European Commission

ERA Scoreboard 2023

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Report

Research and Innovation

ERA Scoreboard 2023

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Manuscript completed in November 2023

PDF	ISBN 978-92-68-07544-9	doi:10.2777/674915	KI-04-23-857-EN-N

Luxembourg: Publications Office of the European Union, 2023

EUROPEAN COMMISSION

ERA Scoreboard 2023

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as part of 'Development of the ERA Scoreboard, the ERA Dashboard and the Regular Reports' project for the European Commission, Directorate-General for Research and Innovation under Framework Contract N° 2018/RTD/A2/OP/PP-07001-2018 Lot 2 (EDAR)

2023 Directorate-General for Research and Innovation EN

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1. Executive summary

The ERA (European Research Area) Scoreboard is one of the components of the new ERA Monitoring Mechanism, covering 18 indicators, including two general indicators measuring progress in the European Research & Innovation (R&I) system and 16 specific indicators, one for each Pact for R&I priority.

The ERA Scoreboard monitors progress towards the ERA objectives at Union level. Of the 18 indicators included in the measurement framework, currently data are available for 15 indicators, for two indicators the construction of the data using the Horizon Dashboard and the Cordis Datalab are being explored, and for one indicator data are not available.

The careful selection of indicators - based on data availability - and the calculation and presentation of the data is key to derive any solid policy conclusions and to monitor progress on the overall ERA objectives in a credible manner.

For each of the indicators, a trend performance at EU level has been evaluated for three time periods, from 2010 to present, from 2015 to present, and for the last three years. Based on the number of times the trend was positive in each of these periods, an indicator is considered to have shown substantial positive change, slower positive change, or little to no positive change.

The results of the ERA Scoreboard 2023 show that for the EU there has been **substantial positive change** in the following Pact for R&I priorities: R&D investments; Gender equality; Global engagement; Synergies with sectorial policies and industrial policies; and Coordination of R&I investments.

The EU has shown **slower positive change** in the following Pact for R&I priorities: Researchers' careers and mobility; Knowledge Valorisation; and Active citizen and societal engagement in R&I.

The EU has shown **limited positive change** in the following Pact for R&I priorities: Scientific leadership; Challenge-based ERA actions; Synergies with education and the European Skills Agenda; More investments and reforms in countries and regions with lower R&I performance; and Support to prioritise and secure long-term R&I investments and policy reforms.

While considering the challenges attached to the indicators and the related data, the results indicate that still some additional effort would be beneficial mainly in the priority areas where "limited positive change" can be observed. These preliminary results need to be scrutinised by future Scoreboards, but might also be reflected in the future ERA Policy Agendas.

2. Résumé exécutif

Le tableau de bord de l'EER (Espace européen de la recherche) est l'une des composantes du nouveau mécanisme de suivi de l'EER, couvrant au maximum 18 indicateurs, dont deux indicateurs généraux mesurant les progrès du système européen de recherche et d'innovation et 16 indicateurs spécifiques, un pour chaque priorité du Pacte pour la R&I.

Le tableau de bord de l'EER suit les progrès réalisés vers la réalisation des objectifs de l'EER au niveau de l'Union. Sur les 18 indicateurs inclus dans le cadre de mesure, les données sont actuellement disponibles pour 15 indicateurs, pour 2 indicateurs, la construction des données à l'aide du Horizon Dashboard et du Cordis Datalab est en cours d'exploration, et pour 1 indicateur, les données ne sont pas disponibles.

La sélection rigoureuse des indicateurs - sur la base de la disponibilité des données - ainsi que le calcul et la présentation des données sont essentiels pour tirer des conclusions politiques solides et pour suivre de manière crédible les progrès accomplis dans la réalisation des objectifs globaux de l'EER.

Pour chacun des indicateurs, une performance tendancielle au niveau de l'UE a été évaluée sur trois périodes, de 2010 à aujourd'hui, de 2015 à aujourd'hui et sur les trois dernières années. En fonction du nombre de fois où la tendance a été positive au cours de chacune de ces périodes, un indicateur est considéré comme ayant montré un changement positif substantiel, un changement positif plus lent ou peu ou pas de changement positif.

Les résultats du tableau de bord de l'EER 2023 montrent que pour l'UE, des changements « positifs substantiels » ont été constatés dans les priorités suivantes du Pacte en matière de R&I: investissements en R&D; Égalité des sexes; Engagement mondial; Synergies avec les politiques sectorielles et les politiques industrielles; et Coordination des investissements en R&I.

L'UE a montré des changements « positifs plus lents » dans les priorités suivantes du Pacte pour la R&I: carrières et mobilité des chercheurs; Valorisation des connaissances; et Engagement citoyen actif et sociétal dans la R&I.

L'UE n'a montré des changements « positifs limités » dans les priorités suivantes du Pacte pour la R&I: leadership scientifique; Actions ERA basées sur des défis; Synergies avec l'éducation et la stratégie européenne en matière de compétences; Davantage d'investissements et de réformes dans les pays et régions ayant de faibles performances en R&I; et Soutien pour prioriser et sécuriser les investissements en R&I et les réformes politiques à long terme.

Si l'on tient compte des défis liés aux indicateurs et aux données qui s'y rapportent, les résultats indiquent qu'un effort supplémentaire serait bénéfique, principalement dans les domaines prioritaires où l'on peut observer des changements « positifs limités ». Ces résultats préliminaires doivent être examinés à la loupe dans le cadre des futurs tableaux de bord, mais ils pourraient également être pris en compte dans les futurs programmes d'action de l'EER (ERA Policy Agenda).

3. Overview of the purpose and content of the report

The report provides the results of the ERA Scoreboard 2023. As requested in the Pact for Research and Innovation, the ERA Scoreboard "should assess the overall consolidation and collective progress of ERA priorities and should only display aggregated data at EU level".[1] Time series allow to monitor progress over time. In addition, the ERA Scoreboard 2023 includes metrics for most indicators showing if performance on each of the indicators has been converging or diverging across Member States.

The ERA Scoreboard 2023 applies 18 indicators[2], including two general indicators measuring progress in the European R&I system and 16 specific indicators, one for each Pact for R&I priority. The indicators are shown in Table 1 below, including information on the source of the data.[3]

The indicators applied for the ERA Scoreboard 2023 use, as much as possible, data from publicly available data sources. Indicators are as timely as possible, so they reflect recent changes in policies. Indicators and data will be regularly checked for updates to ensure an annual update of the Scoreboard. The first two indicators in the ERA Scoreboard 2023 are not directly linked to Pact priorities but are considered important to measure overall progress in the European R&I system. For most indicators, time series data are available. The table also includes information on the timeliness of the data.

For most of the indicators, most recent data would be for 2019, 2020 or 2021. Table 1 also includes information for which Member States data are available. For some indicators, data are not available for all Member States and for these, the EU aggregate is constructed using a smaller group of countries. The last column includes a short rationale why each of the indicators is included in the ERA Scoreboard 2023.[4]

[1] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2021:407:FIN

[2] In the ERA Scorebord 2023, there was no data available for indicators 4, 15 and 16 in a form that would have been required to meanigfully project these indicators. The ERA Scoreboard Methodology Report provides information on what kind of data and calculations would have been necessary. In view of the 2024 monitoring cycle, the Commission will present a report on the refinement of the indicator framework incorporating recommendations on how to fill the indicator and/or data gaps that have been identified in the 2023 ERA monitoring. This report will be brought to the attention of the ERA Forum for further consideration. For all monitoring reports, please consult the ERA Policy Platform.

[3] For more details on the indicators, their selection and caveats, please see "ERA Scoreboard 2023 - Methodology Report".

[4] See "Data gathering and analysis of policy developments and reforms: Study to evaluate the ERA policy framework/ERA monitoring mechanism" (https://op.europa.eu/en/publication-detail/-/publication/98a8edb4-c763-11ec-b6f4-01aa75ed71a1/language-en/format-PDF/source-256243590).

Table 1: Indicators included in the ERA Scoreboard 2023

	ERA Scoreboard indicator	ERA Pact sub-priorities	Source	Time series	Fre-quency	Most recent	Member States	Rationale
1	Gross Domestic Expenditure on R&D (GERD) as a percentage of GDP	R&D Investment	Eurostat (variable rd_e_gerdtot)	Yes	Annual	2021	All	Monitors progress towards the 3% R&D target
2	Researchers (in full-time equivalent) per million inhabitants	R&D Investment	Eurostat (variable rd_p_persocc)	Yes	Annual	2021	All	Direct measure of the number of R&D workers per 1 million people. It is identical to UN SDG indicator 9.5.2
	Deepening a truly functioning internal market for knowledge							
3	Share of publications available in open access	Open Science	OpenAIRE	Yes	Annual	2021	All	Measures share of publications available in open access
4	Share of national public R&D expenditure committed to joint programmes and initiatives, research infrastructures and European Partnerships	Research infra-structures	Not available	n/a	n/a	n/a	n/a	Included in the ERA Pact ("Member States take note of the Commission's proposals to include ... two new voluntary targets for Member States to commit 5 % of national public R&D funding to joint programmes and European Partnerships by 2030")
5	Share of women in grade A positions in higher education institutes	Gender Equality	Women in Science database	Yes	Multi-annual	2018	All	Tracks progress in the participation of women in the highest levels of academia
6	Job-to-job mobility of Human Resources in Science & Technology	Researchers' careers and mobility	Eurostat (variable hrst_fl_mobsex)	Yes	Annual	2020	All	Measures the exchange of knowledge resulting from people moving between one job and another. Not all changes in jobs include the creation of knowledge or the diffusion of knowledge, but it is more likely that knowledge creation and diffusion takes place when more employees move between jobs

	ERA Scoreboard indicator	ERA Pact sub-priorities	Source	Time series	Fre-quency	Most recent	Member States	Rationale
7	Share of innovating firms collaborating with HEI/PRO out of all innovative firms	Knowledge Valorisation	Eurostat: Community Innovation Survey	Yes	Biennial	2020	All	Measures the collaboration and thus exchange of knowledge between the business and public sector
8	Number of scientific publications among the top-10% most cited publications worldwide as a percentage of all publications	Scientific leadership	Web of Science or Scopus	Yes	Annual	2019	All	Measure for scientific impact and relevance of the scientific publications, as highly cited publications are assumed to be more relevant and have a higher scientific impact. There could be a bias towards small or English-speaking countries given the coverage of Scopus' publication data.
9	International co-publications with non-EU partners per 1,000 researchers in the public sector	Global engagement	Scopus and Eurostat	Yes	Annual	2021	No	International scientific co-publications are a proxy for the quality of scientific research as collaboration increases scientific productivity. Non-EU is defined as non-EU Member States
	Taking up together the green transition and digital transformation and other challenges with impact on society, and increasing society's participation in the ERA							
10	Environmentally related government R&D budget as percentage of total government R&D	Challenge-based ERA actions	OECD Green Growth Indicators Database: https://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH	Yes	Annual	2020	23 MS (no data for BG, CY, HR, MT)	Monitors progress on research activities supporting the EU Green deal
11	Share of researchers receiving transferable skills training	Synergies with education and the European Skills Agenda	MORE Survey (https://www.more-4.eu/online-indicator-tool)	No (data for 2016 & 2019)	Irregular	2019	24 MS (no data for CY, EL, MT)	Measures the extent of formal and information training received by PhD students

	ERA Scoreboard indicator	ERA Pact sub-priorities	Source	Time series	Fre-quency	Most recent	Member States	Rationale
12	Direct government support and Indirect government support through R&D tax incentives as a percentage of GDP	Synergies with sectorial policies and industrial policies	Eurostat for data on direct support OECD R&D Tax Incentive Database (http://oe.cd/rdtax) for data on indirect support	Yes	Annual	2019	22 MS (no data for BG, CY, DE, EE, LU)	Public financing of R&D can take two forms: Direct funding for R&D through instruments such as grants and public procurement, and Indirect support through the tax system. Over time, more and more countries have introduced R&D tax incentives
13	Publications on social innovation per million population	Active citizen and societal engagement in R&I	OpenAIRE	Yes	Annual	2021	All	Captures contributions from public and private sector R&I towards solving societal problems
	Enhancing access to research and innovation excellence across the Union and enhancing interconnections between innovation ecosystems across the Union							
14	Increase in total R&D expenditure, expressed as a percentage of GDP	More investments and reforms in countries and regions with lower R&I performance	Eurostat (variable d_e_gerdtot)	Yes	Annual	2020	No	Monitors widening countries' share in EU research activities Widening countries include Bulgaria, Croatia, Cyprus, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia

	ERA Scoreboard indicator	ERA Pact sub-priorities	Source	Time series	Fre-quency	Most recent	Member States	Rationale
15	Share of Seal of Excellence rewards that received funding from other sources	Synergies between Union, national and regional funding programmes	Not available *Horizon Dashboard: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-dashboard*	Aggre-gate for multiple years	n/a	n/a	n/a	The Seal of Excellence is a quality label awarded by the Commission to proposals which have been assessed in a call for proposals under a Union instrument and are deemed to comply with the quality requirements of that Union instrument but could not be funded due to budgetary constraints These projects are judged to deserve funding and might receive support from other Union or national sources of funding. The Seal of Excellence certificate recognises the value of the proposal and helps other funding bodies take advantage of the high-quality Commission evaluation process
16	Number of collaboration networks of RPOs in Widening countries with other EU countries	Increased collaborative links and excellence-based integration of research-performing organisations from countries and regions with lower R&I performance	Not available *CORDIS Datalab (https://cordis.europa.eu/datalab/datalab.php)*	Aggre-gate for multiple years	n/a	n/a	n/a	Monitors the number of collaborations between Widening countries and other EU countries Widening countries include Bulgaria, Croatia, Cyprus, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia
	Advancing concerted research and innovation investments and reforms							

	ERA Scoreboard indicator	ERA Pact sub-priorities	Source	Time series	Fre-quency	Most recent	Member States	Rationale
17	Share of public R&D expenditures financed by the private sector	Support to prioritise and secure long-term R&I investments and policy reforms	Eurostat (variable rd_e_gerdfund)	Yes	Annual	2020	All	Measures public-private co-operation in research. The willingness of the private sector to co-fund public R&I projects could be a proxy for how closely companies work with universities and public research organisations
18	Government budget allocations for R&D (GBARD) allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per FTE researcher	Coordination of R&I investments	Eurostat (variables gba_tncoor & rd_p_persocc)	Yes	Annual	2020	All	Reflects the emphasis on collaboration and sharing of experiences in R&D across borders, whether national, regional or organisational Europe-wide transnational public R&D programmes include R&D programmes that involve the flow of funds across borders for research purposes, as well as those that include transnational cooperation Bilateral or multilateral public R&D programmes comprise non-European Commission funded R&D research conducted jointly by at least two Member State governments, involving either the flow of funds or transnational cooperation

4. Summary of ERA Scoreboard performance

For the ERA Scoreboard 2023, a "traffic light system" is used to monitor EU performance towards the ERA objectives (Table 2). As performance levels are difficult to compare between indicators, the focus is on performance changes, by combining information on relative performance change since 2010, since 2015, and for the last three years.

