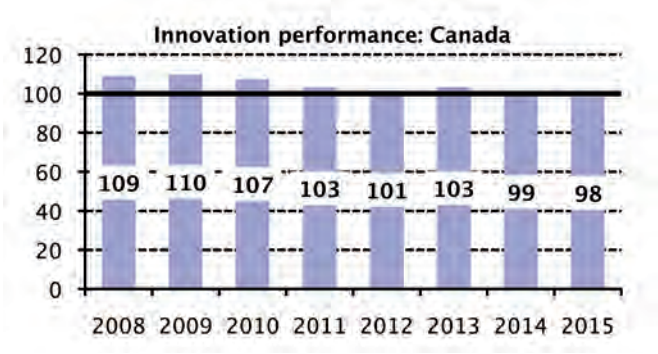
Growth performance of Japan is below that of the EU for nine indicators. The Japanese performance lead has been improving on three indicators, especially on both patent indicators. The gap with the EU has widened on four indicators, especially on International scientific co-publications and Exports of knowledge-intensive services.

	RELATIVE PERFORMANCE	DIFFERENCE IN PERFORMANCE GROWTH
Doctorate graduates	65.8	-0.3%
Tertiary education	147.1	-1.6%
International co-publ.	73.6	-1.7%
Most cited publications	61.4	-0.4%
R&D exp. public sector	104.0	-1.0%
R&D exp. business sector	227.6	-1.4%
Public-private co-publ.	131.8	-2.5%
PCT patents	168.7	2.4%
PCT patents societal ch.	260.8	4.3%
Exports med&high tech prods	122.0	-0.5%
Exports knowledge-int serv	56.9	-1.9%
License and patent rev.	126.0	0.2%

*Performance scores equal 100 * the country's indicator values divided by those of the EU. Growth differences are calculated by subtracting EU growth rates from those of the country.*

Canada

Canada's innovation performance was above the EU until recently, but is currently lagging slightly behind. Relative performance was close to that of the EU from 2008 to 2013, after which it has decreased to 98% of EU performance in 2015.



Scores are calculated by dividing the innovation index by that of the EU and multiplying by 100.

Canada is performing worse than the EU on seven indicators, in particular on License and patent revenues from abroad, and Exports medium and high tech products. Canada is performing better on five indicators: Population with completed tertiary education, where the country is performing almost 70% better than the EU, both international and most cited publications, and R&D expenditures in the public and business sectors.

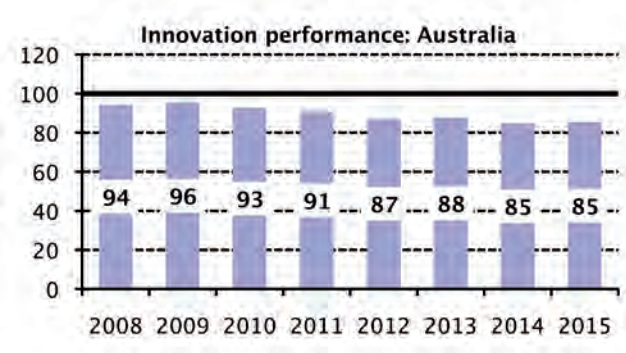
Growth performance for seven indicators is below that of the EU, and above it for four indicators. Canada has been able to improve its performance lead in R&D expenditures in the business sector. The performance leads Canada has on Tertiary education, International co-publications, and R&D expenditures in the public sector are decreasing. The performance gaps in Public-private co-publications, PCT patent applications in societal challenges, Exports of medium and high tech products, and License and patent revenues from abroad have widened.

	RELATIVE PERFORMANCE	DIFFERENCE IN PERFORMANCE GROWTH
Doctorate graduates	72.9	1.0%
Tertiary education	169.2	-1.9%
International co-publ.	167.4	-1.0%
Most cited publications	112.4	0.0%
R&D exp. public sector	111.0	-2.5%
R&D exp. business sector	143.3	2.6%
Public-private co-publ.	94.4	-5.1%
PCT patents	88.2	0.3%
PCT patents societal ch.	85.5	-3.5%
Exports med&high tech prods	56.7	-2.0%
Exports knowledge-int serv	82.6	0.8%
License and patent rev.	38.0	-6.6%

*Performance scores equal 100 * the country's indicator values divided by those of the EU. Growth differences are calculated by subtracting EU growth rates from those of the country.*

Australia

Australia's innovation performance is lagging behind that of the EU, and the innovation gap is slowly widening. The performance gap was at its smallest in 2009, when relative performance was 96% of that of the EU. Relative performance has since steadily decreased to 85% in 2015.



Scores are calculated by dividing the innovation index by that of the EU and multiplying by 100.

Australia is performing worse than the EU on seven indicators, particularly on License and patent revenues from abroad, and Exports of medium and high tech products. Australia is performing better than the EU on five indicators related to the public sector and to the knowledge base: Doctorate graduates, Population having completed tertiary education, R&D expenditures in the public sector, International co-publications, and Most-cited publications.

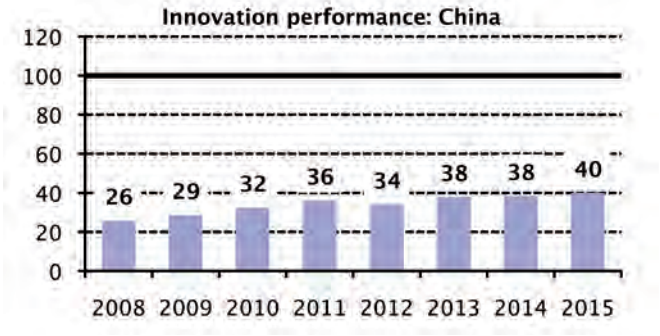
Australia shows a mostly negative growth performance. Australia has improved its performance lead only on Most-cited publications. Australia's performance gap in business R&D expenditures, Public-private co-publications, PCT patent applications, Exports of medium and high tech products, and License and patent revenues from abroad has widened. Australia performs much better in its enabling conditions, but relatively worse in both firm activities and innovation outputs.

	RELATIVE PERFORMANCE	DIFFERENCE IN PERFORMANCE GROWTH
Doctorate graduates	126.2	0.0%
Tertiary education	132.2	-0.3%
International co-publ.	167.4	-1.2%
Most cited publications	116.4	1.2%
R&D exp. public sector	119.9	-0.8%
R&D exp. business sector	97.2	-2.8%
Public-private co-publ.	69.7	-4.6%
PCT patents	79.9	-1.8%
PCT patents societal ch.	69.4	-7.4%
Exports med&high tech prods	14.6	-6.0%
Exports knowledge-int serv	63.3	-0.2%
License and patent rev.	10.5	-8.5%

*Performance scores equal 100 * the country's indicator values divided by those of the EU. Growth differences are calculated by subtracting EU growth rates from those of the country.*

China

China's innovation performance is lagging well behind that of the EU, but its relative performance has been increasing strongly from 26% of the EU average in 2008 to 40% in 2015.



Scores are calculated by dividing the innovation index by that of the EU and multiplying by 100.

China is performing worse than the EU on 11 indicators, in particular on License and patent revenues from abroad, Public-private co-publications, Doctorate graduates, International scientific co-publications, PCT patent applications in societal challenges, and Tertiary education. China is outperforming the EU in R&D expenditures in the business sector.

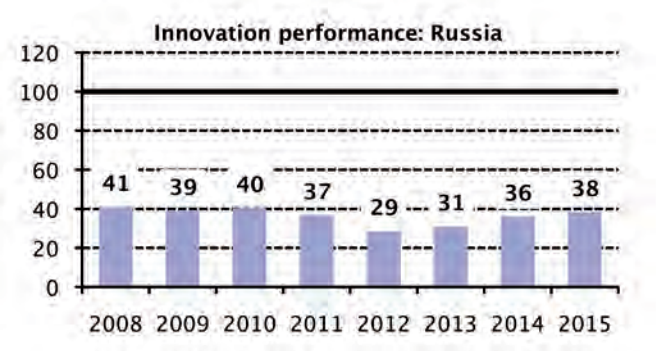
However, China's growth performance has been much stronger than that of the EU, with growth rates of nine indicators being higher, revealing a continuous catch-up process. China's growth rate has been below that of the EU in Doctorate graduates and Licence and patent revenues from abroad. China's performance lead in R&D expenditures in the business sector has increased, and its performance gap has become smaller on eight indicators, in particular on PCT patent applications in societal challenges and on Public-private co-publications. China's performance gap in Doctorate graduates and License and patent revenues from abroad has widened.

	RELATIVE PERFORMANCE	DIFFERENCE IN PERFORMANCE GROWTH
Doctorate graduates	11.4	-2.9%
Tertiary education	35.7	4.5%
International co-publ.	41.2	3.3%
Most cited publications	77.6	3.2%
R&D exp. public sector	64.5	0.8%
R&D exp. business sector	129.2	4.7%
Public-private co-publ.	13.7	17.8%
PCT patents	67.7	6.3%
PCT patents societal ch.	24.1	11.2%
Exports med&high tech prods	91.4	-0.2%
Exports knowledge-int serv	71.1	5.4%
License and patent rev.	1.6	-4.9%

*Performance scores equal 100 * the country's indicator values divided by those of the EU. Growth differences are calculated by subtracting EU growth rates from those of the country.*

Russia

Russia's innovation performance is lagging well behind that of the EU, although lately the innovation gap has been narrowing. Relative innovation performance was around 40% up until 2010, but decreased to 29% in 2012. The strong decline in 2012 was due to a sharp decline in New doctorate graduates. Since 2012, Russia's relative performance has increased to 38% in 2015.



Scores are calculated by dividing the innovation index by that of the EU and multiplying by 100.

Russia is performing worse than the EU on 11 indicators, in particular on Public-private co-publications, License and patent revenues from abroad, PCT patent applications, Exports of medium and high tech products, and Most-cited publications. However, a 69% higher share of Russia's population has completed tertiary education.

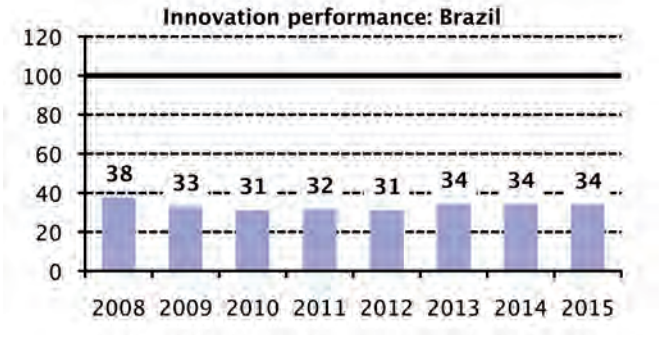
Russia's growth performance is worse than that of the EU with growth rates in ten indicators being below that of the EU, especially for Doctorate graduates, R&D expenditures in the business sector, Public-private co-publications, and PCT patent applications in societal challenges. Growth has been just above that of the EU in R&D expenditures in the public sector. The performance gap with the EU has widened for nine indicators. The performance gap of Russia with the EU has become smaller for R&D expenditures in the public sector.

	RELATIVE PERFORMANCE	DIFFERENCE IN PERFORMANCE GROWTH
Doctorate graduates	78.3	-3.8%
Tertiary education	168.8	-3.1%
International co-publ.	49.9	-1.2%
Most cited publications	31.3	-0.4%
R&D exp. public sector	66.4	0.8%
R&D exp. business sector	57.8	-2.1%
Public-private co-publ.	4.9	-2.2%
PCT patents	34.4	-0.1%
PCT patents societal ch.	11.5	-3.7%
Exports med&high tech prods	16.9	0.0%
Exports knowledge-int serv	75.0	-0.5%
License and patent rev.	6.1	-0.4%

*Performance scores equal 100 * the country's indicator values divided by those of the EU. Growth differences are calculated by subtracting EU growth rates from those of the country.*

Brazil

Brazil's innovation performance is lagging behind that of the EU and is stagnating. Relative performance was at its highest in 2008 at 38% and declined to 31% in 2010. In 2013 performance improved to 34%, and has been constant at that value since.



Scores are calculated by dividing the innovation index by that of the EU and multiplying by 100.

Brazil is performing worse than the EU on 11 indicators, in particular on License and patent revenues from abroad, PCT patent applications, Doctorate graduates, and Public-private co-publications. Brazil is only performing better than the EU on Exports of knowledge-intensive services.

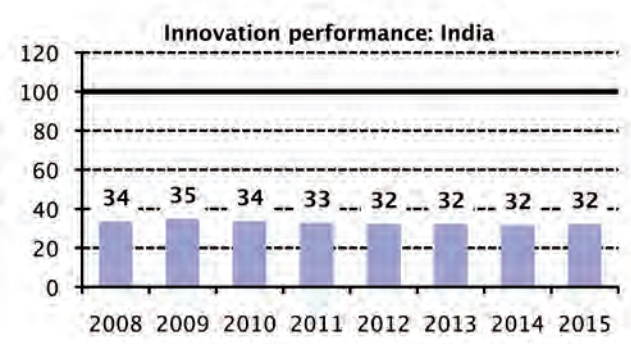
For half of the indicators, however, the growth performance of Brazil exceeds the growth performance of the EU. Growth performance is better than that of the EU in particular in Tertiary education, PCT patent applications in societal challenges, and Exports of knowledge-intensive services. Brazil has managed to reduce its performance gap on five indicators, and has improved its performance lead in Exports of knowledge-intensive services. The performance gap in Doctorate graduates and License and patent revenues from abroad, but also in Exports of medium and high tech products, has clearly widened.

	RELATIVE PERFORMANCE	DIFFERENCE IN PERFORMANCE GROWTH
Doctorate graduates	25.0	-17.2%
Tertiary education	54.3	5.5%
International co-publ.	45.7	1.2%
Most cited publications	46.6	-1.0%
R&D exp. public sector	87.5	-0.5%
R&D exp. business sector	42.5	-1.5%
Public-private co-publ.	5.3	1.3%
PCT patents	27.3	1.1%
PCT patents societal ch.	8.5	5.0%
Exports med&high tech prods	38.5	-4.5%
Exports knowledge-int serv	115.2	2.6%
License and patent rev.	2.7	-9.1%

*Performance scores equal 100 * the country's indicator values divided by those of the EU. Growth differences are calculated by subtracting EU growth rates from those of the country.*

India

India's innovation performance is lagging well behind that of the EU but has remained relatively stable over time.



Scores are calculated by dividing the innovation index by that of the EU and multiplying by 100.

India is performing worse than the EU on ten indicators, in particular on License and patent revenues from abroad, International scientific co-publications, Public-private co-publications, PCT patent applications, and R&D expenditures in the business sector. India is performing better than the EU in Exports of knowledge-intensive services, where its performance is 33% higher than that of the EU.

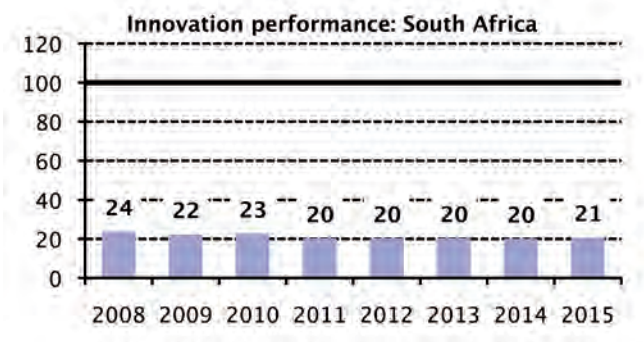
India's growth performance is mixed with growth rates on five indicators being above the EU, in particular for License and patent revenues from abroad, and Exports of medium and high tech products. Growth for six indicators has been below that of the EU, especially in Tertiary education, business R&D expenditures, and PCT patent applications in societal challenges. India has managed to reduce its performance gap on five indicators, especially on License and patent revenues from abroad, and Exports of medium and high tech products. The performance gap has widened for five indicators, especially in Tertiary education. India's performance lead on Knowledge-intensive service exports has slightly decreased.

	RELATIVE PERFORMANCE	DIFFERENCE IN PERFORMANCE GROWTH
Doctorate graduates	n/a	n/a
Tertiary education	30.9	-3.4%
International co-publ.	17.8	1.2%
Most cited publications	60.1	-0.5%
R&D exp. public sector	73.5	-0.9%
R&D exp. business sector	23.7	-2.2%
Public-private co-publ.	1.8	1.1%
PCT patents	32.1	0.3%
PCT patents societal ch.	14.2	-2.5%
Exports med&high tech prods	44.0	2.8%
Exports knowledge-int serv	132.9	-0.2%
License and patent rev.	5.5	8.7%

*Performance scores equal 100 * the country's indicator values divided by those of the EU. Growth differences are calculated by subtracting EU growth rates from those of the country.*

South Africa

The innovation performance of South Africa is lagging far behind that of the EU and is stagnating. Relative performance peaked at 24% of the EU level in 2008, but has been at 20-21% since 2011.



Scores are calculated by dividing the innovation index by that of the EU and multiplying by 100.

South Africa is performing worse than the EU on all 11 indicators. Its gap is largest on License and patent revenues from abroad, Doctorate graduates, and Public-private co-publications. The gap is smallest in International scientific co-publications and Most-cited publications, as well as in R&D expenditures in the public sector, and Exports of medium and high tech products.

For eight indicators, South Africa's growth performance is below that of the EU, but for Doctorate graduates, International co-publications, and Exports of medium and high tech products, performance has grown slightly faster than for the EU.

The performance gap has widened for most indicators, especially for R&D expenditures in the business sector, Public-private co-publications, PCT patent applications, and Tertiary education.

	RELATIVE PERFORMANCE	DIFFERENCE IN PERFORMANCE GROWTH
Doctorate graduates	10.1	1.4%
Tertiary education	20.1	-3.4%
International co-publ.	61.8	1.8%
Most cited publications	66.5	-1.0%
R&D exp. public sector	56.5	-0.3%
R&D exp. business sector	26.4	-8.1%
Public-private co-publ.	5.0	-4.8%
PCT patents	40.0	-3.4%
PCT patents societal ch.	17.3	-6.1%
Exports med&high tech prods	54.5	0.5%
Exports knowledge-int serv	n/a	n/a
License and patent rev.	5.7	-0.4%

*Performance scores equal 100 * the country's indicator values divided by those of the EU. Growth differences are calculated by subtracting EU growth rates from those of the country.*

6. Expected short-term changes in EU innovation performance

This year's report includes, for the first time, a forward-looking analysis of EU innovation performance discussing more recent developments, trends, and expected changes. The aim is to cover 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 will continue to increase on most indicators, leading to a relatively strong increase in the EU innovation index of about 2.5% in two years' time (Figure 30), in particular due to increases in performance in Doctorate graduates, Non-R&D innovation expenditures, Sales due to new product innovations, and Tertiary education attainment. Table 4 shows a summary of the results for those 20 indicators for which the calculation of relatively reliable short-term changes proved possible. EU innovation performance is expected to increase strongly for four indicators, to increase more moderately for 11 indicators, to remain stable for two indicators, and to decrease for three indicators. At the global level, the trends observed in recent years can be expected to continue, with the EU performance gap towards Japan and the United States narrowing further, the gap towards South Korea increasing, and the EU lead over China shrinking.

Section 6.1 discusses trend performance of the EU innovation index compared to four of its main international competitors. Section 6.2 explores EU trend performance for individual indicators, and Section 6.3 discusses expected changes in performance for the six indicators using CIS data, based on provisional 'fast track' CIS 2014 data made available by 18 Member States. Section 6.4 provides details on some of the methodologies used for estimating short-term changes.

Table 4: Changes in two years' time in EU innovation performance

	CURRENT SCORE	EXPECTED CHANGE IN TWO-YEARS' TIME	METHODOLOGY FOR ESTIMATING EXPECTED CHANGE
Human resources			
New doctorate graduates	1.84	>10% increase	Number of doctoral students
Population aged 30-34 with tertiary education	38.5	5-10% increase	Linear regression
Youth aged 20-24 with upper secondary level education	82.6	1-5% increase	Linear regression
Open, excellent and attractive research systems			
International scientific co-publications	459.2	>10% increase	Linear regression
Most-cited scientific publications	10.51	1-5% increase	Linear regression
Non-EU doctorate students	17.8	1-5% increase	Linear regression
Finance and support			
R&D expenditure in the public sector	0.72	1-5% decrease	Budget plan data
Venture capital investment	0.063	>10% decrease	Linear regression
Firm investments			
R&D expenditure in the business sector	1.30	1-5% increase	Survey on Industrial R&D Investment Trends
Non-R&D innovation expenditures	0.69	>10% increase	Fast-track CIS 2014
Linkages & entrepreneurship			
SMEs innovating in-house	28.7	No notable change	Fast-track CIS 2014
Innovative SMEs collaborating with others	10.3	5-10% increase	Fast-track CIS 2014
Intellectual assets			
PCT patents applications	3.53	No notable change	Econometric model using GDP and R&D
PCT patent applications in societal challenges	1.01	5-10% increase	Linear regression
Community trademarks	6.09	5-10% increase	Linear regression
Innovators			
SMEs with product or process innovations	30.6	1-5% increase	Fast-track CIS 2014
SMEs with marketing or organisational innovations	36.2	1-5% decrease	Fast-track CIS 2014
Economic effects			
Employment in knowledge-intensive activities	13.9	1-5% increase	Linear regression
Sales of new-to-market and new-to-firm innovations	12.4	5-10% increase	Fast-track CIS 2014
License and patent revenues from abroad	0.543	>10% increase	Linear regression

Figure 30: EU innovation performance

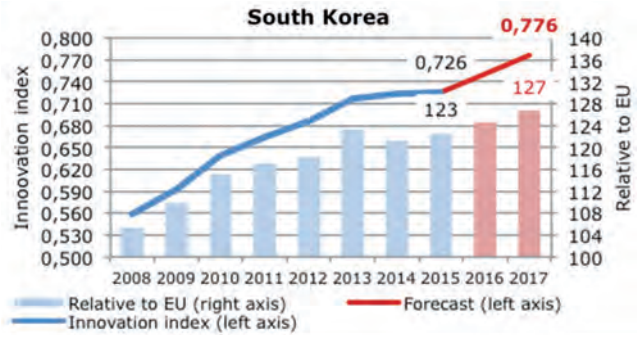
6.1 EU trend performance compared to China, Japan, South Korea, and the United States

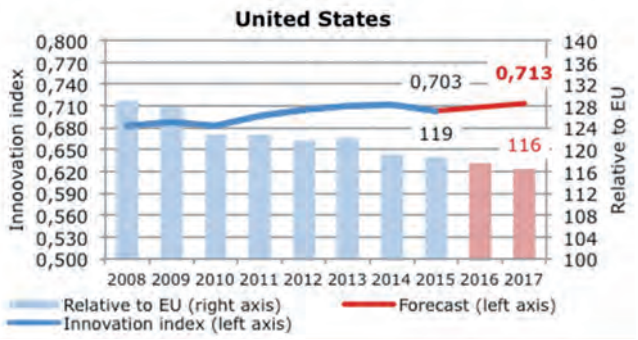
6.1.1 Trend performance of the innovation index

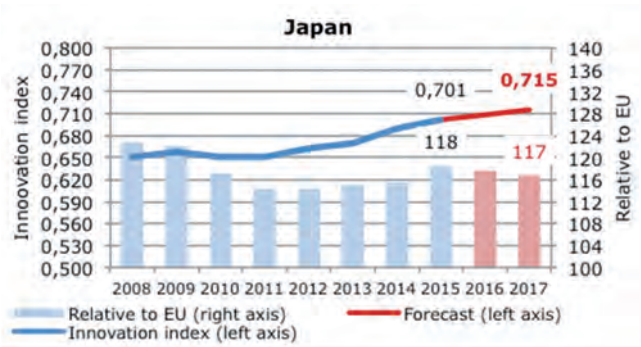
A statistical trend analysis using performance data from the previous eight years shows that the EU performance gap towards South Korea is expected to increase, that the performance gaps towards the United States and Japan are expected to narrow, and that the performance lead over China is expected to decrease.

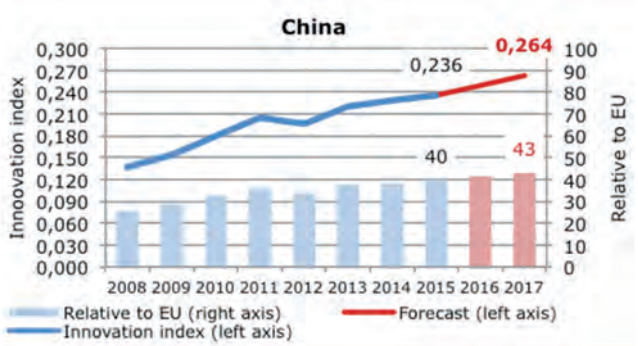
Nowcasts for 2016 and 2017 have been calculated for the EU, China, Japan, South Korea, and the US, using estimates based on nowcasting three-year averages. Details are explained in Section 6.4. The trend line for South Korea as shown in Figure 31 resumes the increase observed until 2013, after a slight deceleration in performance growth in 2014 and 2015. The innovation index would increase from 0.726 in 2015 to 0.776 in 2017, and the performance lead over the EU would further increase from 123% to 127%. After the decline in the innovation index in 2015, the trend line for the United States shows a recovery in 2016 and 2017 similar to the recovery seen after the performance decline in 2010. The innovation index would increase slightly from 0.703 in 2015 to 0.713 in 2017. However, due to relatively stronger expected growth in the EU, the US performance lead over the EU would further decrease from 119% to 116%. The trend line for Japan shows continued performance growth for 2016-2017. The innovation index would increase from 0.701 in 2015 to 0.715 in 2017, but the performance lead over the EU would, after four years of an increasing trend, decrease from 118% to 117%. The trend line for China also shows continued performance growth for 2016-2017. The innovation index would increase more strongly from 0.236 in 2015 to 0.264 in 2017, and China would continue to catch up from 40% of EU performance to 43%.

Figure 31: Expected short-term changes in innovation performance for EU's main competitors









6.1.2 Trend performance of three individual indicators: Tertiary education attainment, Business R&D expenditures, and Licence and patent revenues from abroad

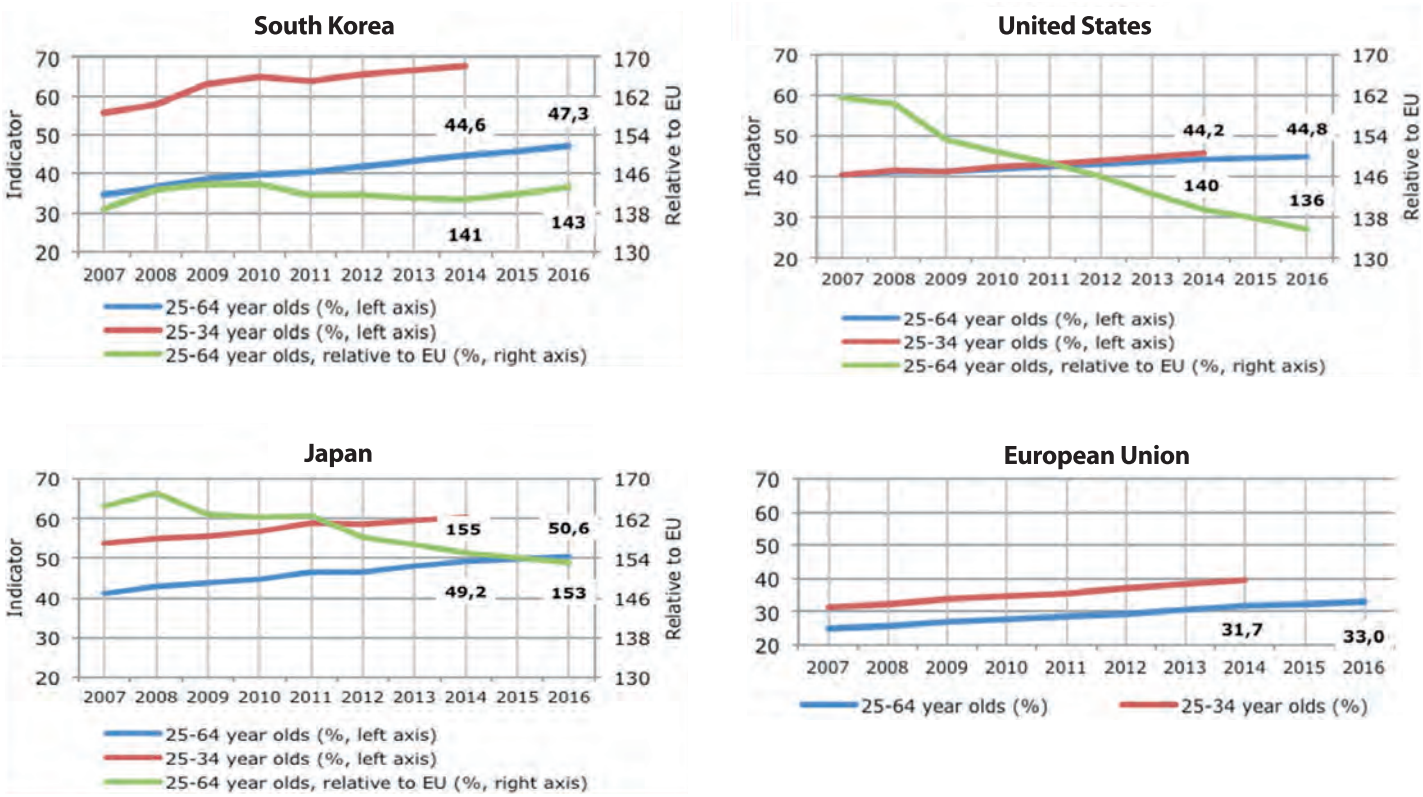
Complementary to the statistical results presented in section 6.1.1, this section will discuss forecasts for three key indicators in greater detail.

Tertiary education attainment

Estimates show that the share of EU population (aged 25-64) having completed tertiary education is expected to increase relative to that of Japan and the United States, but is expected to decrease relative to that of South Korea. For the share of population having completed tertiary education, the comparison between Member States uses data for 30-34 year olds, but due to data limitations for international comparisons, this analysis draws on data for 25-64 year olds. For Japan, South Korea, and the US, tertiary attainment data are available for the younger cohort of 25-34 year olds, and these data can be used for estimating short-term changes in tertiary attainment for the full working age population. For the US, tertiary attainment of both cohorts is similar, suggesting that improvements in the EIS indicator will be small when older cohorts are replaced by younger cohorts (Figure 32). For Japan, South Korea, and the EU, the situation is different, as younger cohorts are more highly educated than older cohorts, and a significant improvement in the EIS indicator is therefore expected in 10 to 15 years. For the more immediate future, i.e. in two years' time, effects of replacing older by younger cohorts will be smaller.

Assuming that the 25-34 year olds cohort contributes 25% to the value of the indicator, one can calculate by how much the indicator would increase in two years' time if individuals with the tertiary attainment level of the younger cohort replaced individuals of the older 35-64 year old cohort (details are explained in Section 6.4). For the EU, the share of population aged 25-64 with completed tertiary education would increase from 31.7% to 33.0% in two years' time (Figure 32). For South Korea, this share would increase more strongly from 44.6% to 47.3%, raising performance relative to the EU to 143%. For the US, this share would increase more modestly from 44.2% to 44.8%, thereby lowering US performance relative to the EU to 136%. Finally, for Japan, this share would increase at a lower rate than that of the EU, from 49.2% to 50.6%, thereby lowering performance relative to the EU to 153%.

Figure 32: Nowcasts for Tertiary education attainment for 25-64 year olds



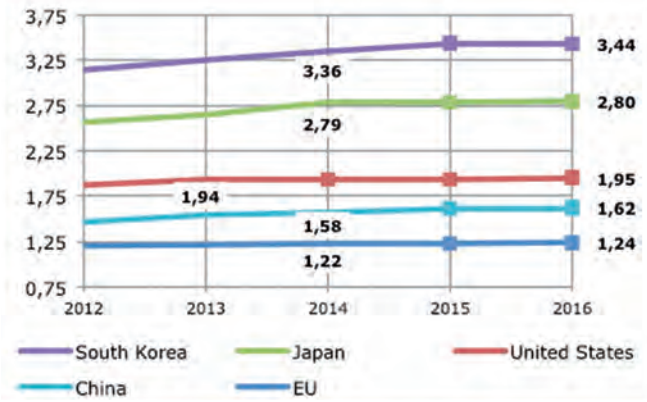
Source data 2007-2014: OECD, Education at a Glance, various editions. No data for China.

Business R&D expenditures

The most recent R&D statistics from the OECD are for 2014[18]. Based on nowcasts which are two years more timely than the data used for the calculation of the Summary Innovation Index, the EU business R&D intensity is expected to increase relative to Japan, to remain stable compared to the United States, and to decrease relative to China and South Korea.

The 2015 EU Survey on R&D Investment Business Trends[19] shows that larger EU companies expect their R&D expenditures in the EU to increase, on average, by 2.6% yearly for 2015-2017. Nominal GDP is expected to increase by 2.0% in 2015 and 2.1% in 2016 (European Economic Forecast - Spring 2016[20]). The EU's business R&D intensity is therefore expected to increase from 1.22 in 2014 to 1.23 in 2015 and 1.24 in 2016 (Figure 33).

Figure 33: Business R&D expenditure as a percentage of GDP



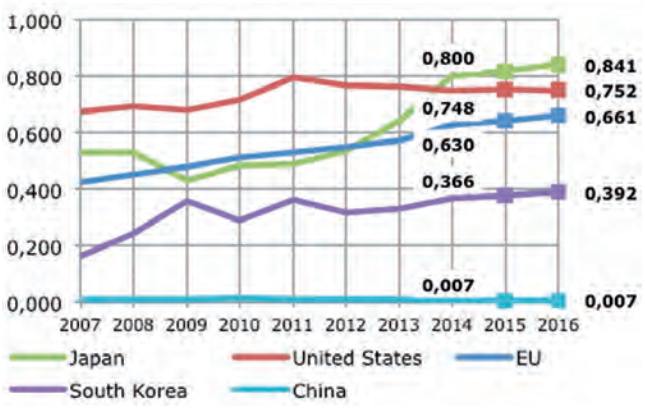
Nowcasts shown by markers.

For South Korea, business R&D expenditures are expected to increase by 5.35% in 2015 and 3.0% in 2016[21], and GDP is expected to increase by 2.7% in 2015 and 3.1% in 2016[22]. The business R&D intensity is therefore expected to increase to 3.44 in both 2015 and 2016, resulting in an increase in the large gap between the EU and South Korea. Forecasts for the United States show an increase in business R&D expenditures of 2.4% in 2014 and 2015[23], and 3.5% in 2016[24]. GDP is expected to increase by 2.4% in both 2014 and 2015 and 2.5% in 2016[25]. The business R&D intensity is therefore expected to decline from 1.94 in 2013 to 1.95 in 2016, such that the gap between the EU and the US would remain relatively constant. For Japan, forecasts for business R&D are not available, but total R&D expenditures are expected to increase by 0.7% in 2015 and 1.2% in 2016[26], and GDP is expected to increase by 0.6% in 2015 and 1.0% in 2016[27]. The business R&D intensity is therefore expected to increase from 2.79 in 2014 to 2.80 in 2016, such that the EU would narrow its performance gap towards Japan. For China, business R&D is expected to increase by 9.3%[28] in 2015 and 6.9% in 2016[29], and GDP is expected to increase by 6.8% in 2015 and 6.5% in 2016[30]. The business R&D intensity is therefore expected to increase from 1.58 in 2014 to 1.62 in 2016, leading to an increasing performance lead over the EU.

License and patent revenues from abroad

Based on a statistical extrapolation of data for 2007-2014, License and patent revenues from abroad as a share of GDP are expected to increase for the EU and most of its international competitors. For the EU, the indicator is expected to increase from 0.630 in 2014 to 0.661 in 2016 (Figure 34). This increase is stronger than that expected for the United Sates, lowering the US performance lead over the EU from 119% to 114% over the two-year forecast. The performance lead of Japan would not change over two years. The EU's performance lead over South Korea would decrease from 172% to 170%, and the performance lead over China would remain substantial.

Figure 34: License and patent revenues from abroad as a percentage of GDP



Nowcasts shown by markers.

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[18] *As in the international comparison in Section 5.2, OECD data are used for nowcasting business R&D expenditures. There is a difference between the OECD results for the EU (business R&D intensity of 1.22 in 2014) and those of Eurostat as used in the European benchmarking exercise (business R&D intensity of 1.30 in 2014).*

[19] *This survey is carried out by the Industrial Research and Innovation (IRI) action of the European Commission's Joint Research Centre (JRC), Institute for Prospective Technological Studies (IPTS). Survey results are available at http://iri.jrc.ec.europa.eu/survey.html*

[20] *http://ec.europa.eu/economy_finance/eu/forecasts/2016_spring_forecast_en.htm*

[21] *Korea Industrial Technology Association, Industry R&D Trends for 2016*

[22] *OECD Economic Outlook No 98, November 2015*

[23] *For 2014, the increase is assumed to be equal to that in 2015: R&D Magazine & Industrial Research Institute, 2016 Global R&D Funding Forecast: www.iriweb.org/sites/default/files/2016GlobalRDFundingForecast.pdf.*

[24] *2016 Industrial Research Institute's R&D Trends Forecast (http://www.iriweb.org/)*

[25] *OECD Economic Outlook No 98, November 2015*

[26] *R&D Magazine & Industrial Research Institute, 2016 Global R&D Funding Forecast:www.iriweb.org/sites/default/files/2016GlobalRDFundingForecast.pdf*

[27] *OECD Economic Outlook No 98, November 2015*

[28] *The Statistics Portal: http://www.statista.com/statistics/279951/internal-research-and-development-expenditure-in-china/*

[29] *Assuming a similar relative increase of 6.9% in 2016 in business R&D as for total R&D (www.iriweb.org/sites/default/files/2016GlobalRDFundingForecast.pdf)*

[30] *OECD Economic Outlook No 98, November 2015*

6.2 Short-term changes in EU innovation performance by indicator

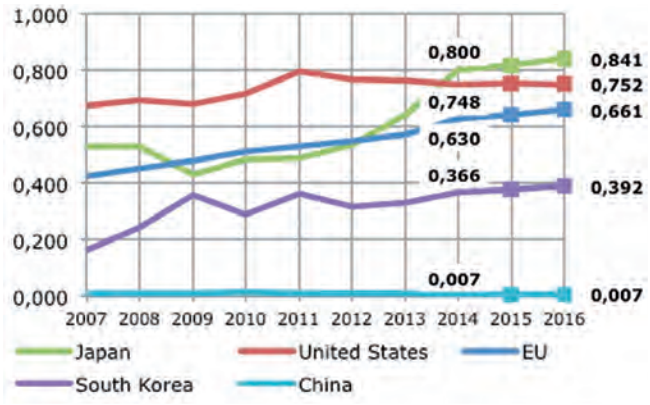
This section discusses expected short-term changes for 20 indicators. For ten of these indicators, changes have been calculated applying a simple linear regression using time series data (see Section 6.4.3 for more details). For the other indicators, a mix of techniques has been used, which will be discussed in this section. For five indicators, short-term changes could not be calculated[31].

Human resources

For the share of Doctorate graduates per 1000 population aged 25-34, data for the EU are available up until 2014[32]. Data on the number of doctoral students per 1000 population aged 25-34 can be used to predict changes in the number of doctorate graduates. For doctoral students, data are available up until 2014. The shares for both doctorate graduates and doctoral students are increasing over time (Figure 35). Assuming an average completion time of five years for finishing a PhD, the 13.5% increase in doctoral students in 2009-2011 as compared to 2008 can be used to forecast the number of doctorate graduates in 2015-2016. Combining this with an expected decline in the population aged 25-3[33], the share of doctorate students per 1000 population aged 25-34 is expected to increase from 1.84 in 2014 to 1.94 in 2015 and 2.04 in 2016.

Between 2008 and 2015, the Population share aged 30-34 having completed tertiary education has shown a steady increase of over one percentage point per year. A simple linear regression for the same period has been used to estimate an increase from 38.5 to 41.1 in two years' time. Between 2008 and 2015, the Youth share aged 20-24 having attained at least upper secondary level education has increased, on average, by 0.6 percentage points per year. A simple linear regression for the same period has been used to estimate an increase from 82.6 to 83.8 in two years' time.

Figure 35: Shares of doctorate graduates and doctoral students



Shares of doctorate graduates and doctoral students [34]

Open, excellent and attractive research systems

The share of International scientific co-publications has shown a steady increase between 2008 and 2015. A simple linear regression for the same period has been used to estimate an increase from 459.2 to 507.5 in two years' time. The share of Most-cited scientific publications has been increasing for most years except for a one-time decrease between 2011 and 2012. A simple linear regression for 2006-2013 has been used to estimate an increase from 10.51 to 10.64 in two years' time. The share of Non-EU doctorate students has been increasing for most years except for a one-time decrease between 2012 and 2013. A simple linear regression for 2007-2014 has been used to estimate an increase from 17.8 to 18.3 in two years' time.