For each period, the percentage change over that period is calculated as the change between the first and last year of that period divided by the average indicator value of the 2010-2021 period.[5] If percentage changes for all three periods are positive[6], the indicator receives the highest score of "dark green"; if percentage changes for two periods are positive, the indicator receives the next highest score of "light green", if percentage changes for one period is positive, the indicator receives the next highest score of "orange"; and if percentage changes for none of the periods are positive, the indicator receives the lowest score of "red".

Pact for R&I Priority areas where the EU is showing the highest level of change ("dark green") include:

- R&D investments
- Gender equality
- Global engagement
- Synergies with sectorial policies and industrial policies
- Coordination of R&I investments

Pact for R&I Priority areas where the EU is showing the second highest level of change ("light green") include:

- Researchers' careers and mobility
- Knowledge Valorisation
- Active citizen and societal engagement in R&I

Pact for R&I Priority areas where the EU is showing the lowest level of change ("orange or red") include:

- Scientific leadership
- Challenge-based ERA actions
- Synergies with education and the European Skills Agenda
- More investments and reforms in countries and regions with lower R&I performance
- Support to prioritise and secure long-term R&I investments and policy reforms

Pact for R&I Priority areas for which data are not (yet) available include:

- Research infrastructures
- Synergies between Union, national and regional funding programmes
- Increased collaborative links and excellence-based integration of research-performing organisations from countries and regions with lower R&I performance

[5] The same 2010-2021 period is used as the denominator for all time periods to make it easier to compare percentage changes. There is no impact on the sign (positive or negative) of these changes compared to using different averages for the denominator for or each time period.

[6] Table 2 shows a positive change by indicating " >0 ", a negative change by indicating " <0 ".

Table 2: ERA Scoreboard 2023

	Indicator	ERA Pact sub-priority	Score	Change 2010-recent	Change 2015-recent	Change last 3 years
1	Gross Domestic Expenditure on R&D (GERD) as a percentage of GDP	R&D Investment		>0	>0	>0
2	Researchers (in full-time equivalent) per million inhabitants	R&D Investment		>0	>0	>0
3	Share of publications available in open access (green, gold and diamond)	Open Science		>0	--	--
4	Share of national public R&D expenditure committed to joint programmes and initiatives, research infrastructures and European Partnerships	Research infrastructures	--	--	--	--
5	Share of women in grade A positions in higher education institutes	Gender Equality		>0	>0	>0
6	Job-to-job mobility of Human Resources in Science & Technology	Researchers' careers and mobility		>0	>0	<0
7	Share of innovating firms collaborating with HEI/PRO out of all innovative firms	Knowledge Valorisation		>0	>0	<0
8	Scientific publications among the top-10% most cited publications worldwide as a percentage of all publications	Scientific leadership		<0	<0	<0
9	International co-publications with non-EU partners per 1,000 researchers (in full-time equivalent) in the public sector	Global engagement		>0	>0	>0
10	Environmentally related government R&D budget as percentage of total government R&D	Challenge-based ERA actions		<0	<0	>0
11	Share of researchers receiving transferable skills training	Synergies with education and the European Skills Agenda		<0	<0	--
12	Direct government support and Indirect government support through R&D tax incentives as a percentage of GDP	Synergies with sectorial policies and industrial policies		>0	>0	>0
13	Research on social innovation	Active citizen and societal engagement in R&I		>0	>0	<0
14	Increase in total R&D expenditure, expressed as a percentage of GDP	More investments and reforms in countries and regions with lower R&I performance		<0	<0	<0
15	Share of Seal of Excellence rewards that received funding from other sources	Synergies between Union, national and regional funding programmes	--	--	--	--
16	Number of collaboration networks of RPOs in Widening countries with other EU countries	Increased collaborative links and excellence-based integration of research-performing organisations from countries and regions with lower R&I performance	--	--	--	--
17	Share of public R&D expenditures financed by the private sector	Support to prioritise and secure long-term R&I investments and policy reforms		<0	<0	<0
18	Government budget allocations for R&D (GBARD) allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per FTE researcher	Coordination of R&I investments		>0	>0	>0

5. Performance by ERA Scoreboard indicator

For each of the indicators the following pages will include the following

- A graph showing the evolution for the EU over time.
- A scatter plot showing the performance and change in performance of the Member States. Member States which perform both above the EU average and where performance has improved more than that of the EU, are seen as having contributed most to the EU average over time.
- A graph showing the evolution of the spread in performance for individual Member States.
- A table showing different metrics that can be used for assessing the evolution in performance differences between Member States, including:
    - The variance and the standard deviation are measures of the spread of the data around the mean. Both metrics summarise how close each observed data value is to the mean value. The smaller the variance and standard deviation, the more the mean value is indicative of the whole dataset. Therefore, if all values of a dataset are the same, the standard deviation and variance are zero.

      Variance is calculated as the sum of the squared deviations of the score of each Member State with the mean score across all Member States. The standard deviation is calculated as the square root of the variance.
    - Range. The difference between the second highest and second lowest score across the Member States.[7]

  Both metrics would indicate if there has also been convergence in performance among the Member States. Ideally, one would like to see an increase in EU performance and a decrease in performance differences among the Member States, as this would indicate that the lowest performers are improving fastest and thereby have contributed most to the increase in EU performance.
- A table showing for the EU, the 27 Member States, and the eight selected Horizon Associated countries:
    - Most recent score
    - Change since 2010
    - Change since 2015
    - Change in last three years for which data are available
    - Change in most recent year for which data are available

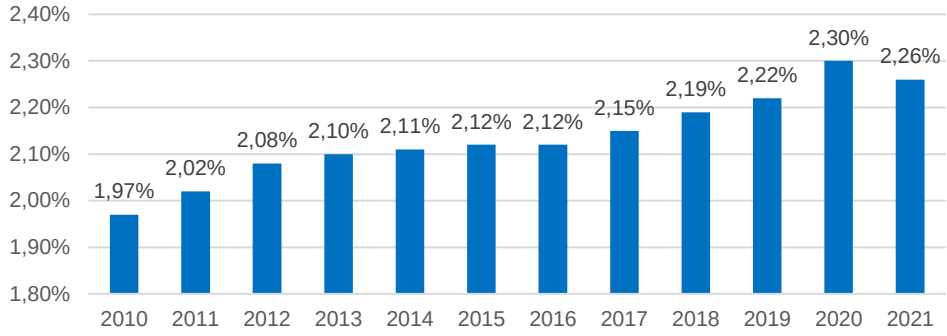
Data sources for all indicators are included in Table 1 and in the ERA Scoreboard Methodology report.

[7] For reducing the possible impact of statistical outliers, the range is not calculated as the difference between the highest and lowest score across the Member States but instead as the difference between the second highest and second lowest score.

5.1. General indicators

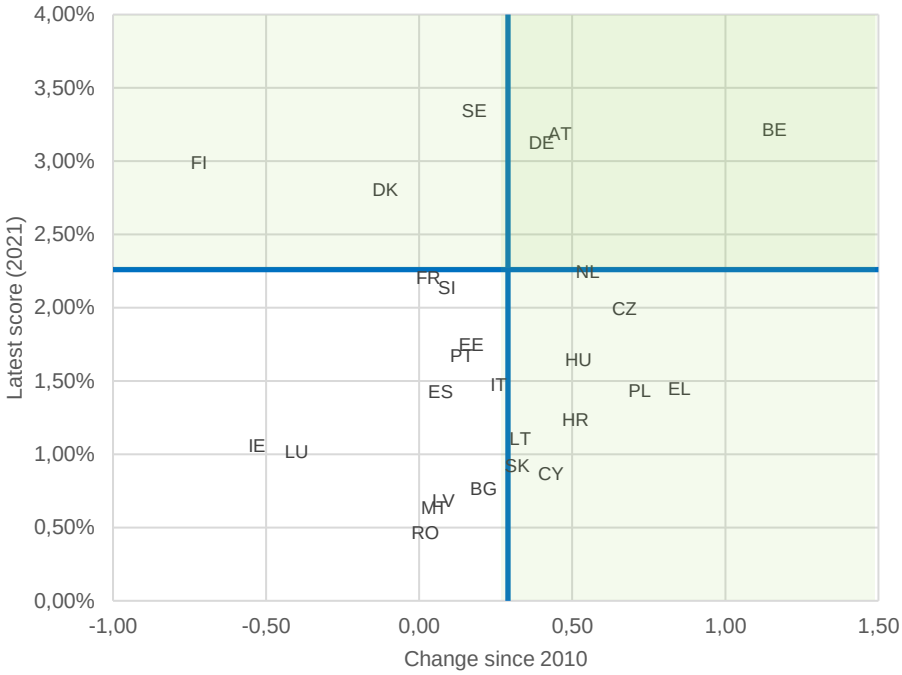
5.1.1. Gross Domestic Expenditure on R&D as a percentage of GDP (R&D intensity)

The indicator measures the share of total expenditures on R&D as a percentage of GDP. For the EU, as shown in the first graph, there has been a continuous increase in the indicator from 1.97% in 2010 to 2.30% in 2020 followed by a decline to 2.26% in 2021, with recent developments being affected by changes in GDP (e.g. the strong increase in 2020 is fully explained by a decrease in GDP in the first Covid year).

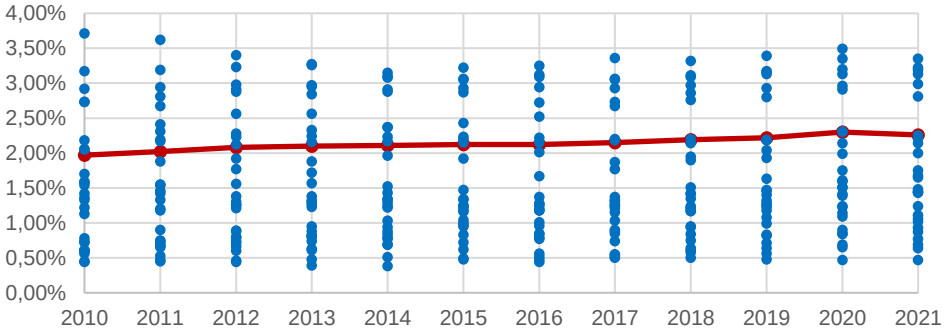


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2021 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Austria, Belgium, and Germany.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences between Member States appear to have become smaller over time as the range has become smaller, but both the standard deviation and variance have increased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.284	0.294	0.313	0.317	0.318	0.314	0.318	0.310	0.314	0.309	0.300	0.308
Variance	0.081	0.086	0.098	0.100	0.101	0.099	0.101	0.096	0.099	0.096	0.090	0.095
Range	2.72	2.72	2.77	2.78	2.59	2.57	2.64	2.55	2.53	2.61	2.70	2.58

Results in Annex 1 show that for the EU and most Member States the indicator increased between 2010 and 2021. For Denmark, Finland, Ireland and Luxembourg the indicator declined. Performance improved most for Belgium, Czechia, Greece, and Poland.

Between 2015 and 2021, the indicator increased for the EU and 18 Member States and declined for nine Member States. Performance improved most for Belgium, Greece, Poland, and Portugal.

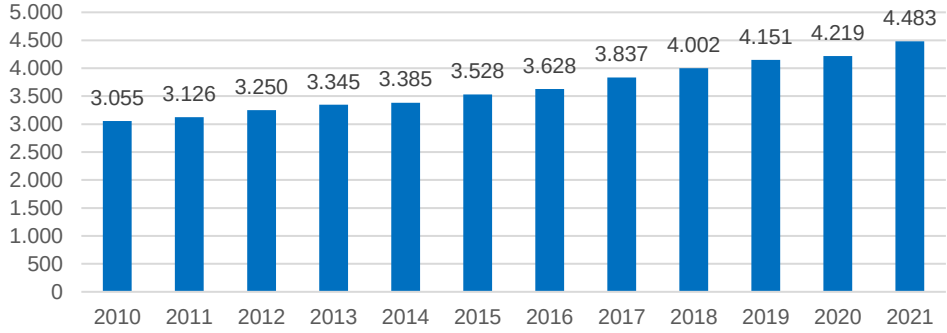
More recently, results over the last three years show an increase for the EU and 20 Member States and a decline for seven Member States. Performance improved most for Finland, Greece, Hungary, Portugal, and Spain.

In 2021, the most recent year, there is a decrease for the EU and 13 Member States and an increase for only eight Member States, which can partly be explained by a recovery of GDP after its decline in most Member States in the first year of the COVID pandemic.

For the Horizon Associated Countries only three countries, Iceland, Serbia, and Türkiye, show an improvement since 2010 and in each of the time periods. For Armenia and Georgia performance has decreased since 2010.

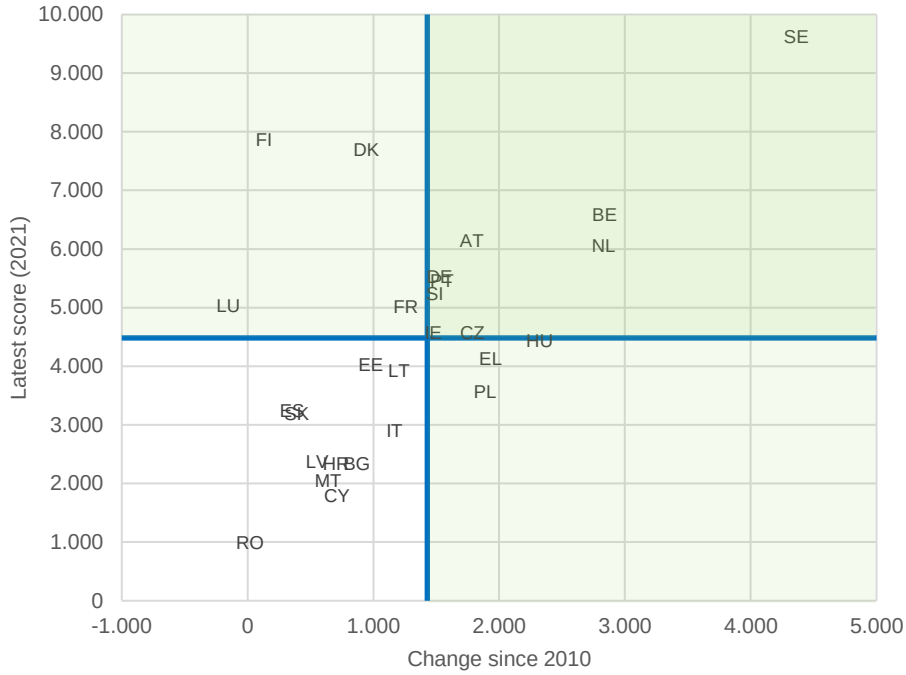
5.1.2. Researchers (in full-time equivalent) per million inhabitants

The indicator measures the share of researchers in full-time equivalents per million population. For the EU, as shown in the first graph, there has been a continuous increase from 3,055 in 2010 to 4,484 in 2021.

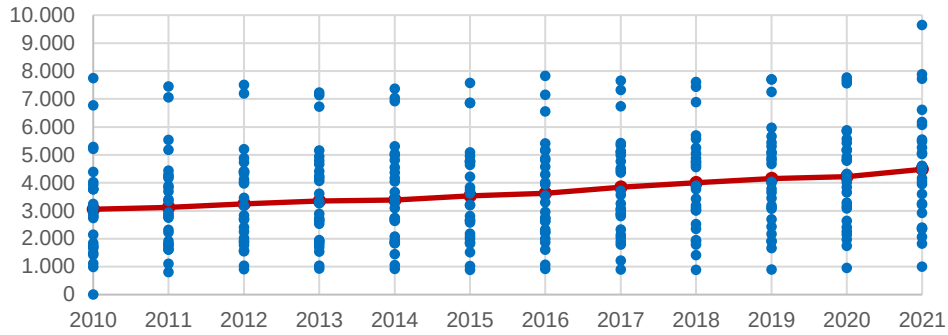


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2021 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Austria, Belgium, Czechia, Germany, Ireland, Netherlands, Portugal, Slovenia, and Sweden.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become larger over time as the range has become larger, but both the standard deviation and variance have decreased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.246	0.237	0.243	0.241	0.241	0.238	0.240	0.235	0.232	0.233	0.234	0.235
Variance	0.061	0.056	0.059	0.058	0.058	0.057	0.058	0.055	0.054	0.054	0.055	0.055
Range	5,659	5954	6,160	6,107	5,971	5,846	6,085	6,107	6,018	6,028	5,912	6,057

Results in Annex 2 show that for the EU and most Member States the indicator increased between 2010 and 2021, and only for Luxembourg has the indicator decreased. Performance improved most for Belgium, Hungary, Netherlands, and Sweden.

Between 2015 and 2021, the indicator increased for the EU and 26 Member States, only for Ireland the indicator decreased. Performance improved most for Belgium, Hungary, and Sweden.

More recently, results over the last three years show an increase for the EU and 24 Member States and a decrease for three Member States.

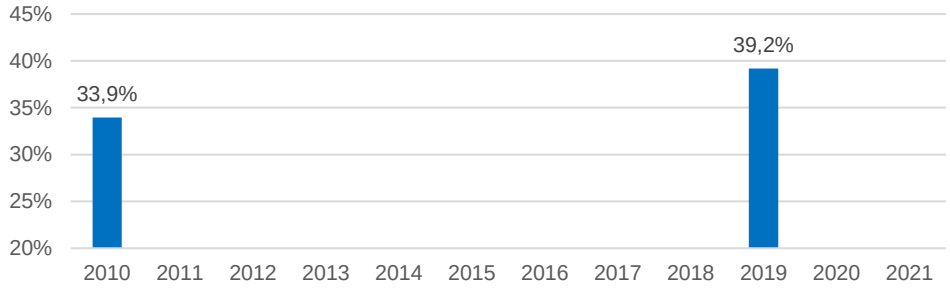
In the most recent year there is an increase for the EU and 25 Member States and a decrease for two Member States.

For the Horizon Associated Countries only two countries, Norway and Türkiye, show an improvement since 2010 and in each of the time periods. For Iceland performance has decreased since 2010. There are no data for Armenia and Israel.

5.2. Deepening a truly functioning internal market for knowledge

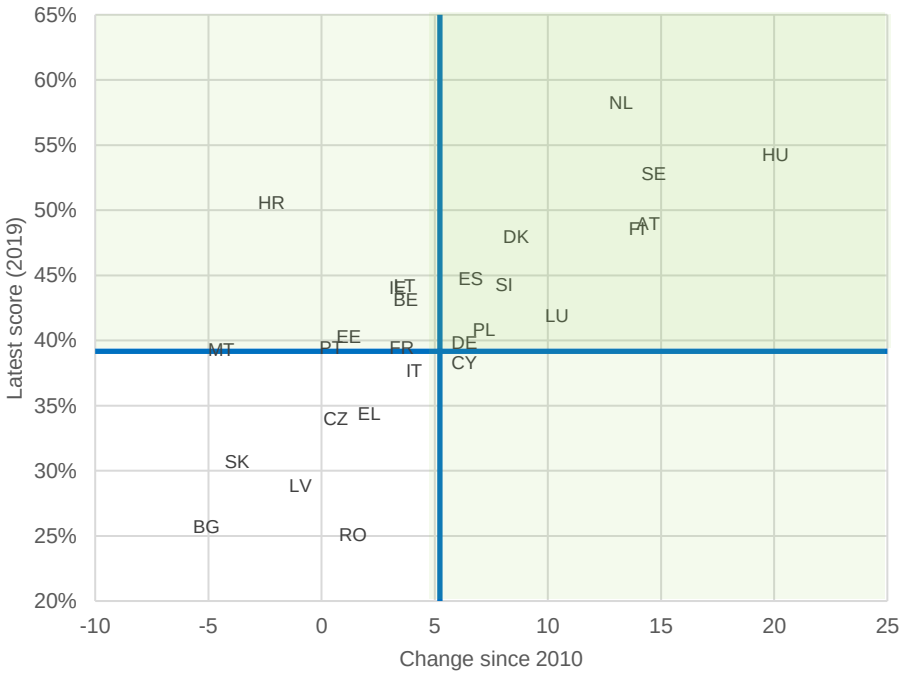
5.2.1. Share of publications available in open access

The indicator measures the share of open-access publications with digital object identifier (DOI) as percentage of total scientific publications with DOI. For the EU, as shown in the first graph, there has been an increase from 33.9% in 2010 to 39.2% in 2019.

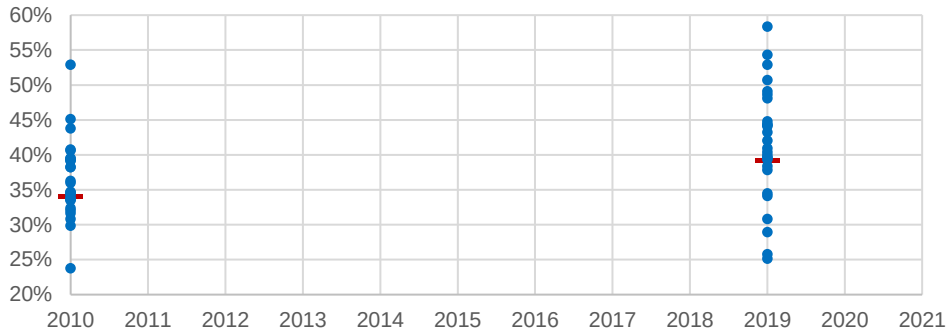


See Table 1 for the data source for this indicator. Data for 2009 (used for 2010) and 2019 are available from the 2022 Science, Research and Innovation Performance of the EU (SRIP) report. New data, including longer time series data, are expected to become available in the 2024 SRIP report.

Member States that contribute most to the EU average in 2019 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU, include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, Austria, Denmark, Finland, Germany, Hungary, Luxembourg, Netherlands, Poland, Slovenia, Spain, and Sweden.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become larger over time as the range has become larger, and both the standard deviation and variance have increased.



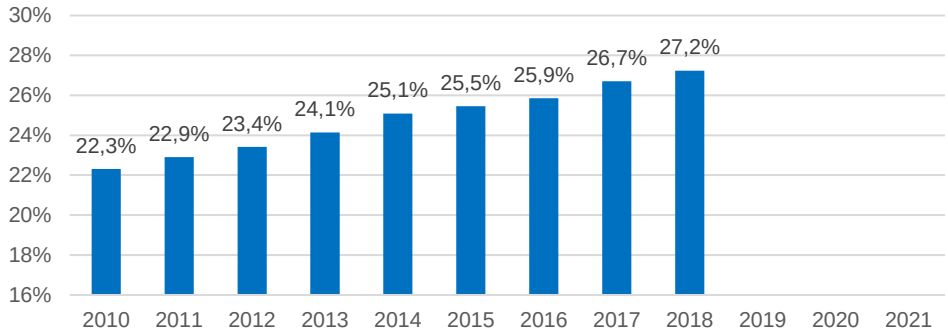
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.192	--	--	--	--	--	--	--	--	0.249	--	--
Variance	0.037	--	--	--	--	--	--	--	--	0.062	--	--
Range	15.3	--	--	--	--	--	--	--	--	28.6	--	--

Results in Annex 3 show that for the EU and 22 Member States the indicator increased between 2010 and 2019, only for Bulgaria, Croatia, Latvia, Malta and Slovakia the indicator declined. Performance improved most for Austria, Finland, Hungary, Luxembourg, Netherlands, and Sweden.

For the Horizon Associated Countries the indicator increased between 2010 and 2019 for Iceland and Norway, and decreased for Israel, Montenegro, Serbia, and Türkiye. There are no data for Armenia and Georgia.

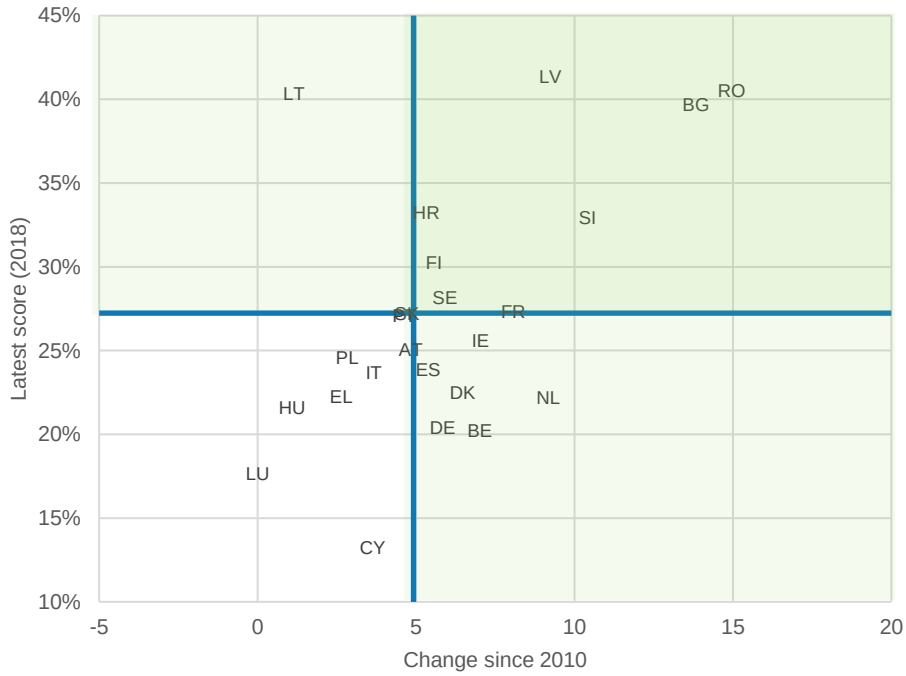
5.2.2. Share of women in grade A positions in higher education

The indicator measures the share of women in grade A positions in higher education. Grade A is the highest level at which research is typically conducted and in most countries grade A is equivalent to a full professorship. For the EU, as shown in the first graph, there has been a strong increase from 22.3% in 2010 to 27.2% in 2018.



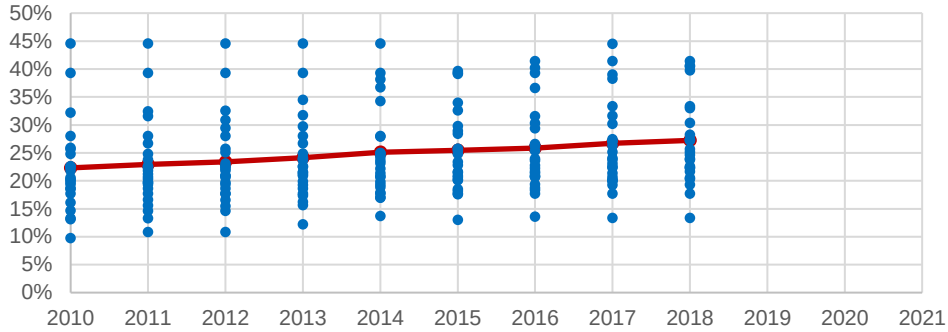
See Table 1 for the data source for this indicator. Data are taken from the 2021 edition of the She Figures report, which uses 2018 as the most recent data.

Member States that contribute most to the EU average in 2018 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Croatia, Finland, France, Latvia, Romania, Slovenia, and Sweden.



Note: Malta is not shown as its performance change of -25.3 is off the horizontal scale.