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[31] *For Public-private co-publications, Community designs, Employment in fast-growing enterprises, Medium and high tech product exports, and Knowledge-intensive services exports, no reliable proxy indicators are available, and linear regression results are weak with adjusted R2's below 0.6.*

[32] *Aggregate data for doctoral students for the EU have been calculated using data for the Member States, where data have been adjusted for sharp declines for Spain from 68,865 in 2011 to 22,542 in 2012, and for the UK from 99,416 in 2007 to 80,906 in 2008.*

[33] *The most recent EU aggregate available from Eurostat as used in the other chapters of this report is for 2013. After the cut-off day of 1 April 2016 for collecting the data for the main analysis, 2014 data for all Member States have become available from Eurostat. The aggregate for all 28 Member States for 2013 and 2014 shows a stable share of 1.84 for both years.*

[34] *A linear regression almost perfectly predicts the evolution in the population aged 25-34 between 2004 and 2014 suggesting a further decline of almost 2% in two years' time.*

Finance and support

Government budget plans can be used to nowcast R&D expenditure in the public sector as a percentage of GDP. Budget plan data for 2015 and 2016 for Austria[35], France[36], Germany[37], Italy[38], the Netherlands[39], and the United Kingdom[40], with these six countries accounting for about 73% of public R&D expenditure in the EU, show that the aggregate spending for these six countries would increase by 6.0% over the next two years, and GDP by 7.1%[41]. Assuming equal growth rates for the EU, R&D expenditure in the public sector as a share of GDP would decrease from 0.72 to 0.71 in two years' time. Venture capital investments as a percentage of GDP have been declining steadily over time, in particular between the first half of the 2009-2015 period. A simple linear regression for 2009-2015 has been used to estimate a further decrease from 0.063 to 0.050 in two years' time.

Firm investments

R&D expenditures in the business sector as a percentage of GDP are expected to increase from 1.30 to 1.32 in two years' time (cf. Section 6.2). Non-R&D innovation expenditures as a share of turnover are expected to increase in two years' time (cf. Section 6.3).

Linkages & entrepreneurship

For the two indicators using CIS data, provisional CIS 2014 data show a stable performance for the share of SMEs innovating in-house, and an increase in the performance for Innovative SMEs collaborating with others (cf. Section 6.3).

Intellectual assets

A working paper by Eurostat[42] discusses several options for nowcasting patent data, including six econometric models using data on GDP, R&D expenditures, researchers, and Human Resources in Science and Technology. Three of these models have been explore[43], of which the model assuming a linear dependence with GDP and R&D expenditures performs best. PCT patent applications per billion GDP are expected to further decrease. PCT patent applications in societal challenges per billion GDP have increased steadily between 2005 and 2011 followed by a decline in 2012. A linear regression for 2005-2012 has been used to estimate an increase from 1.01 to 1.06 in two years' time. Between 2008 and 2015, the indicator score for Community trademarks per billion GDP has increased steadily by almost 0.2 each year. A linear regression for 2008-2015 has been used to estimate an increase from 6.09 to 6.47 in two years' time.

Innovators

For the two indicators using CIS data, provisional CIS 2014 data show a stable performance for the share of SMEs with product or process innovations, and a decrease in performance for the share of SMEs with marketing or organizational innovations (cf. Section 6.3).

Economic effects

Between 2008 and 2014, the Employment share in knowledge-intensive activities has increased by over 0.1 percentage points a year. A simple linear regression for 2008-2014 has been used to estimate an increase from 13.9 to 14.1 in two years' time. For the indicator using CIS data, provisional CIS 2014 data show an increase in performance for the Sales share due to new-to-market or new-to-firm product innovations (cf. Section 6.3). The indicator score for License and patent revenues from abroad as a percentage of GDP has been steadily increasing between 2007 and 2014 at an average rate of 0.041. A simple linear regression for 2007-2014 has been used to estimate an increase from 0.543 to 0.619 in two years' time[44].

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[35] *Austrian Federal Ministry of Science, Research and Economy, Austrian Research and Technology Report 2015 (http://wissenschaft.bmwfw.gv.at/home/research/national/austrian-research-and-technology-report-2015/)*

[36] *Journal Officiel de la République Française, LOI no 2014-1654 du 29 décembre 2014 de finances pour 2015 (https://www.legifrance.gouv.fr/eli/loi/2014/12/29/2014-1654/jo/texte); Journal Officiel de la République Française, LOI no 2015-1785 du 29 décembre 2015 de finances pour 2016 (https://www.legifrance.gouv.fr/eli/loi/2015/12/29/2015-1785/jo/texte)*

[37] *German Bundesministerium der Finanzen, Die Struktur des Bundeshaushaltes (http://www.bundeshaushalt-info.de/#/2016/soll/ausgaben/einzelplan.html)*

[38] *Ministero dell'Economia e delle Finanze, Bilancio finanziario - 2016-2018 (http://www.rgs.mef.gov.it/VERSIONE-I/Attivit--i/Bilancio_di_previsione/Bilancio_finanziario/2016/)*

[39] *Rathenau Instituut, Feiten & Cijfers, Totale Onderzoek Financiering 2011-2017 (https://www.rathenau.nl/nl/file/103/download?token=uTmAlF7D)*

[40] *UK Department for Business Innovation & Skills, The Allocation of Science and Research Funding 2011/12 to 2014/15 (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/422477/bis-10-1356-allocation-of-science-and-research-funding-2011-2015.pdf)*

[41] *Budget data are not a perfect predictor for public R&D expenditures; in some countries, budget data overestimate public R&D expenditures, in other countries, they underestimate these expenditures. In the nowcasting, the ratio between budget data and public R&D expenditures in 2014, or the closest year for which data are available, is assumed not to change in 2015 and 2016, the two years for which nowcasts are calculated.*

[42] *Eurostat, Patent Statistics – Working Paper: Methods for Nowcasting Patent Data, Final version, 21 December 2010.*

[43] *The first model assumes that the number of patent applications is linearly dependent on GDP and R&D expenditures, the second model assumes a linear logarithmic dependence between the same variables, and the third model assumes a linear dependence on R&D expenditures only. The estimates for the first two models are almost identical. All three models cannot predict the decline in PCT applications in the two most recent years, but the first and second model do predict the decline in the value for PCT applications per billion GDP.*

[44] *The analysis in Section 6.1.2 shows different results, as the World Bank data used for license and patent revenues from abroad in the international comparison are different from the Eurostat data used in the Member States' analysis.*

6.3 Provisional CIS 2014 data

The Community Innovation Survey (CIS) is a survey of innovation activity in enterprises. For the CIS 2012, the latest CIS for which final results are available, most questions cover the reference period 2010-2012, i.e. the three-year period from the beginning of 2010 to the end of 2012. According to Commission Regulation No 995/2012, national CIS statistics must be delivered to Eurostat within 18 months of the end of the reference year, i.e. June in even-numbered years (e.g. June 2014 for the CIS 2012). Data are then checked and corrected for detected inconsistencies by Eurostat. Final CIS 2012 data were made available by Eurostat in November 2014. Similarly, final CIS 2014 data are expected to be made available by Eurostat in the last quarter of 2016.

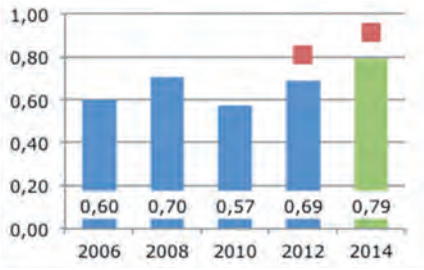
Eurostat has made a request to national data providers to share provisional CIS 2014 data for the indicators used in the EIS. Provisional CIS 2014 data were received from 20 countries, including 18 Member States, Norway and Serbia[45], for all EIS indicators, except for the two indicators using expenditure data for Austria, Finland, France, and Italy (Table 5).
An EU aggregate using data for those Member States which shared provisional CIS 2014 data can be compared with the EU aggregate for the same set of Member States using final CIS 2012 data. For the EU, provisional CIS 2014 data scores are higher for three indicators, almost the same for two indicators, and lower for one indicator as compared to the CIS 2012 (Figure 36).

The share of non-R&D innovation expenditure for the EU has followed a pattern of increases and decreases between 2006 and 2012. Using provisional CIS 2014 data for 14 Member States, the share of non-R&D innovation expenditure for the EU is estimated to increase from 0.69 in 2012 to 0.79 in 2014. For nine Member States, the indicator is expected to increase, and for five Member States, it is expected to decrease, in particular for Latvia. The share of SMEs innovating in-house for the EU has been falling between 2006 and 2012 despite a temporary increase in 2010. Based on provisional CIS 2014 data for 18 Member States, the share of SMEs innovating in-house for the EU is estimated to remain almost constant at 28.9 in 2014. For ten Member States, the indicator is expected to increase, in particular for Lithuania. Relatively strong declines are seen for Italy, Latvia, and the Netherlands.

The share of innovative SMEs collaborating with others for the EU has been mostly increasing between 2006 and 2012. Based on provisional CIS 2014 data for 18 Member States, the share of innovative SMEs collaborating is estimated to increase from 10.3 in 2012 to 11.2 in 2014. For 12 Member States, the indicator is expected to increase, and for six Member States, it is expected to decrease, in particular for the UK. The share of SMEs with product and process innovations for the EU has been falling between 2006 and 2012. Based on provisional CIS 2014 data for 18 Member States, the share of product and process innovators is estimated to increase from 30.6 in 2012 to 31.1 in 2014. For 12 Member States, the indicator is expected to increase, especially for Lithuania. For the Czech Republic, the share of product and process innovators is expected to decline significantly. Notable declines are also observed for Italy and Latvia.

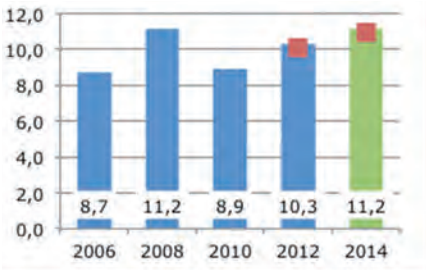
Figure 36: Expected change in EU performance in 2014 for the indicators using CIS data

Share of non-R&D innovation expenditure expected to increase

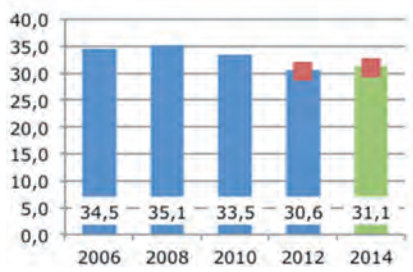


Share of SMEs innovating in-house expected to remain constant

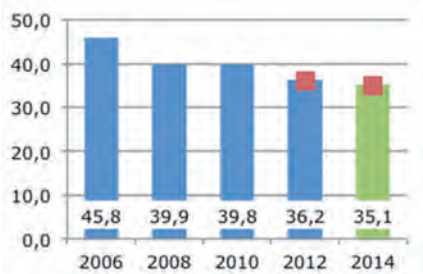
Share of SMEs innovating in-house expected to remain constant



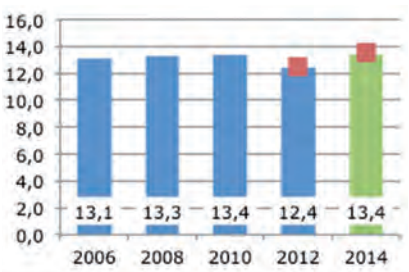
Share of SMEs with product and process innovations expected to increase



Share of SMEs with marketing and organizational innovations expected to decrease



Share of SMEs innovating in-house expected to remain constant



EU averages using data for all Member States shown in blue coloured columns. Data for 2012 and 2014 for the average of those Member States for which provisional CIS 2014 data are available are shown with red coloured dots. The forecast for the EU for 2014, shown in the green colored column, is calculated by taking the vertical difference between the EU (blue column for 2012) and the CIS 2014 subgroup of Member States (the red coloured dot above the blue column) and repeating this difference for 2014. The EU average using data for Member States having made available provisional CIS 2014 data represents 75% of total EU non-R&D innovation expenditure in 2012, 91% of SMEs innovating in-house, 89% of innovative SMEs collaborating with others, 90% of SMEs with product and process innovations, 90% of SMEs with marketing and organizational innovations, and 65% of sales due to new-to-market or new-to-firm product innovations.

[45] *Results for Norway and Serbia are included in the respective Country profiles in Section 7.*

The share of SMEs with marketing and organizational innovations for the EU has been falling between 2006 and 2012. Based on provisional CIS 2014 data for 18 Member States, the share of marketing and organizational innovators is estimated to further decrease from 36.2 in 2012 to 35.1 in 2014. For 11 Member States, the indicator is expected to decrease. The indicator is foreseen to increase strongly in Germany, Spain, and the UK. The sales share due to new-to-market or new-to-firm product innovations for the EU declined in 2012 from a higher level in 2006-2010. Based on provisional CIS 2014 data for 14 Member States, the sales share due to new-to-market and new-to-firm product innovations is estimated to increase from 12.4 in 2012 to 13.4 in 2014, which is equal to the level in 2010. This increase is driven by increasing performance in 11 Member States, including an almost 20 percentage point increase for the Czech Republic.

Table 5: Change between CIS 2012 and CIS 2014 performance for EU and Member States

		NON-R&D INNOVATION EXPENDITURE	SMES INNOVATING IN-HOUSE	INNOVATIVE SMES COLLABORATING WITH OTHERS	SMES WITH PRODUCT/ PROCESS INNOVATIONS	SMES WITH ORGANISATIONAL/ MARKETING INNOVATIONS	SALES OF NEW-TO-MARKET OR NEW-TO-FIRM PRODUCT INNOVATIONS
EU	European Union	0.11	0.22	0.86	0.55	-1.11	1.01
BG	Bulgaria	0.26	-0.43	0.78	0.46	-2.89	0.56
CZ	Czech Republic	0.21	1.68	-1.60	-27.02	-4.46	19.65
DE	Germany	-0.07	-0.66	-1.42	-0.77	2.82	0.24
EL	Greece	-0.11	4.76	2.33	4.95	-4.89	1.00
ES	Spain	0.05	-1.03	0.63	3.84	2.96	1.61
FR	France	n/a	2.54	1.73	3.11	0.42	n/a
HR	Croatia	0.25	1.80	-0.67	3.82	0.46	-4.76
IT	Italy	n/a	-6.12	1.79	-6.14	-10.43	n/a
LV	Latvia	-0.80	-3.65	-1.75	-3.81	-4.09	0.29
LT	Lithuania	0.91	16.39	7.68	17.62	-1.17	3.10
NL	Netherlands	-0.02	-3.89	3.00	2.07	-2.66	-1.03
AT	Austria	n/a	2.95	4.89	5.05	1.17	n/a
PL	Poland	0.51	1.05	-0.35	0.20	-2.81	0.12
RO	Romania	1.25	6.51	2.30	8.12	-6.72	2.76
SK	Slovakia	-0.22	-1.07	1.69	-0.93	-3.80	-0.49
FI	Finland	n/a	1.83	2.49	4.03	0.23	n/a
SE	Sweden	0.33	0.68	0.82	0.50	-3.09	0.79
UK	United Kingdom	0.32	7.62	-2.72	8.46	4.05	1.27

Changes calculated as difference between provisional CIS 2014 indicator score and CIS 2012 indicator score. For Austria, Finland, France, and Italy, data are not available for the two expenditure-based indicators.

6.4 Methodology section

6.4.1 Nowcasting the innovation index for the EU and some of its major competitors

Nowcasts for 2016 and 2017 have been calculated using the following methodology :

- Step 1: Using the innovation index scores for 2008-2015, three-year averages have been calculated for 2009-2014, e.g. the three-year average for 2010 is the unweighted average of the innovation indexes for 2009-2011.
- Step 2: A linear regression has been estimated on the 2009-2014 three-year averages.
- Step 3: Using the intercept and the slope of the linear regression, estimates for three-year averages have been calculated for 2008-2017.
- Step 4: Adjusted estimates for the three-year averages for 2015-2017 have been calculated by correcting the estimates in Step 3 by adjusting for the difference in 2014 between the three-year average calculated in Step 1 and the estimate calculated in Step 3.
- Step 5: An estimate has been calculated for the innovation index in 2016 by taking the difference between the estimates, as calculated in Step 4, for the three-year averages in 2015 and 2016 and the innovation index score in 2015. Similarly, estimates have been calculated for the innovation index in 2017.
- Step 6: Scores relative to the EU have been calculated by dividing the estimates for the respective country by those for the EU and multiplying by 100.

6.4.2 Nowcasting tertiary education attainment for the EU and some of its major competitors

For the share of population aged 25-64 having completed tertiary education, nowcasts are calculated using data for tertiary education attainment for 25-34 year olds as follows:

- Calculate the tertiary education rate of the population aged 35-64 by assuming that this cohort contributes 75% to the indicator value for the population aged 25-64 in any year T, i.e. $X_{35\text{-}64,T}=(4*X_{25\text{-}64,T}-X_{25\text{-}34,T})/3$, where X is the indicator value for the respective age group in year T.
- Calculate the average annual growth rate of the tertiary education rate of the population aged 25-64 for 2007-2014, i.e. $AAGR_{25\text{-}34}=(X_{25\text{-}34,2014}-X_{25\text{-}34,2007})^{(1/7)}-1$.
- Assume that one year of the 35-64 age cohort will be replaced by one year of the 25-34 age cohort in both 2015 and 2016, and also assume that tertiary education rate of the population aged 25-64 will continue to grow at the same growth rate as in 2007-2014: $X_{25\text{-}64,2016}=0.7 * X_{35\text{-}64,2014} + 0.3 * (1+AAGR_{25\text{-}34})^2 * X_{25\text{-}34,2014}$.

6.4.3 Using linear regression for estimating short-term changes for individual indicators

For ten indicators discussed in section 6.2, the coefficients of the slope have been used to estimate results for the EU one (T+1) and two years (T+2) from now by adding the slope to the last known value. Table 6 shows the regression results for these indicators.

Table 6: Nowcasts for ten indicators using linear regressions

	SLOPE	ADJUSTED R^2	CURRENT SCORE	T+1	T+2
Tertiary education attainment	1.0738	0.9855	38.5	39.6	41.1
Youth upper secondary level education	0.6024	0.9435	82.6	83.2	83.8
International scientific co-publications	24.1652	0.9954	459.2	483.4	507.5
Most cited scientific publications	0.0644	0.8696	10.51	10.58	10.64
Non-EU doctorate students	0.2597	0.8445	17.8	18.0	18.3
Venture capital investments	-0.0067	0.8839	0.063	0.056	0.050
PCT patent applications in societal challenges	0.0288	0.8099	1.01	1.03	1.06
Community trademarks	0.1864	0.9368	6.09	6.28	6.47
Employment in knowledge-intensive activities	0.1143	0.9176	13.9	14.0	14.1
License and patent revenues from abroad	0.0381	0.8688	0.543	0.581	0.619

7. Country profiles

This section provides individual profiles for all European countries. Each profile includes the following graphs:

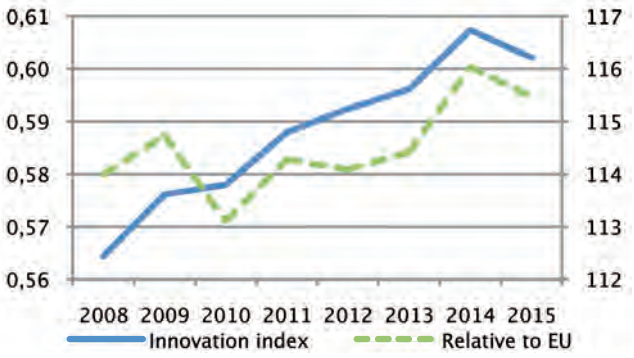
- The first graph shows the development of the country's innovation index over time (as shown by the solid line) and its development relative to the EU average (as shown by the dotted line).
- For those countries which provided provisional CIS 2014 data, the second graph compares the provisional CIS 2014 data with the CIS 2012 data as used in this year's report.
- The third graph provides a comparison of the respective country's performance by indicator and dimension with that of the EU (where the EU performance equals 100), highlighting relative strengths and weaknesses. The comparison of the indicators is based on the real indicator values before being corrected for outliers, being possibly transformed and being normalized (cf. Section 8.1 for more details on the methodology used to construct normalized indicator scores). The comparison of the dimensions is based on the dimensions' composite index values, which are the average of the normalized scores of the indicators captured by the respective dimension.
- The fourth graph shows the average annual growth rates over an eight-year period by indicator and dimension, highlighting which indicators and dimensions have been driving a country's change in innovation performance over time.

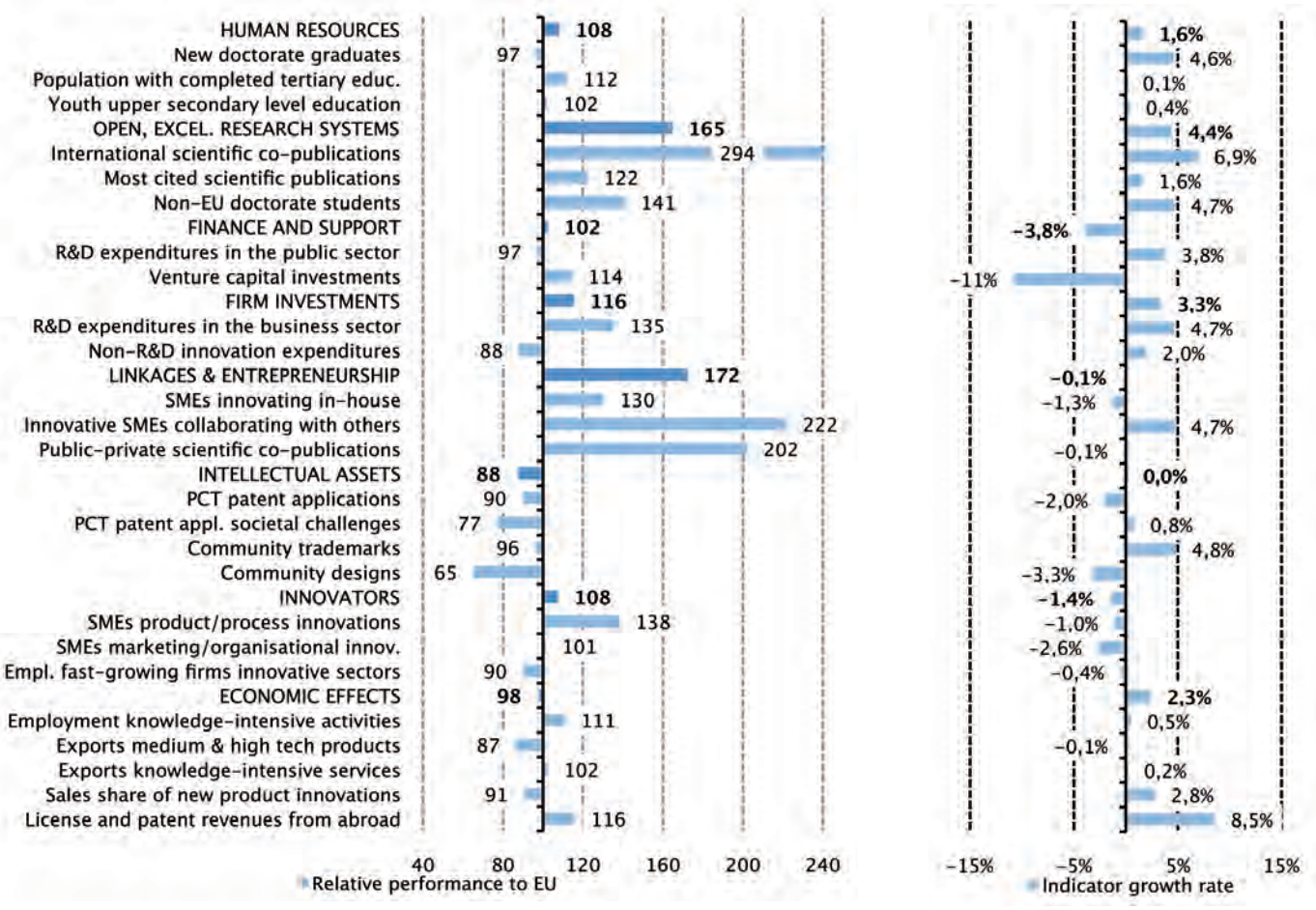
Belgium

Belgium is a **Strong Innovator**. Innovation performance gradually increased over time and then declined in 2015. Over time, performance relative to that of the EU has improved to almost 116% in 2015.

Belgium is performing well above the EU average in *Linkages and entrepreneurship*. Also Belgium's research system is performing well in particular due to a high number of International scientific co-publications. Relative weaknesses are in *Intellectual assets*, where performance is somewhat below the EU average for all four indicators, and in the dimension *Economic effects*.

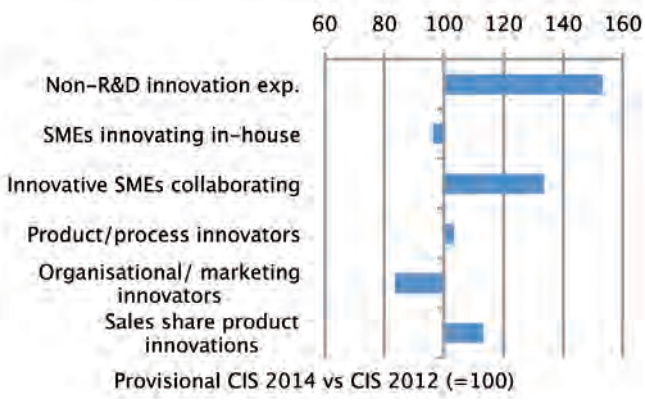
Performance has improved most strongly in *Open, excellent and attractive research systems* (4.4%) and has worsened in *Finance and support* (-3.8%). For nine indicators, performance has declined, in particular in Venture capital investments (-11%).





Note: Performance relative to the EU where the EU = 100.

Bulgaria

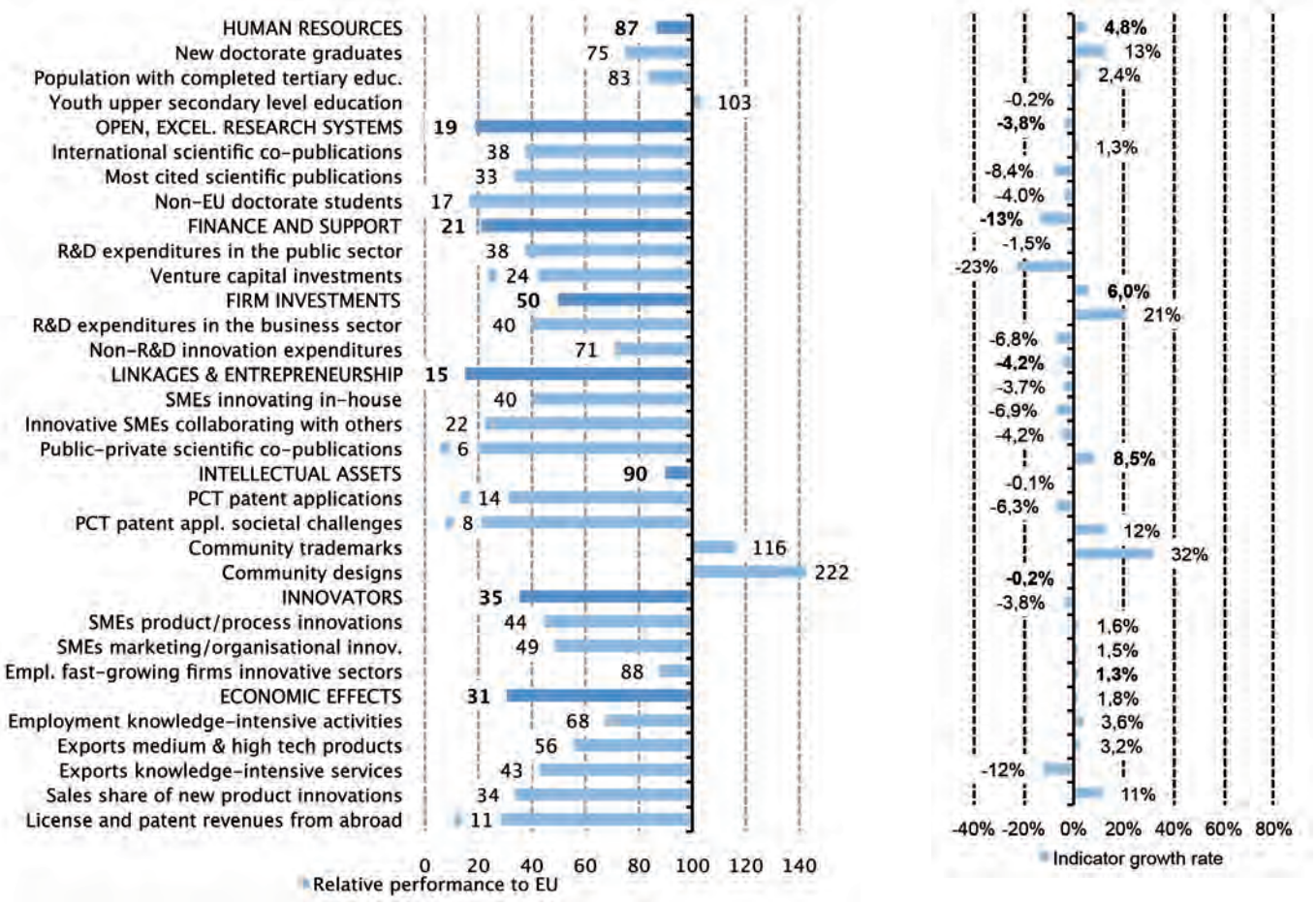


Bulgaria is a **Modest Innovator**. Innovation performance increased over time until 2012, after which it strongly declined in 2013 (due to strong declines in Venture capital investments and Non-R&D innovation expenditures), to increase again in 2014 and 2015. Performance relative to the EU is at 46.3% in 2015.

Bulgaria's relative strengths are in *Human resources* and *Intellectual assets*. Bulgaria has relatively high shares of highly educated people and performs well in applying for Community trademarks and designs. *Linkages and entrepreneurship* and *Finance and support* are the main weaknesses, in particular due to low Venture capital investments. For all indicators, except for Youth with upper secondary level education, Community trademarks and designs, Bulgaria is performing below the EU average.

For 12 indicators, growth has been positive, most notably for Community designs with a growth rate of 32% and R&D expenditures in the business sector (21%). Strong declines in performance are observed in Venture capital investments (-23%) and the Sales shares due to new product innovations (-12%).

Provisional CIS 2014 data show improved performance for four and worsened performance for two indicators. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.242 to 0.248 assuming that for the other indicators performance would not change.



Note: Performance relative to the EU where the EU = 100.

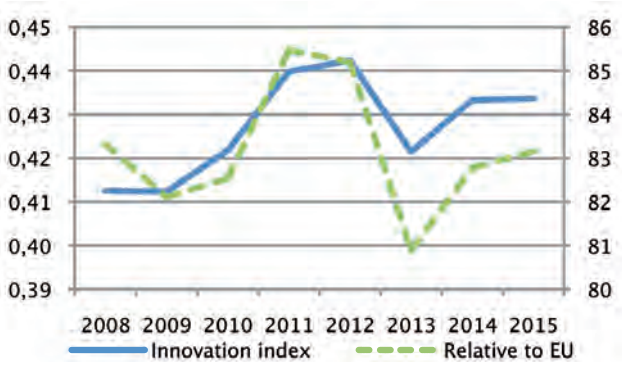
Czech Republic

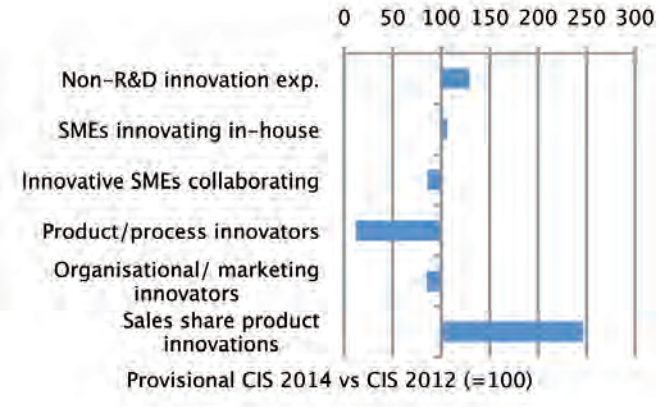
The Czech Republic is a **Moderate Innovator**. Innovation performance increased until 2012, declined in 2013, and increased again in more recent years. The performance relative to that of the EU shows a similar trend. Performance relative to the EU is at 83.1% in 2015.

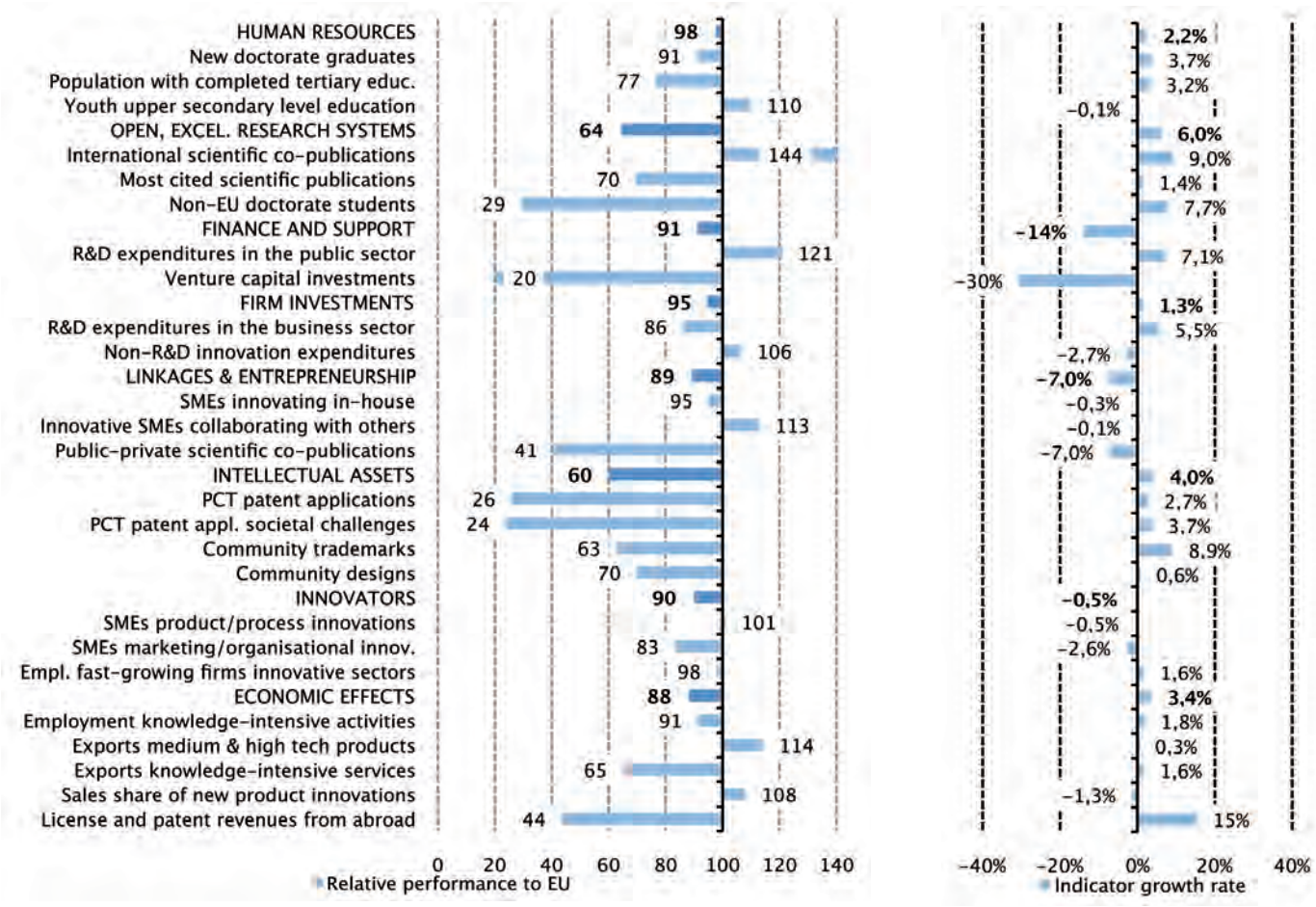
Relative strengths compared to the EU average are in *Human resources, Firm investments,* and *Finance and support*. Relative weaknesses are in *Intellectual assets* and *Open, excellent and attractive research systems*. In the latter, quite a diverse pattern can be observed with below-average performance for Most cited scientific publications and Non-EU doctorate students, and above average performance for International scientific co-publications.

Performance has improved most in *Open, excellent and attractive research systems* (6.0%). The fastest growing indicators are License and patent revenues from abroad (15%), International scientific co-publications (9.0%), and Community trademarks (8.9%). A strong decline is observed in Venture capital investments (-30%).

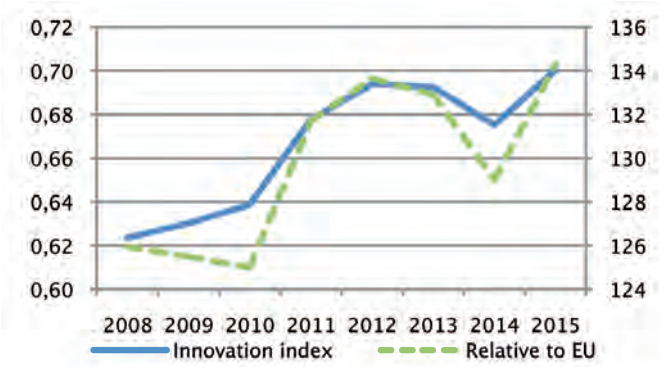
Provisional CIS 2014 data show improved performance for three and worsened performance for three indicators. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.434 to 0.458 assuming that for the other indicators performance would not change.







Note: Performance relative to the EU where the EU = 100.

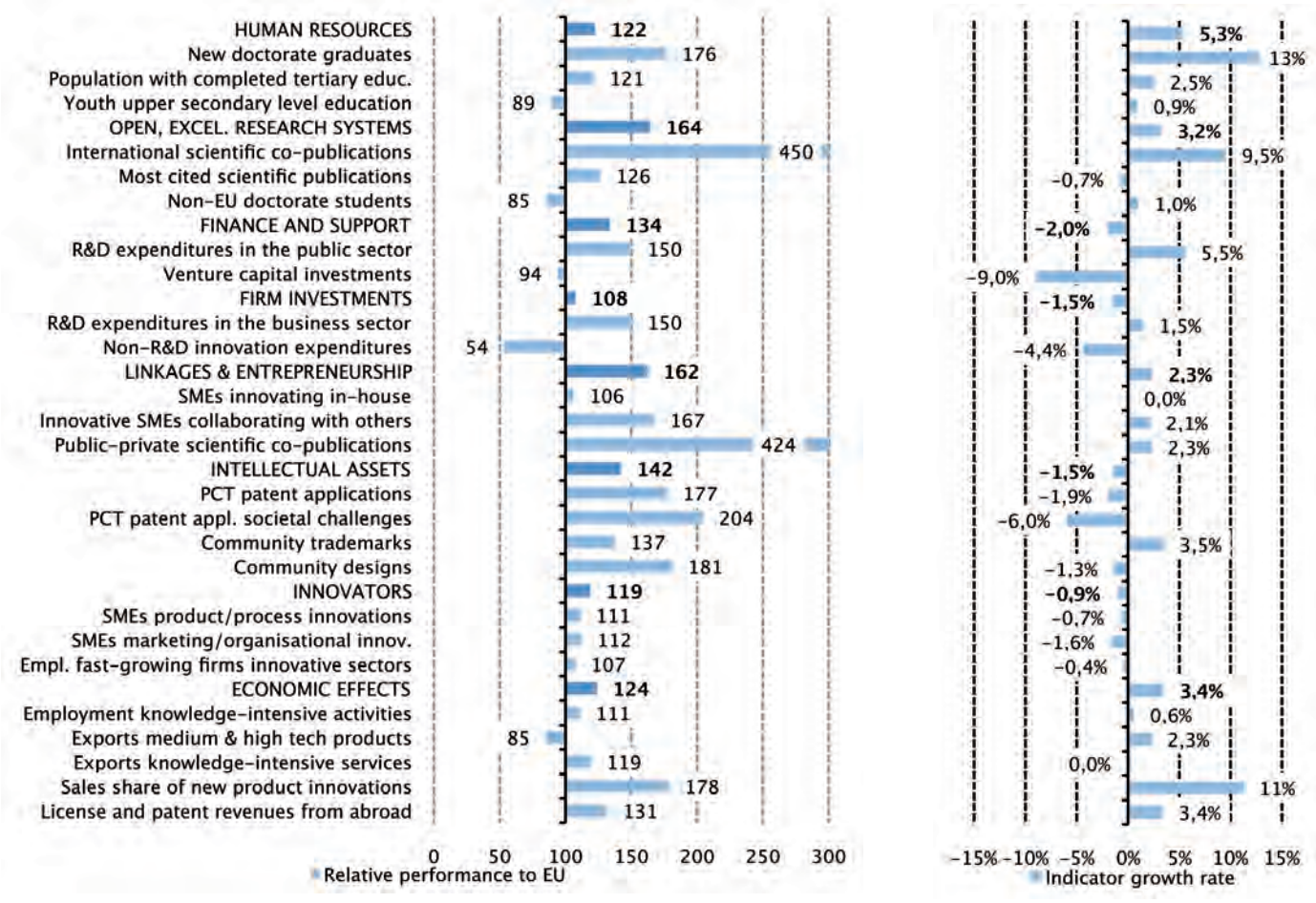


Denmark

Denmark is an **Innovation Leader**. Innovation performance increased until 2012. Performance then declined in 2013 and 2014, and increased again in 2015. Performance relative to the EU has increased from 26% above the EU average in 2008 to 34% in 2015.