The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become smaller over time as the range has become smaller, but both the standard deviation and variance have increased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.222	0.230	0.226	0.231	0.258	0.273	0.267	0.252	0.269	--	--	--
Variance	0.049	0.053	0.051	0.053	0.066	0.074	0.071	0.063	0.072	--	--	--
Range	26.2	26.0	24.7	23.7	22.4	21.7	22.5	23.7	22.9	--	--	--

Results in Annex 4 show that for the EU and 23 Member States the indicator increased between 2010 and 2018, and only decreased for Malta. Performance increased most for Bulgaria, Romania, and Slovenia,

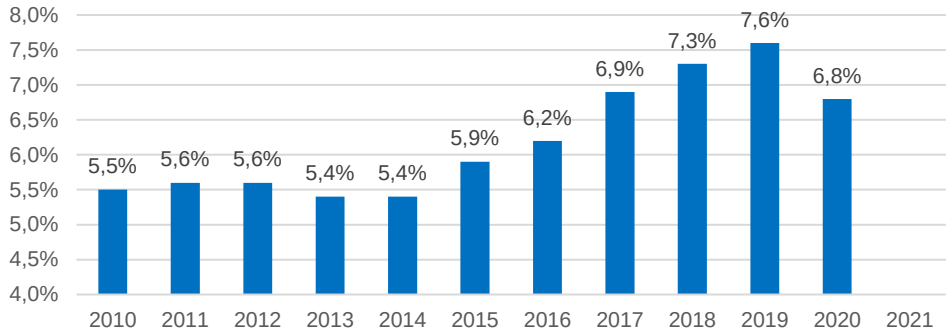
Between 2015 and 2018, performance improved for the EU and 23 Member States, performance only decreased for Malta. Performance increased most for Bulgaria, Ireland, Netherlands, and Slovenia,

In the most recent year there is an increase for the EU and 16 Member States and a decrease for two Member States, Lithuania and Malta.

For the Horizon Associated Countries only two countries, Israel and Norway, show an improvement since 2010 and in each of the time periods. There are no data for Armenia, Georgia, Montenegro, and Serbia.

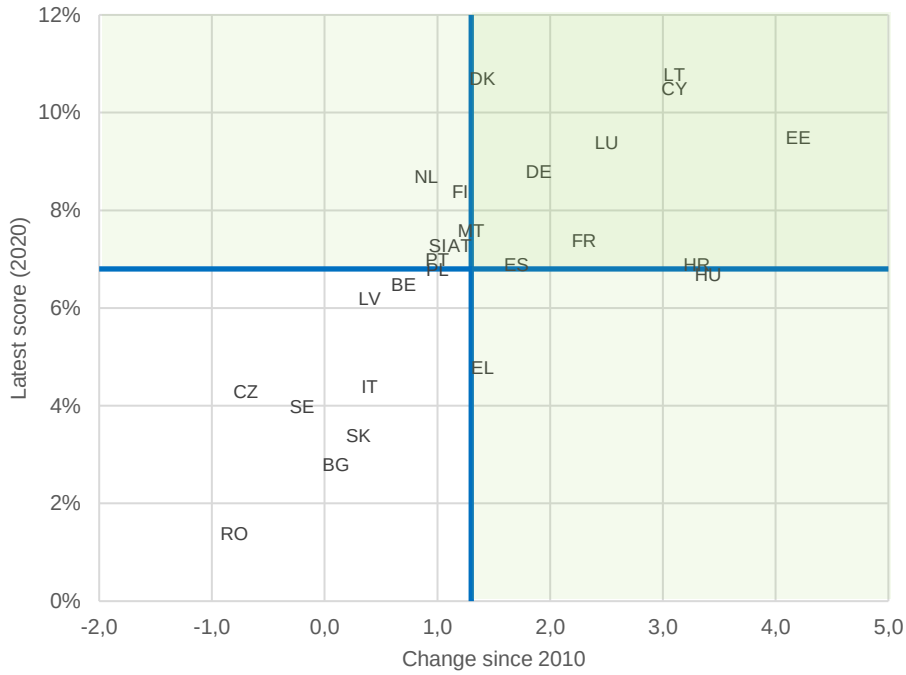
5.2.3. Job-to-job mobility of Human Resources in Science & Technology

The indicator measures job-to-job mobility of Human Resources in Science & Technology (HRST). HRST are people who fulfil at least one of the following conditions: have successfully completed a tertiary level education; not formally qualified as above but employed in a S&T occupation where the above qualifications are normally required. Job-to-job mobility is defined as the movement of individuals between one job and another from one year to the next. For the EU, there has been an increase from 5.5% in 2010 to 7.6% in 2019, followed by a decrease to 6.8% in 2020 due to employees working more from home and switching less between employers during the first year of the Covid-19 pandemic.

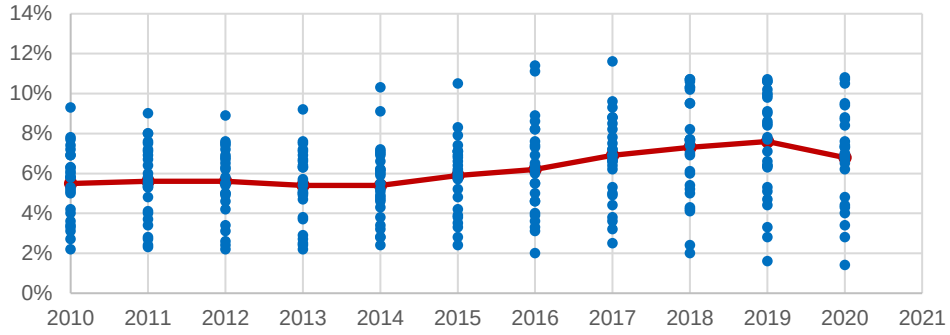


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2020 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Croatia, Cyprus, Denmark, Estonia, France, Germany, Lithuania, Luxembourg, and Spain.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become larger over time as the range has become larger, and both the standard deviation and variance have increased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.214	0.214	0.214	0.214	0.214	0.211	0.234	0.216	0.270	0.269	0.255	--
Variance	0.046	0.046	0.046	0.046	0.046	0.045	0.055	0.047	0.073	0.072	0.065	--
Range	5.1	5.6	5.2	5.2	6.3	5.5	8.0	6.4	8.3	7.8	7.9	--

Results in Annex 5 show that for the EU and 23 Member States the indicator increased between 2010 and 2020, performance only decreased for Czechia, Romania, and Sweden. Performance increased most for Croatia, Cyprus, Estonia, Hungary, and Lithuania.

Between 2015 and 2020, the indicator increased for the EU and 22 Member States, performance only decreased for Romania and Sweden. Performance improved most for Cyprus, Estonia, and Lithuania.

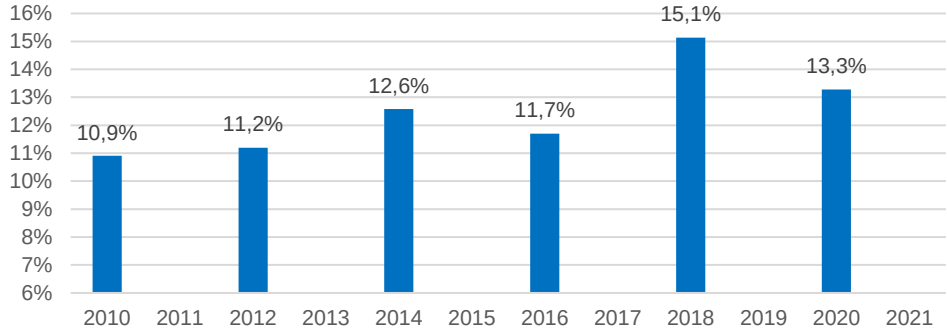
More recently, results over the last three years show a decrease for the EU and 15 Member States and an increase for 11 Member States.

In the most recent year there is a decrease for the EU and 16 Member States and an increase for seven Member States.

For five Horizon Associated Countries performance increased between 2010 and 2020 and for performance decreased in the most recent year. There are no data for Armenia, Georgia, and Israel.

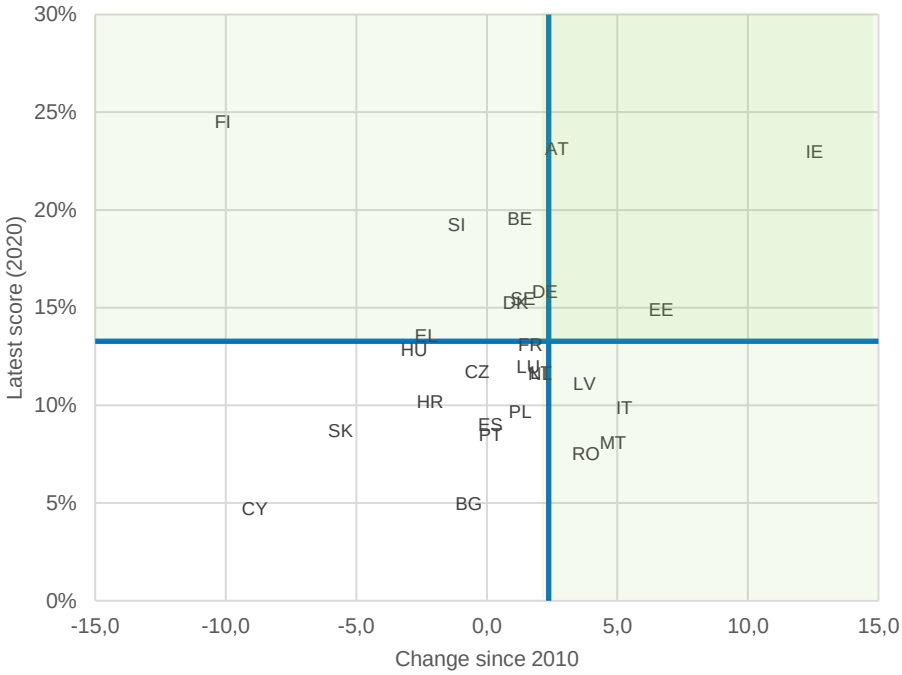
5.2.4. Share of innovating firms collaborating with HEI/PRO out of all innovative firms

The indicator measures the share of firms that innovate and that collaborate with higher education institutes and public research organisations. For the EU, as shown in the first graph, there has been a strong increase from 8.5% in 2010 to 15.1% in 2018, followed by a decrease to 13.3% in 2020.

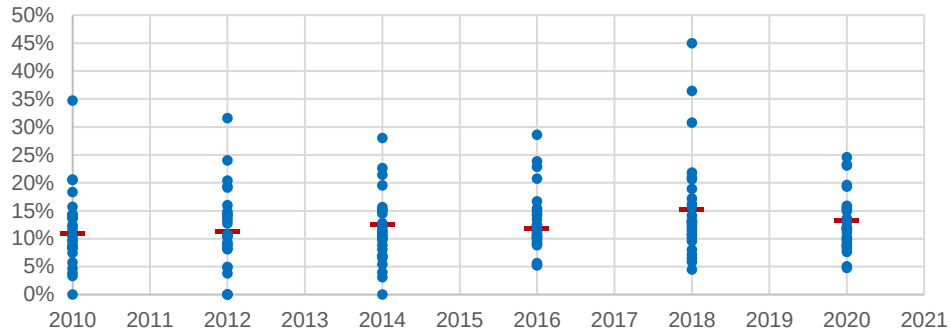


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2020 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Austria, Estonia, and Ireland.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become larger over time as the range has become larger, and both the standard deviation and variance have increased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.218	--	0.242	--	0.257	--	0.240	--	0.230	--	0.266	--
Variance	0.048	--	0.059	--	0.066	--	0.058	--	0.053	--	0.071	--
Range	14.0	--	15.1	--	15.4	--	18.6	--	30.6	--	18.2	--

Results in Annex 6 show that for the EU and 18 Member States the indicator increased between 2010 and 2020. Performance improved most for Estonia, Ireland, Italy, and Malta.

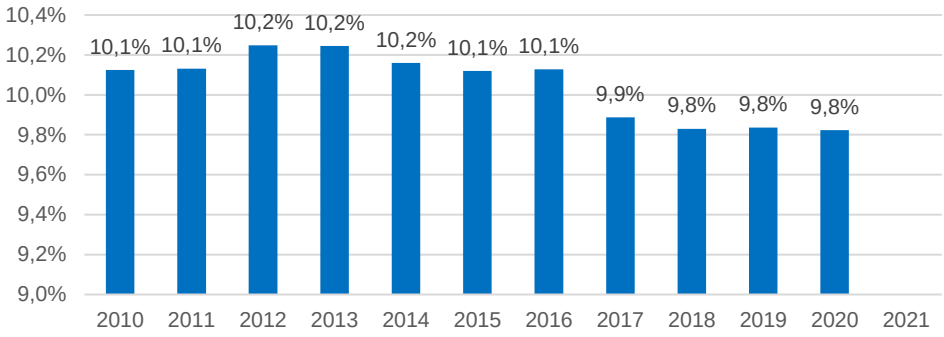
Between 2015 and 2020, the indicator increased for the EU and 14 Member States and decreased for 13 Member States.

More recently, results over the last three years show a decrease for the EU and 20 Member States and an increase for seven Member States.

For the Horizon Associated Countries the indicator has increased since 2010 for Iceland, Serbia, and Türkiye, and decreased for Norway. There are no data for Armenia, Georgia, Israel, and Montenegro.

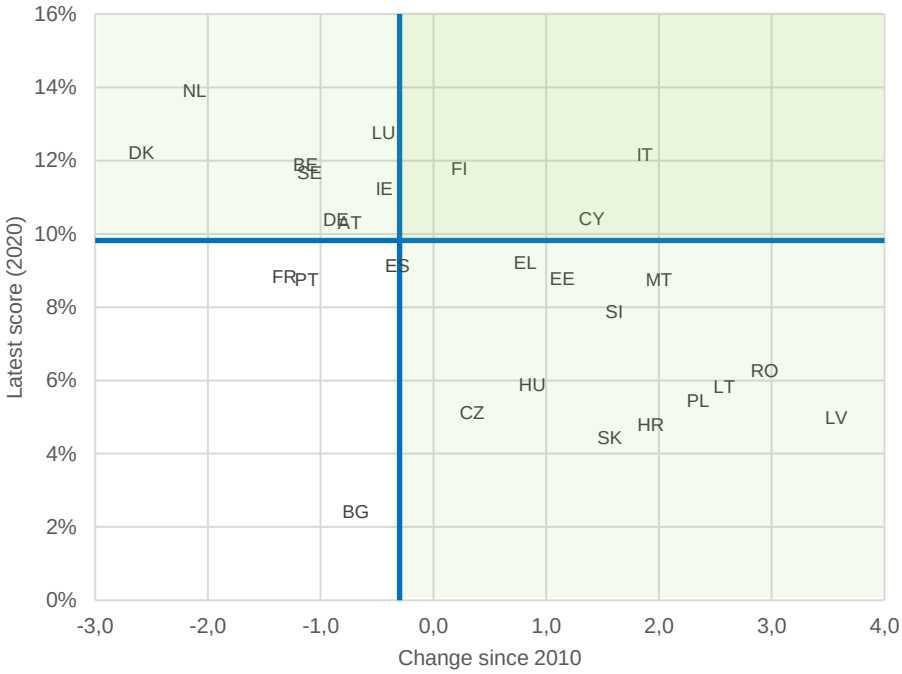
5.2.5. Number of scientific publications among the top-10% most cited publications worldwide as a percentage of all publications

The indicator is a proxy for the scientific impact and relevance of the scientific publications. For the EU, as shown in the first graph, there has been a decrease from 10.1% in 2010 to 9.8% in 2020.