Denmark is performing above the EU average in all dimensions, most notably in *Open, excellent and attractive research systems*, *Linkages and entrepreneurship*, and *Intellectual assets*. In particular in International scientific co-publications and Public-private co-publications, the country is performing well above the EU average. Relative weaknesses are in Non-R&D innovation expenditures.

Performance has improved for 14 indicators and on average most strongly in the dimensions *Human resources* (5.3%) and *Economic effects* (3.4%). Performance has declined in *Finance and support* (-2.0%), due to a relatively sharp decline in Venture capital investments (-9.0%).



Note: Performance relative to the EU where the EU = 100.

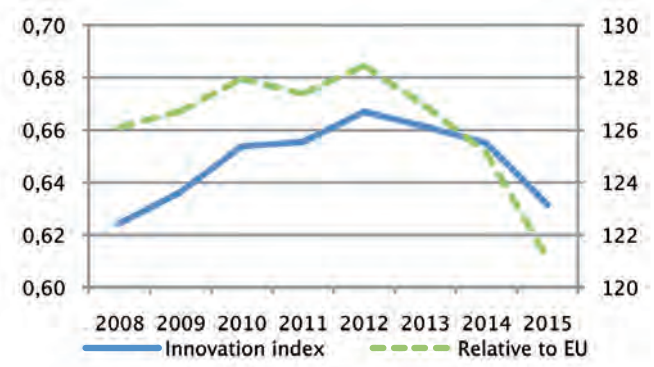
Germany

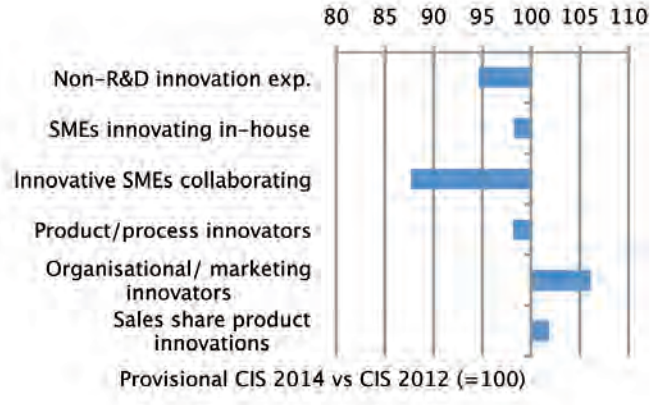
Germany is an **Innovation Leader**. Innovation performance increased up until 2012, after which it started to decline. Relative to EU, performance was highest at 28% above the average in 2012, but has dropped to 21% above the EU in 2015.

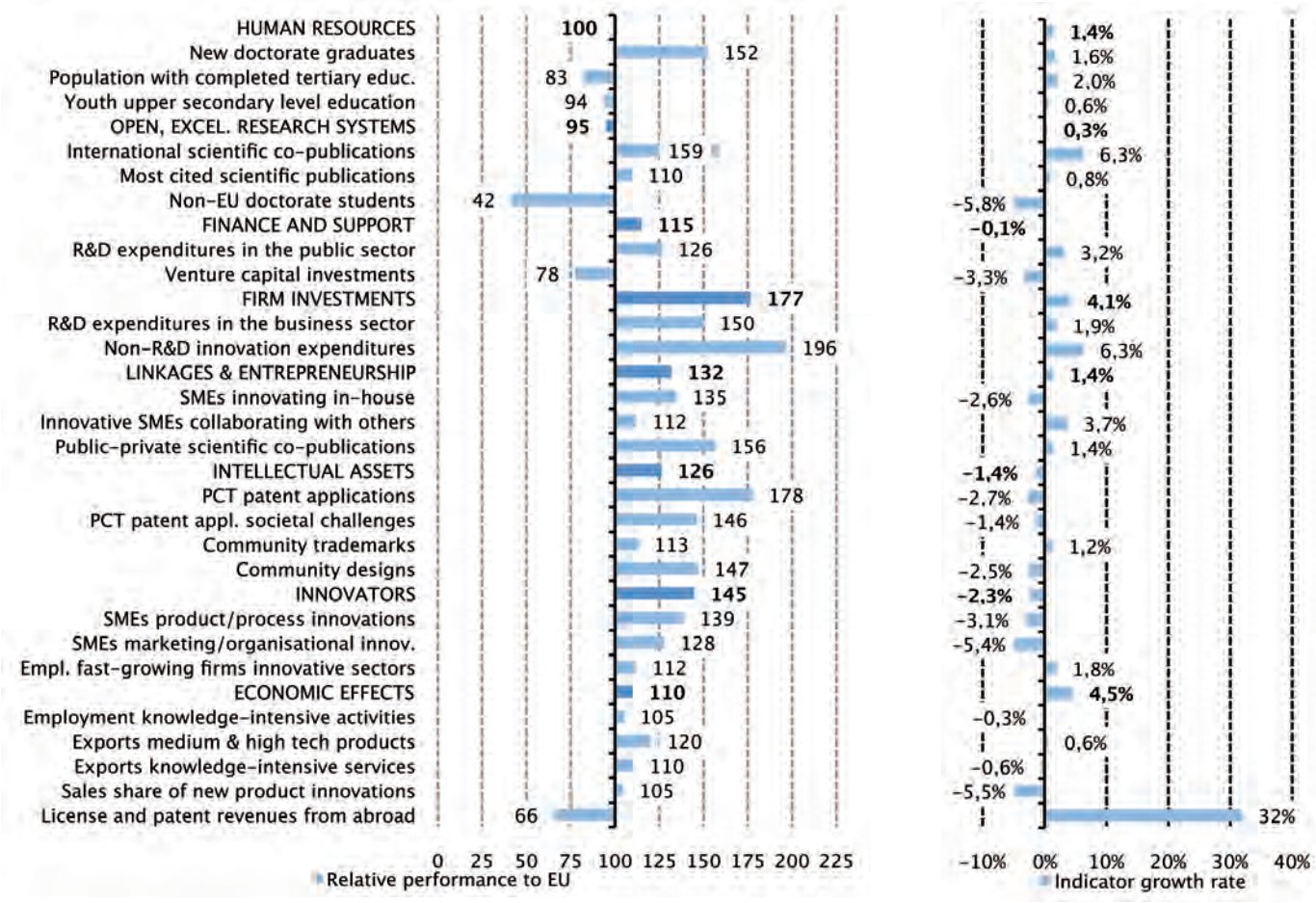
Germany's strongest dimensions are *Firm investments* and *Innovators*. In all other dimensions except *Open, excellent and attractive research systems*, the country is also performing above the EU average. Relative weaknesses are in Non-EU doctorate students and License and patent revenues from abroad.

Performance has improved most strongly in License and patent revenues from abroad (32%), Non-R&D innovation expenditures (6.3%), and International scientific co-publications (6.3%). Strong performance declines are observed for Non-EU doctorate students (-5.8%) and Sales share of new product innovations (-5.5%).

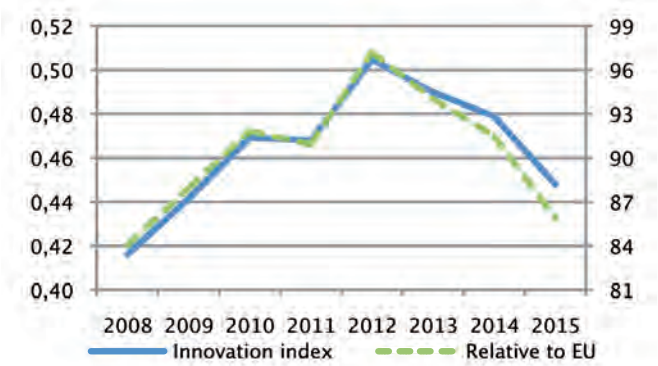
Provisional CIS 2014 data show worsened performance for four and improved performance for two indicators. The overall impact on the innovation index is expected to be negative with the index possibly declining from 0.632 to 0.629 assuming that for the other indicators performance would not change.







Note: Performance relative to the EU where the EU = 100.

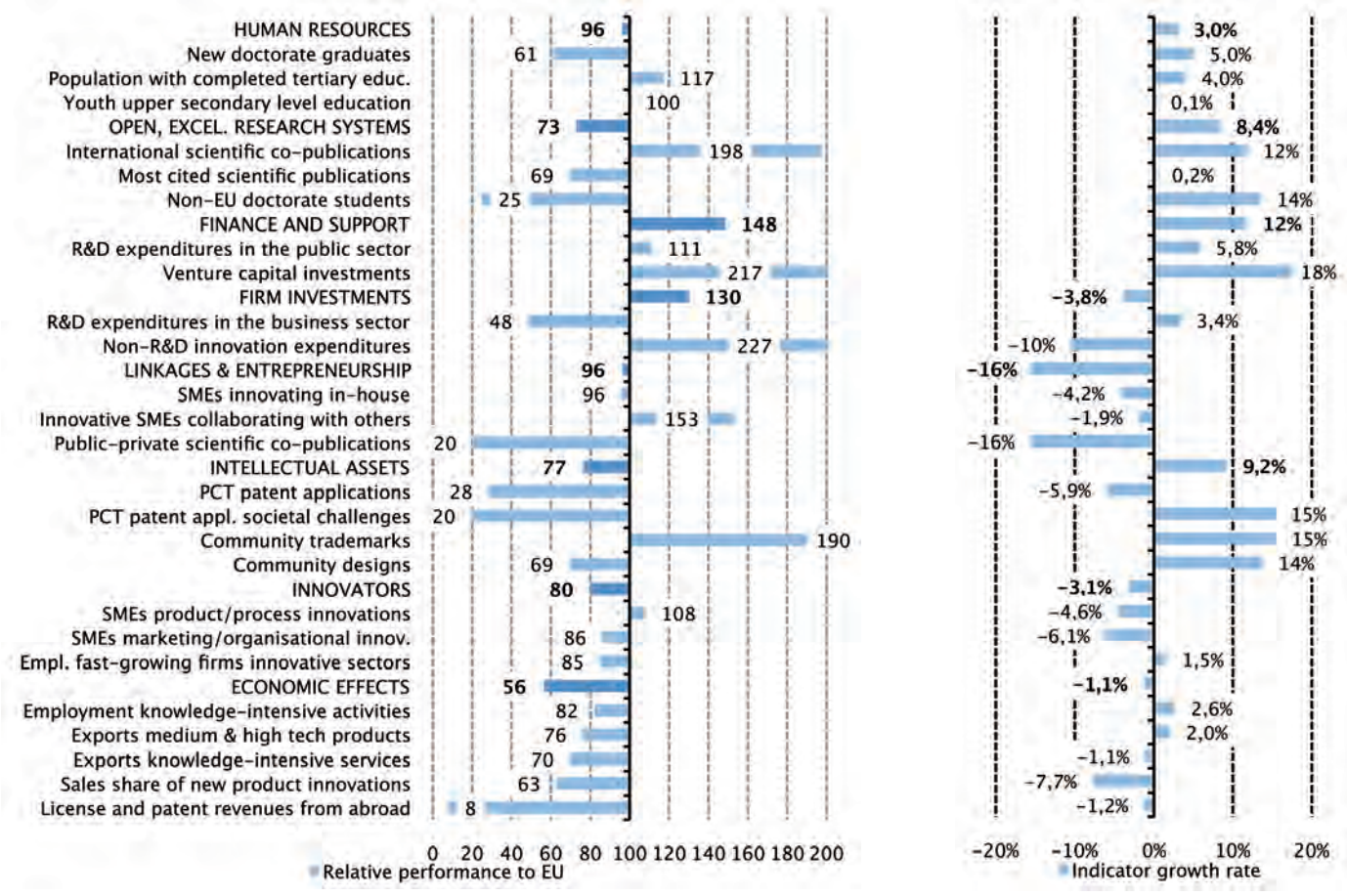


Estonia

Estonia is a **Moderate Innovator**. Innovation performance increased at a steady rate until 2012, but started to decline since 2013. Estonia's performance relative to that of the EU has improved from 84% in 2008 to 86% in 2015, with a peak of 97% in 2012.

Estonia's relatively strong dimensions are *Finance and support* and *Firm investments*. Estonia performs well above average on Non-R&D innovation expenditures, Venture capital investments, International scientific co-publications, and Community trademarks. Performance is well below the EU average for License and patent revenues from abroad, PCT patent applications in societal challenges, and Public-private co-publications.

Performance has improved most strongly in Venture capital investments (18%), PCT patent applications in societal challenges (15%), and Community trademarks (15%). Strong performance declines are observed for Public-private co-publications (-16%), Non-R&D innovation expenditures (-10%) and Sales share of new product innovations (-7.7%).



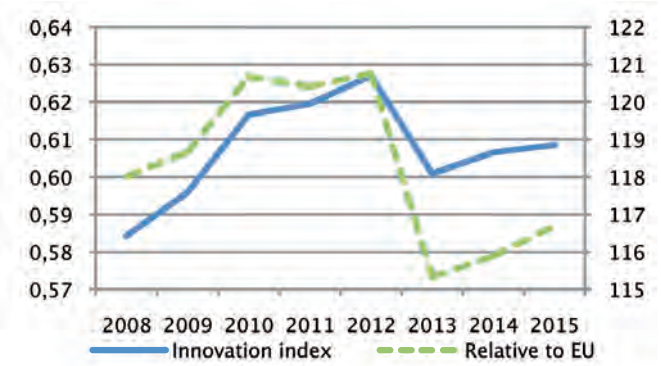
Note: Performance relative to the EU where the EU = 100.

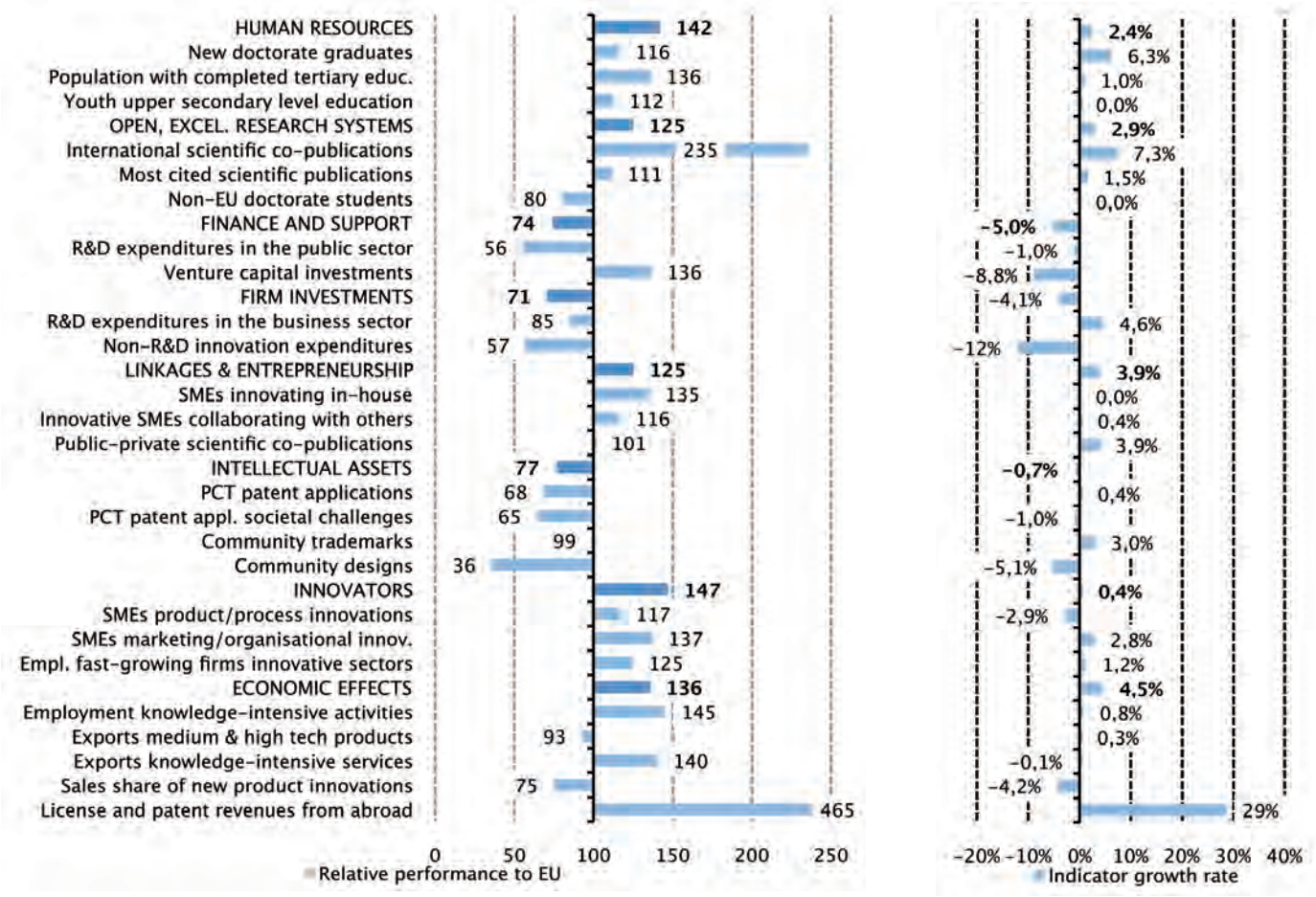
Ireland

Ireland is a **Strong Innovator**. Irish innovation performance increased until 2012. Performance declined strongly in 2013, after which it increased again in 2014-2015. Performance relative to the EU shows a similar trend, with a significant drop in 2013, and increased relative performance in 2014-2015.

Ireland's relative strengths are in *Innovators* and *Human resources*. Ireland performs well above the EU average on License and patent revenues from abroad and International scientific co-publications. Other strong performing indicators are Exports of knowledge-intensive services and Employment in knowledge-intensive activities. Relative weaknesses are in Community designs, Non-R&D innovation expenditures, and R&D expenditures in the public sector.

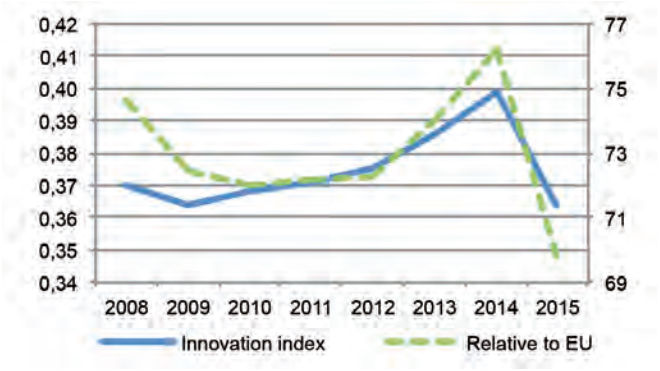
Performance has increased considerably in License and patent revenues from abroad (29%), International scientific co-publications (7.3%), and New doctorate graduates (6.3%). Performance has declined most in Non-R&D innovation expenditures (-12%) and Venture capital investments (-8.8%).

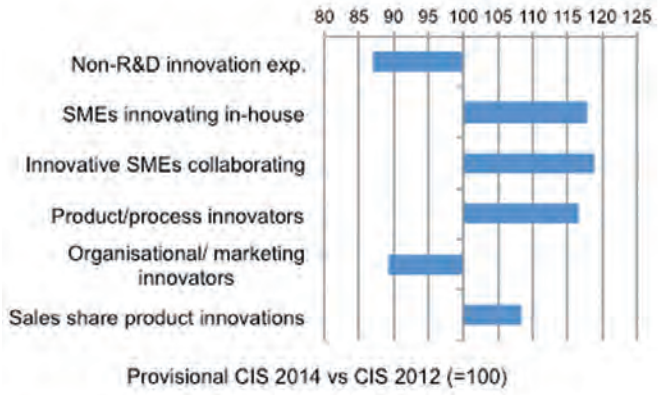




Note: Performance relative to the EU where the EU = 100.

Greece



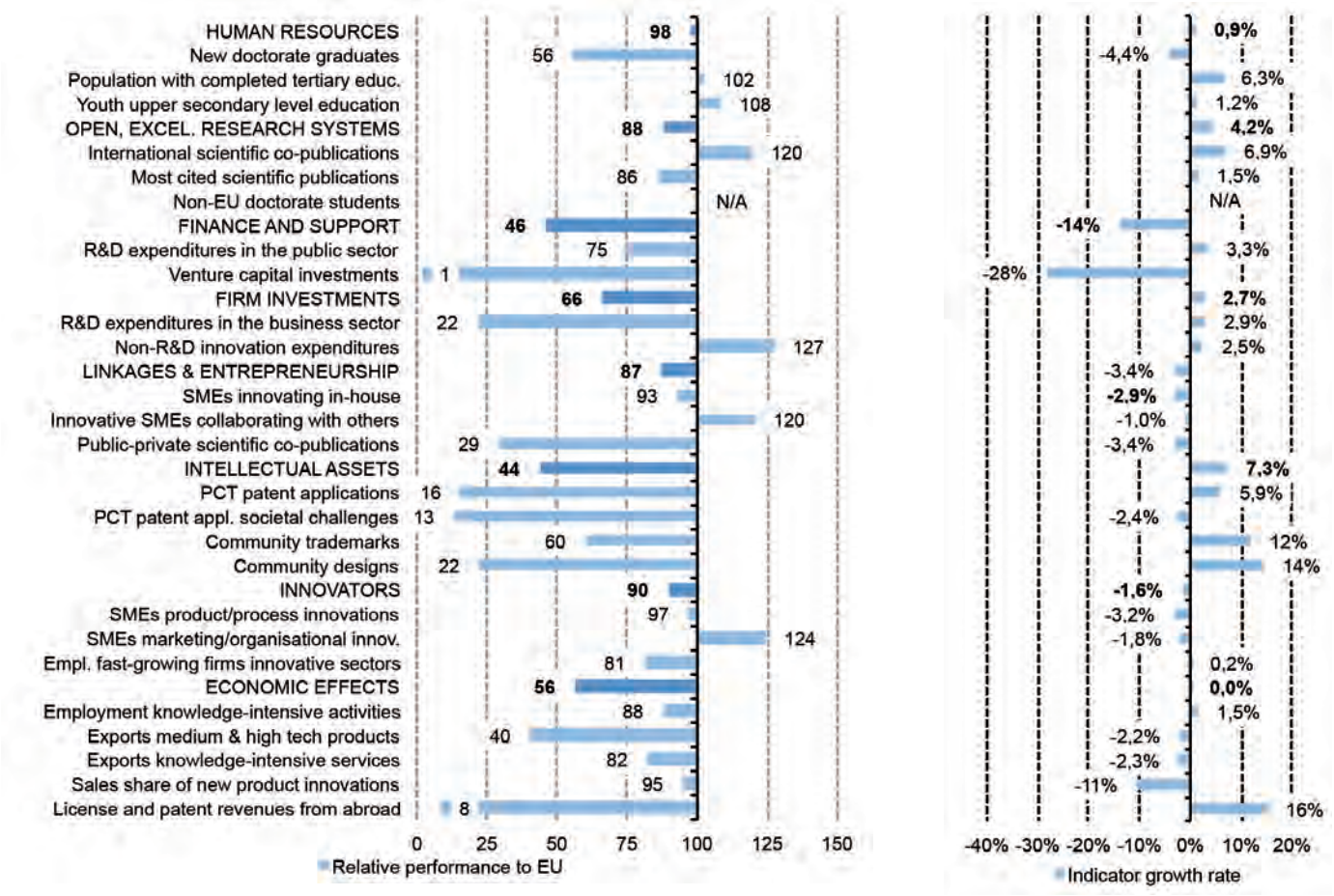


Greece is a **Moderate Innovator**. Over time, its innovation performance improved until 2014, followed by a strong decline in 2015. Relative performance to the EU reached a peak of 76% in 2014, but has declined to 70% in 2015.

Greece performs below the EU average on all dimensions. Relative strengths are in *Human resources* and *Innovators*. Performance in *Finance and support* and *Intellectual assets* is particularly lagging relative to the EU. Low performing indicators include Venture capital investments, License and patent revenues from abroad, and PCT patent applications (in societal challenges). Greece performs above the EU average on Non-R&D innovation expenditures, SMEs with marketing and/or organisational innovations, International scientific co-publications, and Innovative SMEs collaborating with others.

Performance in *Intellectual assets* has experienced the highest growth (7%). Highest indicator growth is observed for License and patent revenues from abroad (16%), Community designs (14%), and Community trademarks (12%). Performance has declined strongly in Venture capital investments (-28%).

Provisional CIS 2014 data show improved performance for four and worsened performance for two indicators. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.364 to 0.374 assuming that for the other indicators performance would not change.



Note: Performance relative to the EU where the EU = 100. No data for non-EU doctorate students.

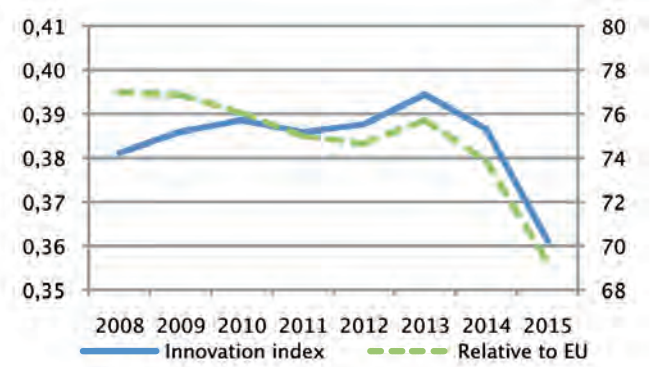
Spain

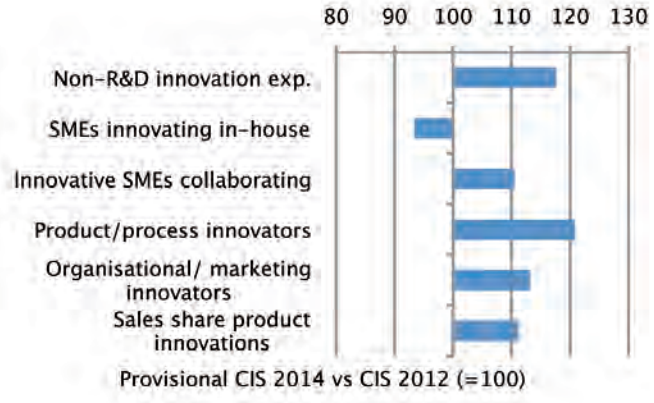
Spain is a **Moderate Innovator**. Innovation performance improved steadily until 2013, after which the innovation index has declined. In 2015, performance is at a significantly lower level compared to 2008. Spain's gap with the EU has increased over time. In 2008, the relative performance level was at its highest at 77%, whereas in 2015 it has decreased to 69%.

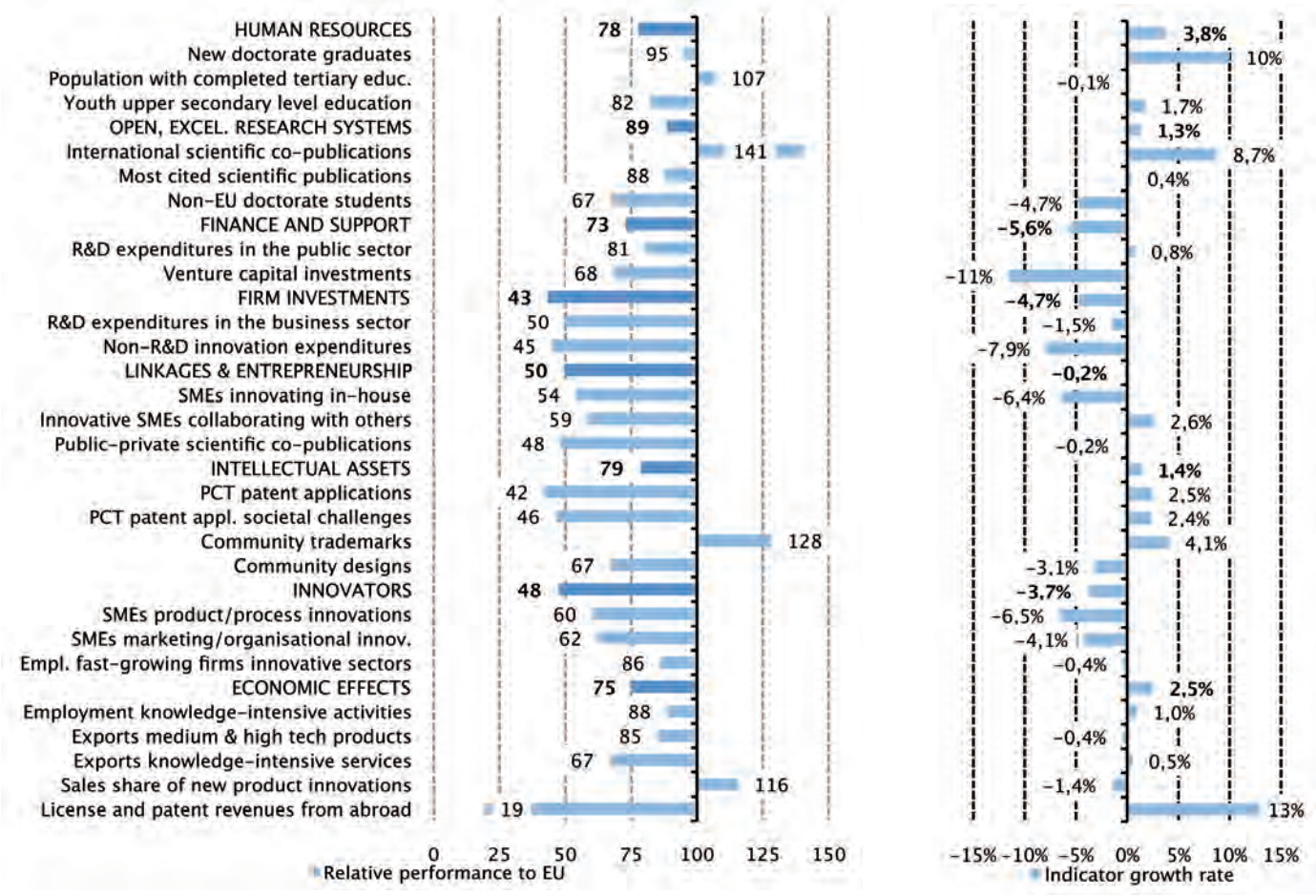
For most indicators, Spain is performing below the EU average. Performance in *Open, excellent and attractive research systems* is close to the average performance of the EU, mainly because of strong relative performance in International scientific co-publications. In relative terms, the weakest indicator is License and patent revenues from abroad.

Performance has improved most in the dimension of *Human resources* (3.8%). The indicator that has improved most is License and patent revenues from abroad (13%), and Venture capital investments (-11%) has declined most.

Provisional CIS 2014 data show improved performance for five indicators and worsened performance for one indicator. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.361 to 0.372 assuming that for the other indicators performance would not change.

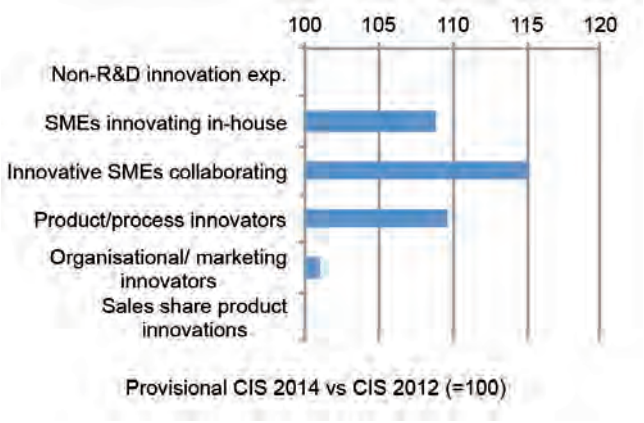






Note: Performance relative to the EU where the EU = 100.

France

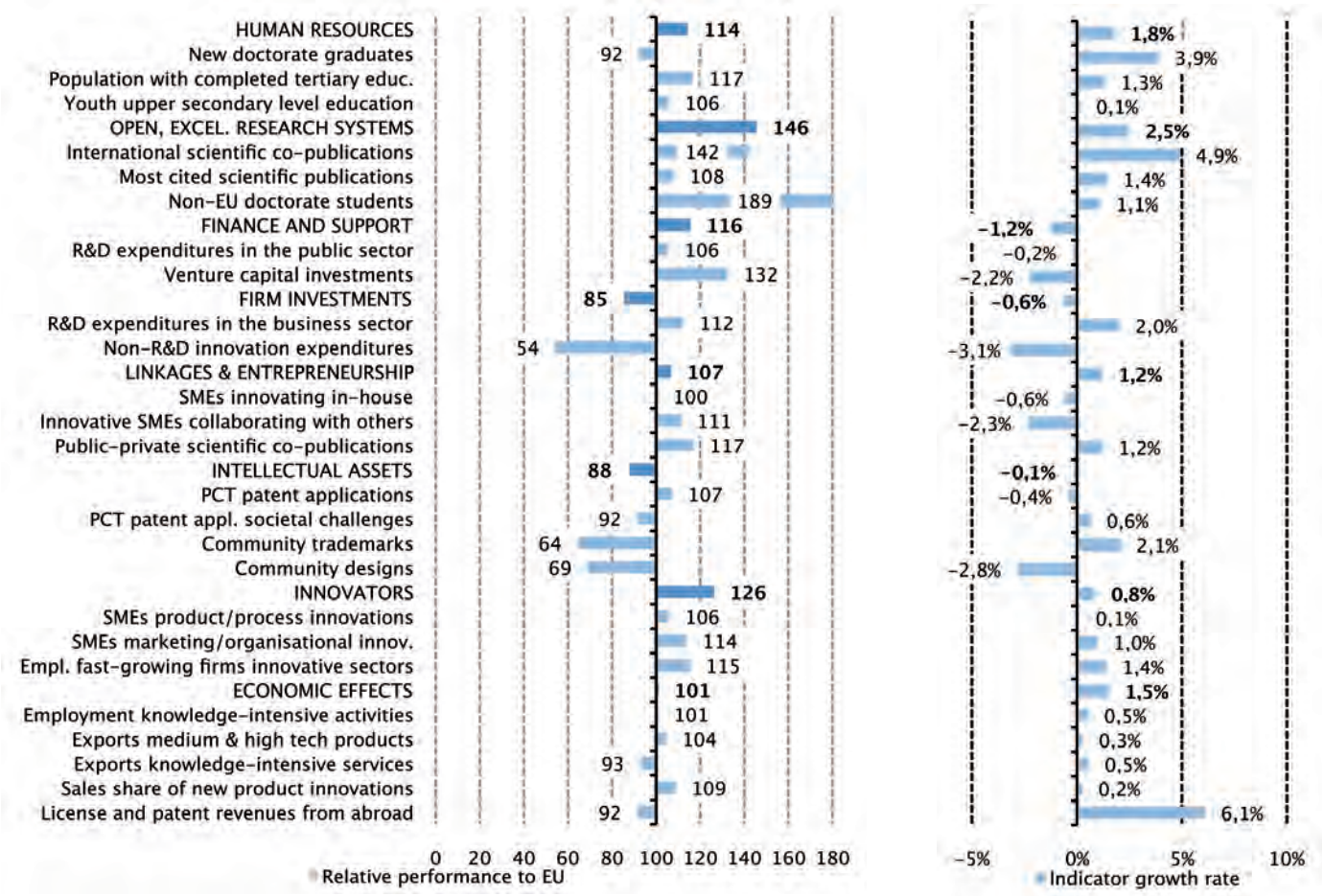


France is a **Strong Innovator**. Innovation performance increased between 2008 and 2012, declined in 2013-2014, and increased again in 2015. The performance level relative to the EU reached a peak of almost 10% above the average in 2010, and is at 9% above the EU average in 2015.

France's relative strengths are in *Open, excellent and attractive research systems* and *Innovators*. The best performing indicator is Non-EU doctorate students. France is experiencing relative weaknesses in *Firm investments* and *Intellectual assets*. Performance is particularly weak in Non-R&D innovation expenditures, Community trademarks, and Community designs.

France has experienced positive growth for most indicators, particularly in License and patent revenues from abroad (6.1%), International scientific co-publications (4.9%), and New doctorate graduates (3.9%). The sharpest performance decline is observed for Non-R&D innovation expenditures (-3.1%) and Community designs (-2.8%).

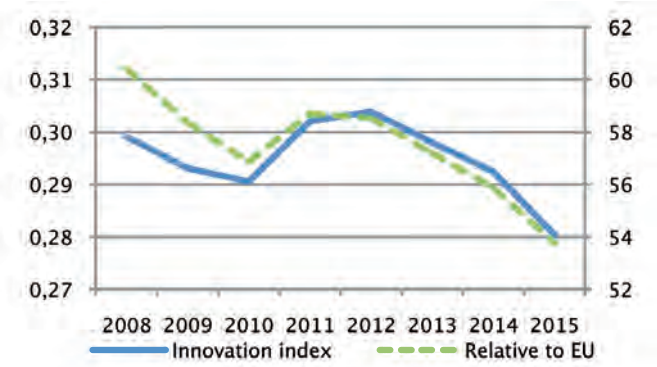
Provisional CIS 2014 data show improved performance for all four indicators for which data are available. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.568 to 0.578 assuming that for the other indicators performance would not change.



Note: Performance relative to the EU where the EU = 100.

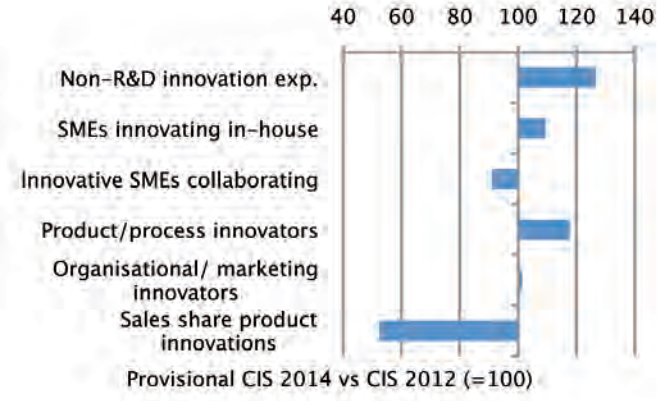
Croatia

Croatia is a **Moderate Innovator**. Innovation performance improved until 2012 and then declined. After a decline until 2010, innovation performance improved until 2012 and then declined again. Performance relative to the EU was above 60% in 2008, but has fallen to less than 54% by 2015.

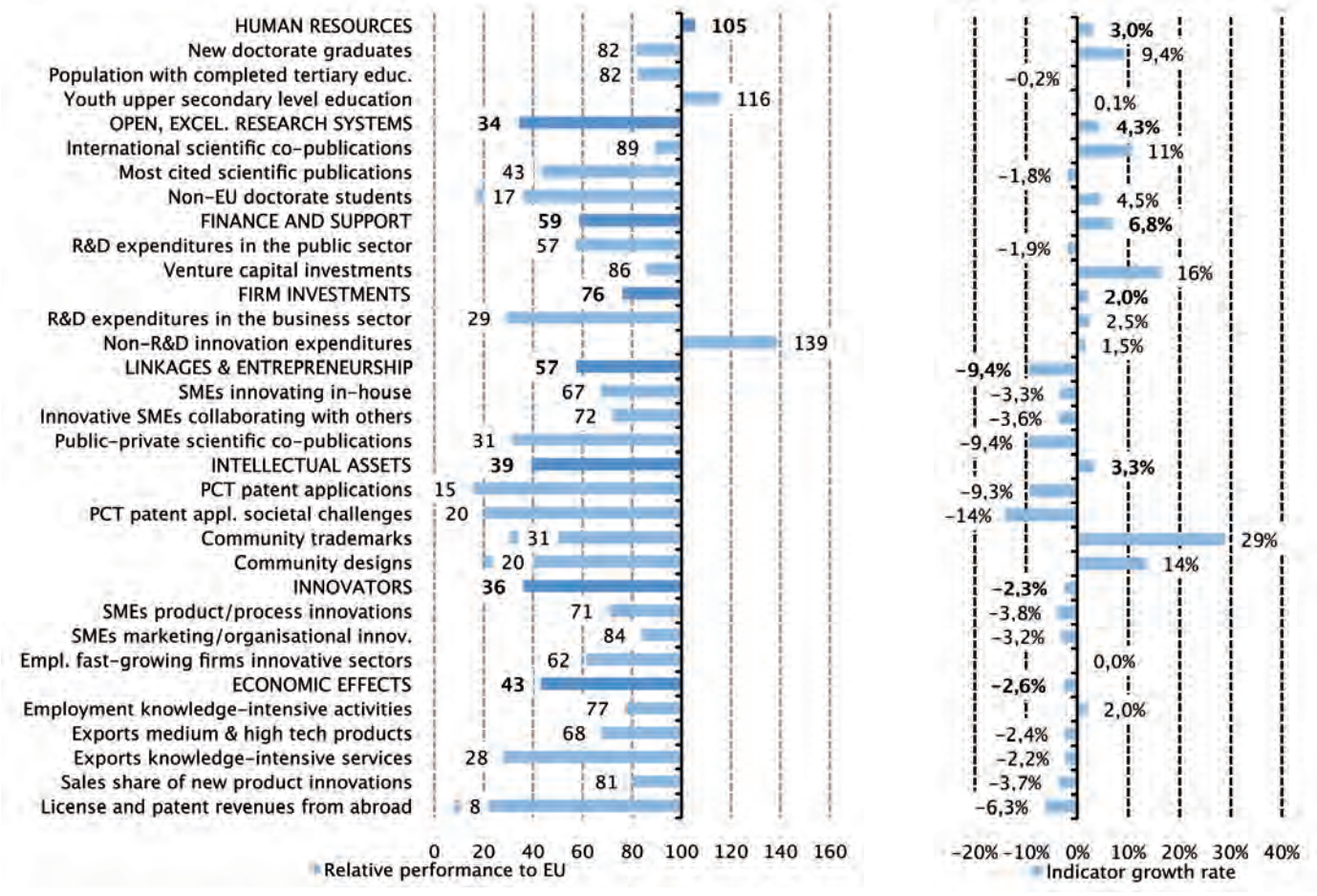


Croatia is performing below the EU average in most dimensions. It only performs above the EU average in *Human resources*, due to above-average performance in Youth with upper secondary level education. The weakest performing dimensions are *Open, excellent and attractive research systems*, *Innovators*, and *Intellectual assets*. Non-R&D innovation expenditures is the best performing indicator.

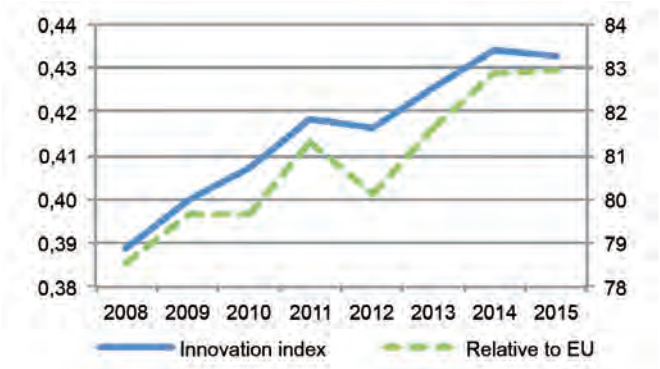
Performance increases in dimensions are observed in *Finance and support* (6.8%) and *Open, excellent and attractive research systems* (4.3%), with the largest improvement at the indicator level for Community trademarks (29%). Performance has worsened in *Linkages and entrepreneurship* (-9.4%), *Economic effects* (-2.6%) and *Innovators* (-2.3%), with the indicators declining most being PCT patent applications in societal challenges (-14%), Public-private co-publications (-9.4%) and PCT patent applications (-9.3%).

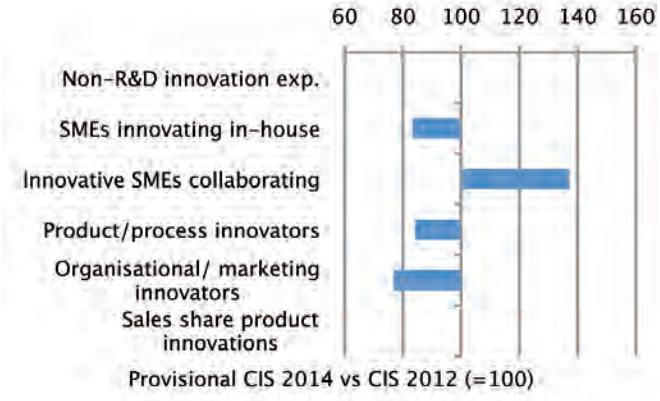


Provisional CIS 2014 data show improved performance for four and worsened performance for two indicators. The overall impact on the innovation index is expected to be small with the index possibly increasing from 0.280 to 0.281 assuming that for the other indicators performance would not change.



Note: Performance relative to the EU where the EU = 100.





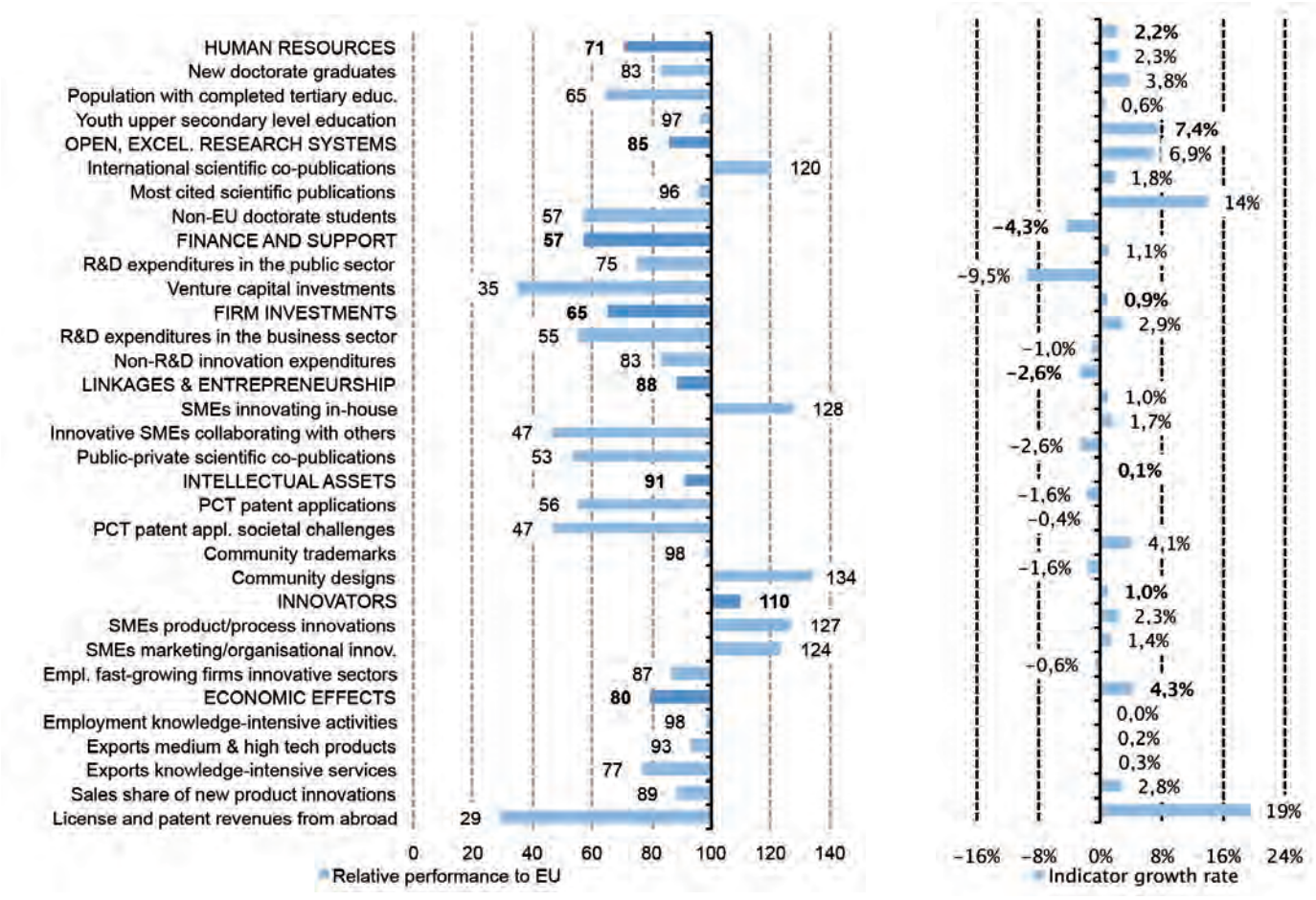
Italy

Italy is a **Moderate Innovator**. Its innovation performance increased steadily until 2011, experienced a decline in 2012, and increased again in 2013-2014. Performance declined slightly in 2015. Italy has been increasing its innovation performance relative to the EU from 78% in 2008 to almost 83% in 2015.

Italy performs below the EU average in most dimensions, in particular in *Finance and support* and in *Firm investments*, with the worst relative performance in Venture capital investments and License and patent revenues from abroad. In the *Innovators* dimension, Italy performs better than the EU average.

Italy has experienced performance increases for most indicators. Growth has been strong in the dimension of *Open, excellent and attractive research systems* (7.4%), due to performance improvements in Non-EU doctorate students (14%) and International scientific co-publications (6.9%). Performance has also increased strongly in License and patent revenues from abroad (19%). A strong performance decline is observed in Venture capital investments (-9.5%).

Provisional CIS 2014 data show improved performance for one and worsened performance for three indicators. The overall impact on the innovation index is expected to be negative with the index possibly declining from 0.432 to 0.414 assuming that for the other indicators performance would not change.



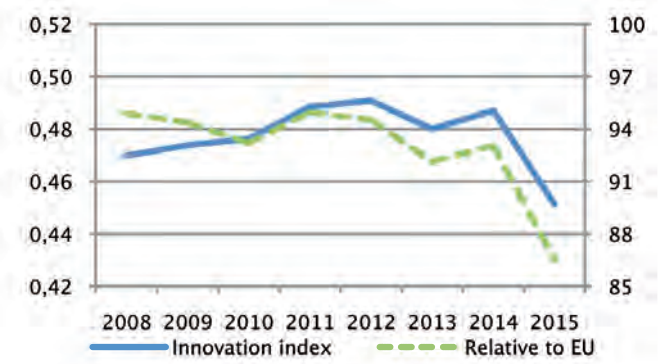
Note: Performance relative to the EU where the EU = 100.

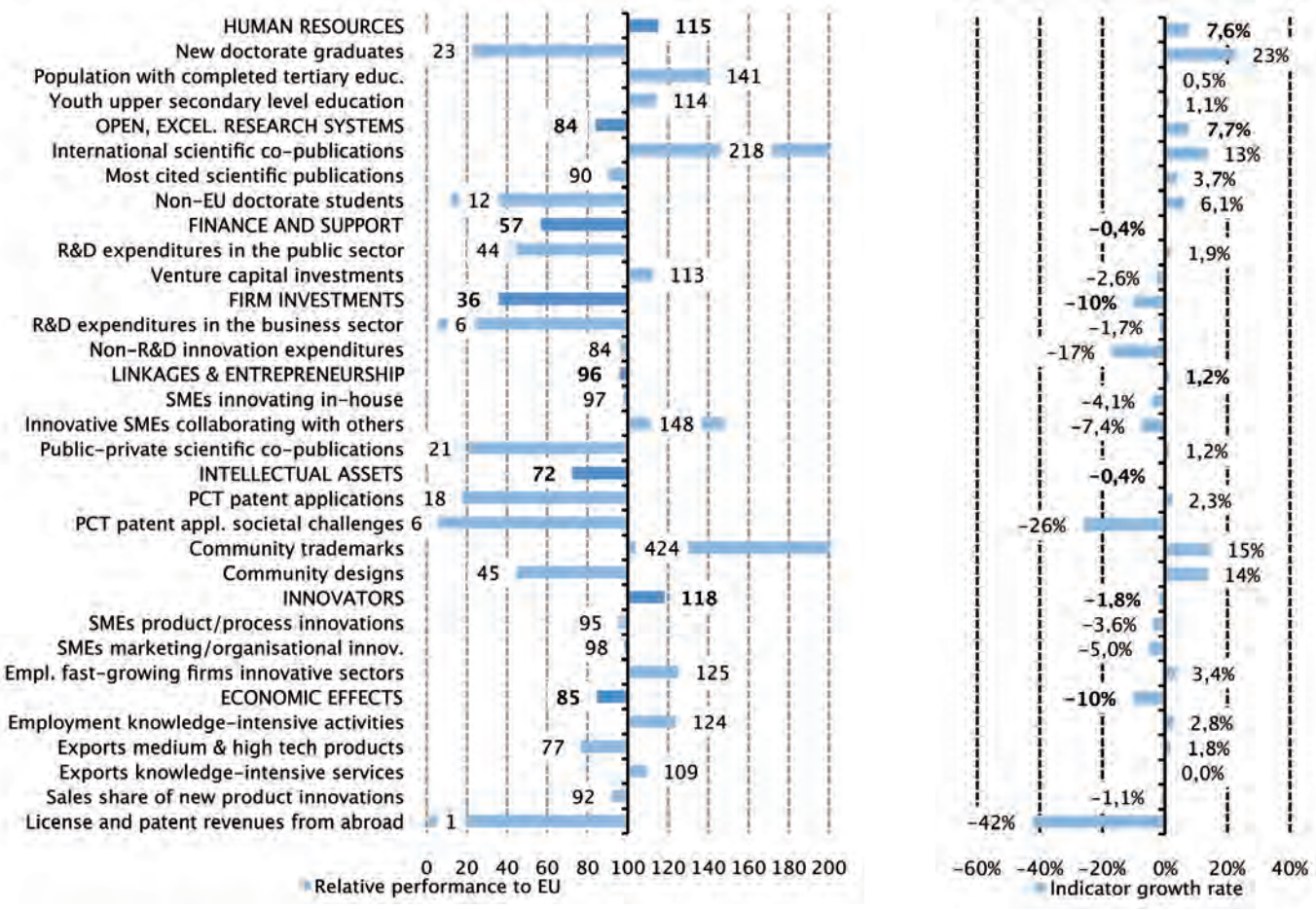
Cyprus

Cyprus is a **Moderate Innovator**. Innovation performance fluctuated over time, with a peak in 2012. The performance relative to the EU peaked in 2011 (95%), but has declined to 86.5% in 2015.

Cyprus performs below the EU average for most dimensions. At the indicator level, performance is well below average in License and patent revenues from abroad, R&D expenditures in the business sector, PCT patent applications in societal challenges, and Non-EU doctorate students. Relatively strong performance is observed for Community trademarks and International scientific co-publications.

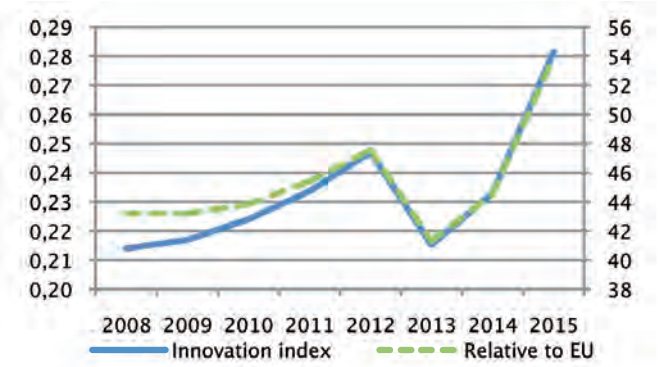
Performance has improved in some dimensions, in particular in Open and excellent research systems (7.7%) and *Human resources* (7.6%). The indicator with the strongest growth is New doctorate graduates (23%). Performance has worsened most in *Economic effects* and *Firm investments*, in particular due to strong growth declines in License and patent revenues from abroad (-42%) and Non-R&D innovation expenditures (-17%).

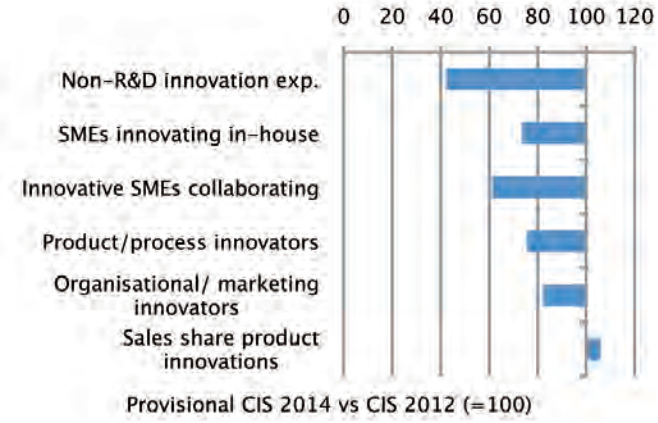




Note: Performance relative to the EU where the EU = 100.

Latvia



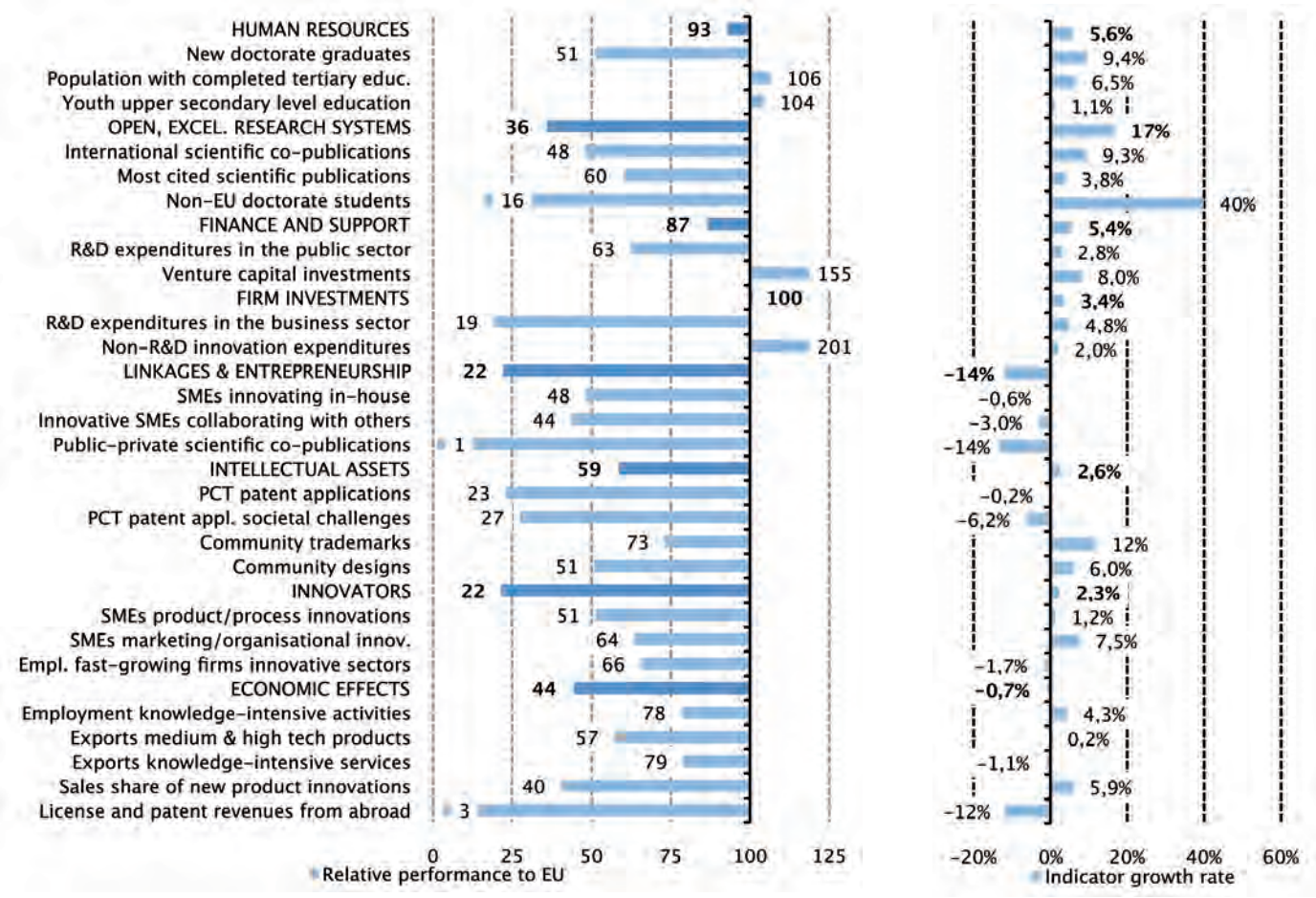


Latvia is a **Moderate Innovator**. Innovation performance increased until 2012 but dropped in 2013. In 2014, the innovation index recovered and increased sharply in 2015. The performance relative to the EU shows a similar trend.

Latvia performs well below the EU average for most dimensions, particularly for *Linkages and entrepreneurship*, *Open, excellent and attractive research systems*, and *Innovators*. The relatively worst performing indicators are Public-private co-publications and License and patent revenues from abroad. Relative strengths for Latvia are in Non-R&D innovation expenditures and Venture capital investments.

Performance is increasing for about two-thirds of the indicators. High growth is observed for Non-EU doctorate students (40%), Community trademarks (12%), New doctorate graduates (9.4%), and International scientific co-publications (9.3%). A large decline in performance is observed for Public private co-publications (-14%) and License and patent revenues from abroad (-12%).

Provisional CIS 2014 data show worsened performance for five indicators. The overall impact on the innovation index is expected to be negative with the index possibly declining from 0.248 to 0.249 assuming that for the other indicators performance would not change.



Note: Performance relative to the EU where the EU = 100.

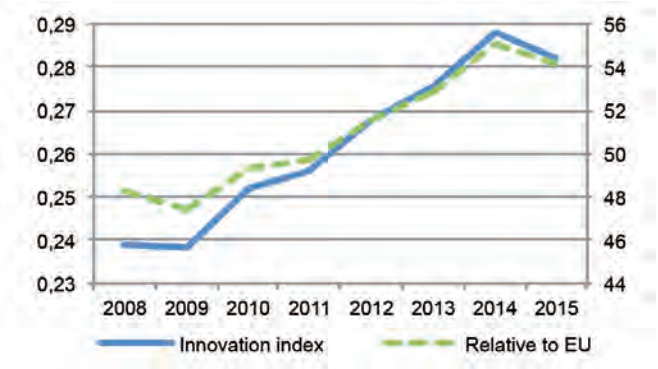
Lithuania

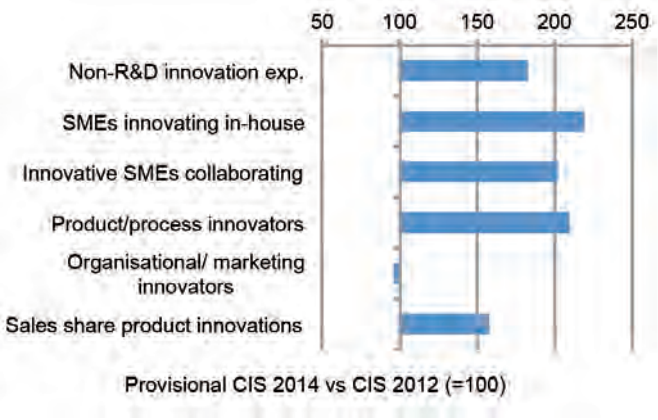
Lithuania is a **Moderate Innovator**. Despite some minor fluctuations, the overall innovation performance has been improving since 2008, with a small decline in 2015. The performance relative to the EU has also been improving with a small decline in 2015.

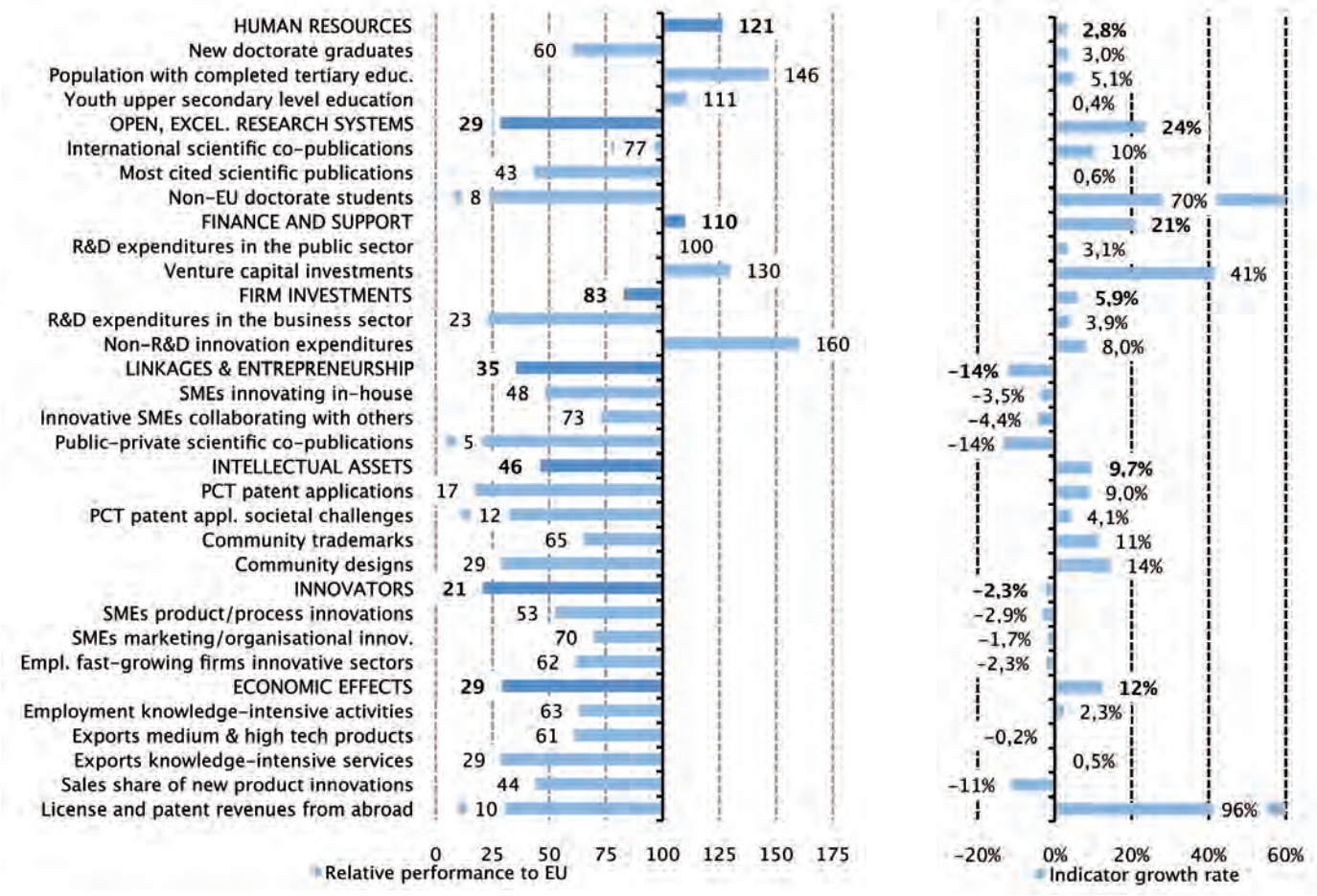
Lithuania performs below the average of the EU for most dimensions, except for *Human resources* and *Finance and support*. Relatively worst performing indicators are Public-private co-publications, Non-EU doctorate students, License and patent revenues from abroad, PCT patent applications in societal challenges, and PCT patent applications. Performance above average is observed for Non-R&D innovation expenditures, Population with completed tertiary education, Venture capital investments and Youth with upper secondary level education.

Particularly high growth is observed for License and patent revenues from abroad (96%), Non-EU doctorate students (70%), and Venture capital investments (41%). The largest performance declines are for Public-private co-publications (-14%) and Sales share of new product innovations (-11%).

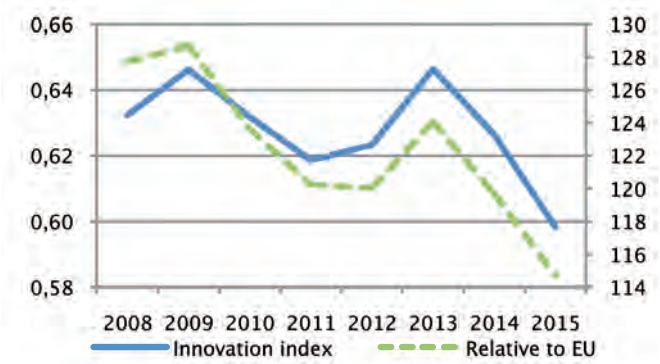
Provisional CIS 2014 data show improved performance for five and worsened performance for one indicator. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.282 to 0.359 assuming that for the other indicators performance would not change.







Note: Performance relative to the EU where the EU = 100.

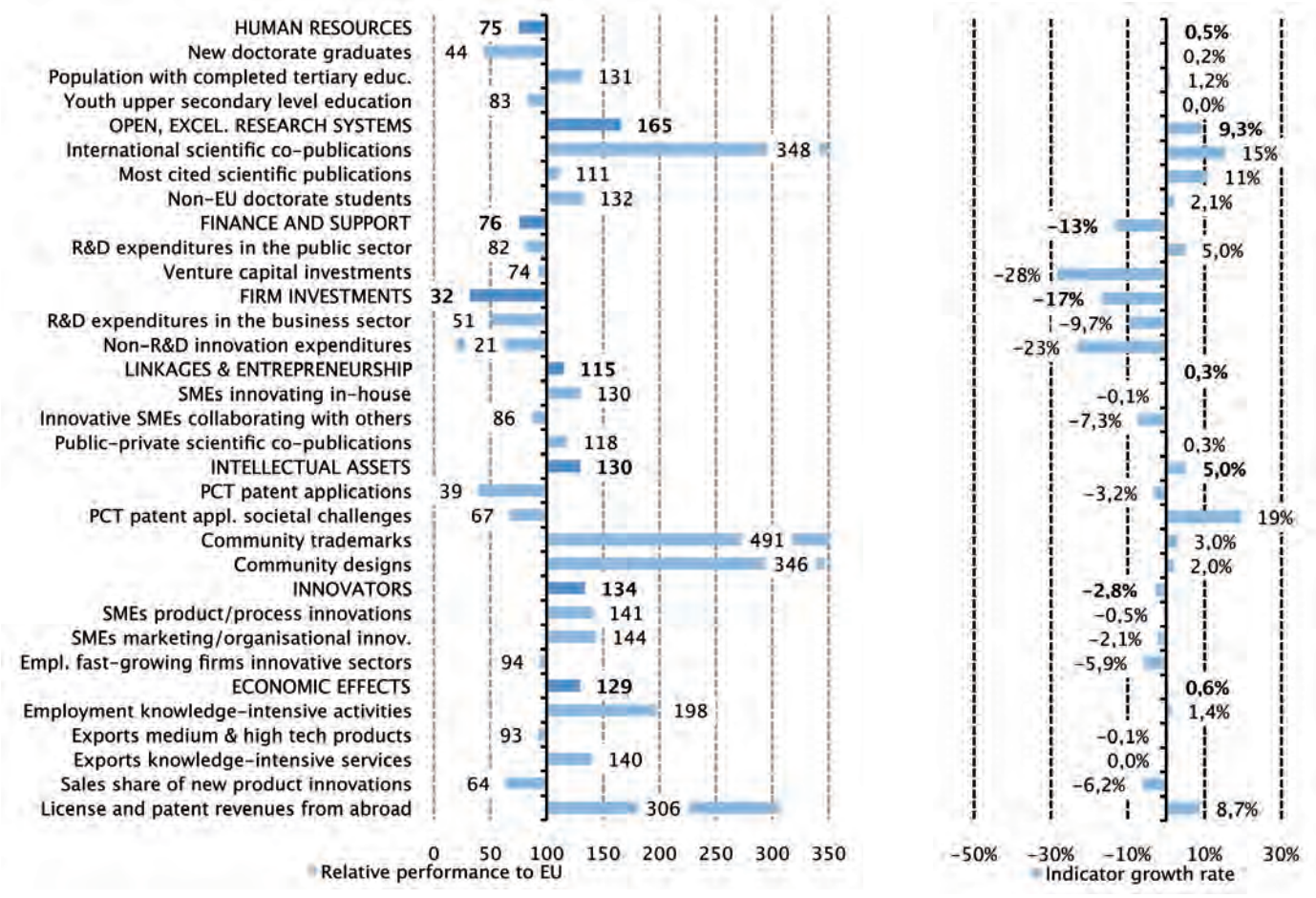


Luxembourg

Luxembourg is a **Strong Innovator**. Performance declined in 2010 and 2011 (due to a much worse performance in Non-R&D innovation expenditures), but more than fully recovered in 2012 and 2013. However, in 2014 and 2015 there is again a significant decline, and the innovation index in 2015 is even below the level of 2008. The performance relative to the EU has declined over time from 28% above the EU in 2008 to about 15% above the EU in 2015.

Luxembourg performs best on the dimensions *Open and excellent research systems* and *Innovators*. Relative strengths for Luxembourg at the indicator level are Community trademarks, International scientific co-publications, Community designs, and License and patent revenues from abroad. Luxembourg performs well below the average on the dimension *Firm investments*, in particular at the indicator level on Non-R&D innovation expenditures.

Performance in Luxembourg's research system has been growing strongly (9.3%), mainly because of high growth in International scientific co-publications (15%) and Most cited publications (11%). Strong declines are observed in Venture capital investments (-28%), Non-R&D innovation expenditures (-23%) and R&D expenditures in the business sector (-9.7%).



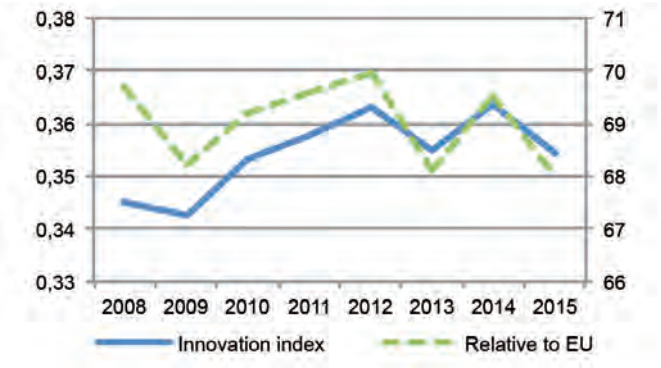
Note: Performance relative to the EU where the EU = 100.

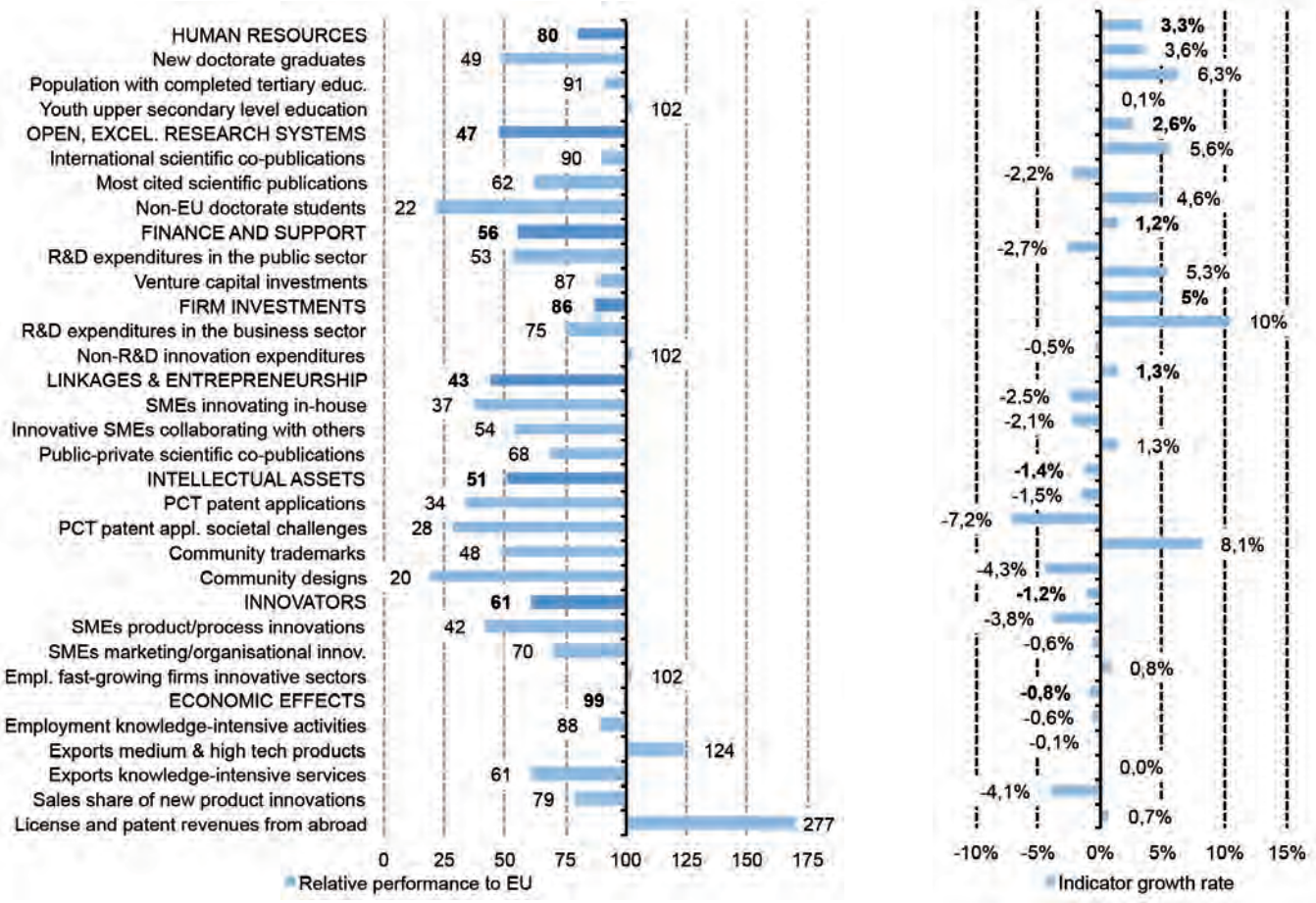
Hungary

Hungary is a **Moderate Innovator**. The country's innovation performance, despite some fluctuations, has improved between 2008 and 2015. The performance relative to the EU also had fluctuations, over time it has declined from almost 70% in 2008 to 68% in 2015.

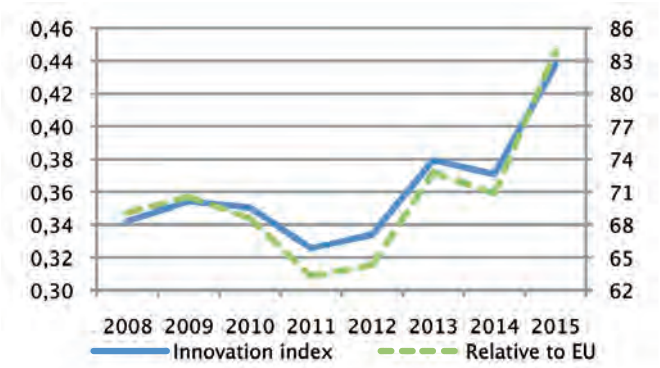
Hungary performs below the EU average for all dimensions, and nearly all indicators, especially for Community designs and Non-EU doctorate students. Relative strengths in terms of indicators are observed in License and patent revenues from abroad and Exports of medium and high tech products.

For more than half of the indicators, performance has improved. High growth is observed for R&D expenditures in the business sector (10%), Community trademarks (8.1%) and Population with completed tertiary education (6.3%). Notable declines in performance are observed in PCT patent applications in societal challenges (-7.2%), Community designs (-4.3%), and Sales share of new product innovations (-4.1%).





Note: Performance relative to the EU where the EU = 100.

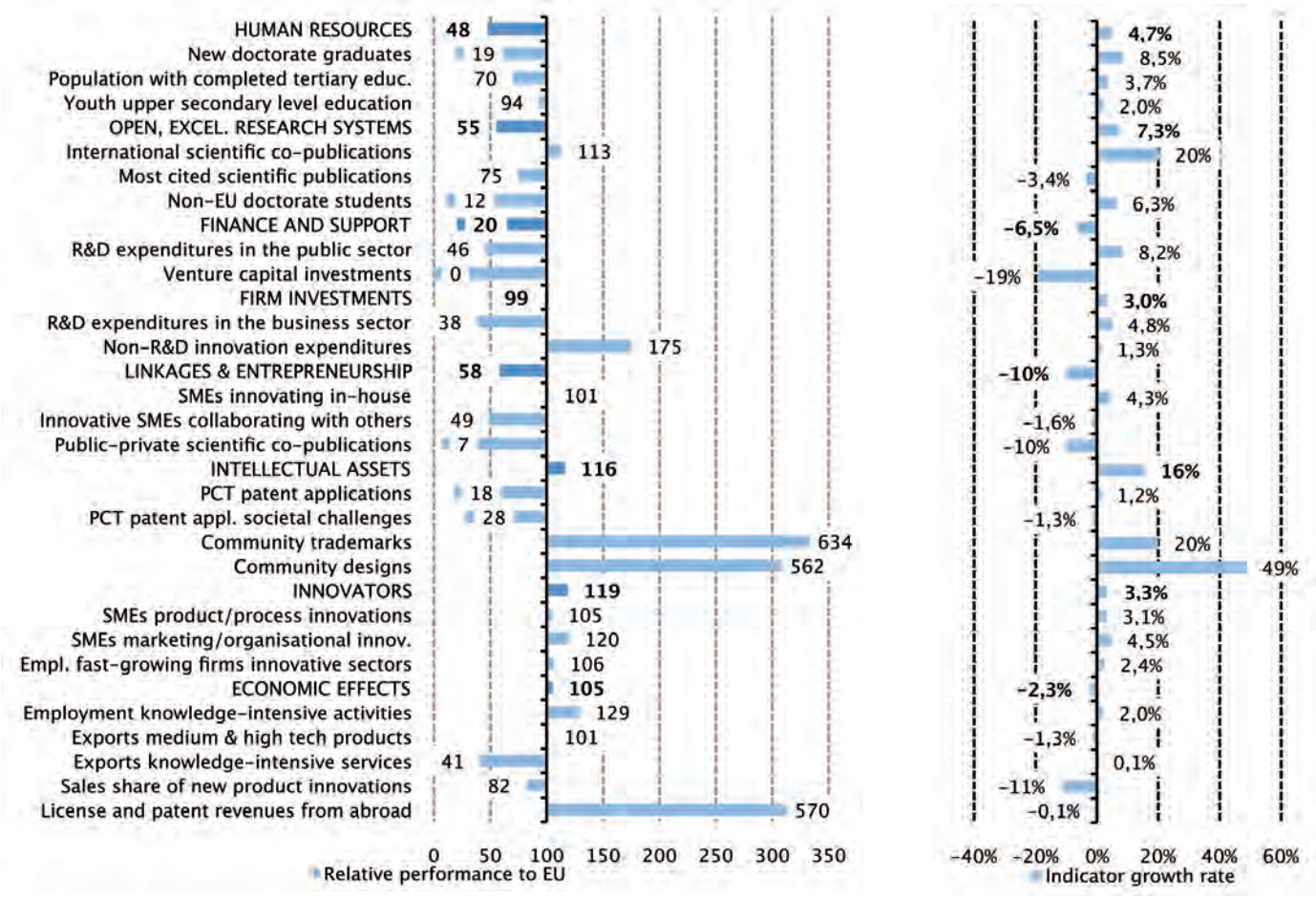


Malta

Malta is a **Moderate Innovator**. Innovation performance was fairly stable until 2012 after which it increased strongly in 2013 to 2015. The performance relative to the EU was 69% in 2008 and reached almost 84% in 2015.