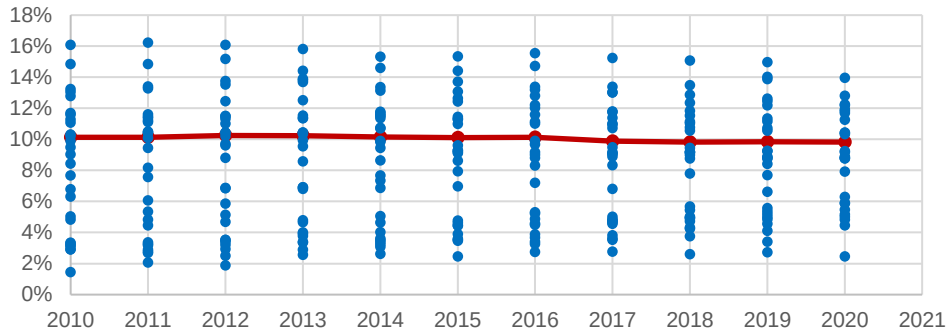


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2020 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Cyprus, Finland, and Italy.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become smaller over time as the range has become smaller, and both the standard deviation and variance have decreased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.287	0.300	0.299	0.313	0.312	0.301	0.308	0.294	0.277	0.289	0.267	--
Variance	0.082	0.090	0.089	0.098	0.097	0.091	0.095	0.086	0.077	0.084	0.071	--
Range	11.93	12.18	12.67	11.51	11.52	10.94	11.46	9.86	9.73	10.61	8.33	--

Results in Annex 7 show that for the EU and 12 Member States the indicator decreased between 2010 and 2020 and increased for 15 Member States. Performance improved most for Latvia, Lithuania, Malta, Poland, and Romania.

Between 2015 and 2020, the indicator decreased for the EU and 12 Member States and increased for 15 Member States.

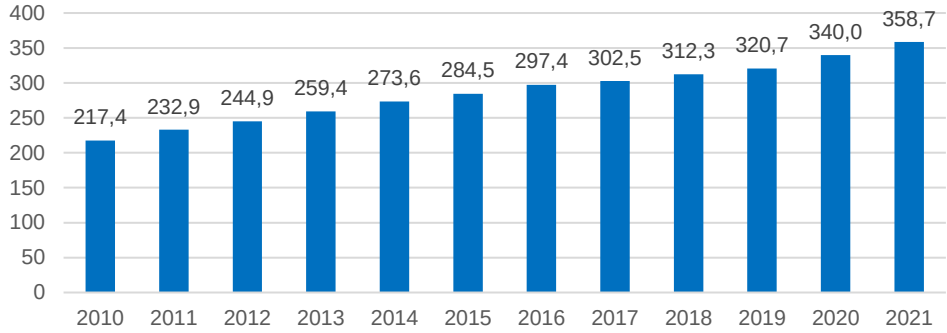
More recently, change results over the last three years show a decrease for the EU (although marginal) and 11 Member States (including AT, BE, BG, DE, DK, EE, FI, IE, NL, PT, SE) and an increase for 16 Member States.

In the most recent year there is a marginal decrease for the EU), a decrease for 13 Member States and an increase for 14 Member States.

For the Horizon Associated Countries the indicator has increased for all time periods for Serbia and Türkiye. The indicator decreased for all time periods for Israel and Norway.

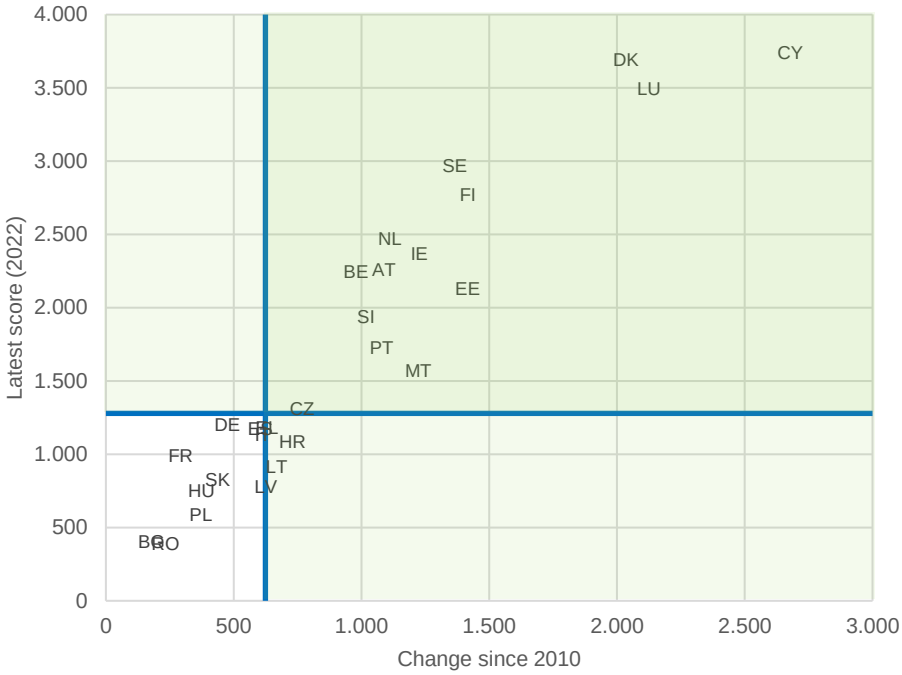
5.2.6. International co-publications with non-EU partners per million population

The indicator measures the number of scientific co-publications per 1,000 researchers with at least one co-author from a non-EU country at the EU level. From the perspective of individual countries, the indicator is more broadly defined by including co-publications with at least one co-author in any foreign country (including another EU country). Data limited to only non-EU countries are not available and such a limitation is in any case considered to be less relevant as for individual countries all publications with a foreign co-author contribute to international collaborations. For the EU, as shown in the first graph, there has been a strong increase from 217.4 in 2010 to 358.7 in 2021.



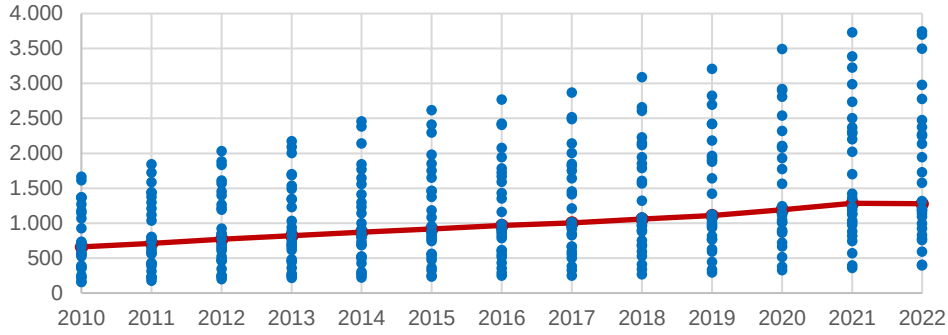
See Table 1 for the data source for this indicator

Member States that contribute most to the EU average - including all publications with foreign partners (i.e. the second definition) - in 2021 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including 14 Member States.



Note: blue lines for EU shows results for co-publications with all foreign partners.

The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become larger over time as the range has become larger, but both the standard deviation and variance have decreased.



Note: red line for EU shows results for co-publications with all foreign partners.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Standard deviation	0.311	0.303	0.303	0.308	0.293	0.289	0.282	0.278	0.276	0.281	0.277	0.285	0.298
Variance	0.096	0.092	0.092	0.095	0.086	0.083	0.080	0.078	0.076	0.079	0.077	0.081	0.089
Range	1,449	1,505	1,648	1,848	2,128	2,162	2,136	2,193	2,319	2,486	2,539	2,989	3,294

Results in Annex 8 show that for the EU and all Member States the indicator increased between both assessed periods, i.e. between 2010 and 2021 (2022 for the Member States) and between 2015 and 2021 (2022 for the Member States). In both time periods performance has increased most for Cyprus, Denmark, and Luxembourg.

More recently, results over only the last three years show an increase for the EU and 25 Member States. Performance decreased only for France and Slovakia.

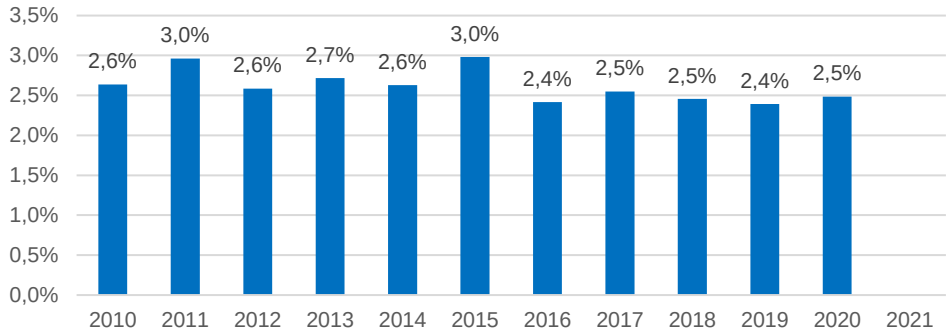
In only the most recent year there is an increase for the EU (in 2021) and 13 Member States (in 2022) and a decrease for 14 Member States (in 2022). However, using the second definition also for the EU – including co-publications with all foreign partners – shows a decrease for the EU in 2022.

For the Horizon Associated Countries the indicator has increased for all countries between 2010 and 2022. More recently the indicator only decreased for Montenegro.

5.3. Taking up together the green transition and digital transformation and other challenges with impact on society, and increasing society's participation in the ERA

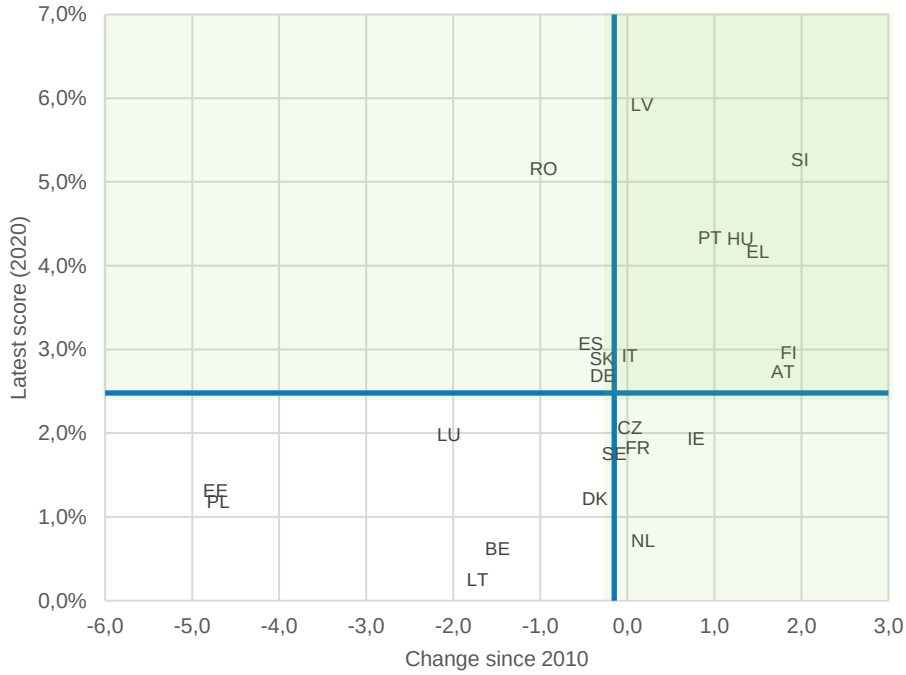
5.3.1. Environmentally related government R&D budget as % of total government R&D

The indicator measures the share of the R&D budget of the government dedicated to environmentally related research. For the EU, as shown in the first graph, this share has declined from an average of about 2.8% for 2010-2015 to 2.5% for 2016-2020.

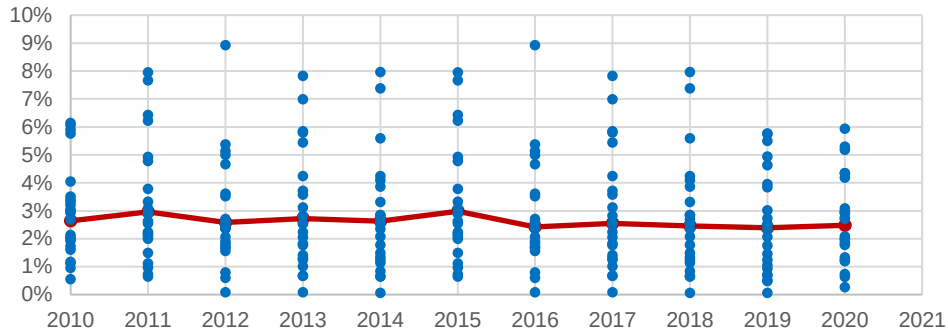


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2020 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Austria, Finland, Greece, Hungary, Italy, Latvia, Portugal, and Slovenia.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become smaller over time as the range has become smaller, and both the standard deviation and variance have decreased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.299	0.291	0.219	0.275	0.259	0.291	0.219	0.275	0.259	0.320	0.278	--
Variance	0.090	0.085	0.048	0.076	0.067	0.085	0.048	0.076	0.067	0.102	0.077	--
Range	5.10	6.94	4.77	6.32	6.73	6.94	4.77	6.32	6.73	5.26	4.65	--

Results in Annex 9 show that for the EU and nine Member States the indicator decreased between 2010 and 2020. The indicator increased for 12 Member States and most strongly for Austria, Finland, Greece, and Slovenia.

Between 2015 and 2020, the indicator decreased for the EU and 12 Member States, and performance increased for nine Member States.