Malta is performing below the average of the EU for most dimensions and indicators. The strongest relative weaknesses are in Venture capital investments, Non-EU doctorate students, and Public-private scientific co-publications. Relative strengths are in particular in Community trademarks, License and patent revenues from abroad, and Community designs.

A strongly growing innovation dimension is *Intellectual assets*, in particular the indicators Community designs and Community trademarks. Performance for most indicators has improved, with other large increases observed in International scientific co-publications (20%) and New doctorate graduates (8.5%). Declining performance is observed in particular for Venture capital investments (-19%), Sales share of new product innovations (-11%) and Public-private co-publications (-10%).



Note: Performance relative to the EU where the EU = 100.

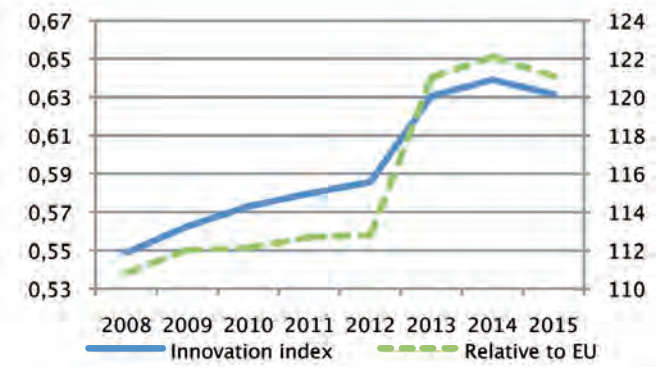
The Netherlands

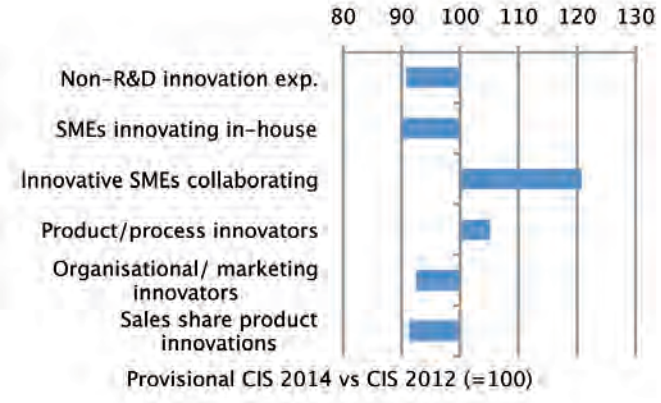
The Netherlands is an **Innovation Leader**. Performance improved steadily up until 2012, then increased strongly in 2013 (among others due to an increase in the share of product or process innovators), and after an increase in 2014 it declined in 2015. The performance relative to the EU is at 21% above the EU average.

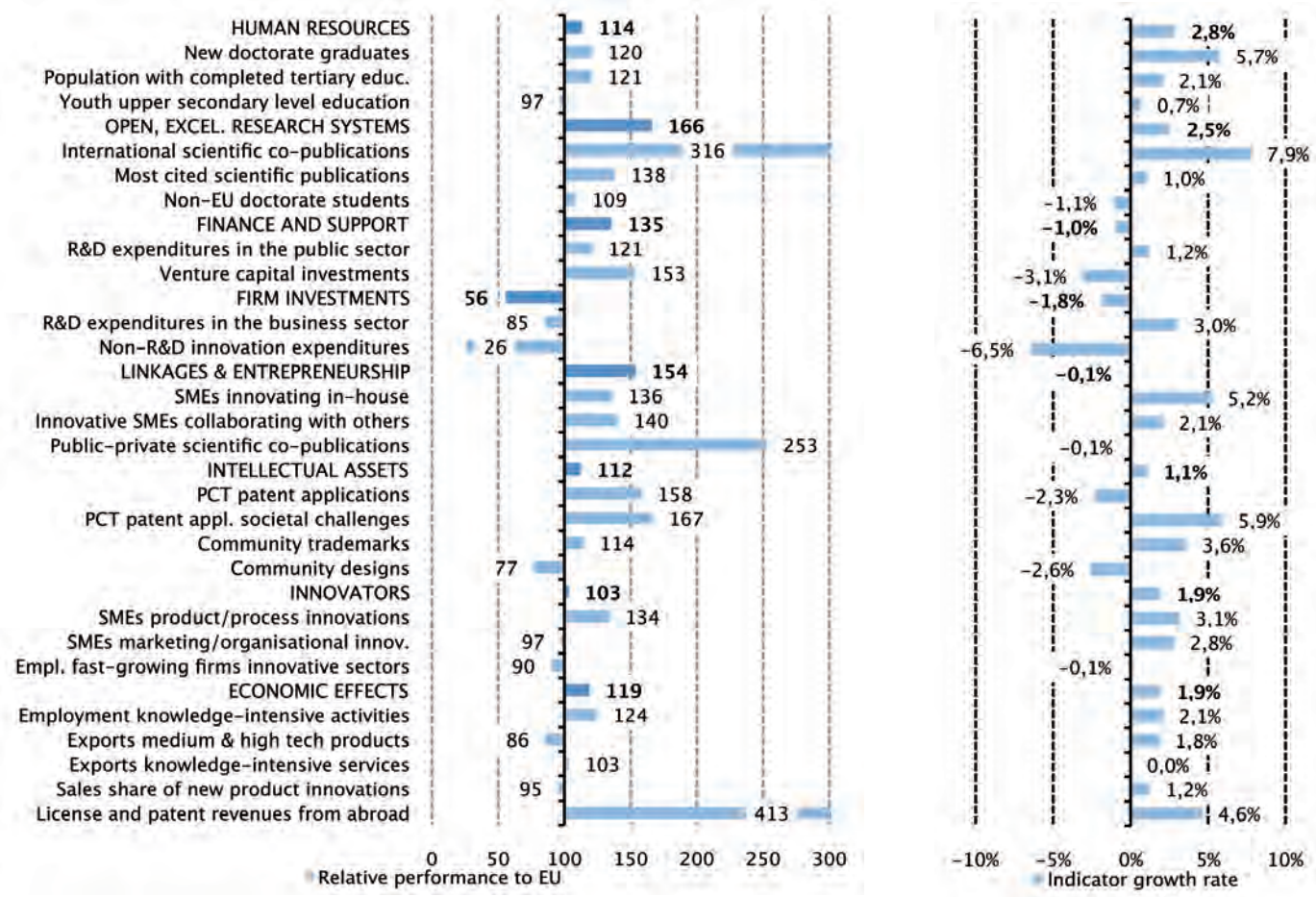
The Netherlands is performing above the EU average for most dimensions, except for *Firm investments*, because of poor relative performance in Non-R&D innovation expenditures. Excellent relative performance is observed in License and patent revenues from abroad, International scientific co-publications, and Public-private co-publications. Relative weaknesses are in Non-R&D innovation expenditures and Community designs.

Performance has improved for most dimensions and indicators. High growth is observed, in particular, for International co-publications (7.9%), PCT patent applications in societal challenges (5.9%) and New doctorate graduates (5.7%). Significant declines in performance are observed for Non-R&D innovation expenditures (-6.5%) and Venture capital investments (-3.1%).

Provisional CIS 2014 data show improved performance for two and worsened performance for four indicators. The overall impact on the innovation index is expected to be negative with the index possibly declining from 0.630 to 0.618 assuming that for the other indicators performance would not change.

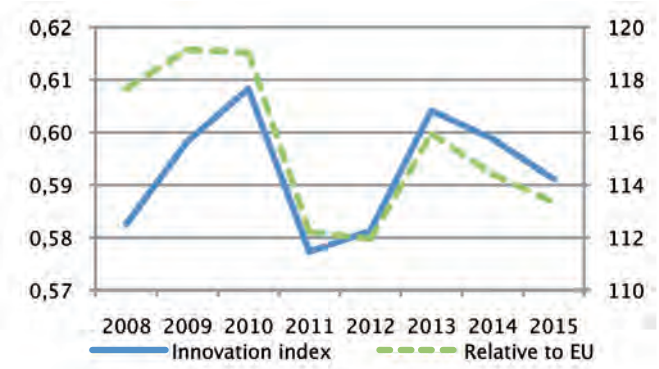


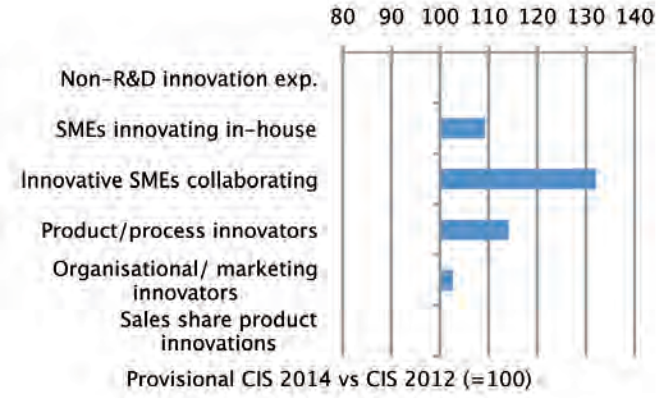




Note: Performance relative to the EU where the EU = 100.

Austria



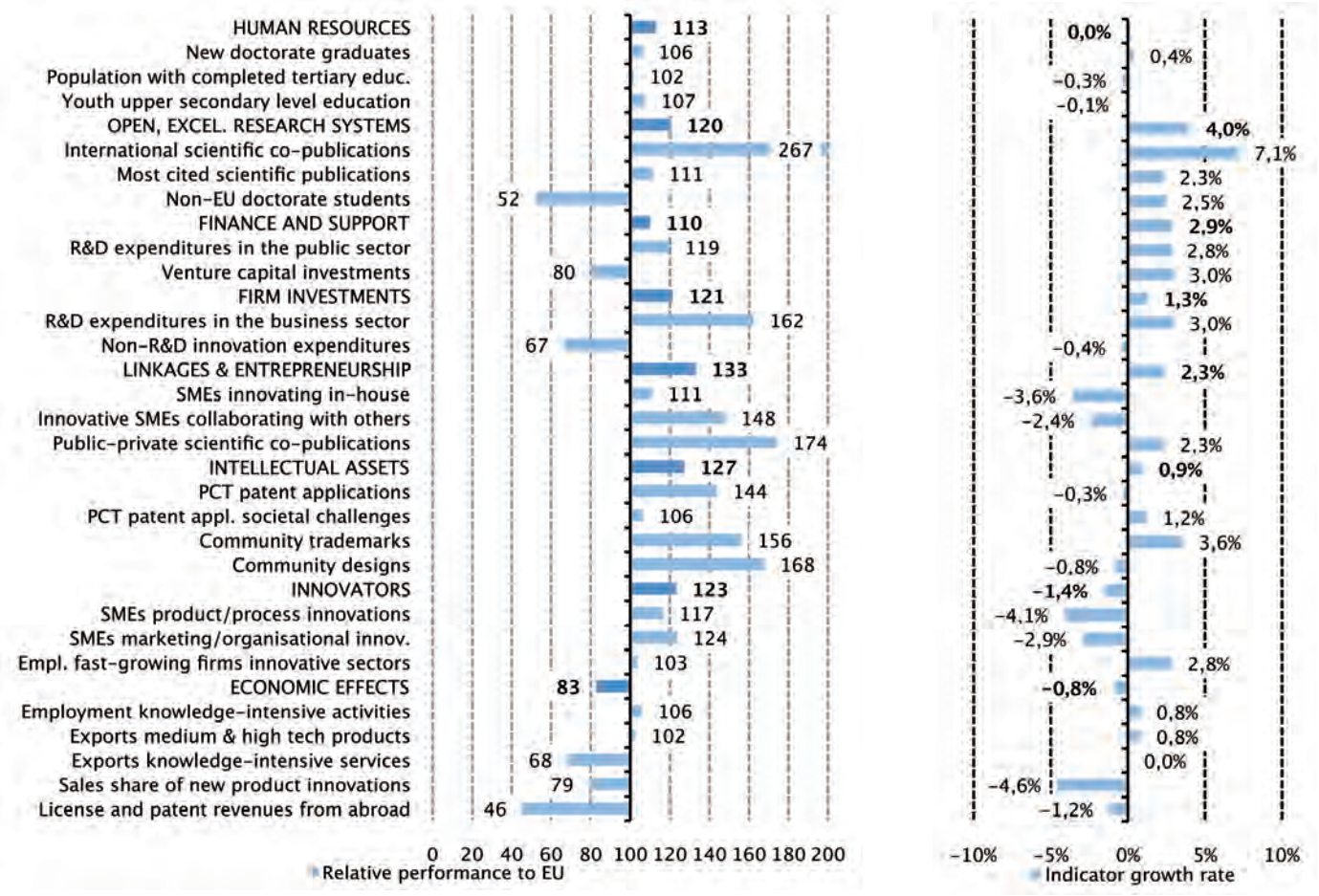


Austria is a **Strong Innovator**. Innovation performance increased until 2010, but declined strongly in 2011, followed by a strong recovery in 2012 and 2013. In 2014 and 2015, performance has declined once again. The performance relative to the EU peaked at 119% in 2010 and is at 13.3% above average in 2015.

Austria performs better than the EU in most dimensions, except in *Economic effects* because of poor relative performance in License and patent revenues from abroad and Exports of knowledge-intensive services. In terms of indicators, relative strengths for Austria are particularly International scientific co-publications, Public-private co-publications, Community designs, R&D expenditures in the business sector, and Community trademarks.

Most dimensions and indicators show positive growth. The strongest increases in performance are observed for International scientific co-publications (7.1%) and Community trademarks (3.6%). Significant declines in performance are observed in Sales share of new innovations (-4.6%) and SMEs with product or process innovations (-4.1%).

Provisional CIS 2014 data show improved performance for four indicators. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.591 to 0.609 assuming that for the other indicators performance would not change.



Note: Performance relative to the EU where the EU = 100.

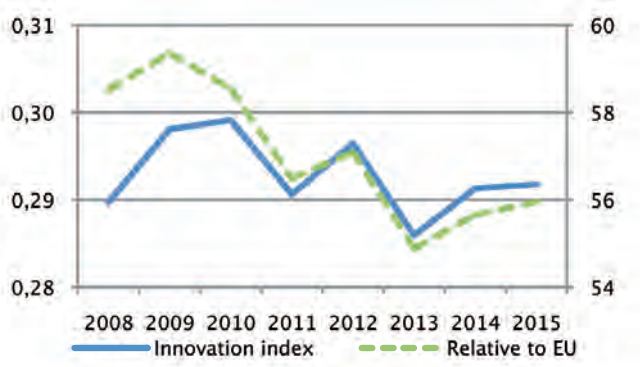
Poland

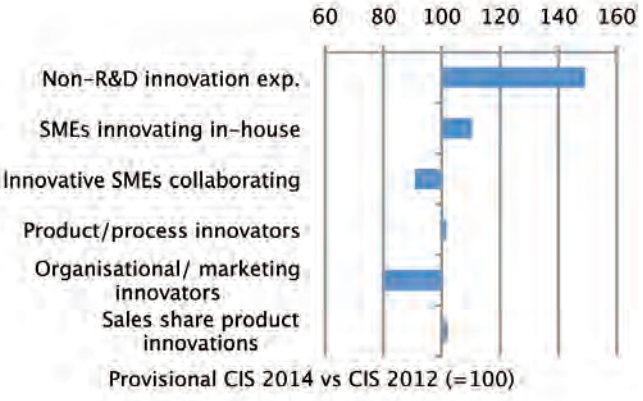
Poland is a **Moderate Innovator**. Innovation performance has been somewhat volatile within a relatively narrow range. Compared to 2008, performance has increased marginally. Poland's relative performance has declined from 59% in 2009 to 56% in 2015.

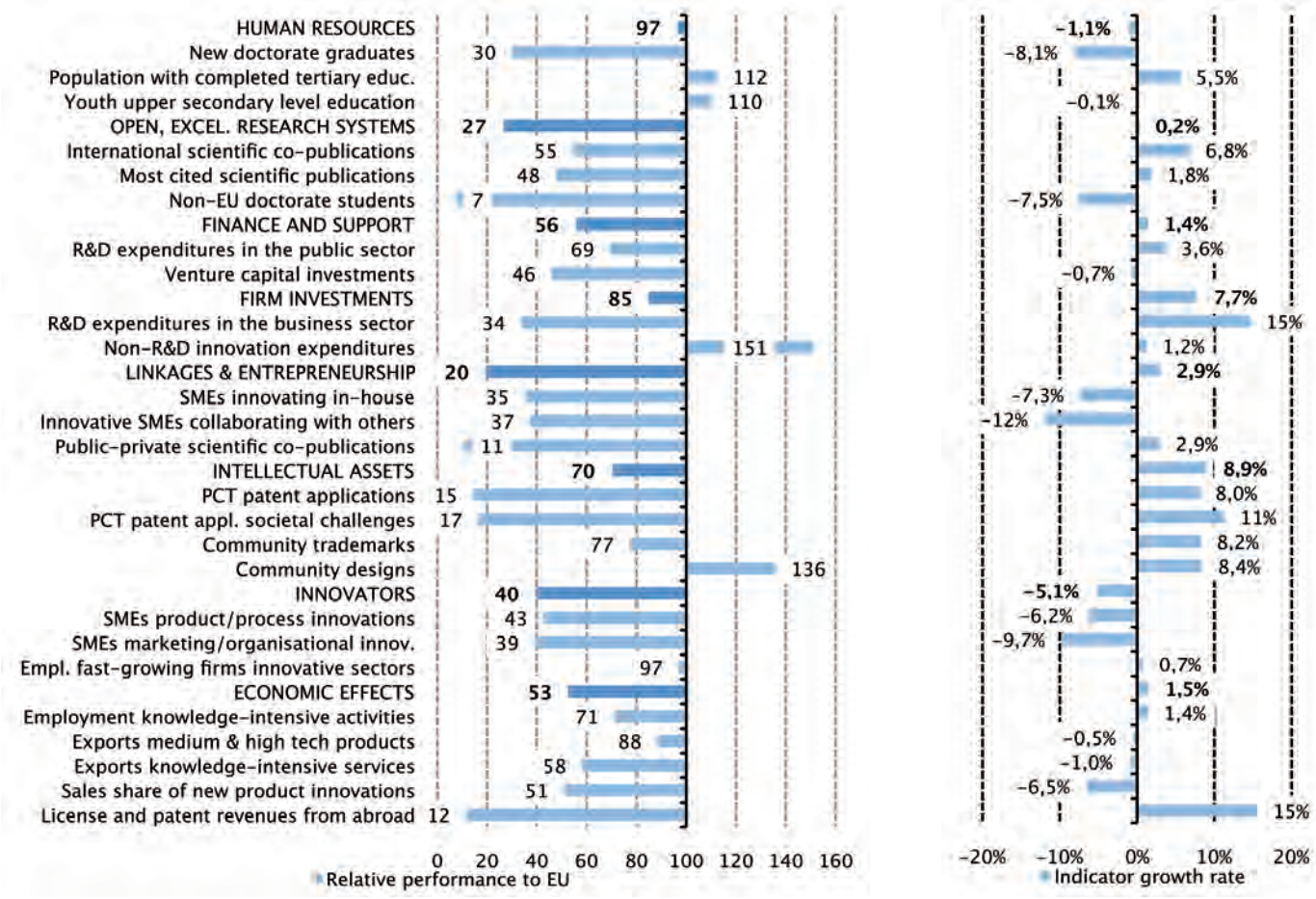
Poland is performing below the EU average in all dimensions, particularly in *Linkages and entrepreneurship* and *Open, excellent and attractive research systems*. For most indicators, performance is also below the EU average, with largest relative weaknesses in Non-EU doctorate students, Public-private co-publications, PCT patent applications (in societal challenges), and License and patent revenues from abroad. Relative strengths are in Non-R&D innovation expenditures and Community designs.

Performance has increased for most of the dimensions and indicators. High growth is observed for R&D expenditures in the business sector (15%) and License and patent revenues from abroad (15%). Fairly strong declines in performance are observed in Innovative SMEs collaborating with others (-12%) and SMEs with marketing or organisational innovations (-9.7%).

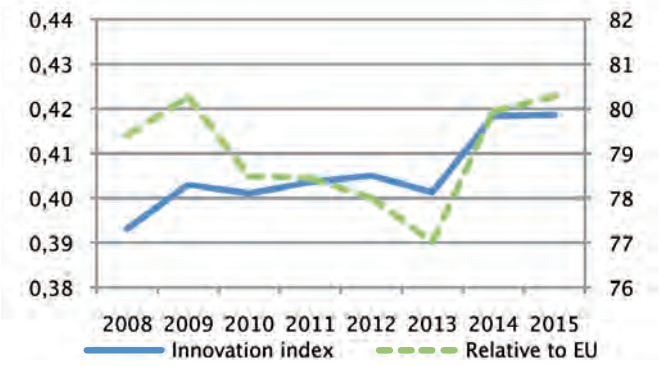
Provisional CIS 2014 data show improved performance for four and worsened performance for two indicators. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.292 to 0.305 assuming that for the other indicators performance would not change.







Note: Performance relative to the EU where the EU = 100.

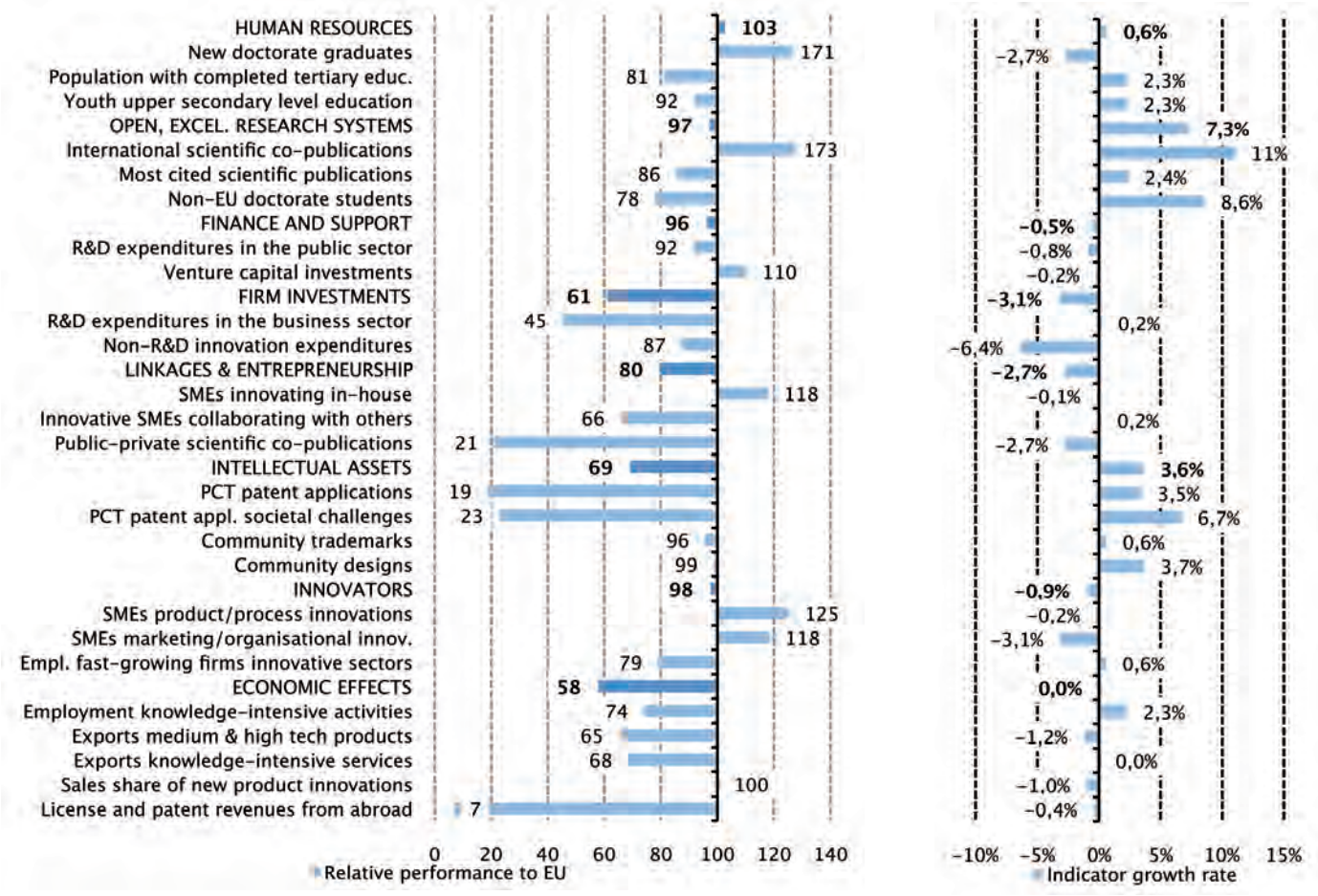


Portugal

Portugal is a **Moderate Innovator**. Innovation performance has increased over time with a large increase in 2014. Performance relative to the EU declined until 2013. In 2014 and 2015, performance relative to the EU has increased to 80% of the EU average.

Portugal performs below the EU average in most dimensions, except in *Human resources*. In the dimensions *Innovators, Open, excellent and attractive research systems* and *Finance and support,* performance is close to the EU average. Performance for most indicators is also below average, in particular for License and patent revenues from abroad, PCT patent applications, Public-private co-publications, and PCT patent applications in societal challenges. Relative strengths for Portugal are in New doctorate graduates, International scientific co-publications, SMEs with product or process innovations, and SMEs innovating in-house.

High growth is observed for the dimension *Open, excellent and attractive research systems* (7.3%). High growth in performance at the indicator level is observed for International scientific co-publications (11%), Non-EU doctorate students (8.6%), and PCT patent applications in societal challenges (6.7%). Notable declines in performance are observed in Non-R&D innovation expenditures (-6.4%) and SMEs with marketing or organisational innovations (-3.1%).



Note: Performance relative to the EU where the EU = 100.

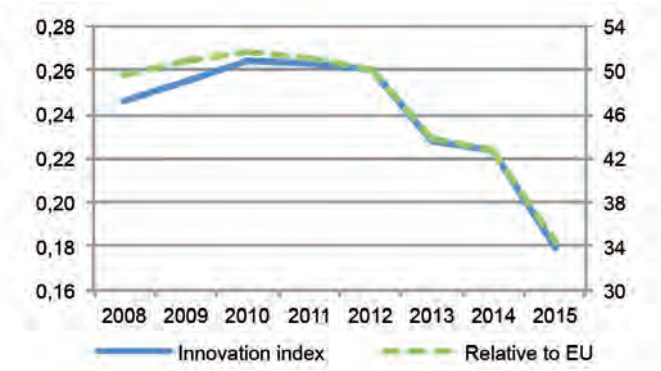
Romania

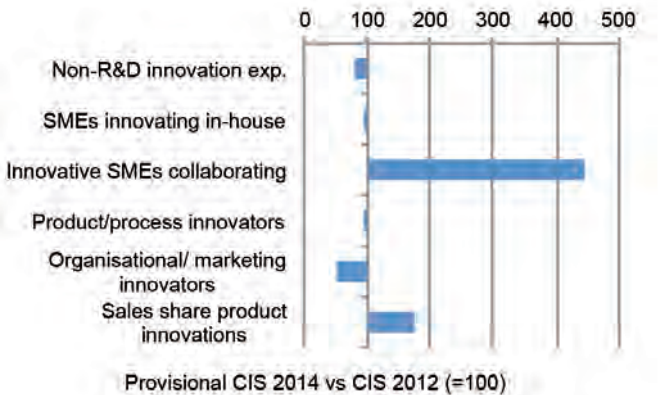
Romania is a **Modest Innovator**. Innovation performance increased until 2010, after which it has been declining. Innovation performance in 2015 is at a significantly lower level than in 2008. The development of Romania's relative performance to the EU has closely followed the development of the innovation index. Over time, the relative performance has worsened from almost 50% in 2008 to 34.4% in 2015.

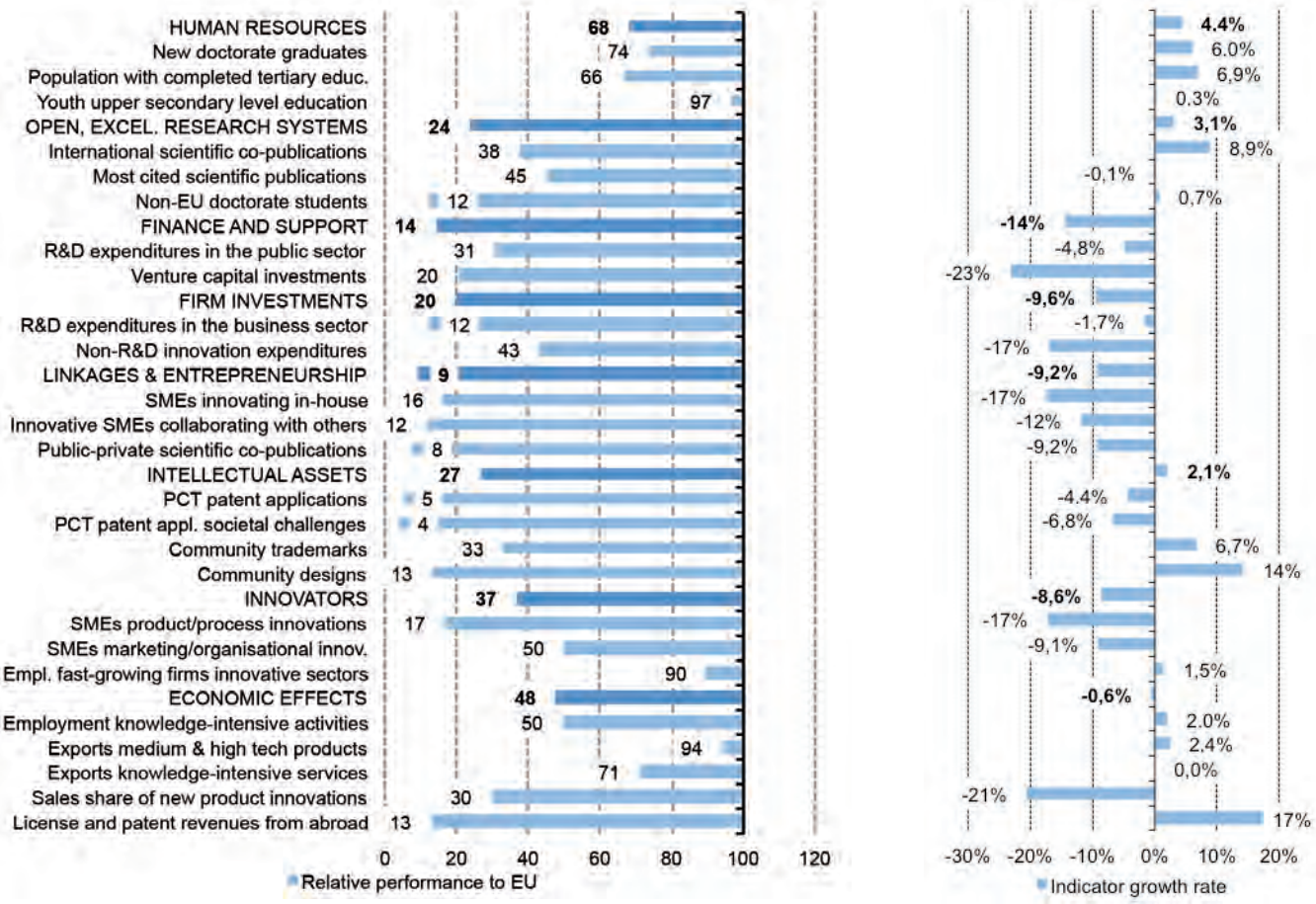
Romania is performing well below the average of the EU on all dimensions and all indicators. The weakest relative performance in terms of dimensions is *Linkages and entrepreneurship*, while in terms of indicators, the worst relative performance is observed for PCT patent applications in societal challenges and PCT patent applications. Romania performs similar to the EU average for a number of indicators, in particular Youth with upper secondary level education, Exports in medium & high tech products, and Employment in fast-growing firms in innovative sectors.

Performance has increased the most for the innovation dimension *Human resources* (4.4%). High growth at the indicator level is observed for License and patent revenues from abroad (17%) and Community designs (14%). The strongest declines in performance are observed in Venture capital investments (-23%), Sales share of new product innovations (-21%), Non-R&D innovation expenditures (-17%), SMEs innovating in-house (-17%), and SMEs with product or process innovations (-17%).

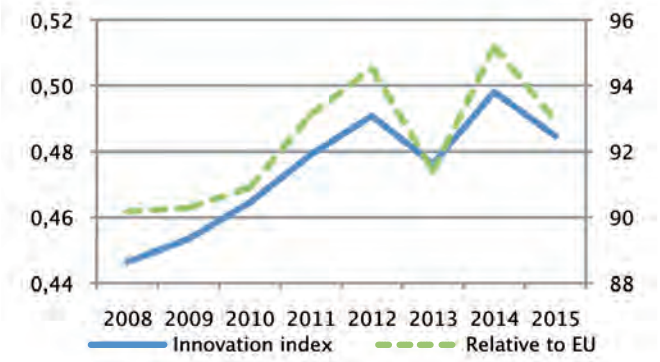
Provisional CIS 2014 data show improved performance for two indicators. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.180 to 0.188 assuming that for the other indicators performance would not change.







Note: Performance relative to the EU where the EU = 100.

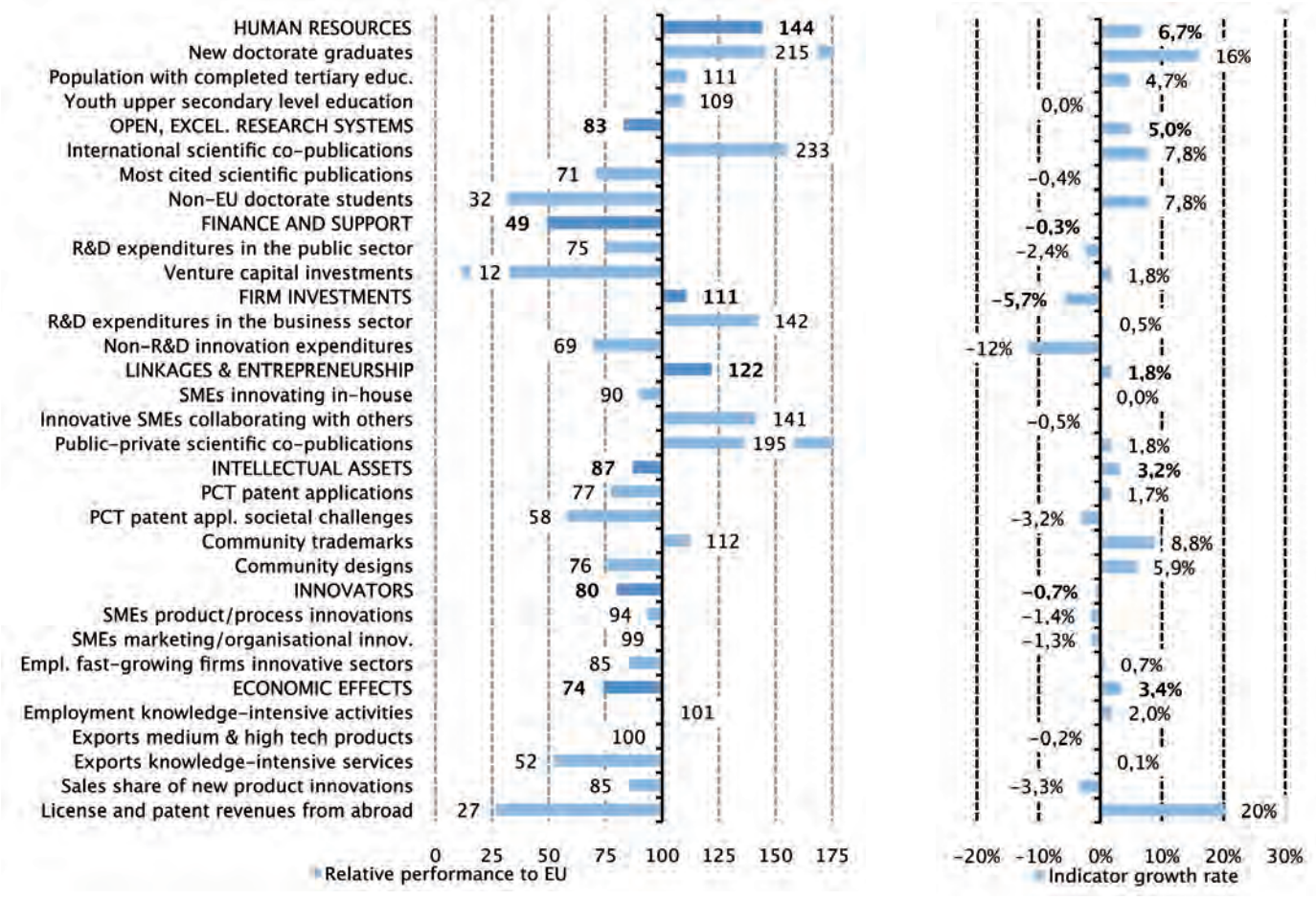


Slovenia

Slovenia is a **Strong Innovator**. Innovation performance has been steadily increasing with minor declines in 2013 and 2015. Slovenia's relative performance to the EU has improved from 90% in 2008 to 93% in 2015.

Slovenia performs close to the EU average with performance for three dimensions being above and for five dimensions being below the average. Particular relative strengths are in International scientific co-publications, New doctorate graduates, and Public-private co-publications. Strong relative weaknesses are observed for Venture capital investments, License and patent revenues from abroad, and Non-EU doctorate students.

Performance in most dimensions and indicators has improved. The fastest growing dimension is *Human resources* (6.7%), followed by *Open, excellent and attractive research systems* (5.0%). The fastest growing indicators are License and patent revenues from abroad (20%) and New doctorate graduates (16%). A strong decline in performance is observed in Non-R&D innovation expenditures (-12%).



Note: Performance relative to the EU where the EU = 100.

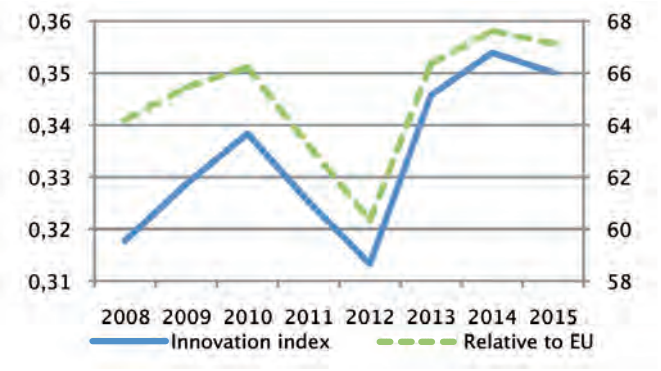
Slovakia

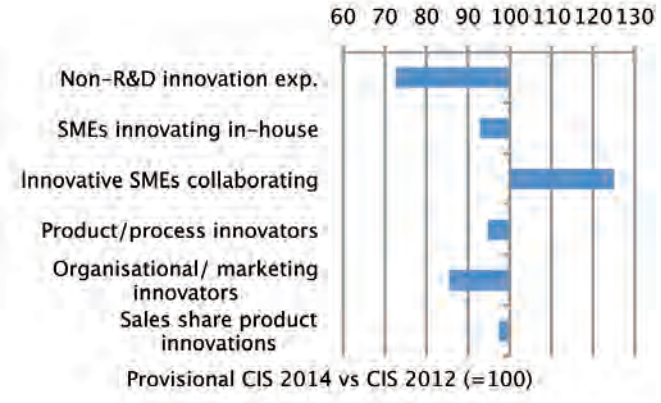
Slovakia is a **Moderate Innovator**. Innovation performance has increased between 2008 and 2015, but declined in 2011 and in 2012. The performance relative to the EU shows a similar trend. Performance relative to the EU reached a peak in 2014 at almost 68% of the EU average, and is at 67% in 2015.

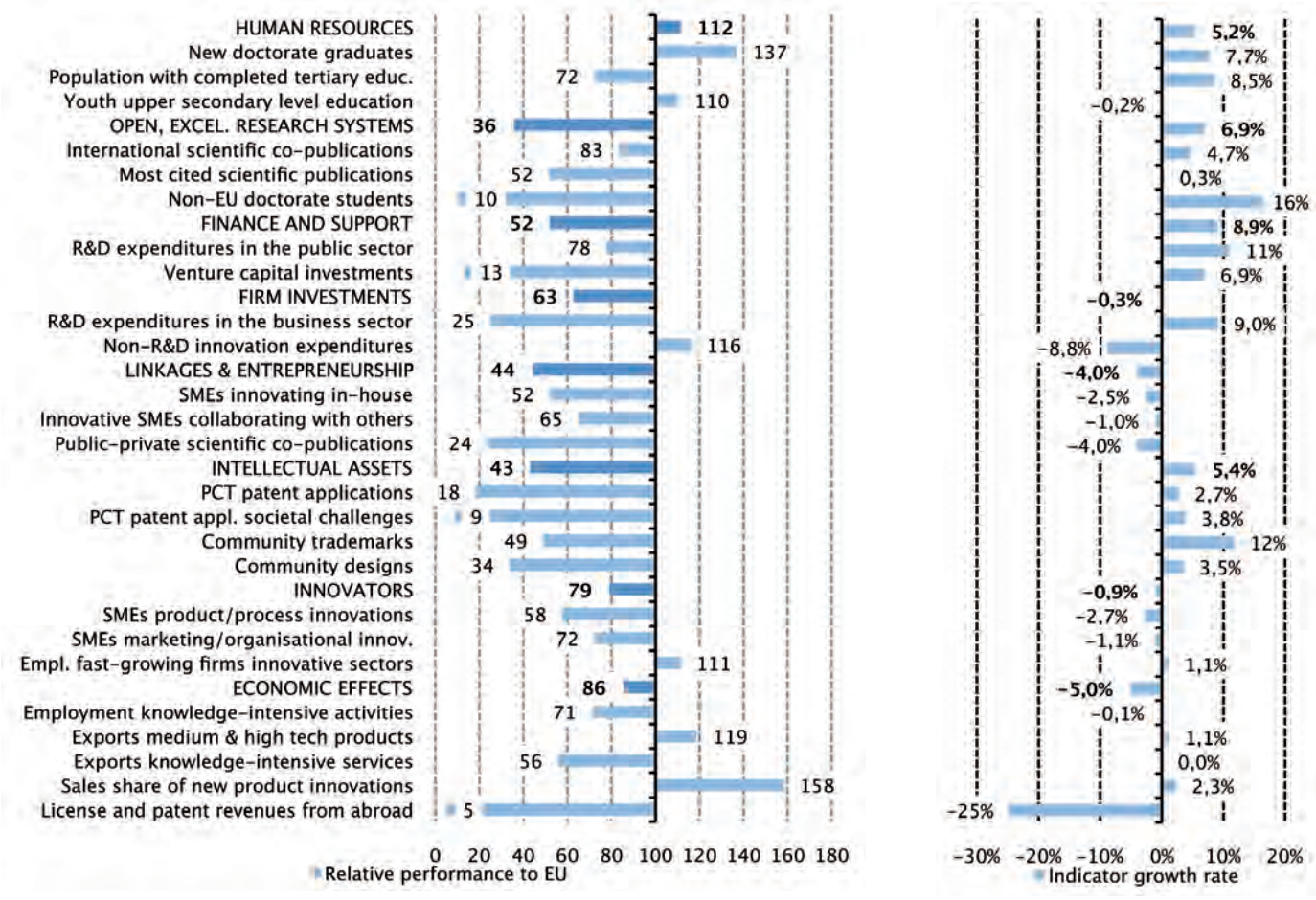
Except for *Human resources*, Slovakia performs below the EU average for all dimensions, and also for most indicators. Large relative strengths in terms of indicators are in Sales share of new innovations and New doctorate graduates. Large relative weaknesses are in License and patent revenues from abroad, PCT patent applications in societal challenges, Non-EU doctorate students, Venture capital investments, and PCT patent applications.

Performance in most dimensions and most indicators has improved. The highest growth in terms of indicators is observed for Non-EU doctorate students (16%), Community trademarks (12%) and R&D expenditures in the public sector (11%). A very strong decline in performance can be observed in License and patent revenues from abroad (-25%) and Non-R&D innovation expenditures (-8.8%).

Provisional CIS 2014 data show improved performance for one and worsened performance for five indicators. The overall impact on the innovation index is expected to be negative with the index possibly declining from 0.350 to 0.342 assuming that for the other indicators performance would not change.

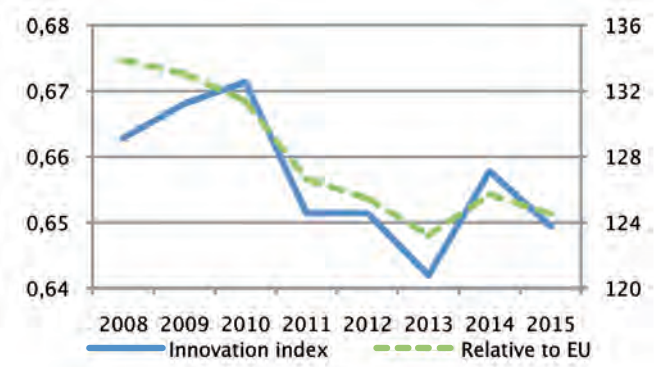


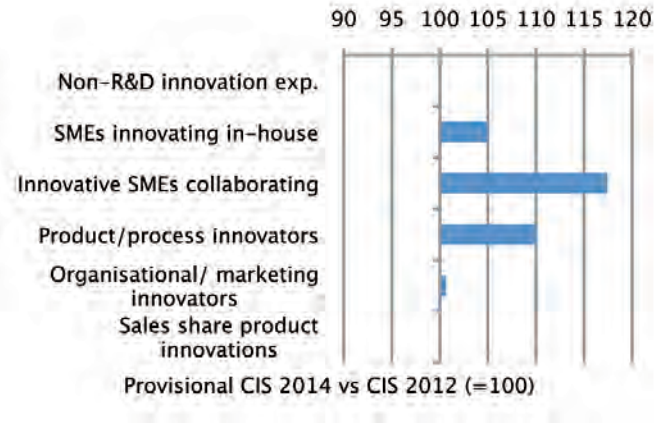




Note: Performance relative to the EU where the EU = 100.

Finland



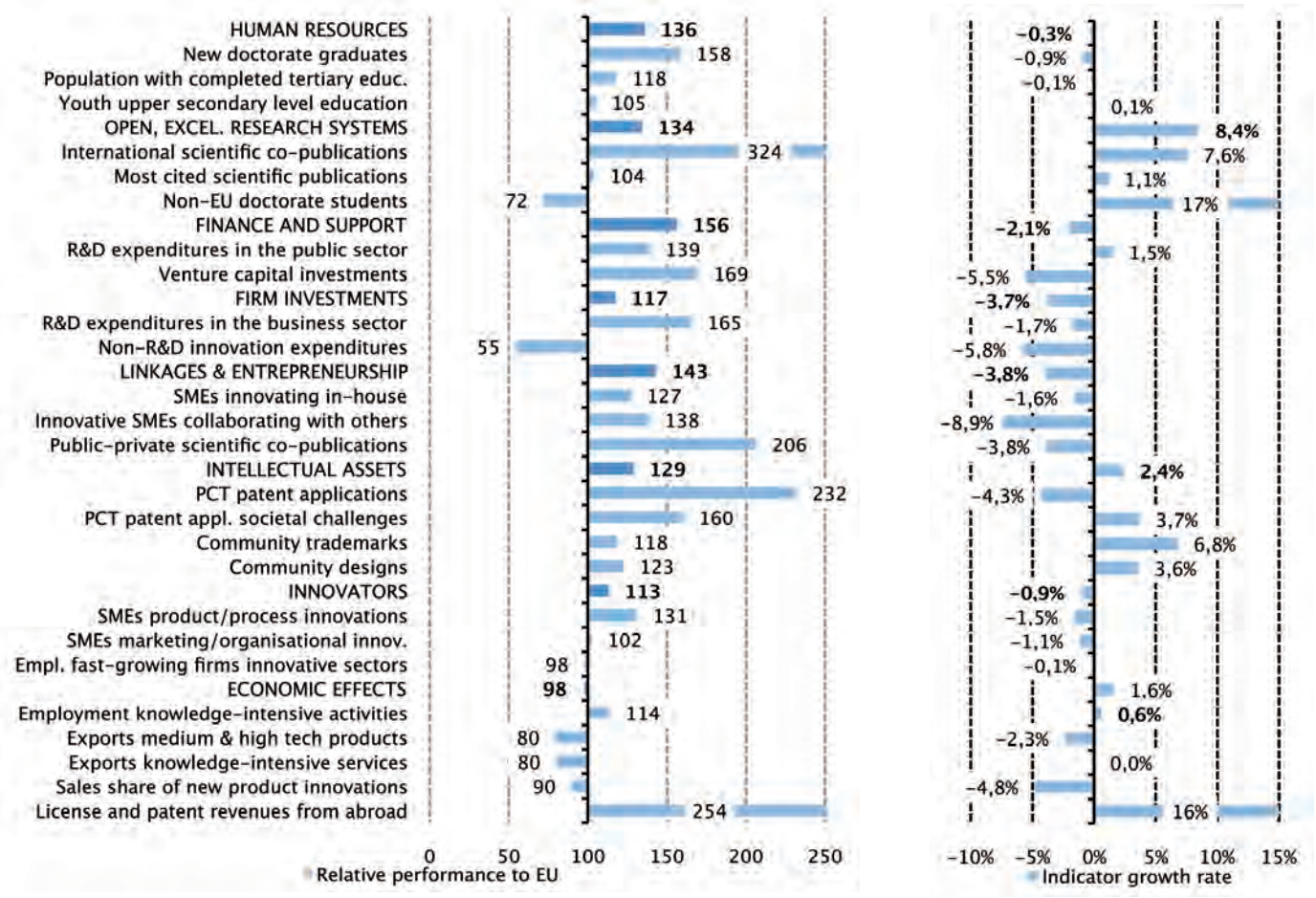


Finland is an **Innovation Leader**. Innovation performance has decreased since 2010, with a small increase in 2014, followed by a decrease in 2015. Finland's performance relative to the EU has also been declining from its peak of 134% in 2008 to 124.5% in 2015.

Finland is performing above average for all dimensions except *Economic effects*, and for most of the individual indicators. The strongest relative strengths are in International scientific co-publications, License and patent revenues from abroad, PCT patent applications, and Public-private co-publications. Relative weaknesses are in Non-R&D innovation expenditures, Non-EU doctorate students, Exports of medium & high tech products, and Exports of knowledge-intensive services.

Performance in *Open, excellent and attractive research systems* has increased the most with 8.4%. Performance in less than half of the indicators has improved. Particularly high growth is observed for Non-EU doctorate students (17%) and License and patent revenues from abroad (16%). Notable declines in performance are observed for Innovative SMEs collaborating with others (-8.9%), Non-R&D innovation expenditures (-5.8%), and Venture capital investments (-5.5%).

Provisional CIS 2014 data show improved performance for four indicators. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.649 to 0.660 assuming that for the other indicators performance would not change.



Note: Performance relative to the EU where the EU = 100.

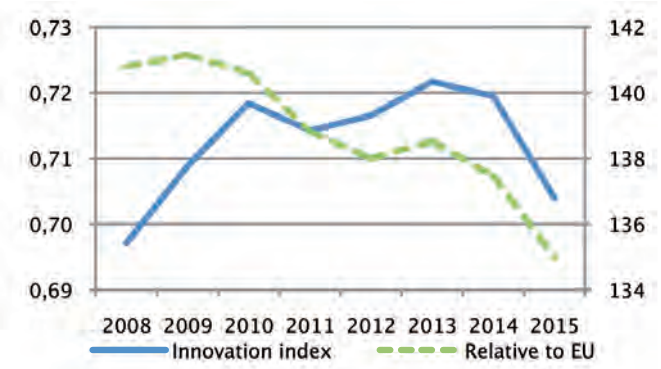
Sweden

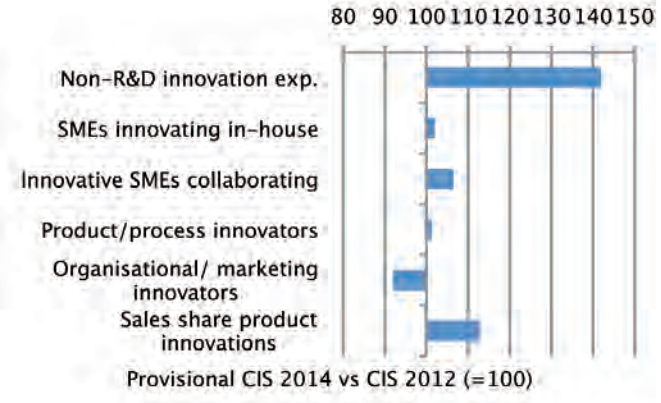
Sweden is an **Innovation Leader**. Its innovation performance increased until 2013, but has been declining since, with the decline being rather sharp in 2015. The performance relative to the EU has been declining over the whole period from its peak of 141% in 2008 and 2009 to 135% in 2015.

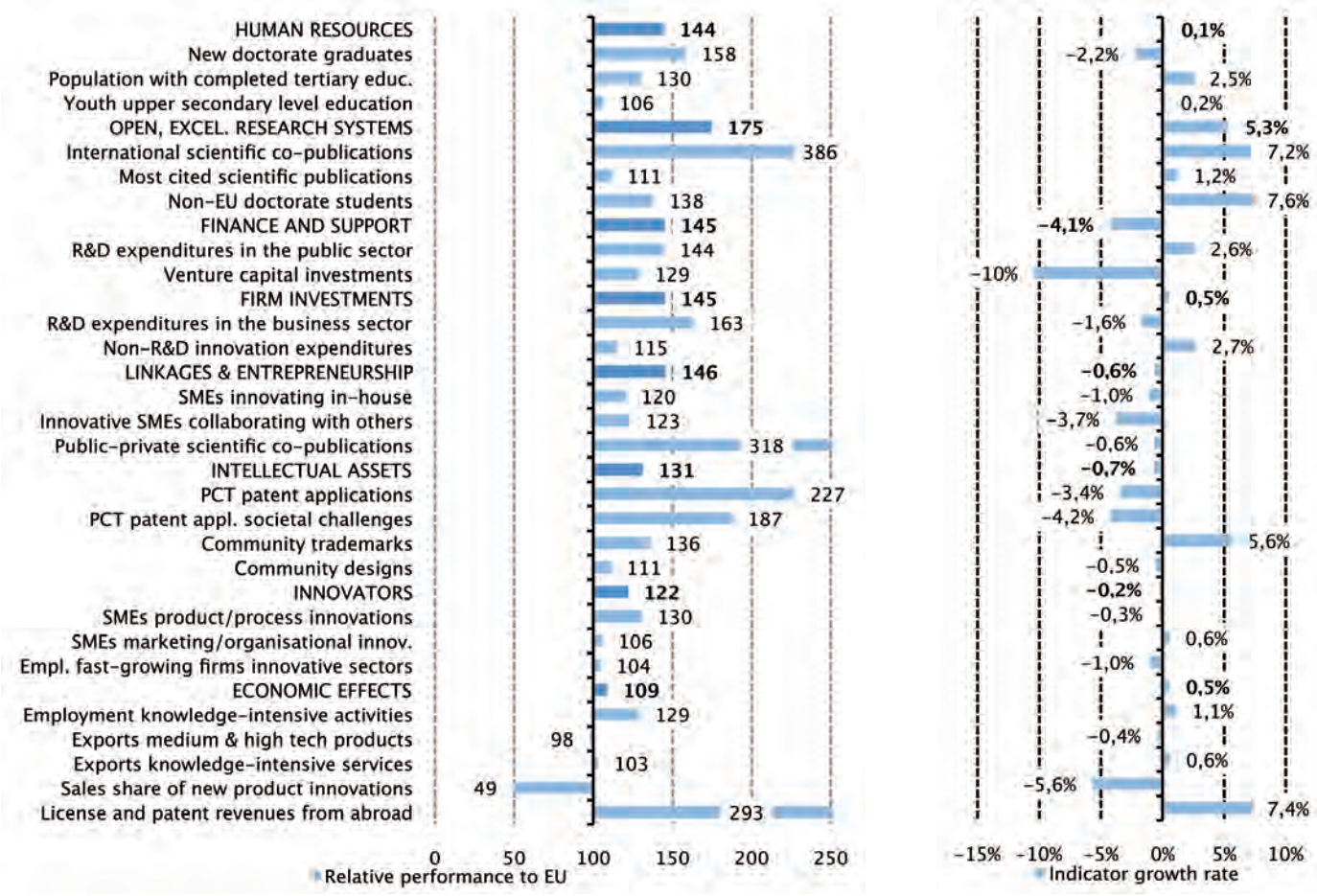
Sweden is performing above the EU average for all dimensions. Performance in nearly all of the indicators is also above the EU average, especially in International scientific co-publications, Public-private co-publications, License and patent revenues from abroad, and PCT patent applications (in societal challenges).

Performance has improved strongly in *Open, excellent and attractive research systems* (5.3%) but declined most notably in *Finance and support* (-4.1%). Performance for the indicators has shown significant positive growth in Non-EU doctorate students (7.6%), License and patent revenues from abroad (7.4%) and International scientific co-publications (7.2%). A strong decline in indicator performance can be observed for Venture capital investments (-10%).

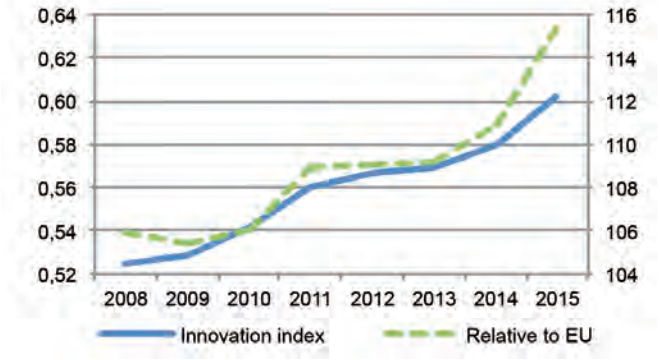
Provisional CIS 2014 data show improved performance for five indicators and worsened performance for one indicator. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.704 to 0.714 assuming that for the other indicators performance would not change.







Note: Performance relative to the EU where the EU = 100.



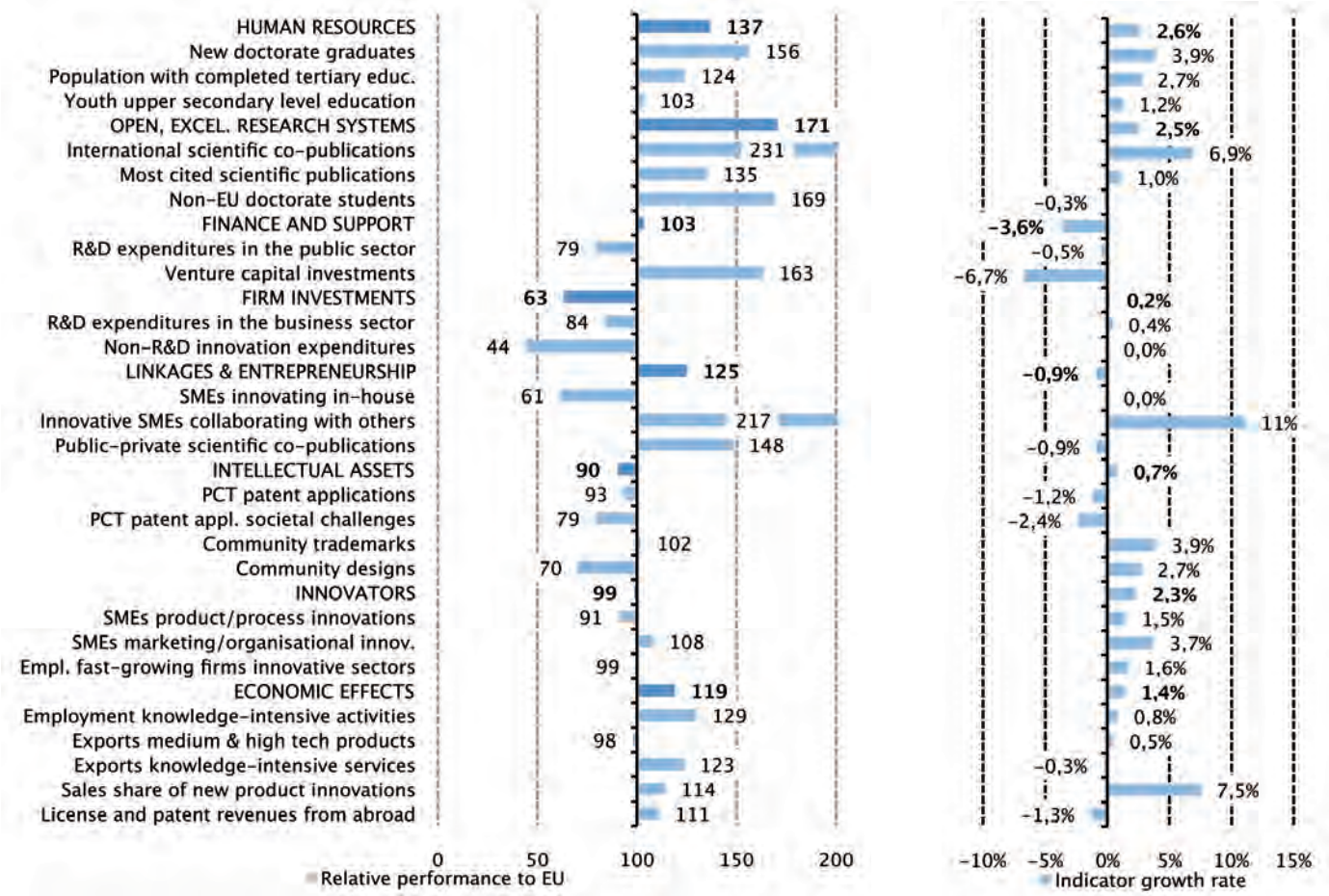
The United Kingdom

The United Kingdom is a **Strong Innovator**. Its innovation performance has been improving at a steady rate between 2008 and 2015. The performance relative to the EU has also been on the rise in the period 2008-2015. The performance was 6% above the EU average in 2008, and is more than 15% above the average in 2015.

The UK performs better than the EU average for most dimensions, and above or close to the average for the indicators. The best performing dimensions are *Open, excellent and attractive research systems* and *Human resources*. Relative best performance is in International scientific co-publications, Innovative SMEs collaborating with others, Non-EU doctorate students, and Venture capital investments. A relative weakness is the dimension of *Firm investments*, especially due to bad relative performance in Non-R&D innovation expenditures.

Performance in most dimensions and indicators has improved, although in most cases growth is modest. Performance has improved most clearly for Innovative SMEs collaborating with others (11%) and Sales share of new product innovations (7.5%). A strong decline in performance is observed in the dimension *Finance and support* (-3.6%), mainly due to a strong decline in Venture capital investments (-6.7%).

Provisional CIS 2014 data show improved performance for five indicators. The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.602 to 0.627 assuming that for the other indicators performance would not change.



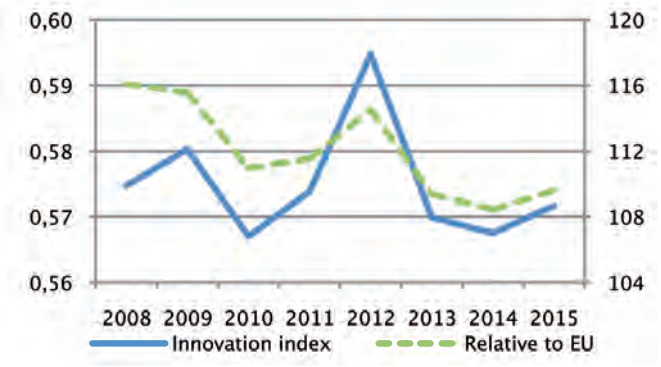
Note: Performance relative to the EU where the EU = 100.

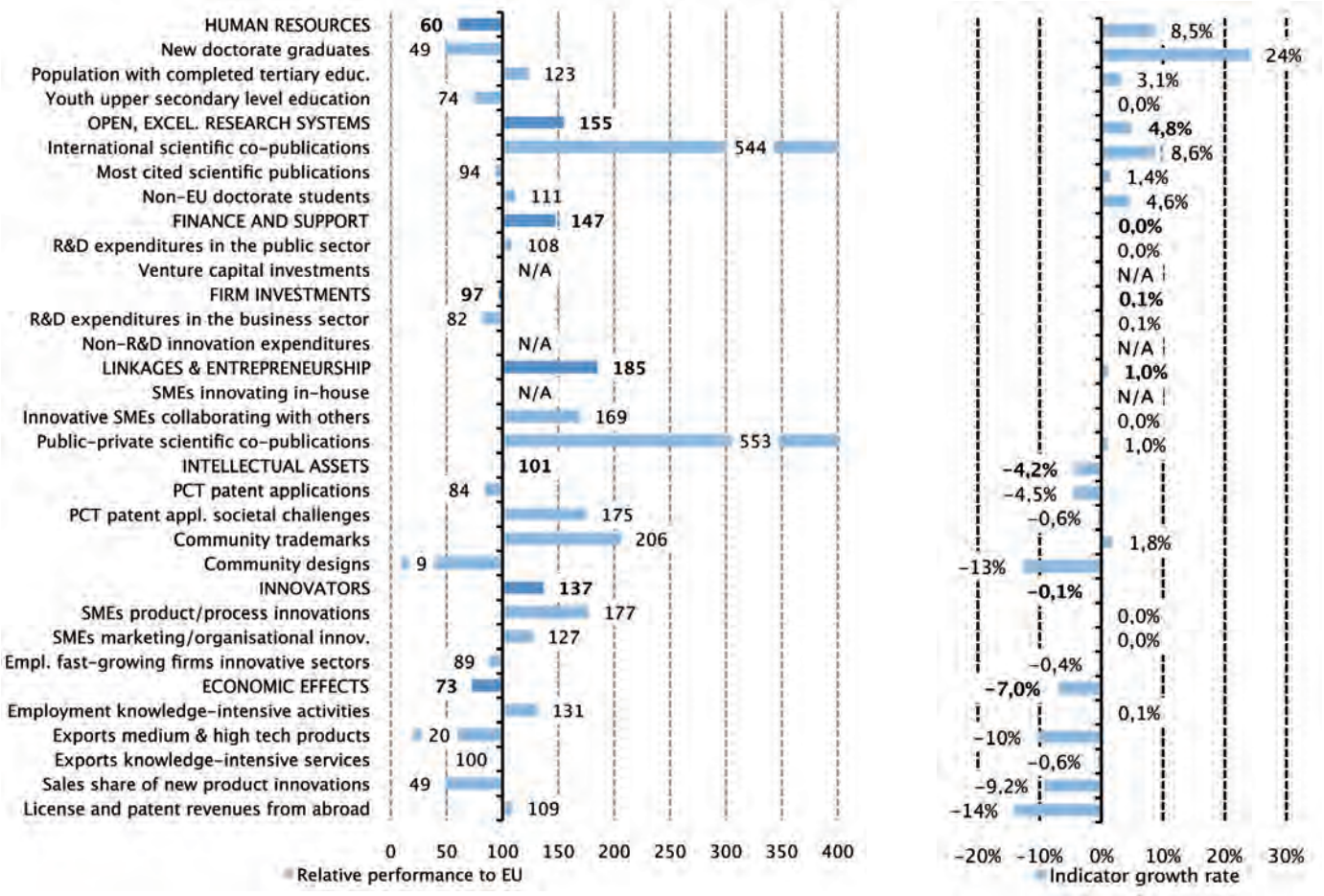
Iceland

Iceland is a **Strong Innovator**. Despite some fluctuations, performance has remained relatively stable in the observed time period. In 2015, innovation performance was at the same level as in 2008. The performance relative to the EU has declined from being 16% above the EU average in 2008 to 10% above average in 2015.

Iceland performs better than the EU average in most innovation dimensions. The overwhelmingly strongest relative strengths for Iceland in terms of indicators are International scientific co-publications, Public-private co-publications and, to a lesser extent, Community trademarks. Relative weaknesses are in Community designs, Exports in medium and high tech products, Sales share of new innovations, and New doctorate graduates.

For Iceland, time series data are not available for all indicators. For about half of the dimensions and about half of the indicators, performance has improved. The highest growth is observed in New doctorate graduates (24%) and International co-publications (8.6%). Fairly significant declines in performance are observed in License and patent revenues from abroad (-14%), Community designs (-13%), Exports in medium and high tech products (-10%), and Sales share of new product innovations (-9.2%).

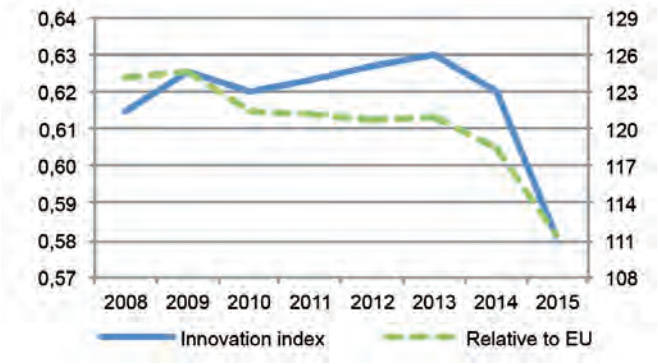




Note: Performance relative to the EU where the EU = 100. No data for Venture capital investments, Non-R&D innovation expenditures and SMEs innovating in-house.

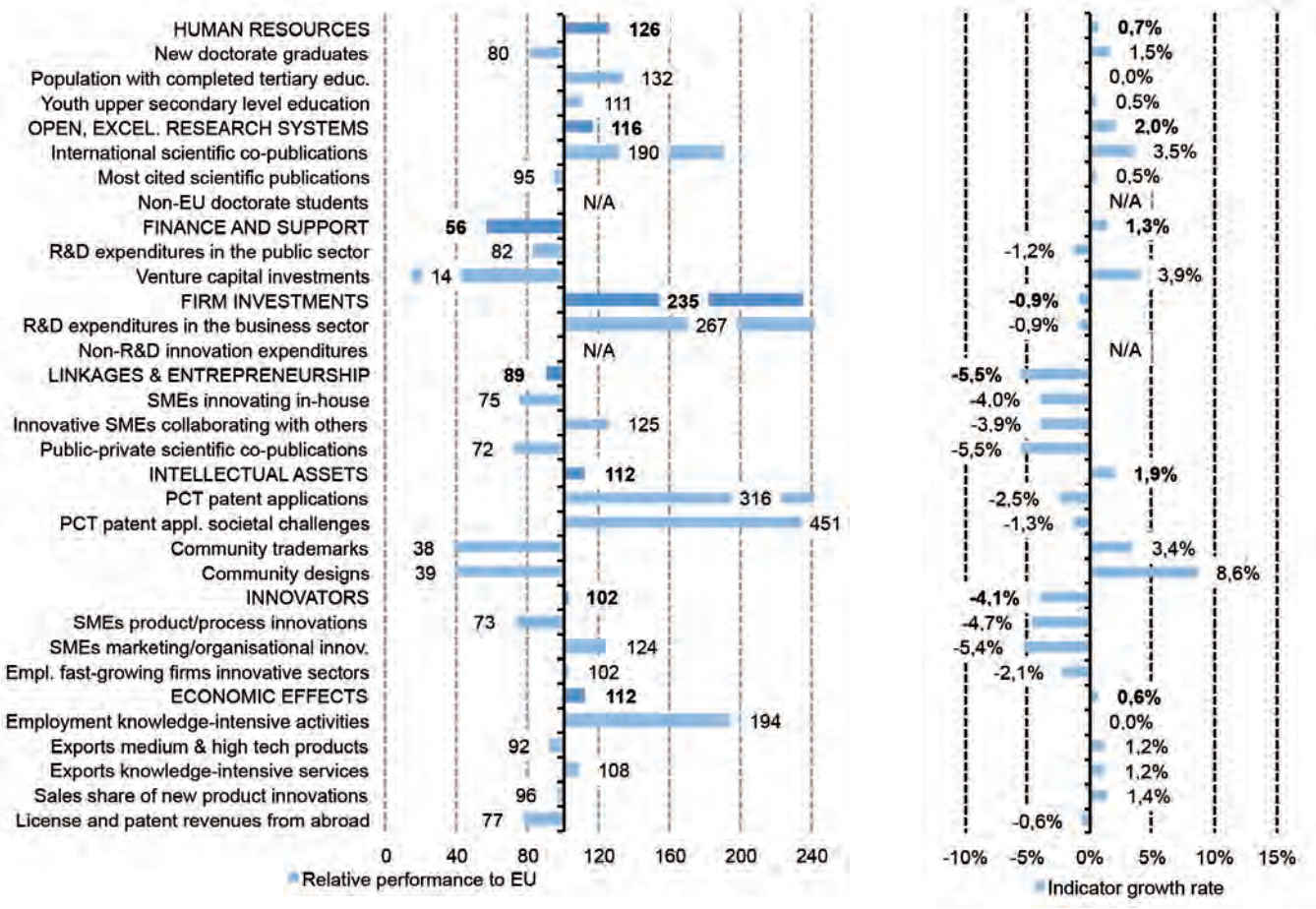
Israel

Israel is a **Strong Innovator**. Performance remained relatively stable until 2014, after which it declined strongly in 2015. The performance relative to the EU has declined from being 24% above the EU average in 2008 to 11% above average in 2015, in particular due to a strong decline between 2014 and 2015.



Israel performs better than the EU average in most innovation dimensions. The overwhelmingly strongest relative strengths for Israel in terms of indicators are PCT patent applications in societal challenges, PCT patent applications, R&D expenditures in the business sector, International scientific co-publications, and Employment in knowledge-intensive activities. Relative weaknesses are especially in Venture capital investments, Community trademarks, and Community designs.

Performance has increased the most in the dimensions of *Open, excellent and attractive research systems* (2.0%) and *Intellectual assets* (1.9%), and it has declined the most in the dimension *Linkages and entrepreneurship* (-5.5%). At the indicator level, performance has increased most in Community designs (8.6%) and Venture capital investments (3.9%). It has decreased the most in Public-private co-publications (-5.5%), SMEs with marketing or organisational innovations (-5.4%), and SMEs with product or process innovations (-4.7%).



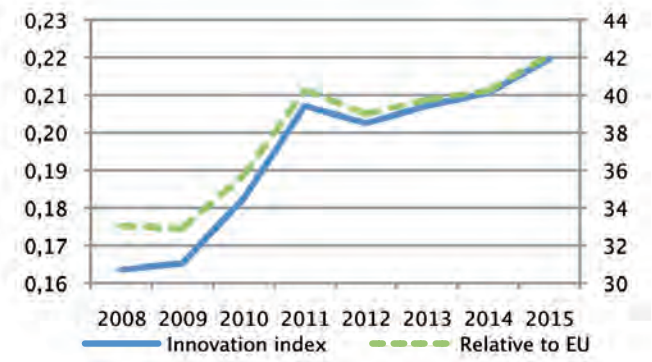
Note: Performance relative to the EU where the EU = 100. No data for Non-EU doctorate students and Non-R&D innovation expenditures. Data for Israel have been partly supplied by the Israel Central Bureau of Statistics (ICBS). Data from the innovation surveys are for 2006-2008 and 2010-2012. The question on marketing and organisational innovation was changed between the two surveys, which might partly explain a decrease in the percentage of marketing and organisational innovators. Data for Venture capital have been supplied by ICBS, but the data source is IVC Research Center, and data do not necessarily comply to the quality standards of ICBS. For Employment in knowledge-intensive activities as of 2012, data refer to the entire labour force (including compulsory or permanent military service).

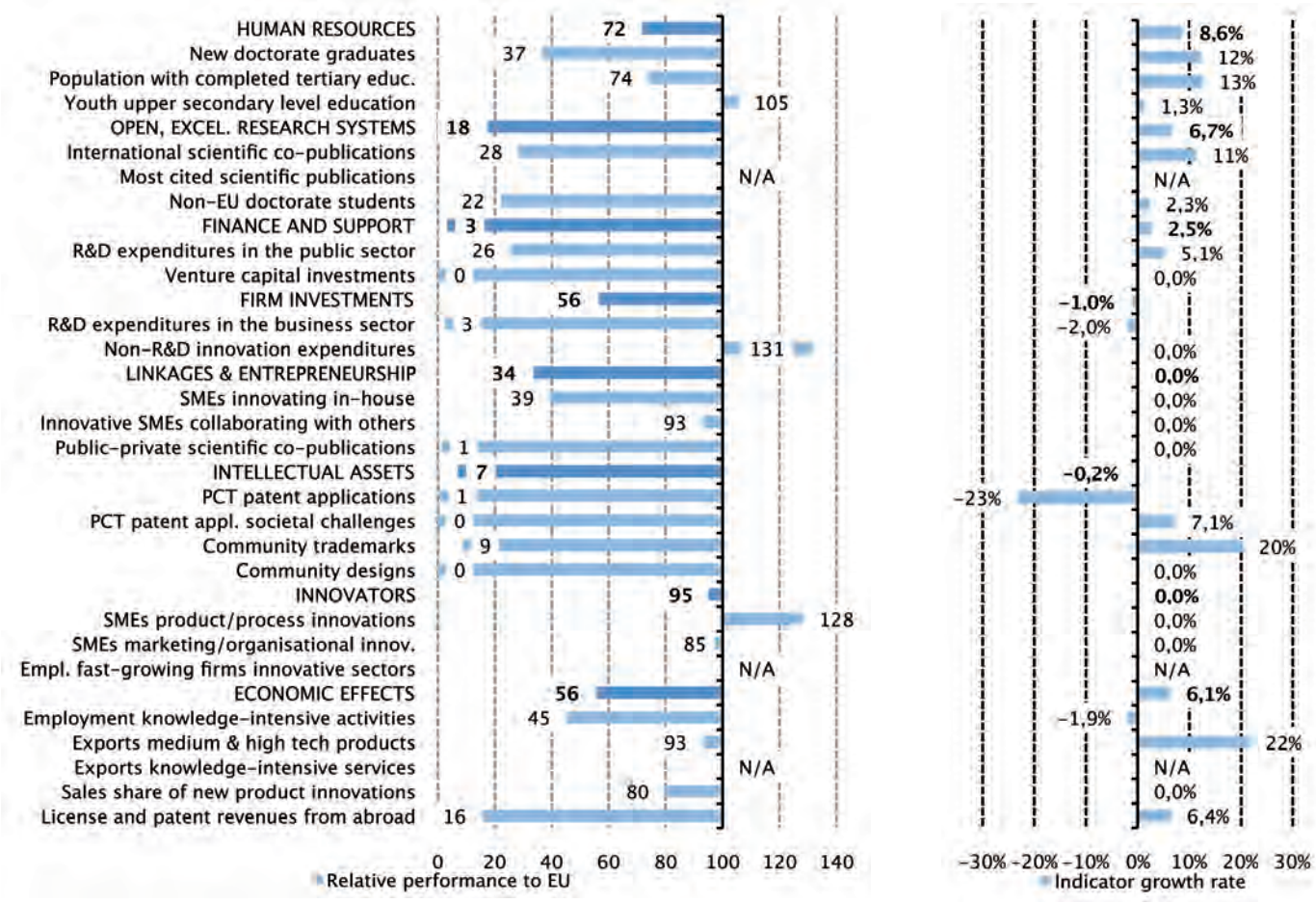
Former Yugoslav Republic of Macedonia

The Former Yugoslav Republic of Macedonia (FYROM) is a **Modest Innovator**. Innovation performance has increased over time. The country has been gradually catching up to the performance level of the EU: its relative performance improved from 33% in 2008 to 42% in 2015.

FYROM is performing well below the EU average for nearly all dimensions and indicators. In relative terms, the worst performing dimension is *Finance and support*. Relative performance is weak for a substantial share of the indicators. Relative strengths can be found in Non-R&D innovation expenditures and SMEs with product or process innovations.

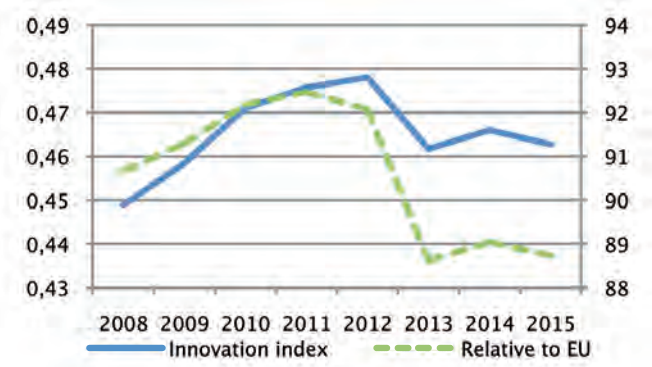
For several indicators, performance has not changed over time as, due to a lack of data, data is available for one year only. Performance has increased most significantly for the dimensions of *Human resources* (8.6%) and *Open, excellent and attractive research systems*. At the indicator level, the highest growth can be observed for Exports of medium and high tech products (22%) and Community trademarks (20%). The only strong decline in performance can be observed for PCT patent applications (-23%).





Note: Performance relative to the EU where the EU = 100. No data for Most-cited publications, Employment in fast-growing firms of innovative sectors, and Exports of knowledge-intensive services.