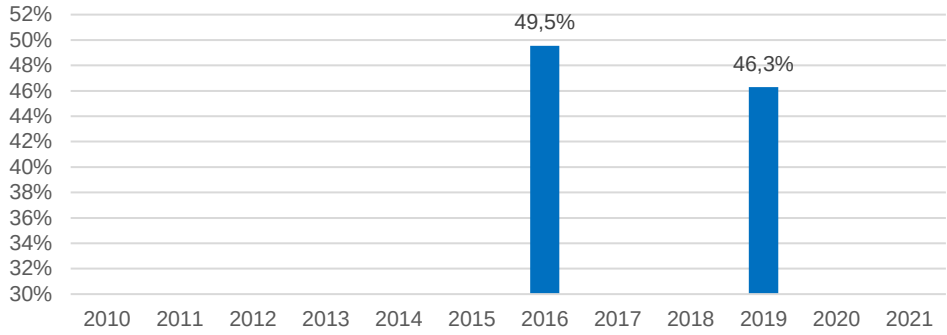
More recently, results over the last three years show a marginal increase for the EU, an increase for 16 Member States, and a decrease for five Member States.

In the most recent year there is an increase for the EU and 13 Member States and a decrease for eight Member States.

For the Horizon Associated Countries the indicator has increased for Norway and decreased for Türkiye. There are no data for Armenia, Georgia, Iceland, Israel, Montenegro, and Serbia.

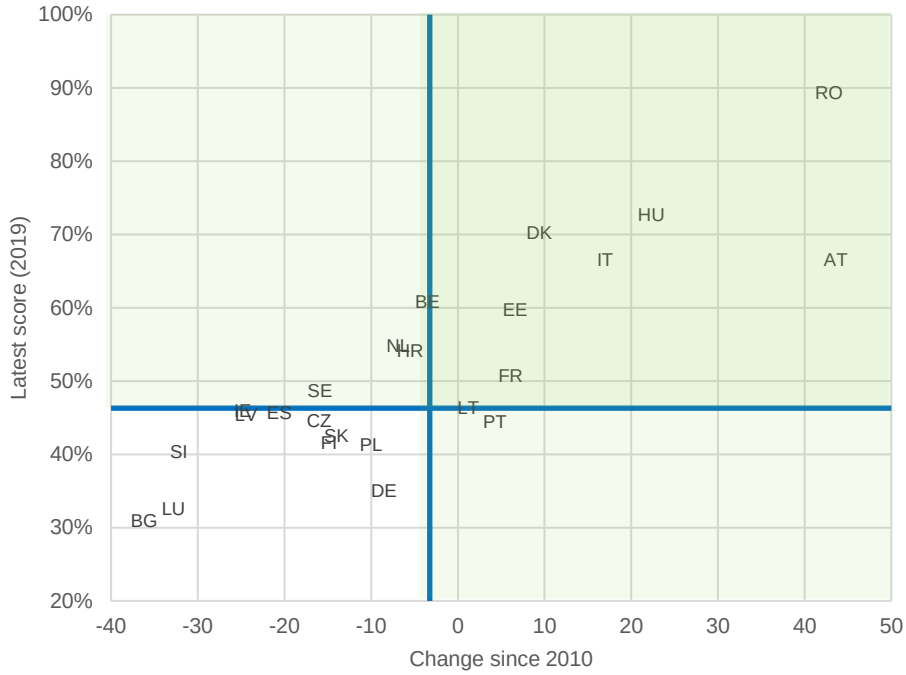
5.3.2. Share of researchers receiving transferable skills training

The indicator measures the share of R1 – Doctoral or equivalent – researchers enrolled in a PhD programme or R2 – Post-Doctoral or equivalent – researchers with a PhD that indicate they received training in transferable skills or developed transferable skills through work experience. For the EU, as shown in the first graph, there has been a strong increase from 49.5% in 2016 to 46.3% in 2019.

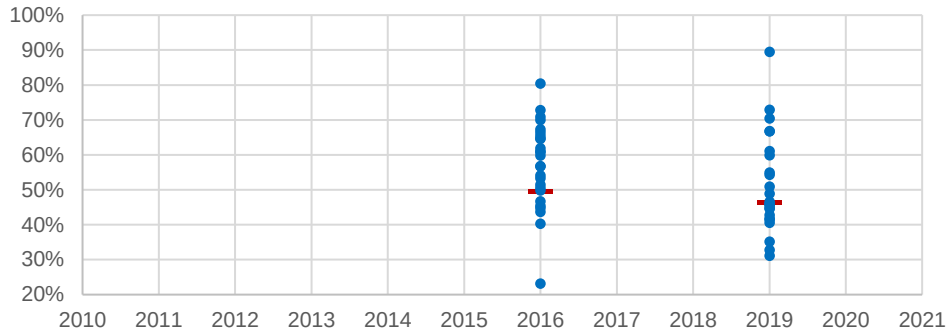


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2019 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Denmark, Estonia, France, Hungary, Italy, Lithuania, and Romania.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become larger over time as the range has become larger, and both the standard deviation and variance have increased.



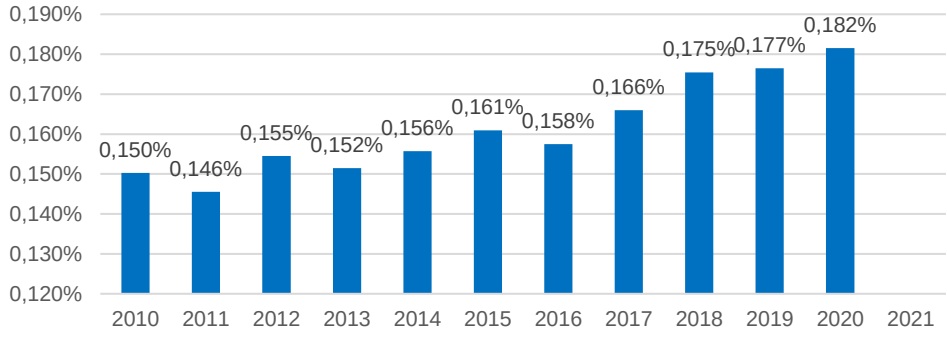
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	--	--	--	--	--	--	0.214	--	--	0.251	--	--
Variance	--	--	--	--	--	--	0.046	--	--	0.063	--	--
Range	--	--	--	--	--	--	32.5	--	--	40.1	--	--

Results in Annex 10 show that for the EU and 15 Member States the indicator decreased between 2016 and 2019 and increased for nine Member States. Performance improved most for Austria, Hungary, Italy, and Romania.

For the two Horizon Associated Countries for which data are available, the indicator decreased for Norway between 2016 and 2019 and stayed the same for Iceland.

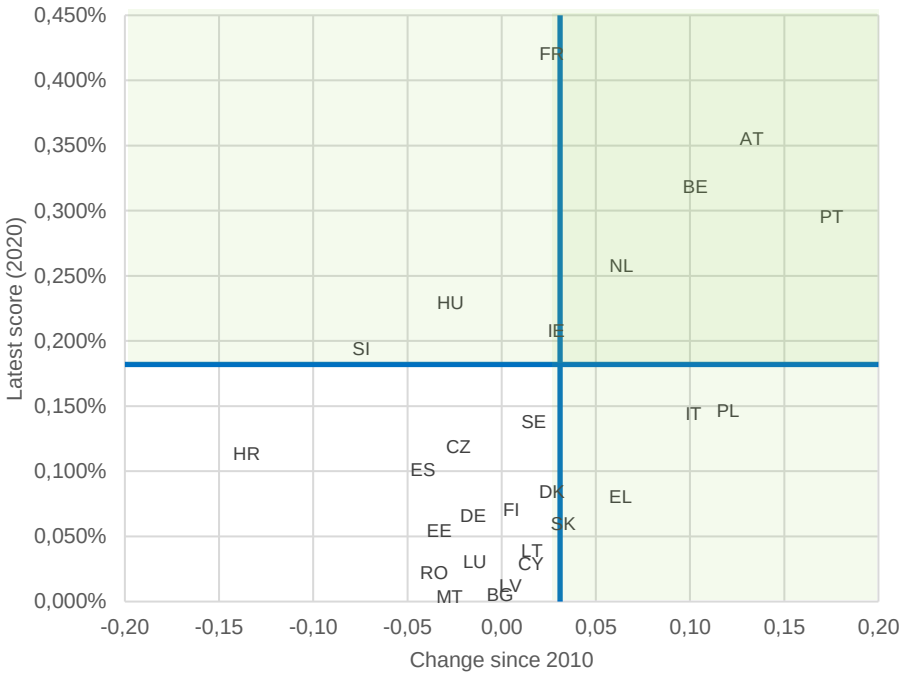
5.3.3. Direct government support and Indirect government support through R&D tax incentives as a percentage of GDP

The indicator measures total government support to business R&D. Public financing of R&D can take two forms: direct funding for R&D through instruments such as grants and public procurement, and indirect support through the tax system. This indicator measures the sum of both as a percentage share of GDP. For the EU, as shown in the first graph, there has been an increase from 0.150% in 2010 to 0.182% in 2020.

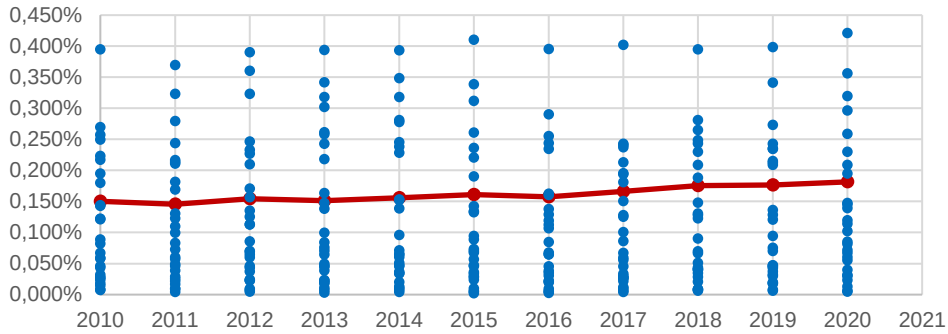


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2019 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Austria, Belgium, Netherlands, and Portugal.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become larger over time as the range has become larger, and both the standard deviation and variance have increased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.262	0.285	0.288	0.305	0.306	0.278	0.259	0.253	0.272	0.285	0.276	--
Variance	0.069	0.081	0.083	0.093	0.094	0.077	0.067	0.064	0.074	0.081	0.076	--
Range	0.261	0.314	0.353	0.334	0.341	0.334	0.286	0.237	0.273	0.333	0.350	--

Results in Annex 11 show that for the EU and 16 Member States the indicator increased between 2010 and 2020. The indicator improves most for Austria, Belgium, Italy, Poland, and Portugal.

Between 2015 and 2020, the indicator increased for the EU and 18 Member States.

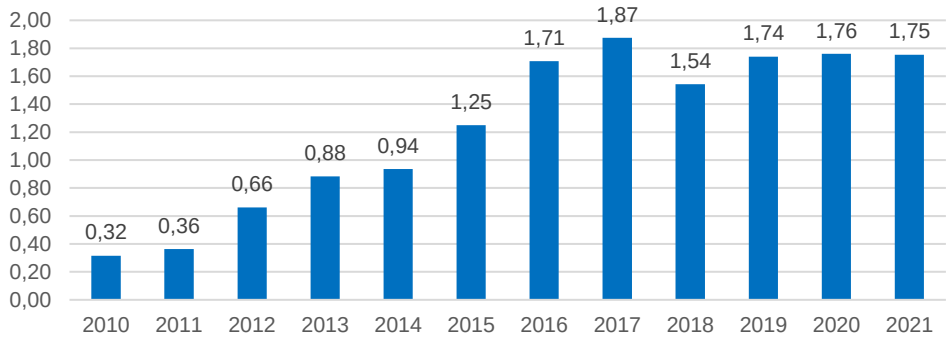
More recently, results over the last three years show an increase for the EU and 21 Member States.

In the most recent year there is an increase for the EU and 18 Member States, and a decrease for nine Member States.

For five Horizon Associated Countries the indicator has increased between 2010 and 2020, it only decreased for Israel. There are no data for Armenia and Georgia.

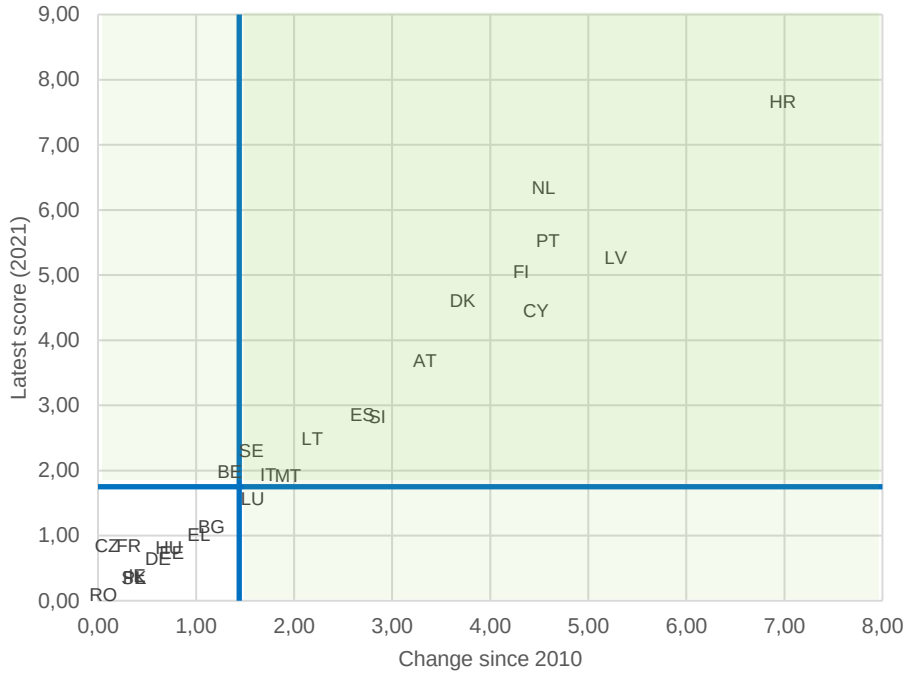
5.3.4. Scientific publications on social innovation per million population

The indicator measures the share of publications related to social innovation per million population. For the EU, as shown in the first graph, there has been a strong increase from 0.32 in 2010 to 1.87 in 2017, followed by decline to 1.75 in 2021.