Norway

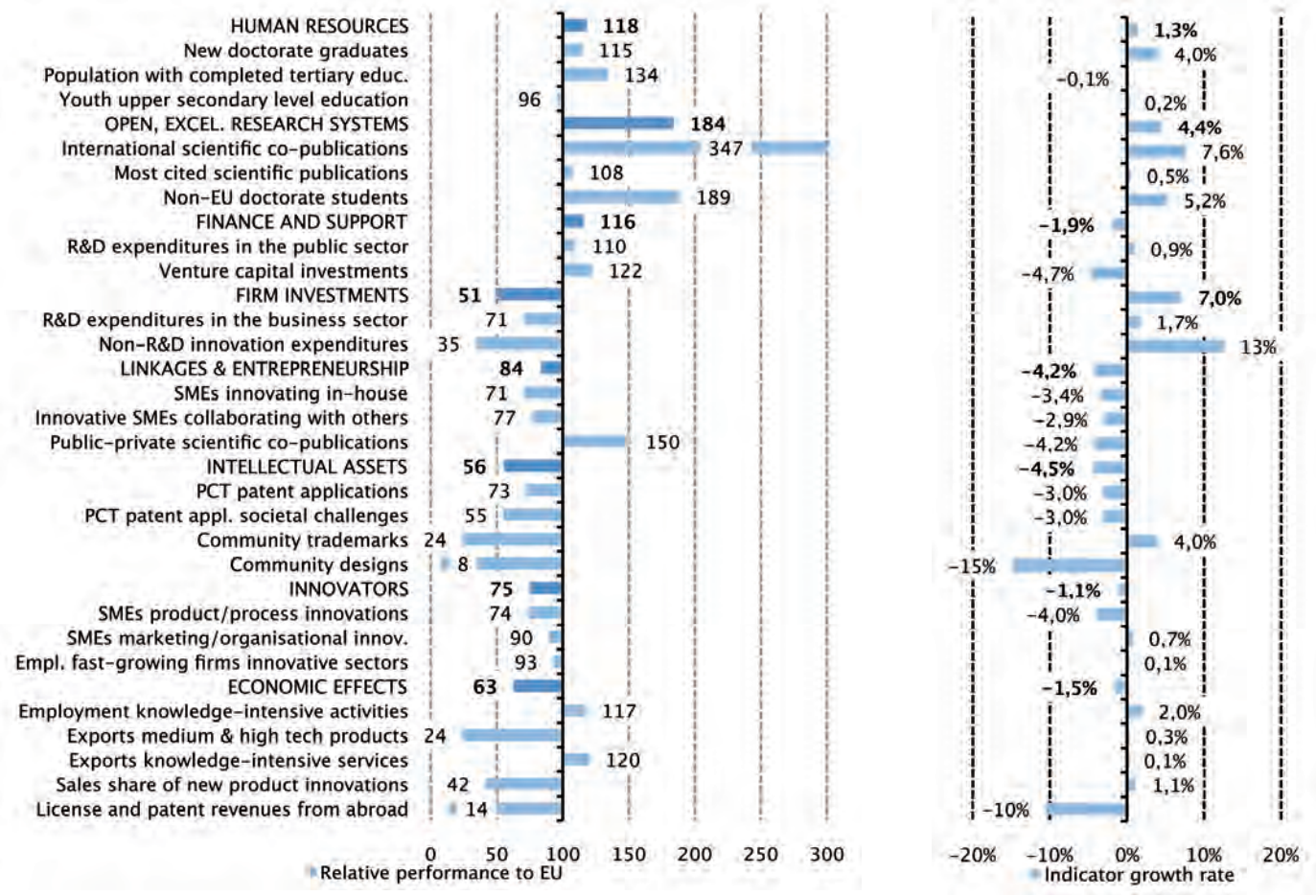


Norway is a **Moderate Innovator**. Norwegian innovation performance increased until 2012, declined slightly in 2013, and has been steady since then. Norway's performance compared to the EU increased until 2011, peaking at close to 93%, but relative performance has since then been in decline and is just below 89% of the EU average in 2015.

Norway is performing below the EU average for most dimensions and indicators, particularly for Community designs and License and patent revenues from abroad. A strong innovation dimension is *Open, excellent and attractive research systems*, due to exceptional relative performance in International scientific co-publications.

Performance in three innovation dimensions and about half the indicators has increased. The highest growth at the indicator level is observed for Non-R&D innovation expenditures (13%). Large performance declines are observed in Community designs (-15%) and License and patent revenues from abroad (-10%).

Provisional CIS 2014 data show strongly improved performance for all six indicators. These strong increases are a direct effect of changing to a separate innovation survey in 2014 resulting in considerable higher reported innovation activity compared to previous combined R&D and innovation surveys (explaining why there are no labels on the horizontal axis in the graph). The overall impact on the innovation index is expected to be positive with the index possibly increasing from 0.463 to 0.534 assuming that for the other indicators performance would not change.



Note: Performance relative to the EU where the EU = 100.

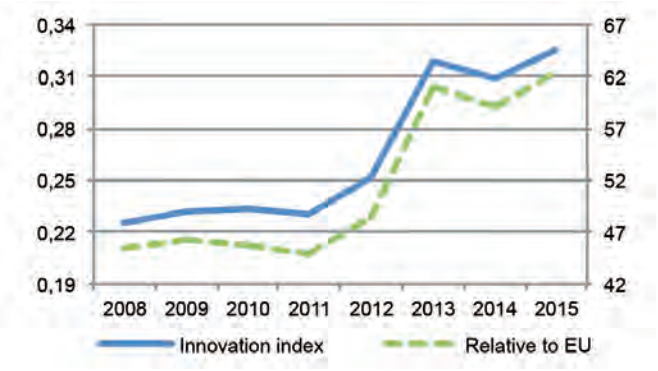
Serbia

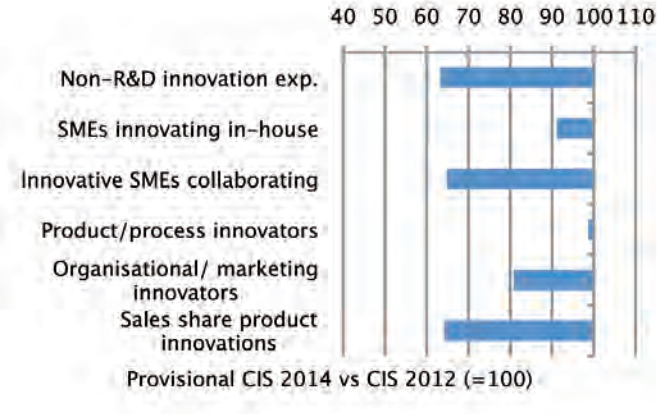
Serbia is a **Moderate Innovator**, and innovation performance has increased over the whole period. Relative performance to the EU has improved significantly from 45% in 2008 to almost 62% in 2015.

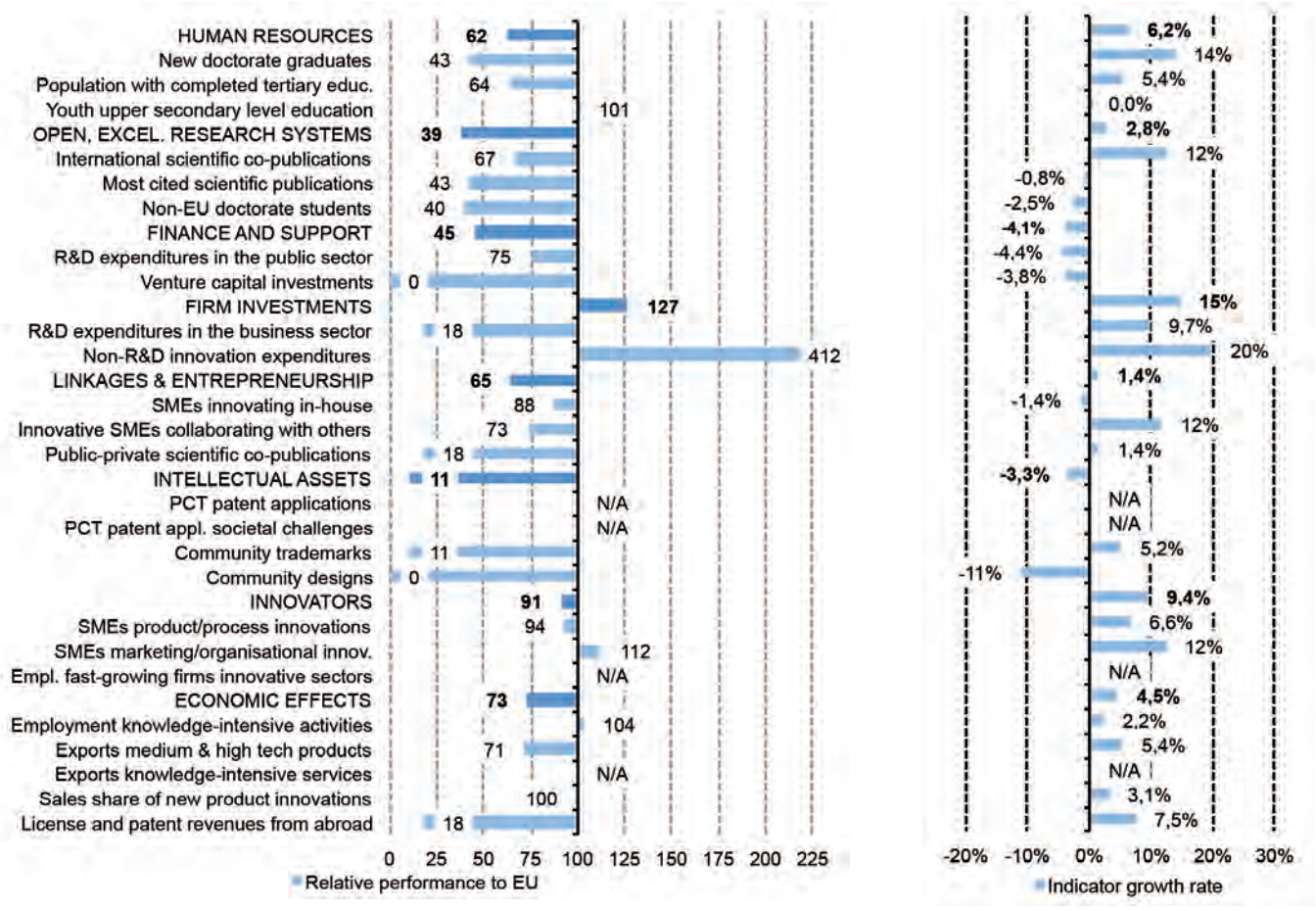
Serbia is performing below the EU average for nearly all dimensions and indicators. The most significant relative strength is in Non-R&D innovation expenditures, which lifts *Firm investments* to the best performing dimension. Strongest relative weaknesses are in Venture capital investments, Community designs, Community trademarks, Public-private co-publications, R&D expenditures in the business sector, and License and patent revenues from abroad.

Performance has increased for most dimensions and most indicators. The dimension of *Firm investments* has grown most strongly at 15%. Highest indicator growth is observed for Non-R&D innovation expenditures (20%) and New doctorate graduates (14%). A strong decline in performance is only observed for Community designs (-11%).

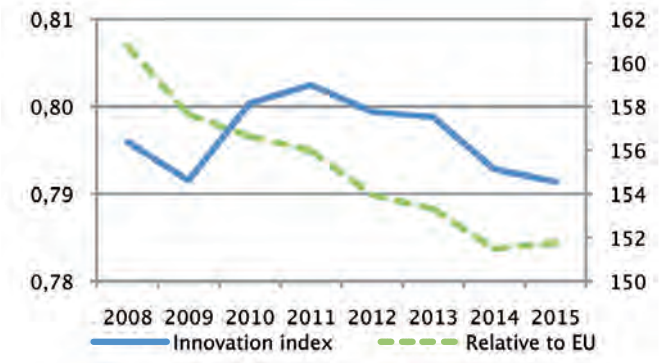
Provisional CIS 2014 data show worsened performance for all six indicators. The overall impact on the innovation index is expected to be negative with the index possibly declining from 0.325 to 0.301 assuming that for the other indicators performance would not change.







Note: Performance relative to the EU where the EU = 100. No data for PCT patent applications, PCT patent applications in societal challenges, Employment in fast-growing firms of innovative sectors, and Exports of knowledge-intensive services.

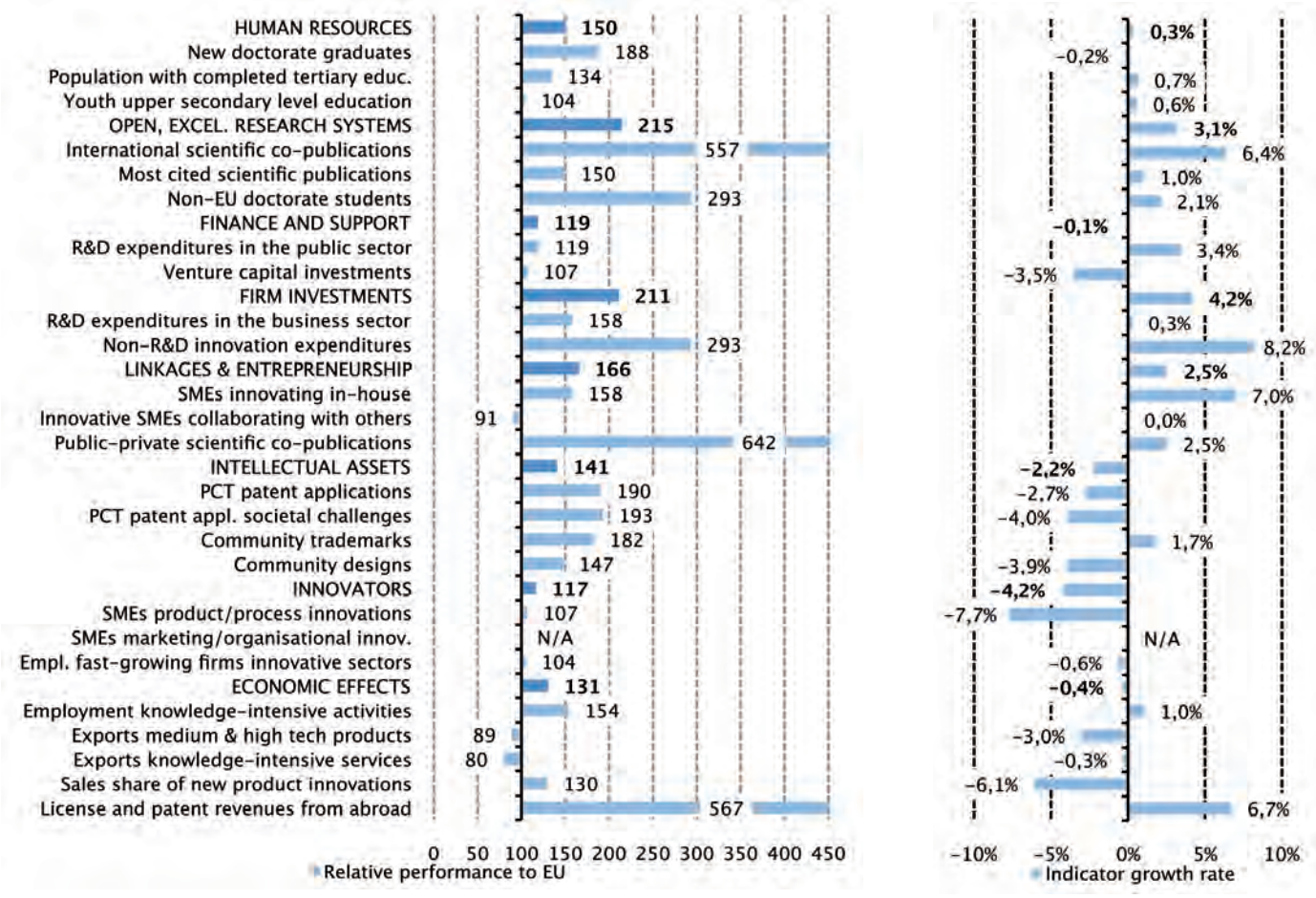


Switzerland

Switzerland is an **Innovation Leader** and the most innovative country in Europe. Its performance increased until 2011, after which it declined. The lead over the EU has been declining over time until 2014, and increased slightly to almost 52% above the EU average in 2015.

Switzerland is performing well above the EU average for all dimensions and for most indicators, in particular on three indicators: International scientific co-publications, Public-private co-publications, and License and patent revenues from abroad. Relative weaknesses are only in Exports of knowledge-intensive services, Innovative SMEs collaborating with others, and Exports of medium & high tech products.

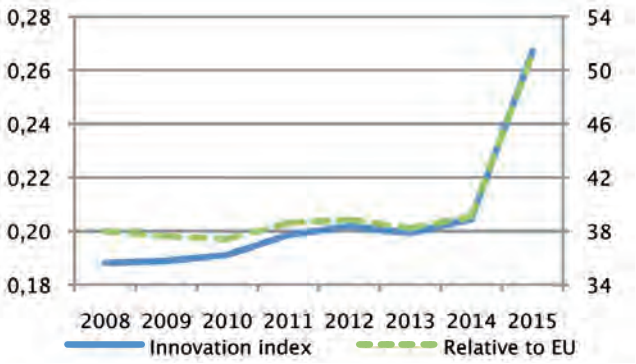
For half of the innovation dimensions and more than half of the indicators, performance has increased. Performance has improved most for Non-R&D innovation expenditures (8.2%), SMEs innovating in-house (7.0%), License and patent revenues from abroad (6.7%), and International scientific co-publications (6.4%). The strongest declines in performance are observed in SMEs with product or process innovations (-7.7%) and Sales share of new product innovations (-6.1%).



Note: Performance relative to the EU where the EU = 100. No data for SMEs with marketing or organisational innovations.

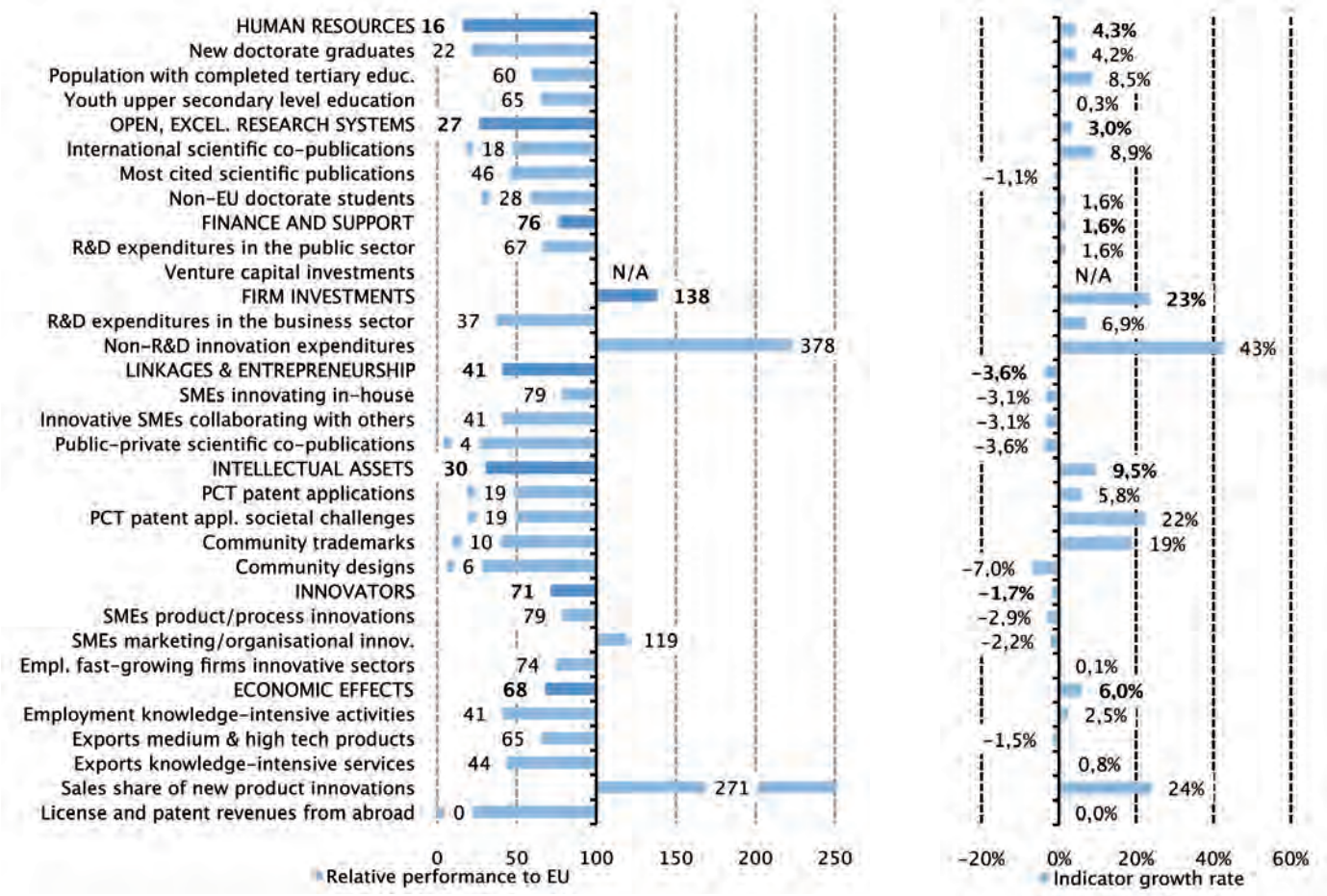
Turkey

Turkey is a **Moderate Innovator**. Innovation performance has been improving at a slow but steady rate between 2008 and 2014, and for 2015 a sharp increase can be observed. Turkey is catching up to the EU; its relative performance has improved from 38% in 2008 to 39% in 2014 and then jumped to 51% in 2015 turning the country from a Modest into a Moderate Innovator. The strong increase from 2014 to 2015 is the result of an almost twelvefold increase in Non-R&D innovation expenditures and a more than fourfold increase in Sales share of new product innovations using CIS 2012 data as compared to CIS 2010 data.



Turkey is performing well below the average of the EU for all dimensions except Firms investments – due to high relative performance in Non-R&D innovation expenditures – and on almost all indicators. Another strong relative performance is observed for Sales share of new innovations. The most significant relative weaknesses are in License and patent revenues from abroad, Public-private scientific co-publications, Community designs, and Community trademarks.

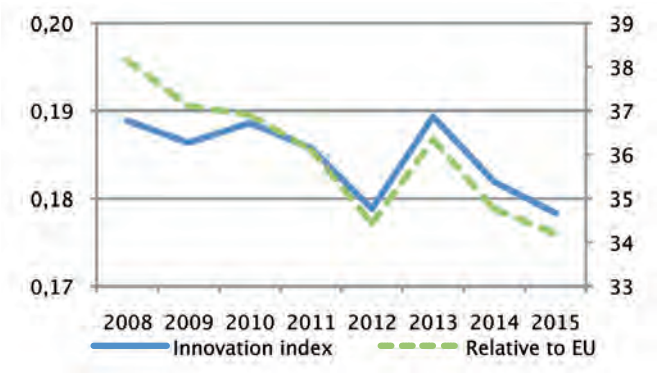
In nearly all dimensions – especially *Firm investments* – and most indicators, performance has improved. Particularly high growth is observed for Non-R&D innovation expenditures (43%), Sales share of new product innovations (24%), PCT patent applications in societal challenges (22%), and Community trademarks (19%). The few declines in performance are minor, with the relatively largest ones in Community designs (-7.0%) and Public-private scientific co-publications (-3.6%).



Note: Performance relative to the EU where the EU = 100. No data for Venture capital investments.

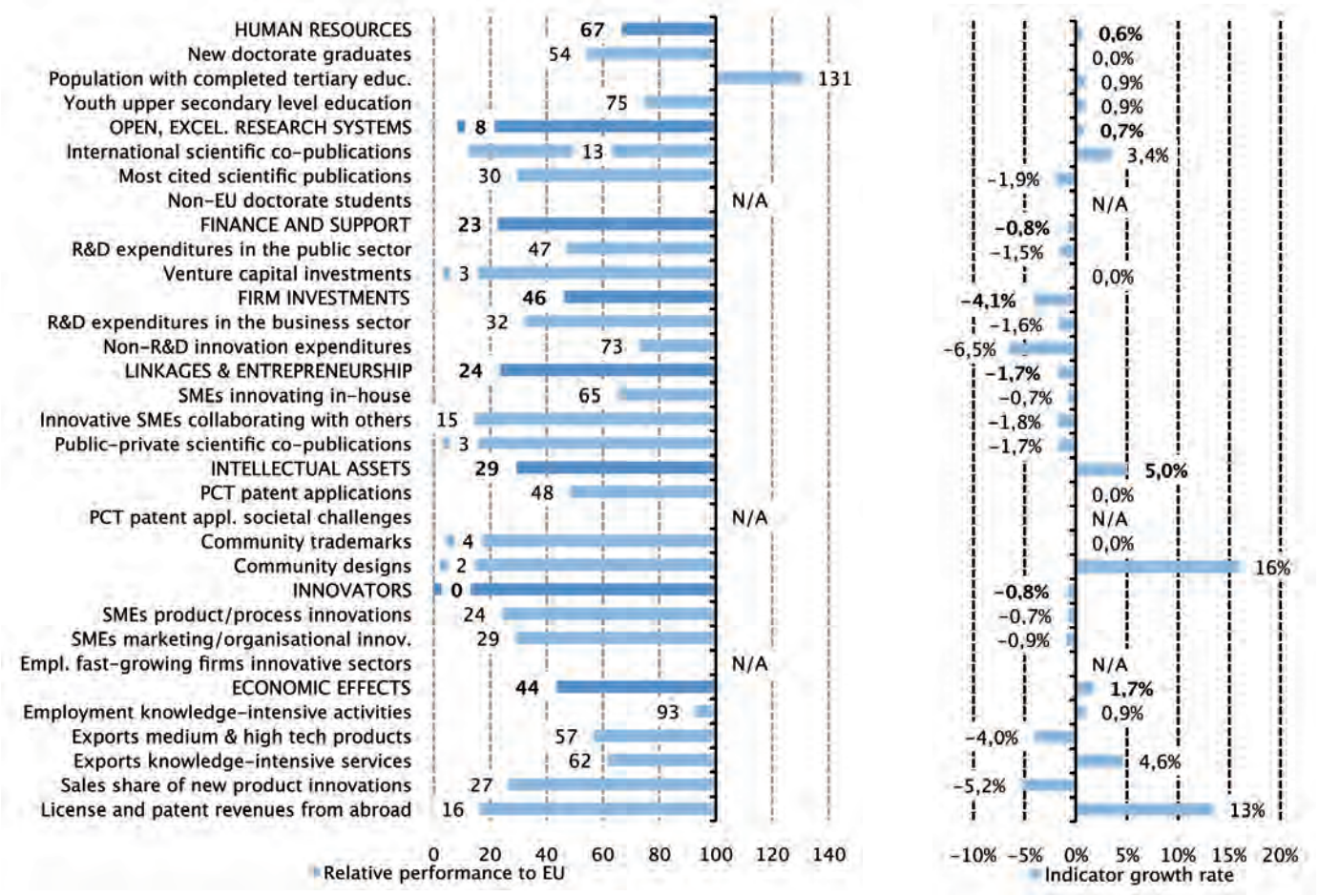
Ukraine

Ukraine is a **Modest Innovator**. Innovation performance has declined somewhat over time. Performance relative to the EU has decreased from 38% in 2008 to just above 34% in 2015.



Ukraine is performing well below the average of the EU for all dimensions and on almost all indicators. The only strong relative performance is for Population with completed tertiary education. The most significant relative weaknesses at the indicator level are in Public-private scientific co-publications, Community designs, Community trademarks, and Venture capital investments.

For four dimensions, performance has improved, especially for *Intellectual assets* (5.0%). The strongest growth is for Community designs (16%) and License and patent revenues from abroad (13%), and the largest declines are for Non-R&D innovation expenditures (-6.5%) and Sales share of new product innovations (-5.2%).



Note: Performance relative to the EU where the EU = 100. No data for Non-EU doctorate students, PCT patent applications in societal challenges and Employment in fast-growing firms of innovative sectors. Data have been partly made available by the National Academy of Sciences of Ukraine.

8. European Innovation Scoreboard methodology

Full details on the EIS methodology, including the impact on the results of the changes to the indicators as discussed in the Introduction, are available in the EIS 2016 Methodology report: http://ec.europa.eu/DocsRoom/documents/17189.

8.1 How to calculate composite indicators

The overall innovation performance of each country has been summarized in a composite indicator (the Summary Innovation Index). The methodology used for calculating this composite innovation indicator will be explained in detail.

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. Thus for the EIS 2016, the reference year will be 2014 or 2015 for most indicators (cf. Table 1).

Step 3: Imputing for missing values

Reference year data are then used for "2015", etc. If data for a year-in-between is not available, we substitute with the value for the previous year. If data are not available at the beginning of the time series, we replace missing values 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) (Table 7).

Step 4: Determining Maximum and Minimum scores

The Maximum score is the highest score found for the whole time period within all countries excluding positive outliers. Similarly, the Minimum score is the lowest score found for the whole time 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 performance levels). For the following indicators, data have been transformed using a square root transformation: Venture capital investments, Public-private co-publications, PCT patent applications, PCT patent applications in societal challenges, Community trademarks, and License and patent revenues from abroad. 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 (1/25 if data are available for all 25 indicators).

Table 7: Examples of imputing missing data

LATEST YEAR MISSING	"2015"	"2014"	"2013"	"2012"	"2011"
Available data	**N/A**	45	40	35	30
Use most recent year	**45**	45	40	35	30
YEAR-IN-BETWEEN MISSING	**"2015"**	**"2014"**	**"2013"**	**"2012"**	**"2011"**
Available data	50	**N/A**	40	35	30
Substitute with previous year	50	**40**	40	35	30
BEGINNING-OF-PERIOD MISSING	**"2015"**	**"2014"**	**"2013"**	**"2012"**	**"2011"**
Available data	50	45	40	35	**N/A**
Substitute with next available year	50	45	40	35	**35**

8.2 How to calculate growth rates

Average annual growth rates - usually referred to as compound average growth rates - of the Summary Innovation Index, the innovation dimensions and the individual indicators are calculated using the following formula where the number of years equals 7 (i.e. the number of yearly changes between 2008 and 2015):

$$\text{Growth rate} = \left(\frac{\text{Value end of period}}{\text{Value beginning of period}}\right)^{\left(\frac{1}{\text{number of years}}\right)} - 1$$

8.3 International benchmarking

The methodology for calculating average innovation performance for the EU and its major global competitors is similar to that used for calculating average innovation performance for the EU Member States:

1. Calculate normalised scores for all indicators as follows: Yi = ((Xi - smallest X for all countries) / (largest X for all countries – smallest X for all countries)) such that all normalised scores are between 0 and 1
2. Calculate the arithmetic average over these index scores (CIi)
3. Calculate performance relative to that of the EU: CIi* = 100*CIi/CIEU

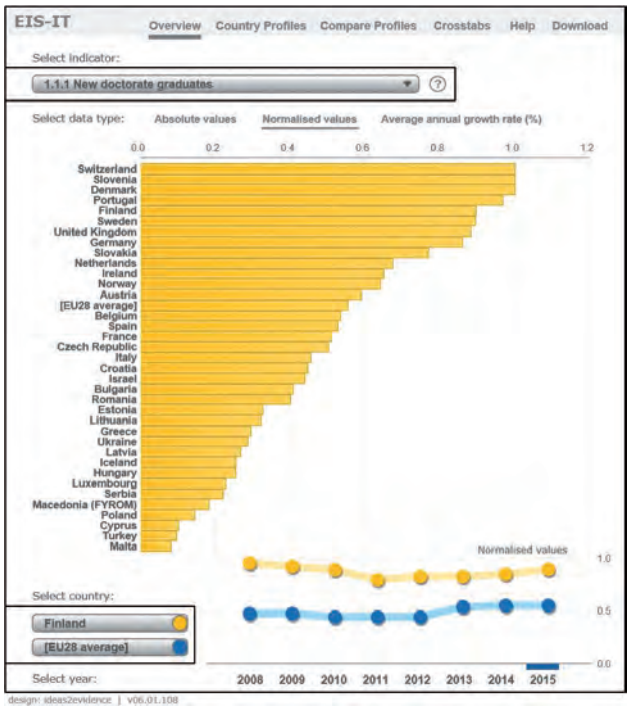
Note that the results for country i depend on the data from the other countries, as the smallest and largest scores used in the normalisation procedure are calculated over all countries.

8.4 Interactive Tool

The EIS 2016 is accompanied by an Interactive Tool which allows for customized comparisons of the performance scores discussed in the report. The tool contains four modules or screens, with metadata on indicators, definitions of innovation performance groups, etc. The EIS Interactive Tool is available at: http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm.

The **OVERVIEW** module provides a comparison of countries' performance on each of the innovation dimensions and indicators over an eight-year time period. Users can select one indicator or dimension at a time, and visualise on a bar chart the performance of all countries as well as the EU28 average for a particular year and type of data (absolute indicator values, normalised values, average annual growth). In addition, a trend line chart allows for a direct comparison of performance over time of any pair of European countries. An example is shown in Figure 37.

Figure 37: Example of Overview module



Overview (normalised values)

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	Former Yugoslav Republic of Macedonia
CN	China	MT	Malta
CY	Cyprus	NL	Netherlands
CZ	Czech Republic	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 only on the EIS website: http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm.

Annex C: Current performance

	EU28	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT
ENABLERS																			
Human resources																			
1.1.1 New doctorate graduates	1.8	1.8	1.4	1.7	3.2	2.8	1.1	2.1	1.0	1.8	1.7	1.5	1.5	0.4	0.9	1.1	0.8	0.9	0.4
1.1.2 Population completed tertiary education	38.5	43.1	32.0	29.5	46.7	31.8	45.2	52.3	39.4	41.1	44.9	31.7	24.9	54.2	41.0	56.4	50.5	34.9	27.0
1.1.3 Youth with upper secondary level education	82.6	84.3	85.2	90.7	73.4	77.4	82.6	92.8	89.5	67.9	87.3	95.5	80.0	94.2	86.2	91.3	68.6	84.3	77.4
Open, excellent and attractive research systems																			
1.2.1 International scientific co-publications	459	1352	173	661	2067	729	908	1080	549	645	651	410	552	999	221	355	1599	414	517
1.2.2 Scientific publications among top 10% most cited	10.5	12.9	3.5	7.3	13.3	11.5	7.3	11.7	9.0	9.2	11.3	4.5	10.1	9.5	6.3	4.5	11.7	6.5	7.9
1.2.3 Non-EU doctorate students	17.8	25.0	3.0	5.2	15.2	7.4	4.4	14.3	n/a	12.0	33.6	3.0	10.1	2.2	2.9	1.4	23.5	3.8	2.1
Finance and support																			
1.3.1 R&D expenditure in the public sector	0.72	0.70	0.27	0.87	1.08	0.91	0.80	0.40	0.54	0.58	0.76	0.41	0.54	0.32	0.45	0.72	0.59	0.38	0.33
1.3.2 Venture capital investments	0.063	0.072	0.015	0.013	0.059	0.049	0.136	0.086	0.001	0.043	0.083	0.054	0.022	0.071	0.098	0.081	0.047	0.055	0.000
FIRM ACTIVITIES																			
Firm investments																			
2.1.1 R&D expenditure in the business sector	1.30	1.76	0.52	1.12	1.95	1.95	0.63	1.11	0.28	0.65	1.46	0.38	0.72	0.08	0.25	0.30	0.66	0.98	0.50
2.1.2 Non-R&D innovation expenditure	0.69	0.60	0.49	0.73	0.37	1.35	1.55	0.39	0.87	0.31	0.37	0.95	0.57	0.58	1.38	1.10	0.14	0.70	1.20
Linkages & entrepreneurship																			
2.2.1 SMEs innovating in-house	28.7	37.4	11.6	27.3	30.4	38.6	27.4	38.8	26.6	15.5	28.8	19.3	36.6	27.9	13.8	13.8	37.2	10.6	29.0
2.2.2 Innovative SMEs collaborating with others	10.3	22.9	2.3	11.6	17.3	11.5	15.8	12.0	12.4	6.0	11.5	7.5	4.8	15.3	4.5	7.5	8.9	5.6	5.1
2.2.3 Public-private co-publications	33.9	68.5	2.1	13.8	143.5	53.0	6.8	34.3	9.9	16.3	39.6	10.6	18.0	7.0	0.5	1.7	40.0	23.2	2.4
Intellectual Assets																			
2.3.1 PCT patent applications	3.53	3.17	0.48	0.91	6.24	6.26	1.00	2.40	0.55	1.48	3.77	0.54	1.96	0.63	0.82	0.60	1.39	1.19	0.62
2.3.2 PCT patent applications in societal challenges	1.01	0.77	0.08	0.24	2.05	1.47	0.20	0.65	0.13	0.47	0.92	0.20	0.47	0.06	0.28	0.12	0.68	0.29	0.28
2.3.3 Community trademarks	6.09	5.87	7.07	3.83	8.35	6.88	11.56	6.03	3.66	7.81	3.92	1.87	5.96	25.84	4.46	3.99	29.88	2.94	38.63
2.3.4 Community designs	4.44	2.90	9.87	3.10	8.03	6.52	3.08	1.59	0.98	2.97	3.06	0.90	5.93	1.98	2.26	1.29	15.36	0.87	24.94
OUTPUTS																			
Innovators																			
3.1.1 SMEs introducing product or process innovations	30.6	42.3	13.6	30.9	33.9	42.4	33.0	35.7	29.6	18.4	32.4	21.6	38.8	29.2	15.7	16.1	43.1	12.8	32.0
3.1.2 SMEs introducing marketing/organisational innovations	36.2	36.7	17.6	30.2	40.4	46.2	31.2	49.6	45.0	22.6	41.2	30.4	44.7	35.6	23.1	25.2	52.1	25.3	43.3
3.1.3 Employment fast-growing firms innovative sectors	18.8	16.9	16.5	18.4	20.1	21.0	16.0	23.4	15.2	16.2	21.7	11.6	16.3	23.5	12.3	11.6	17.7	19.2	20.0
Economic effects																			
3.2.1 Employment in knowledge-intensive activities	13.9	15.4	9.4	12.7	15.4	14.6	11.4	20.2	12.2	12.3	14.0	10.7	13.6	17.2	10.9	8.8	27.5	12.3	17.9
3.2.2 Medium & high-tech product exports	56.1	48.5	31.2	64.0	47.7	67.4	42.6	52.1	22.7	47.7	58.5	37.9	52.3	43.0	32.1	34.4	52.1	69.5	56.7
3.2.3 Knowledge-intensive services exports	63.1	64.6	27.1	41.1	75.1	69.6	43.9	88.5	51.8	42.2	58.6	17.8	48.5	69.0	49.8	18.3	88.4	38.3	25.9
3.2.4 Sales of new to market and new to firm innovations	12.4	11.2	4.2	13.4	22.1	13.0	7.8	9.3	11.8	14.3	13.5	10.0	11.0	11.4	5.0	5.5	7.9	9.7	10.2
3.2.5 License and patent revenues from abroad	0.54	0.63	0.06	0.24	0.71	0.36	0.04	2.53	0.05	0.10	0.50	0.04	0.16	0.01	0.02	0.05	1.66	1.51	3.10