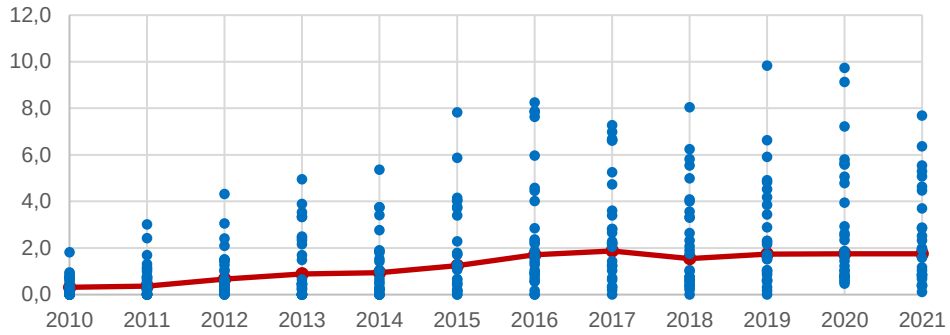


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2021 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Austria, Croatia, Cyprus, Denmark, Finland, Italy, Latvia, Lithuania, Malta, Netherlands, Portugal, Slovenia, Spain, and Sweden.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become larger over time as the range has become larger, and both the standard deviation and variance have increased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.246	0.252	0.241	0.299	0.268	0.257	0.320	0.320	0.274	0.239	0.290	0.277
Variance	0.061	0.064	0.058	0.090	0.072	0.066	0.103	0.102	0.075	0.057	0.084	0.077
Range	0.95	2.41	3.05	3.89	3.74	5.86	7.87	6.80	6.02	6.46	8.56	5.99

Results in Annex 12 show that for the EU and 25 Member States the indicator increased between 2010 and 2021, it only decreased for Estonia and Malta. The indicator increased most for Croatia, Cyprus, Latvia, Netherlands, and Portugal.

Between 2015 and 2021, the indicator increased for the EU and 18 Member States.

More recently, results over the last three years show an increase for the EU (although marginal) and 12 Member States, and a decrease for 15 Member States.

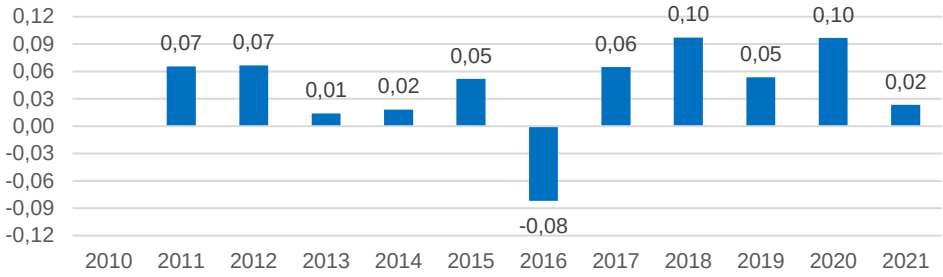
In the most recent year there is a decrease for the EU (although marginal) and 19 Member States, and an increase for eight Member States.

For the Horizon Associated Countries the indicator has increased for six countries between 2010 and 2021, including Armenia, Iceland, Israel, Norway, Serbia, and Türkiye. It decreased in the most recent year only for Iceland.

5.4. Enhancing access to research and innovation excellence across the Union and enhancing inter-connections between innovation ecosystems across the Union

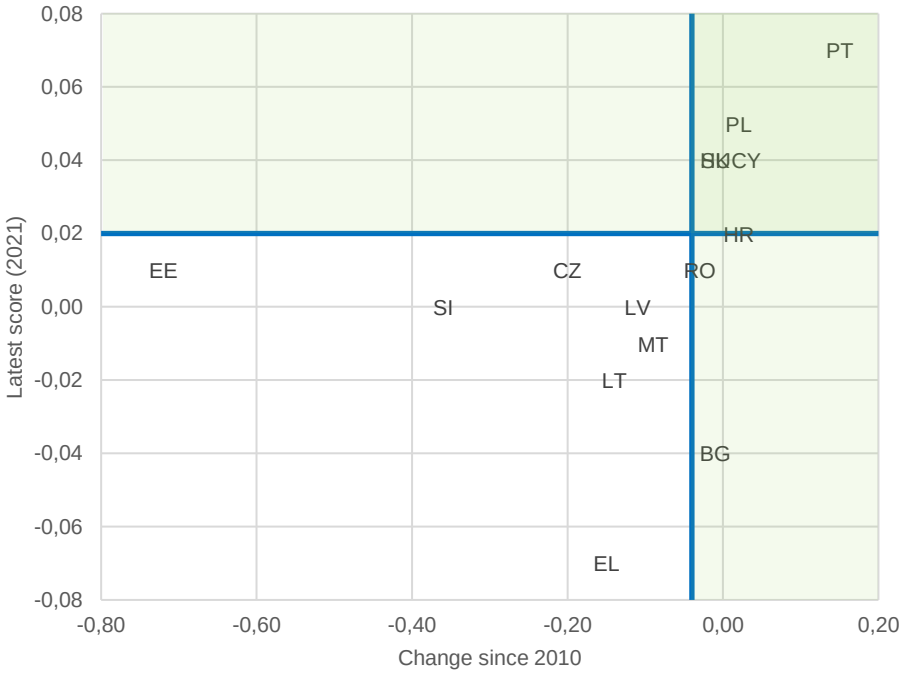
5.4.1. Increase in total R&D expenditure, expressed as a percentage of GDP

The indicator measures the increase in total R&D expenditure for widening countries as a percentage of GDP, with the percentage change calculated as the differences between the average R&D intensities in two consecutive years. For the widening countries, as shown in the first graph, the indicator shows positive annual changes for all years except 2016.

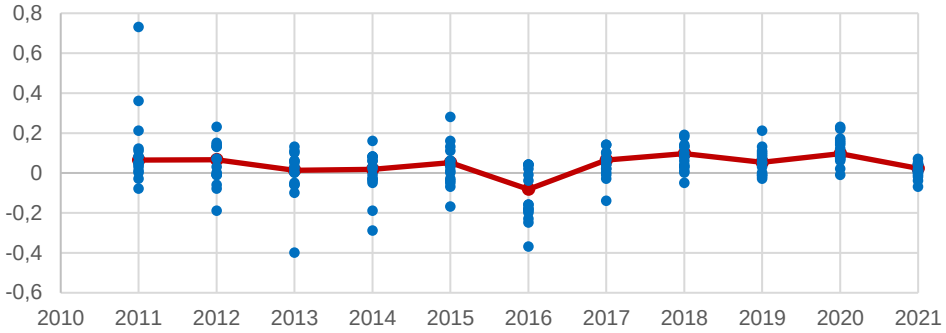


See Table 1 for the data source for this indicator. Widening countries include Bulgaria, Croatia, Cyprus, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, and Slovenia.

Widening countries that contribute most to the average in 2021 include all countries above the horizontal blue line in the graph below. Widening countries for which performance has changed more than that of the average include all countries to the right of the vertical blue line. Widening countries in the top-right quadrant have contributed most to the average over time, including Cyprus, Hungary, Poland, Portugal, and Slovakia.



The evolution of the spread in performance for individual widening countries is shown in the graph below, with the average for the group of widening countries shown as a red line and each individual country with a blue dot. Differences appear to have become smaller over time as the range has become smaller, and both the standard deviation and variance have decreased marginally.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	--	0.195	0.194	0.177	0.185	0.181	0.274	0.202	0.265	0.236	0.314	0.193
Variance	--	0.038	0.038	0.031	0.034	0.033	0.075	0.041	0.070	0.056	0.098	0.037
Range	--	0.39	0.23	0.21	0.27	0.23	0.29	0.17	0.18	0.15	0.20	0.09

Annex 13 show results for all Member States and Horizon Associated countries.

For the group of widening countries as a collective and 11 of these individual countries, the indicator decreased between 2011 and 2021, indicating that the annual increase is slowing down, not that the share of R&D expenditures in GDP as such is falling. Performance increased only for Croatia, Cyprus, Poland, and Portugal.

Between 2015 and 2021, the indicator decreased for the group of widening countries and nine of these countries. Performance increased for Cyprus, Czechia, Hungary, Latvia, Portugal, and Slovenia.

More recently, results over the last three years show a decrease for the group of widening countries and nine of these countries.

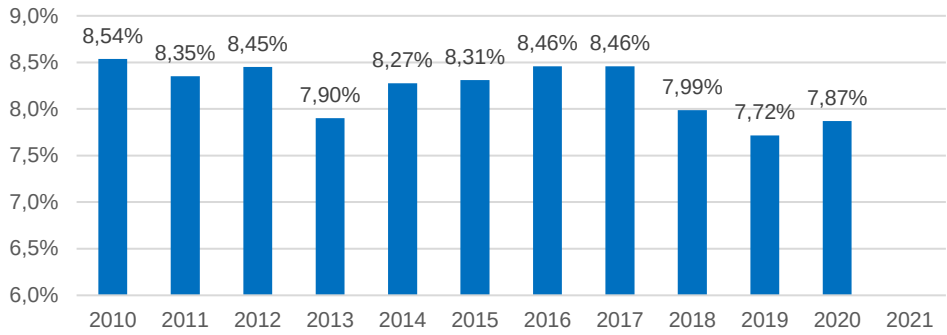
In the most recent year there is a decrease for the EU as a whole and 14 of the widening countries. The annual change in the R&D intensity only increased for Romania.

For the Horizon Associated Countries the indicator has increased between 2011 and 2021 for Serbia and Türkiye and decreased for Armenia, Georgia, Israel, and Norway.

5.5. Advancing concerted research and innovation investments and reforms

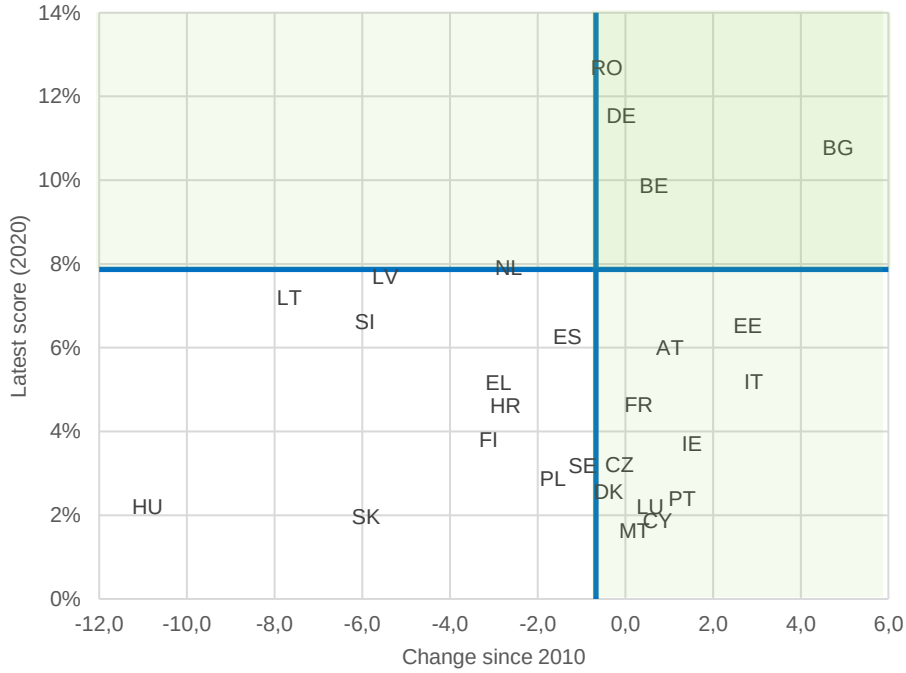
5.5.1. Share of public R&D expenditures financed by the private sector

The indicator measures the share of R&D expenditures by the higher education and government sector that are financed by the business sector. For the EU, as shown in the first graph, there has been a decrease from 8.54% in 2010 to 7.87% in 2020.

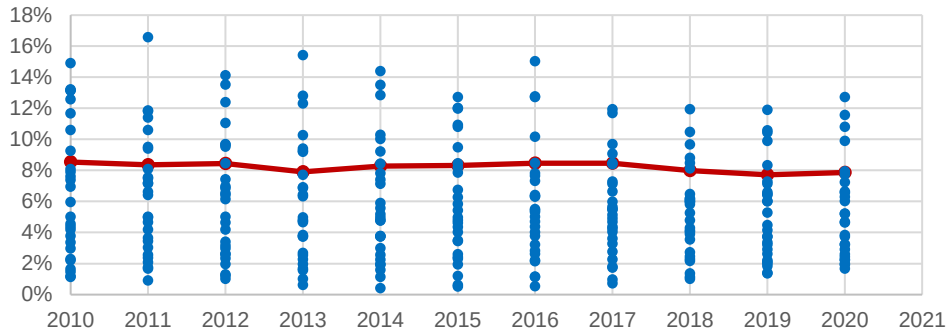


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2021 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Belgium, Bulgaria, Germany, and Romania.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have become smaller over time as the range has become smaller, and both the standard deviation and variance have decreased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	0.314	0.248	0.296	0.264	0.278	0.302	0.254	0.270	0.266	0.290	0.284	--
Variance	0.099	0.062	0.087	0.070	0.077	0.091	0.065	0.073	0.071	0.084	0.081	--
Range	12.04	10.19	12.32	11.78	12.39	11.41	11.62	10.72	9.34	9.18	9.66	--

Results in Annex 14 show that for the EU and 16 Member States the indicator decreased between 2010 and 2020, and performance increased for 11 Member States. Performance increased most for Bulgaria, Estonia, and Italy.

Between 2015 and 2020, the indicator decreased for the EU and 14 Member States, and performance increased for 13 Member States.

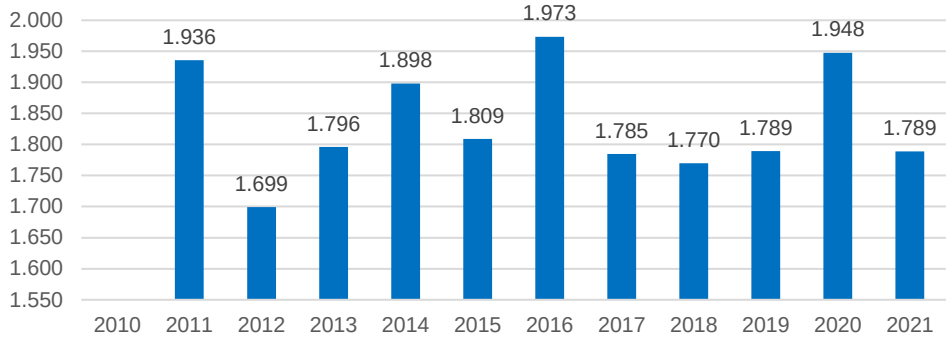
More recently, results over the last three years show a decrease for the EU and 15 Member States.