	EU28	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK	IS	IL	MK	NO	RS	CH	TR	UA
ENABLERS																			
Human resources																			
1.1.1 New doctorate graduates	1.8	2.2	2.0	0.6	3.1	1.4	3.9	2.5	2.9	2.9	2.9	0.9	1.5	0.7	2.1	0.8	3.5	0.4	1.0
1.1.2 Population completed tertiary education	38.5	46.4	39.1	43.2	31.3	25.5	42.6	27.9	45.3	50.0	47.7	47.5	51.0	28.5	51.6	24.7	51.5	23.0	50.3
1.1.3 Youth with upper secondary level education	82.6	79.8	88.7	90.9	75.9	79.9	90.1	91.2	86.6	87.7	85.4	61.4	91.4	87.1	79.1	83.4	86.0	53.7	61.7
Open, excellent and attractive research systems																			
1.2.1 International scientific co-publications	459	1450	1226	251	795	173	1069	383	1486	1774	1059	2498	872	130	1592	308	2557	82	58
1.2.2 Scientific publications among top 10% most cited	10.5	14.5	11.7	5.0	9.0	4.7	7.4	5.5	10.9	11.7	14.2	9.8	10.0	n/a	11.3	4.5	15.7	4.8	3.1
1.2.3 Non-EU doctorate students	17.8	19.3	9.3	1.3	13.9	2.1	5.7	1.8	12.8	24.5	30.0	19.8	n/a	3.9	33.5	7.1	52.1	5.0	n/a
Finance and support																			
1.3.1 R&D expenditure in the public sector	0.72	0.87	0.86	0.50	0.66	0.22	0.54	0.56	1.00	1.04	0.57	0.78	0.59	0.19	0.79	0.54	0.86	0.48	0.34
1.3.2 Venture capital investments	0.063	0.096	0.051	0.029	0.069	0.013	0.007	0.008	0.107	0.081	0.103	n/a	0.009	0.000	0.077	0.000	0.067	n/a	0.002
FIRM ACTIVITIES																			
Firm investments																			
2.1.1 R&D expenditure in the business sector	1.30	1.11	2.11	0.44	0.59	0.16	1.85	0.33	2.15	2.12	1.09	1.07	3.47	0.03	0.92	0.23	2.05	0.48	0.42
2.1.2 Non-R&D innovation expenditure	0.69	0.18	0.46	1.04	0.60	0.30	0.48	0.79	0.37	0.79	0.30	n/a	n/a	0.90	0.24	2.82	2.01	2.59	0.50
Linkages & entrepreneurship																			
2.2.1 SMEs innovating in-house	28.7	38.9	31.8	10.1	33.8	4.7	25.8	15.0	36.5	34.4	17.6	n/a	21.6	11.3	20.3	25.2	45.2	22.5	18.7
2.2.2 Innovative SMEs collaborating with others	10.3	14.5	15.3	3.9	6.8	1.2	14.6	6.7	14.3	12.7	22.4	17.5	12.9	9.6	7.9	7.6	9.4	4.2	1.5
2.2.3 Public-private co-publications	33.9	85.6	59.0	3.7	7.1	2.6	66.0	8.1	69.9	107.8	50.2	187.3	24.2	0.5	50.9	6.2	217.6	1.4	1.0
Intellectual Assets																			
2.3.1 PCT patent applications	3.53	5.57	5.06	0.51	0.66	0.17	2.73	0.65	8.17	7.99	3.30	2.97	11.15	0.03	2.56	n/a	6.70	0.66	1.70
2.3.2 PCT patent applications in societal challenges	1.01	1.68	1.07	0.17	0.23	0.04	0.59	0.09	1.61	1.88	0.80	1.76	4.53	0.00	0.56	n/a	1.94	0.19	n/a
2.3.3 Community trademarks	6.09	6.97	9.51	4.71	5.83	2.02	6.82	2.99	7.22	8.26	6.21	12.52	2.34	0.54	1.47	0.67	11.10	0.61	0.27
2.3.4 Community designs	4.44	3.41	7.44	6.02	4.38	0.59	3.37	1.51	5.44	4.92	3.13	0.42	1.74	0.00	0.35	0.01	6.55	0.26	0.10
OUTPUTS																			
Innovators																			
3.1.1 SMEs introducing product or process innovations	30.6	40.9	35.7	13.1	38.3	5.2	28.7	17.7	40.1	39.9	27.8	54.2	22.2	39.2	22.5	28.6	32.6	24.0	7.4
3.1.2 SMEs introducing marketing/organisational innovations	36.2	35.2	44.7	14.2	42.8	18.1	35.9	26.2	37.0	38.2	39.1	46.0	44.9	30.8	32.4	40.6	n/a	43.2	10.5
3.1.3 Employment fast-growing firms innovative sectors	18.8	16.9	19.4	18.2	14.8	16.9	16.0	20.9	18.4	19.6	18.7	16.7	19.3	n/a	17.5	n/a	19.6	14.0	n/a
Economic effects																			
3.2.1 Employment in knowledge-intensive activities	13.9	17.3	14.7	9.9	10.3	6.9	14.0	9.9	15.8	17.9	18.0	18.2	26.9	6.3	16.3	14.4	21.4	5.7	12.9
3.2.2 Medium & high-tech product exports	56.1	48.0	57.4	49.6	36.7	52.8	56.0	66.6	44.6	54.7	54.8	11.5	51.5	52.2	13.6	40.0	49.9	36.6	31.8
3.2.3 Knowledge-intensive services exports	63.1	65.3	43.2	36.7	43.2	44.7	32.9	35.3	50.6	65.0	77.9	62.9	68.3	n/a	75.8	n/a	50.4	27.7	38.9
3.2.4 Sales of new to market and new to firm innovations	12.4	11.8	9.8	6.3	12.4	3.7	10.5	19.6	11.1	6.1	14.1	6.1	11.9	9.9	5.2	12.4	16.1	33.6	3.3
3.2.5 License and patent revenues from abroad	0.54	2.24	0.25	0.06	0.04	0.07	0.14	0.03	1.38	1.59	0.60	0.59	0.42	0.08	0.08	0.10	3.08	n/a	0.09

Annex D: Growth performance

	EU28	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT
ENABLERS																			
Human resources																			
1.1.1 New doctorate graduates	2.0%	4.6%	12.6%	3.7%	12.7%	1.6%	5.0%	6.3%	-4.4%	10.0%	3.9%	9.4%	2.3%	22.6%	9.4%	3.0%	0.2%	3.6%	8.5%
1.1.2 Population completed tertiary education	3.0%	0.1%	2.4%	3.2%	2.5%	2.0%	4.0%	1.0%	6.3%	-0.1%	1.3%	-0.2%	3.8%	0.5%	6.5%	5.1%	1.2%	6.3%	3.7%
1.1.3 Youth with upper secondary level education	0.7%	0.4%	-0.2%	-0.1%	0.9%	0.6%	0.1%	0.0%	1.2%	1.7%	0.1%	0.1%	0.6%	1.1%	1.1%	0.4%	0.0%	0.1%	2.0%
Open, excellent and attractive research systems																			
1.2.1 International scientific co-publications	6.5%	6.9%	1.3%	9.0%	9.5%	6.3%	11.8%	7.3%	6.9%	8.7%	4.9%	10.5%	6.9%	13.5%	9.3%	10.2%	15.4%	5.6%	20.3%
1.2.2 Scientific publications among top 10% most cited	0.5%	1.6%	-8.4%	1.4%	-0.7%	0.8%	0.2%	1.5%	1.5%	0.4%	1.4%	-1.8%	1.8%	3.7%	3.8%	0.6%	10.8%	-2.2%	-3.4%
1.2.3 Non-EU doctorate students	1.7%	4.7%	-4.0%	7.7%	1.0%	-5.8%	13.5%	0.0%	n/a	-4.7%	1.1%	4.5%	13.9%	6.1%	39.8%	70.0%	2.1%	4.6%	6.3%
Finance and support																			
1.3.1 R&D expenditure in the public sector	1.9%	3.8%	-1.5%	7.1%	5.5%	3.2%	5.8%	-1.0%	3.3%	0.8%	-0.2%	-1.9%	1.1%	1.9%	2.8%	3.1%	5.0%	-2.7%	8.2%
1.3.2 Venture capital investments	-5.9%	-10.7%	-22.5%	-30.4%	-9.0%	-3.3%	18.1%	-8.8%	-28.3%	-11.5%	-2.2%	16.2%	-9.5%	-2.6%	8.0%	41.4%	-28.2%	5.3%	-19.2%
FIRM ACTIVITIES																			
Firm investments																			
2.1.1 R&D expenditure in the business sector	2.0%	4.7%	20.6%	5.5%	1.5%	1.9%	3.4%	4.6%	2.9%	-1.5%	2.0%	2.5%	2.9%	-1.7%	4.8%	3.9%	-9.7%	10.4%	4.8%
2.1.2 Non-R&D innovation expenditure	1.9%	2.0%	-6.8%	-2.7%	-4.4%	6.3%	-10.4%	-12.1%	2.5%	-7.9%	-3.1%	1.5%	-1.0%	-17.0%	2.0%	8.0%	-23.3%	-0.5%	1.3%
Linkages & entrepreneurship																			
2.2.1 SMEs innovating in-house	-0.8%	-1.3%	-3.7%	-0.3%	0.0%	-2.6%	-4.2%	0.0%	-2.9%	-6.4%	-0.6%	-3.3%	1.0%	-4.1%	-0.6%	-3.5%	-0.1%	-2.5%	4.3%
2.2.2 Innovative SMEs collaborating with others	2.5%	4.7%	-6.9%	-0.1%	2.1%	3.7%	-1.9%	0.4%	-1.0%	2.6%	-2.3%	-3.6%	1.7%	-7.4%	-3.0%	-4.4%	-7.3%	-2.1%	-1.6%
2.2.3 Public-private co-publications	-0.1%	-0.1%	-4.2%	-7.0%	2.3%	1.4%	-15.6%	3.9%	-3.4%	-0.2%	1.2%	-9.4%	-2.6%	1.2%	-13.5%	-14.2%	0.3%	1.3%	-9.9%
Intellectual Assets																			
2.3.1 PCT patent applications	-1.7%	-2.0%	-0.1%	2.7%	-1.9%	-2.7%	-5.9%	0.4%	5.9%	2.5%	-0.4%	-9.3%	-1.6%	2.3%	-0.2%	9.0%	-3.2%	-1.5%	1.2%
2.3.2 PCT patent applications in societal challenges	-0.3%	0.8%	-6.3%	3.7%	-6.0%	-1.4%	15.3%	-1.0%	-2.4%	2.4%	0.6%	-14.3%	-0.4%	-26.0%	-6.2%	4.1%	19.4%	-7.2%	-1.3%
2.3.3 Community trademarks	3.6%	4.8%	12.3%	8.9%	3.5%	1.2%	15.4%	3.0%	11.8%	4.1%	2.1%	28.9%	4.1%	14.7%	11.7%	11.4%	3.0%	8.1%	20.0%
2.3.4 Community designs	-0.6%	-3.3%	31.5%	0.6%	-1.3%	-2.5%	13.7%	-5.1%	14.4%	-3.1%	-2.8%	13.5%	-1.6%	13.5%	6.0%	14.5%	2.0%	-4.3%	48.5%
OUTPUTS																			
Innovators																			
3.1.1 SMEs introducing product or process innovations	-1.7%	-1.0%	-3.8%	-0.5%	-0.7%	-3.1%	-4.6%	-2.9%	-3.2%	-6.5%	0.1%	-3.8%	2.3%	-3.6%	1.2%	-2.9%	-0.5%	-3.8%	3.1%
3.1.2 SMEs introducing marketing/organisational innovations	-3.3%	-2.6%	1.6%	-2.6%	-1.6%	-5.4%	-6.1%	2.8%	-1.8%	-4.1%	1.0%	-3.2%	1.4%	-5.0%	7.5%	-1.7%	-2.1%	-0.6%	4.5%
3.1.3 Employment fast-growing firms innovative sectors	1.2%	-0.4%	1.5%	1.6%	-0.4%	1.8%	1.5%	1.2%	0.2%	-0.4%	1.4%	0.0%	-0.6%	3.4%	-1.7%	-2.3%	-5.9%	0.8%	2.4%
Economic effects																			
3.2.1 Employment in knowledge-intensive activities	0.7%	0.5%	1.8%	1.8%	0.6%	-0.3%	2.6%	0.8%	1.5%	1.0%	0.5%	2.0%	0.0%	2.8%	4.3%	2.3%	1.4%	-0.6%	2.0%
3.2.2 Medium & high-tech product exports	0.4%	-0.1%	3.6%	0.3%	2.3%	0.6%	2.0%	0.3%	-2.2%	-0.4%	0.3%	-2.4%	0.2%	1.8%	0.2%	-0.2%	-0.1%	-0.1%	-1.3%
3.2.3 Knowledge-intensive services exports	0.1%	0.2%	3.2%	1.6%	0.0%	-0.6%	-1.1%	-0.1%	-2.3%	0.5%	0.5%	-2.2%	0.3%	0.0%	-1.1%	0.5%	0.0%	0.0%	0.1%
3.2.4 Sales of new to market and new to firm innovations	-0.8%	2.8%	-12.0%	-1.3%	11.2%	-5.5%	-7.7%	-4.2%	-10.5%	-1.4%	0.2%	-3.7%	2.8%	-1.1%	5.9%	-11.1%	-6.2%	-4.1%	-11.4%
3.2.5 License and patent revenues from abroad	11.3%	8.5%	11.2%	15.3%	3.4%	31.9%	-1.2%	28.6%	15.5%	13.5%	6.1%	-6.3%	19.3%	-42.3%	-11.8%	96.1%	8.7%	0.7%	-0.1%

	EU28	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK	IS	IL	MK	NO	RS	CH	TR	UA
ENABLERS																			
Human resources																			
1.1.1 New doctorate graduates	2.0%	5.7%	0.4%	-8.1%	-2.7%	6.0%	16.0%	7.7%	-0.9%	-2.2%	3.9%	24.0%	1.5%	12.2%	4.0%	13.8%	-0.2%	4.2%	0.0%
1.1.2 Population completed tertiary education	3.0%	2.1%	-0.3%	5.5%	2.3%	6.9%	4.7%	8.5%	-0.1%	2.5%	2.7%	3.1%	0.0%	12.6%	-0.1%	5.4%	0.7%	8.5%	0.9%
1.1.3 Youth with upper secondary level education	0.7%	0.7%	-0.1%	-0.1%	2.3%	0.3%	0.0%	-0.2%	0.1%	0.2%	1.2%	0.0%	0.5%	1.3%	0.2%	0.0%	0.6%	0.3%	0.9%
Open, excellent and attractive research systems																			
1.2.1 International scientific co-publications	6.5%	7.9%	7.1%	6.8%	11.0%	8.9%	7.8%	4.7%	7.6%	7.2%	6.9%	8.6%	3.5%	11.3%	7.6%	12.4%	6.4%	8.9%	3.4%
1.2.2 Scientific publications among top 10% most cited	0.5%	1.0%	2.3%	1.8%	2.4%	-0.1%	-0.4%	0.3%	1.1%	1.2%	1.0%	1.4%	0.5%	n/a	0.5%	-0.8%	1.0%	-1.1%	-1.9%
1.2.3 Non-EU doctorate students	1.7%	-1.1%	2.5%	-7.5%	8.6%	0.7%	7.8%	16.3%	17.2%	7.6%	-0.3%	4.6%	n/a	2.3%	5.2%	-2.5%	2.1%	1.6%	n/a
Finance and support																			
1.3.1 R&D expenditure in the public sector	1.9%	1.2%	2.8%	3.6%	-0.8%	-4.8%	-2.4%	11.0%	1.5%	2.6%	-0.5%	0.0%	-1.2%	5.1%	0.9%	-4.4%	3.4%	1.6%	-1.5%
1.3.2 Venture capital investments	-5.9%	-3.1%	3.0%	-0.7%	-0.2%	-23.2%	1.8%	6.9%	-5.5%	-10.4%	-6.7%	n/a	3.9%	0.0%	-4.7%	-3.8%	-3.5%	n/a	0.0%
FIRM ACTIVITIES																			
Firm investments																			
2.1.1 R&D expenditure in the business sector	2.0%	3.0%	3.0%	14.6%	0.2%	-1.7%	0.5%	9.0%	-1.7%	-1.6%	0.4%	0.1%	-0.9%	-2.0%	1.7%	9.7%	0.3%	6.9%	-1.6%
2.1.2 Non-R&D innovation expenditure	1.9%	-6.5%	-0.4%	1.2%	-6.4%	-16.9%	-11.5%	-8.8%	-5.8%	2.7%	0.0%	n/a	n/a	0.0%	12.6%	19.7%	8.2%	42.6%	-6.5%
Linkages & entrepreneurship																			
2.2.1 SMEs innovating in-house	-0.8%	5.2%	-3.6%	-7.3%	-0.1%	-17.5%	0.0%	-2.5%	-1.6%	-1.0%	0.0%	n/a	-4.0%	0.0%	-3.4%	-1.4%	7.0%	-3.1%	-0.7%
2.2.2 Innovative SMEs collaborating with others	2.5%	2.1%	-2.4%	-11.9%	0.2%	-11.8%	-0.5%	-1.0%	-8.9%	-3.7%	11.1%	0.0%	-3.9%	0.0%	-2.9%	11.7%	0.0%	-3.1%	-1.8%
2.2.3 Public-private co-publications	-0.1%	-0.1%	2.3%	2.9%	-2.7%	-9.2%	1.8%	-4.0%	-3.8%	-0.6%	-0.9%	1.0%	-5.5%	0.0%	-4.2%	1.4%	2.5%	-3.6%	-1.7%
Intellectual Assets																			
2.3.1 PCT patent applications	-1.7%	-2.3%	-0.3%	8.0%	3.5%	-4.4%	1.7%	2.7%	-4.3%	-3.4%	-1.2%	-4.5%	-2.5%	-23.1%	-3.0%	n/a	-2.7%	5.8%	0.0%
2.3.2 PCT patent applications in societal challenges	-0.3%	5.9%	1.2%	11.2%	6.7%	-6.8%	-3.2%	3.8%	3.7%	-4.2%	-2.4%	-0.6%	-1.3%	7.1%	-3.0%	n/a	-4.0%	22.4%	n/a
2.3.3 Community trademarks	3.6%	3.6%	3.6%	8.2%	0.6%	6.7%	8.8%	11.7%	6.8%	5.6%	3.9%	1.8%	3.4%	20.3%	4.0%	5.2%	1.7%	19.1%	0.0%
2.3.4 Community designs	-0.6%	-2.6%	-0.8%	8.4%	3.7%	14.3%	5.9%	3.5%	3.6%	-0.5%	2.7%	-12.7%	8.6%	0.0%	-14.8%	-11.0%	-3.9%	-7.0%	15.9%
OUTPUTS																			
Innovators																			
3.1.1 SMEs introducing product or process innovations	-1.7%	3.1%	-4.1%	-6.2%	-0.2%	-17.2%	-1.4%	-2.7%	-1.5%	-0.3%	1.5%	0.0%	-4.7%	0.0%	-4.0%	6.6%	-7.7%	-2.9%	-0.7%
3.1.2 SMEs introducing marketing/organisational innovations	-3.3%	2.8%	-2.9%	-9.7%	-3.1%	-9.1%	-1.3%	-1.1%	-1.1%	0.6%	3.7%	0.0%	-5.4%	0.0%	0.7%	12.3%	n/a	-2.2%	-0.9%
3.1.3 Employment fast-growing firms innovative sectors	1.2%	-0.1%	2.8%	0.7%	0.6%	1.5%	0.7%	1.1%	-0.1%	-1.0%	1.6%	-0.4%	-2.1%	n/a	0.1%	n/a	-0.6%	0.1%	n/a
Economic effects																			
3.2.1 Employment in knowledge-intensive activities	0.7%	2.1%	0.8%	1.4%	2.3%	2.0%	2.0%	-0.1%	0.6%	1.1%	0.8%	0.1%	0.0%	-1.9%	2.0%	2.2%	1.0%	2.5%	0.9%
3.2.2 Medium & high-tech product exports	0.4%	1.8%	0.8%	-0.5%	-1.2%	2.4%	-0.2%	1.1%	-2.3%	-0.4%	0.5%	-10.2%	1.2%	21.6%	0.3%	5.4%	-3.0%	-1.5%	-4.0%
3.2.3 Knowledge-intensive services exports	0.1%	0.0%	0.0%	-1.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.6%	-0.3%	-0.6%	1.2%	n/a	0.1%	n/a	-0.3%	0.8%	4.6%
3.2.4 Sales of new to market and new to firm innovations	-0.8%	1.2%	-4.6%	-6.5%	-1.0%	-20.6%	-3.3%	2.3%	-4.8%	-5.6%	7.5%	-9.2%	1.4%	0.0%	1.1%	3.1%	-6.1%	24.0%	-5.2%
3.2.5 License and patent revenues from abroad	11.3%	4.6%	-1.2%	15.5%	-0.4%	17.1%	20.1%	-25.0%	15.6%	7.4%	-1.3%	-14.0%	-0.6%	6.4%	-10.5%	7.5%	6.7%	n/a	13.4%

Annex E: Definitions of indicators

INDICATOR	DEFINITION NUMERATOR	DEFINITION DENOMINATOR	INTERPRETATION
	Source	Source	
1.1.1 New doctorate graduates (ISCED 8) per 1000 population aged 25-34	Number of doctorate graduates (ISCED 8) Eurostat	Population between and including 25 and 34 years Eurostat	The indicator is a measure of the supply of new second-stage tertiary graduates in all fields of training. For most countries ISCED 8 captures PhD graduates.
1.1.2 Percentage population aged 30-34 having completed tertiary education	Number of persons in age class with some form of post-secondary education (ISCED 5-8) Eurostat	Population between and including 30 and 34 years Eurostat	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 narrow share of the population aged 30 to 34 and will more easily and quickly reflect changes in educational policies leading to more tertiary graduates.
1.1.3 Percentage youth aged 20-24 having attained at least upper secondary education	Number of young people aged 20-24 years having attained at least upper secondary education Eurostat	Population between and including 20 and 24 years Eurostat	The indicator measures the qualification level of the population aged 20-24 years in terms of formal educational degrees. It provides a measure for the "supply" of human capital of that age group and for the output of education systems in terms of graduates. Completed upper secondary education is generally considered to be the minimum level required for successful participation in a knowledge-based society.
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) Web of Science (data provided by CWTS as part of a contract to DG Research and Innovation)	Total population Eurostat	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 % of total scientific publications of the country	Number of scientific publications among the top-10% most cited publications worldwide Web of Science (data provided by CWTS as part of a contract to DG Research and Innovation)	Total number of scientific publications Web of Science (data provided by CWTS as part of a contract to DG Research and Innovation)	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 Non-EU doctorate students as a % of all doctorate students	For EU Member States: number of doctorate students from non-EU countries (for non-EU countries: number of non-national doctorate students) Eurostat	Total number of doctorate students Eurostat	The share of non-EU doctorate students reflects the mobility of students as an effective way of diffusing knowledge. Attracting high-skilled foreign doctorate students will add to creating a net brain gain and will secure a continuous supply of researchers.
1.3.1 R&D expenditure in the public sector (% of GDP)	All R&D expenditures in the government sector (GOVERD) and the higher education sector (HERD) Eurostat	Gross Domestic Product Eurostat	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. Research and development spending is essential for making the transition to a knowledge-based economy as well as for improving production technologies and stimulating growth.
1.3.2 Venture capital (% of GDP)	Venture capital investment 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	Gross Domestic Product Eurostat	The amount of venture capital is a proxy for the relative dynamism of new business creation. In particular for enterprises using or developing new (risky) technologies venture capital is often the only available means of financing their (expanding) business. Comment: Three-year averages have been used

INDICATOR	DEFINITION NUMERATOR	DEFINITION DENOMINATOR	INTERPRETATION
	Source	Source	
2.1.1 R&D expenditure in the business sector (% of GDP)	All R&D expenditures in the business sector (BERD) Eurostat	Gross Domestic Product Eurostat	The indicator captures the formal creation of new knowledge within firms. It is particularly important in the science-based sector (pharmaceuticals, chemicals and some areas of electronics) where most new knowledge is created in or near R&D laboratories.
2.1.2 Non-R&D innovation expenditures (% of turnover)	Sum of total innovation expenditure for enterprises, in thousand Euros and current prices excluding intramural and extramural R&D expenditures Eurostat (Community Innovation Survey)	Total turnover for all enterprises Eurostat (Community Innovation Survey)	This indicator measures non-R&D innovation expenditure as percentage of total turnover. Several of the components of innovation expenditure, such as investment in equipment and machinery and the acquisition of patents and licenses, measure the diffusion of new production technology and ideas.
2.2.1 SMEs innovating in-house (% of SMEs)[46]	Sum of SMEs with in-house innovation activities. Innovative firms are defined as those firms which have introduced new products or processes either 1) in-house or 2) in combination with other firms. Eurostat (Community Innovation Survey)	Total number of SMEs Eurostat (Community Innovation Survey)	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.
2.2.2 Innovative SMEs collaborating with others (% of SMEs)	Sum of SMEs 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 SMEs Eurostat (Community Innovation Survey)	This indicator measures the degree to which SMEs are involved in innovation co-operation. Complex innovations, in particular in ICT, often depend on the ability to draw on diverse sources of information and knowledge, or to collaborate on 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.
2.2.3 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/countries in which the business companies or other private sector organisations are located. Web of Science (data provided by CWTS as part of a contract to DG Research and Innovation)	Total population Eurostat	This indicator captures public-private research linkages and active collaboration activities between business sector researchers and public sector researchers resulting in academic publications.
2.3.1 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 in Purchasing Power Standard € Eurostat	The capacity of firms to develop new products will determine their competitive advantage. One indicator of the rate of new product innovation is the number of patents. This indicator measures the number of PCT patent applications.
2.3.2 PCT patent applications in societal challenges per billion GDP (in PPS€)	Number of PCT patent applications in Environment-related technologies and Health. Patents in Environment-related technologies include those in Climate change mitigation technologies related to buildings, Climate change mitigation technologies related to energy generation, transmission or distribution, Capture, storage, sequestration or disposal of greenhouse gases, Environmental manage¬ment, Climate change mitigation technologies related to transportation and Water-related adaptation technologies. Patents in health-related technologies include those in Medical technology and Pharmaceuticals. OECD	Gross Domestic Product in in Purchasing Power Standard € Eurostat	This indicator measures PCT applications in health technology and environment-related technologies and is relevant as increased numbers of patent applications in health technology and environment-related technologies will be necessary to meet the societal needs of an ageing European society and sustainable growth.

[46] *The EIS 2016 Methodology report provides detailed instructions how to calculate this indicator using tabulated CIS data as available from Eurostat's Statistics Database. http://ec.europa.eu/DocsRoom/documents/17189.*

INDICATOR	DEFINITION NUMERATOR	DEFINITION DENOMINATOR	INTERPRETATION
	Source	Source	
2.3.3 Community trademarks per billion GDP (in PPS€)	Number of new community trademarks applications European Union Intellectual Property Office (EUIPO)	Gross Domestic Product in in Purchasing Power Standard € Eurostat	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 is a form of communication, a basis for publicity and advertising. Comment: two-year averages have been used
2.3.4 Community designs per billion GDP (in PPS€)	Number of new community designs European Union Intellectual Property Office (EUIPO)	Gross Domestic Product in in Purchasing Power Standard € Eurostat	A design is the outward appearance of a product or part of it resulting from the lines, contours, colours, shape, texture, materials and/or its ornamentation. A product can be any industrial or handicraft item including packaging, graphic symbols and typographic typefaces but excluding computer programs. It also includes products that are composed of multiple components, which may be disassembled and reassembled. Community design protection is directly enforceable in each Member State and it provides both the option of an unregistered and a registered Community design right for one area encompassing all Member States. Comment: two-year averages have been used
3.1.1 SMEs introducing product or process innovations (% of SMEs)	Number of SMEs who introduced a new product or a new process to one of their markets Eurostat (Community Innovation Survey)	Total number of SMEs Eurostat (Community Innovation Survey)	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 (% of SMEs)	Number of SMEs who introduced a new marketing innovation or organisational innovation to one of their markets Eurostat (Community Innovation Survey)	Total number of SMEs Eurostat (Community Innovation Survey)	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 that SMEs innovate through non-technological innovation.
3.1.3 Employment in fast-growing enterprises (average innovativeness scores) (% of total employment)	Employment in fast-growing enterprises in innovative sectors is calculated through sector-specific innovation coefficients, reflecting the level of innovativeness of each sector, serving as a proxy for distinguishing innovative enterprises. These coefficients are weighted with sectoral shares of employment in fast-growing enterprises, providing an indication of the dynamism of fast-growing firms in innovative sectors. Fast-growing enterprises are defined as firms with average annualised growth in number of employees of more than 10 % a year, over a three-year period, and with 10 or more employees at the beginning of the observation period (period of growth). [47] Eurostat	Total employment in high-growth enterprises in the business economy Eurostat	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.

INDICATOR	DEFINITION NUMERATOR	DEFINITION DENOMINATOR	INTERPRETATION
	Source	Source	
3.2.1 Employment in knowledge-intensive activities (% 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	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.
3.2.2 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. Medium-high and high tech exports include 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	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 the 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.
3.2.3 Knowledge-intensive services exports as % 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, SI, SJ and SK1. Eurostat	Total value of services exports (S) Eurostat	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.
3.2.4 Sales of new-to-market and new-to-firm innovations as % 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)	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).
3.2.5 License and patent revenues from abroad as % of GDP	Export part of the international transactions in royalties and license fees Eurostat	Gross Domestic Product Eurostat	Trade in technology comprises four main categories: Transfer of techniques (through patents and licences, disclosure of know-how); Transfer (sale, licensing, franchising) of designs, trademarks and patterns; Services with a technical content, including technical and engineering studies, as well as technical assistance; and Industrial R&D. License and patent revenues capture disembodied technology exports.

[47] *The economic sectors included are the three-digit NACE business economy sectors as identified by the national statistical office based on national business register data and based on the number of employees in these enterprises. More details are provided in section 3.4 of the Staff Working Document SWD(2013) 325 on "Developing an indicator of innovation output"* http://ec.europa.eu/research/press/2013/pdf/staff_working_document_indicator_of_innovation_output.pdf

Annex F: Summary Innovation Index (SII) time series

	2008	2009	2010	2011	2012	2013	2014	2015	GROWTH RATE
EU28	0.495	0.502	0.511	0.514	0.519	0.521	0.523	0.521	0.74%
BE	0.564	0.576	0.578	0.588	0.592	0.596	0.607	0.602	0.93%
BG	0.219	0.209	0.230	0.238	0.240	0.210	0.238	0.242	1.40%
CZ	0.413	0.412	0.422	0.440	0.442	0.421	0.433	0.434	0.71%
DK	0.624	0.630	0.639	0.678	0.694	0.693	0.675	0.700	1.67%
DE	0.624	0.636	0.654	0.655	0.667	0.661	0.655	0.632	0.16%
EE	0.416	0.441	0.469	0.468	0.505	0.490	0.479	0.448	1.06%
IE	0.584	0.596	0.617	0.619	0.627	0.601	0.607	0.609	0.58%
EL	0.370	0.364	0.368	0.371	0.375	0.386	0.399	0.364	-0.21%
ES	0.381	0.386	0.389	0.386	0.388	0.394	0.387	0.361	-0.76%
FR	0.539	0.550	0.560	0.562	0.566	0.560	0.556	0.568	0.76%
HR	0.299	0.293	0.291	0.302	0.304	0.298	0.292	0.280	-0.92%
IT	0.389	0.400	0.407	0.418	0.416	0.425	0.434	0.432	1.53%
CY	0.470	0.474	0.476	0.488	0.491	0.480	0.487	0.451	-0.57%
LV	0.214	0.217	0.224	0.234	0.247	0.215	0.233	0.281	3.99%
LT	0.239	0.238	0.252	0.256	0.268	0.275	0.288	0.282	2.39%
LU	0.632	0.646	0.632	0.619	0.623	0.646	0.626	0.598	-0.79%
HU	0.345	0.343	0.354	0.358	0.363	0.355	0.364	0.355	0.39%
MT	0.342	0.354	0.351	0.326	0.334	0.379	0.371	0.437	3.57%
NL	0.549	0.563	0.573	0.580	0.586	0.631	0.639	0.631	2.03%
AT	0.583	0.598	0.608	0.577	0.581	0.604	0.599	0.591	0.21%
PL	0.290	0.298	0.299	0.291	0.296	0.286	0.291	0.292	0.10%
PT	0.393	0.403	0.401	0.404	0.405	0.401	0.418	0.419	0.90%
RO	0.246	0.255	0.264	0.263	0.261	0.228	0.223	0.180	-4.38%
SI	0.446	0.453	0.464	0.479	0.491	0.476	0.498	0.485	1.18%
SK	0.318	0.329	0.338	0.325	0.313	0.346	0.354	0.350	1.39%
FI	0.663	0.668	0.671	0.651	0.651	0.642	0.658	0.649	-0.29%
SE	0.697	0.709	0.718	0.714	0.717	0.722	0.719	0.704	0.14%
UK	0.525	0.529	0.542	0.560	0.566	0.569	0.580	0.602	1.98%
IS	0.575	0.580	0.567	0.574	0.595	0.570	0.568	0.572	-0.08%
IL	0.615	0.626	0.620	0.623	0.627	0.630	0.620	0.581	-0.80%
MK	0.164	0.165	0.183	0.207	0.202	0.207	0.211	0.220	4.30%
NO	0.449	0.458	0.471	0.476	0.478	0.462	0.466	0.463	0.43%
RS	0.225	0.232	0.233	0.231	0.251	0.318	0.309	0.325	5.35%
CH	0.796	0.792	0.800	0.802	0.799	0.799	0.793	0.791	-0.08%
TR	0.188	0.189	0.191	0.199	0.202	0.199	0.205	0.267	5.14%
UA	0.189	0.186	0.189	0.186	0.179	0.189	0.182	0.178	-0.82%

Annex G: Performance scores per dimension

	HUMAN RESOURCES	RESEARCH SYSTEMS	FINANCE AND SUPPORT	FIRM INVESTMENTS	LINKAGES & ENTREPRENEURSHIP	INTELLECTUAL ASSETS	INNOVATORS	ECONOMIC EFFECTS
EU28	0.575	0.466	0.490	0.426	0.473	0.556	0.526	0.573
BE	0.622	0.768	0.502	0.492	0.814	0.487	0.565	0.561
BG	0.498	0.087	0.104	0.212	0.071	0.500	0.186	0.176
CZ	0.561	0.300	0.446	0.404	0.422	0.336	0.473	0.505
DK	0.703	0.765	0.654	0.459	0.767	0.789	0.624	0.709
DE	0.573	0.443	0.563	0.753	0.624	0.701	0.761	0.630
EE	0.554	0.340	0.727	0.555	0.456	0.426	0.422	0.323
IE	0.816	0.582	0.363	0.300	0.593	0.426	0.773	0.777
EL	0.562	0.408	0.224	0.281	0.412	0.243	0.471	0.322
ES	0.448	0.413	0.357	0.185	0.236	0.437	0.250	0.432
FR	0.657	0.678	0.566	0.363	0.505	0.488	0.663	0.578
HR	0.606	0.160	0.287	0.324	0.271	0.218	0.190	0.247
IT	0.407	0.398	0.279	0.277	0.418	0.505	0.577	0.456
CY	0.662	0.392	0.278	0.153	0.454	0.403	0.621	0.485
LV	0.534	0.168	0.424	0.426	0.105	0.326	0.113	0.255
LT	0.726	0.134	0.538	0.352	0.167	0.256	0.109	0.168
LU	0.431	0.771	0.372	0.136	0.544	0.720	0.704	0.742
HU	0.462	0.218	0.272	0.367	0.206	0.281	0.319	0.570
MT	0.274	0.258	0.100	0.423	0.276	0.645	0.624	0.602
NL	0.653	0.774	0.663	0.237	0.727	0.624	0.542	0.681
AT	0.650	0.561	0.538	0.517	0.629	0.707	0.647	0.475
PL	0.556	0.125	0.274	0.361	0.094	0.391	0.210	0.301
PT	0.591	0.453	0.471	0.260	0.378	0.385	0.513	0.332
RO	0.392	0.111	0.070	0.084	0.045	0.149	0.193	0.273
SI	0.829	0.386	0.241	0.472	0.576	0.484	0.420	0.424
SK	0.642	0.166	0.255	0.267	0.209	0.239	0.415	0.490
FI	0.783	0.625	0.765	0.500	0.676	0.716	0.595	0.561
SE	0.831	0.814	0.710	0.619	0.689	0.728	0.640	0.622
UK	0.786	0.795	0.506	0.270	0.591	0.502	0.519	0.681
IS	0.348	0.722	0.722	0.412	0.875	0.559	0.719	0.418
IL	0.722	0.538	0.275	1.000	0.422	0.621	0.534	0.643
MK	0.413	0.082	0.016	0.241	0.159	0.039	0.501	0.320
NO	0.678	0.857	0.566	0.217	0.395	0.309	0.394	0.359
RS	0.359	0.179	0.222	0.540	0.306	0.063	0.479	0.420
CH	0.862	1.000	0.582	0.899	0.783	0.782	0.613	0.749
TR	0.093	0.124	0.374	0.590	0.194	0.169	0.375	0.389
UA	0.384	0.039	0.111	0.197	0.112	0.163	0.000	0.251

Annex H: International data

	EU28	AU	BR	CA	CN	IN	JP	KR	RU	SA	US
Human resources											
1.1.1 New doctorate graduates	1.8	2.5	0.5	1.3	0.2	n/a	1.2	1.6	1.4	0.2	1.5
1.1.2 Population completed tertiary education (aged 25-64)	31.7	41.9	17.2	53.6	11.3	9.8	46.6	44.6	53.5	6.4	44.2
Open, excellent and attractive research systems											
1.2.1 International scientific co-publications	344.3	1413.5	72.0	989.7	58.3	11.0	186.7	331.4	85.8	131.4	473.1
1.2.2 Scientific publ. among top 10% most cited	10.5	12.2	4.9	11.8	8.2	6.3	6.5	6.2	3.3	7.0	14.0
Finance and support											
1.3.1 R&D expenditure in the public sector	0.72	0.86	0.63	0.80	0.46	0.53	0.75	0.87	0.48	0.41	0.72
Firm investments											
2.1.1 R&D expenditure in the business sector	1.22	1.19	0.52	1.76	1.58	0.29	2.79	3.36	0.71	0.32	1.94
Linkages & entrepreneurship											
2.2.3 Public-private co-publications	33.9	23.6	1.8	32.0	4.6	0.6	44.6	58.4	1.7	1.7	62.1
Intellectual Assets											
2.3.1 PCT patent applications	2.60	1.66	0.19	2.03	1.19	0.27	8.82	6.97	0.31	0.42	3.60
2.3.2 PCT patent applications in societal challenges	0.66	0.46	0.06	0.56	0.16	0.09	2.00	1.42	0.08	0.11	0.86
Economic effects											
3.2.2 Exports of medium & high tech products	59.7	8.7	23.0	33.9	54.6	26.3	72.9	71.0	10.1	32.6	49.7
3.2.3 Exports of knowledge-intensive services	56.1	35.6	64.7	46.4	39.9	77.8	32.0	45.1	42.1	n/a	46.7
3.2.5 License and patent revenues from abroad	0.585	0.061	0.016	0.223	0.009	0.032	0.800	0.365	0.036	0.033	0.748

PERFORMANCE LEAD (EU=100)	AU	BR	CA	CN	IN	JP	KR	RU	SA	US
Human resources										
1.1.1 New doctorate graduates	126.2	25.0	72.9	11.4	n/a	65.8	86.1	78.3	10.1	82.5
1.1.2 Population completed tertiary education (aged 25-64)	132.2	54.3	169.2	35.7	30.9	147.1	140.6	168.8	20.1	139.6
Open, excellent and attractive research systems										
1.2.1 International scientific co-publications	167.4	45.7	167.4	41.2	17.8	73.6	98.1	49.9	61.8	117.2
1.2.2 Scientific publ. among top 10% most cited	116.4	46.6	112.4	77.6	60.1	61.4	59.3	31.3	66.5	133.4
Finance and support										
1.3.1 R&D expenditure in the public sector	119.9	87.5	111.0	64.5	73.5	104.0	120.8	66.4	56.5	100.0
Firm investments										
2.1.1 R&D expenditure in the business sector	97.2	42.5	143.3	129.2	23.7	227.6	242.1	57.8	26.4	158.1
Linkages & entrepreneurship										
2.2.3 Public-private co-publications	69.7	5.3	94.4	13.7	1.8	131.8	172.4	4.9	5.0	183.2
Intellectual Assets										
2.3.1 PCT patent applications	79.9	27.3	88.2	67.7	32.1	168.7	163.6	34.4	40.0	117.7
2.3.2 PCT patent applications in societal challenges	69.4	8.5	85.5	24.1	14.2	260.8	216.0	11.5	17.3	131.2
Economic effects										
3.2.2 Exports of medium & high tech products	14.6	38.5	56.7	91.4	44.0	122.0	118.9	16.9	54.5	83.2
3.2.3 Exports of knowledge-intensive services	63.3	115.2	82.6	71.1	132.9	56.9	80.3	75.0	n/a	83.1
3.2.5 License and patent revenues from abroad	10.5	2.7	38.0	1.6	5.5	126.0	62.4	6.1	5.7	126.0

CHANGE IN PERFORMANCE LEAD	AU	BR	CA	CN	IN	JP	KR	RU	SA	US
Human resources										
1.1.1 New doctorate graduates	0.0%	-17%	1.0%	-2.9%	n/a	-0.3%	3.4%	-3.8%	1.4%	-1.8%
1.1.2 Population completed tertiary education (aged 25-64)	-0.3%	5.5%	-1.9%	4.5%	-3.4%	-1.6%	0.2%	-3.1%	-3.4%	-2.1%
Open, excellent and attractive research systems										
1.2.1 International scientific co-publications	-1.2%	1.2%	-1.0%	3.3%	1.2%	-1.7%	0.7%	-1.2%	1.8%	-0.4%
1.2.2 Scientific publ. among top 10% most cited	1.2%	-1.0%	0.0%	3.2%	-0.5%	-0.4%	0.0%	-0.4%	-1.0%	-0.8%
Finance and support										
1.3.1 R&D expenditure in the public sector	-0.8%	-0.5%	-2.5%	0.8%	-0.9%	-1.0%	1.8%	0.8%	-0.3%	0.0%
Firm investments										
2.1.1 R&D expenditure in the business sector	-2.8%	-1.5%	2.6%	4.7%	-2.2%	-1.4%	1.8%	-2.1%	-8.1%	-1.3%
Linkages & entrepreneurship										
2.2.3 Public-private co-publications	-4.6%	1.3%	-5.1%	17.8%	1.1%	-2.5%	2.2%	-2.2%	-4.8%	-0.7%
Intellectual Assets										
2.3.1 PCT patent applications	-1.8%	1.1%	0.3%	6.3%	0.3%	2.4%	3.8%	-0.1%	-3.4%	1.3%
2.3.2 PCT patent applications in societal challenges	-7.4%	5.0%	-3.5%	11.2%	-2.5%	4.3%	14.1%	-3.7%	-6.1%	-1.9%
Economic effects										
3.2.2 Exports of medium & high tech products	-6.0%	-4.5%	-2.0%	-0.2%	2.8%	-0.5%	-0.3%	0.0%	0.5%	-3.0%
3.2.3 Exports of knowledge-intensive services	-0.2%	2.6%	0.8%	5.4%	-0.2%	-1.9%	-3.4%	-0.5%	n/a	1.7%
3.2.5 License and patent revenues from abroad	-8.5%	-8.5%	-6.6%	-4.9%	8.7%	0.2%	7.4%	-0.4%	-0.4%	-3.1%

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