In the most recent year there is an increase for the EU and nine Member States.

For the Horizon Associated Countries the indicator has increased between 2010 and 2020 or Montenegro and decreased for Iceland, Norway, Serbia and Türkiye. There are no data for Armenia, Georgia, and Israel.

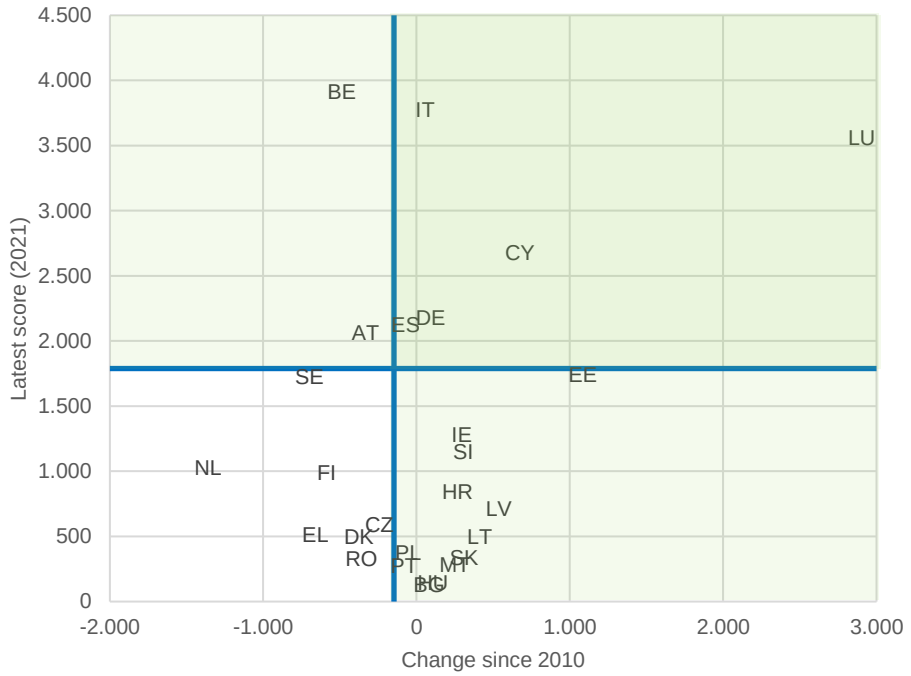
5.5.2. Government budget allocations for R&D allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per FTE researcher

The indicator measures the share of government budget allocations for R&D allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per million researchers. For the EU, as shown in the first graph, performance fluctuates over time, starting from a high value of 1,936 in 2011 but falling to 1,789 in 2021 despite two peaks in 2016 and 2020.

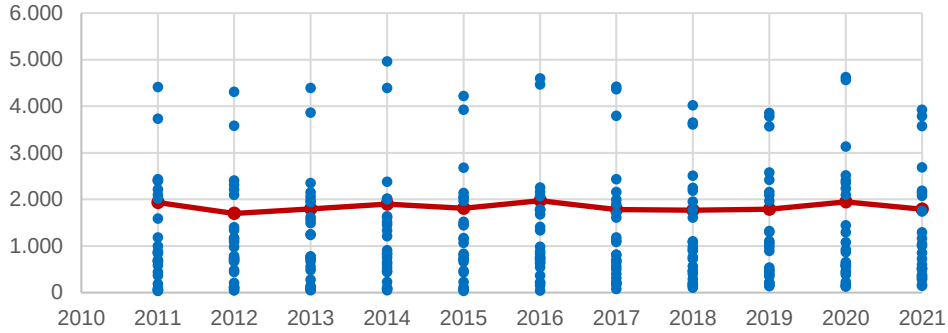


See Table 1 for the data source for this indicator

Member States that contribute most to the EU average in 2021 include all countries above the horizontal blue line in the graph below. Member States for which performance has changed more than that of the EU include all countries to the right of the vertical blue line. Member States in the top-right quadrant have contributed most to the EU average over time, including Cyprus, Germany, Italy, Luxembourg, and Spain.



The evolution of the spread in performance for individual Member States is shown in the graph below, with the EU shown as a red line and each Member State with a blue dot. Differences appear to have stayed the same over time as the range has hardly changed, but both the standard deviation and variance have increased.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Standard deviation	--	0.267	0.255	0.261	0.247	0.262	0.254	0.290	0.296	0.312	0.289	0.304
Variance	--	0.071	0.065	0.068	0.061	0.069	0.064	0.084	0.087	0.097	0.083	0.093
Range	--	3690	3531	3797	4320	3856	4318	4199	3504	3632	4434	3631

Results in Annex 15 show that for the EU and 12 Member States the indicator decreased between 2011 and 2021, and it increased for 14 Member States. Performance increased most for Estonia and Luxembourg.

Between 2015 and 2020, the indicator decreased for the EU and 13 Member States and increased for 13 Member States.

More recently, results over the last three years show a marginal decrease for the EU, a decrease for 12 Member States, and an increase for 14 Member States.

In the most recent year there is a decrease for the EU and 14 Member States.

For the Horizon Associated Countries performance increased for Serbia and decreased for Norway. There are no data for Armenia, Georgia, Iceland, Israel, Montenegro, and Türkiye.

6. Results for Horizon Europe Associated Countries

The most recent results for all indicators for each of the eight Horizon Europe Associated Countries are shown in Table 3. Data availability is good for Norway, with data for 15 indicators, Iceland and Türkiye, with data for 13 indicators, and Serbia, with data for 12 indicators. Data availability is relatively good for Montenegro, with data for 10 indicators, and Israel, with data for eight indicators. Data availability is relatively poor for Georgia, with data for six indicators, and Armenia, with data for five indicators.

Table 3: ERA Scoreboard 2023: data for Horizon Europe Associated Countries

		AM	GE	IS	IL	ME	NO	RS	TR
#1	Gross Domestic Expenditure on R&D (GERD) as a percentage of GDP	0.21	0.25	2.81	5.56	0.50	1.94	0.99	1.13
#2	Researchers (in full-time equivalent) per million inhabitants	N/A	1,624	6,944	N/A	4,763	7,162	789	2,207
#3	Open access scientific publications with digital object identifier (DOI) as % of total scientific publications with (DOI)	N/A	N/A	51.4	36.7	40.8	53.7	42.1	29.8
#4	Share of national public R&D expenditure committed to joint programmes and initiatives, research infrastructures and European Partnerships	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
#5	Share of women in grade A positions in higher education institutes	N/A	N/A	26.3	19.5	N/A	30.9	N/A	30.5
#6	Job-to-job mobility of Human Resources in Science & Technology	N/A	N/A	8.9	N/A	3.4	9.2	5.7	7.1
#7	Share of innovating firms collaborating with HEI/PRO out of all innovative firms	N/A	N/A	14.1	N/A	N/A	14.3	16.9	15.9
#8	Number of scientific publications among the top-10% most cited publications worldwide as a percentage of all publications	2.1	3.7	10.7	8.6	4.2	10.9	5.3	7.4
#9	International co-publications with non-EU partners per 1,000 researchers (in full-time equivalent) in the public sector	256.1	269.8	4348	1271	736.6	3358	697.2	203.1
#10	Environmentally related government R&D budget as percentage of total government R&D	N/A	N/A	N/A	N/A	N/A	3.05	N/A	0.80
#11	Share of researchers receiving transferable skills training	N/A	N/A	70.5	N/A	N/A	50.9	N/A	N/A
#12	Direct government support and Indirect government support through R&D tax incentives as a percentage of GDP	N/A	N/A	0.106	0.104	0.001	0.235	0.023	0.202
#13	Research on social innovation	0.34	0.00	2.71	0.11	0.00	8.16	0.29	0.30
#14	Increase in total R&D expenditure, expressed as a percentage of GDP	0.00	-0.05	0.32	-0.15	0.00	-0.31	0.08	0.00
#15	Share of Seal of Excellence rewards that received funding from other sources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
#16	Number of collaboration networks of RPOs in Widening countries with other EU countries	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
#17	Share of public R&D expenditures financed by the private sector	N/A	N/A	4.79	N/A	14.85	3.79	0.12	1.09
#18	Government budget allocations for R&D (GBARD) allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per FTE researcher	N/A	N/A	N/A	N/A	N/A	2,075	1,375	N/A

6.1. Armenia

For Armenia, most indicators do not have data available. For those indicators for which data are available, Armenia is performing below the level of the EU. Gross Domestic Expenditure on R&D is very low at only 0.21% of GDP. Scientific articles are of lower quality as only a small share is among the top-10% most cited papers. The number of international scientific co-publications is also relatively low.

6.2. Georgia

For Georgia, most indicators do not have data available. For those indicators for which data are available, Georgia is performing below the level of the EU. Gross Domestic Expenditure on R&D is very low at only 0.25% of GDP and has decreased in 2021. The share of researchers per million inhabitations is substantially below that of the EU. Scientific articles are of lower quality as only a small share is among the top-10% most cited papers. The number of international scientific co-publications is also relatively low.

6.3. Iceland

For Iceland, data are missing for only two indicators. For 10 indicators performance is above that of the EU and for three indicators performance is below that of the EU. Iceland is spending 2.81% of its GDP on R&D, with almost 7,000 researchers per million inhabitants, resulting in a very high number of international scientific co-publications. The share of open access publications is above that of the EU. Scientific articles are of good quality as almost 11% are among the top-10% most cited papers. A small share of innovative enterprises collaborates with higher education institutes and public research organisations. A large share of researchers receives transferable skills training. Direct and indirect government support to business enterprises' R&D is below that of the EU. A relatively small share of public R&D expenditures is financed by the business sector.

6.4. Israel

For Israel, data are missing for almost half (seven) indicators. The performance of two indicators is above that of the EU and the performance of six indicators is below that of the EU. Israel is spending a very high share of its GDP on R&D (5.56%), resulting in a high number of international scientific co-publications. The share of open access publications is close to that of the EU. Scientific articles are of relatively good quality as almost 9% are among the top-10% most cited papers. Direct and indirect government support to business enterprises' R&D is below that of the EU.

6.5. Montenegro

For Montenegro, data are missing for five indicators. The performance of four indicators is above that of the EU and the performance of six indicators is below that of the EU. Gross Domestic Expenditure on R&D is relatively low at 0.50% of GDP. The share of open access publications is close to that of the EU. Scientific articles are of relatively low quality with less than 5% being among the top-10% most cited papers. Direct and indirect government support

to business enterprises' R&D is close to 0% of GDP. A relatively large share of public R&D expenditures is financed by the business sector.

6.6. Norway

For Norway, the performance of 12 indicators is above that of the EU and the performance of three indicators is below that of the EU. Norway is spending 1.94% of its GDP on R&D, with more than 7,000 researchers per million inhabitants, resulting in a high number of international scientific co-publications. The share of open access publications is above that of the EU. A small share of innovative enterprises collaborates with higher education institutes and public research organisations. Scientific articles are of good quality as almost 11% are among the top-10% most cited papers. A large share of researchers receives transferable skills training. Direct and indirect government support to business enterprises' R&D is above that of the EU. A relatively small share of public R&D expenditures is financed by the business sector. Government budget allocations for R&D (GBARD) allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per FTE researcher are above that of the EU.

6.7. Serbia

For Serbia, data are missing for three indicators. The performance of four indicators is above that of the EU and the performance of eight indicators is below that of the EU. Gross Domestic Expenditure on R&D is relatively low at almost 1% of GDP. The share of open access publications is close to that of the EU. A small share of innovative enterprises collaborates with higher education institutes and public research organisations. Scientific articles are of relatively low quality with close to 5% being among the top-10% most cited papers. Direct and indirect government support to business enterprises' R&D is below that of the EU. A very small share of public R&D expenditures is financed by the business sector. Government budget allocations for R&D (GBARD) allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per FTE researcher are below that of the EU.

6.8. Türkiye

For Türkiye, data are missing for only two indicators. The performance of four indicators is above that of the EU and for nine indicators performance is below that of the EU. Gross Domestic Expenditure on R&D is relatively low at 1.13% of GDP. The share of open access publications is below that of the EU. A small share of innovative enterprises collaborates with higher education institutes and public research organisations. Scientific articles are of relatively low quality with almost 7.5% being among the top-10% most cited papers. Direct and indirect government support to business enterprises' R&D is above that of the EU. A share of public R&D expenditures is financed by the business sector.

7. Conclusions

The first edition of the new ERA Scoreboard analyses data for 15 of the 18 included indicators, with two indicators measuring progress in the European Research & Innovation system and 16 specific indicators, one for each Pact for R&I priority.

For each of the indicators an EU trend performance has been evaluated for three time periods, from 2010 to present, from 2015 to present, and for the last three years. Based on the number of times the trend was positive in each of these periods, an indicator is considered to have made substantial positive change, slower positive change, or little to no positive change, irrespective of the size of the improvement.

The results of the ERA Scoreboard 2023 show that for the EU there has been **substantial positive change** in the following five Pact for R&I priorities:

- R&D investments
- Gender equality
- Global engagement
- Synergies with sectorial policies and industrial policies
- Coordination of R&I investments.

The EU has shown **slower positive change** in the following three Pact for R&I priorities:

- Researchers' careers and mobility
- Knowledge Valorisation
- Active citizen and societal engagement in R&I.

The EU has shown **limited positive change** in the following five Pact for R&I priorities:

- Scientific leadership
- Challenge-based ERA actions
- Synergies with education and the European Skills Agenda
- More investments and reforms in countries and regions with lower R&I performance
- Support to prioritise and secure long-term R&I investments and policy reforms

Data availability for the selected eight Horizon Associated Countries is relatively poor, in particular for Armenia and Georgia.

While considering the challenges attached to the indicators and the related data, the results indicate that still some additional effort would be beneficial mainly in the priority areas where "limited positive change" can be observed. These preliminary results need to be scrutinised by future Scoreboards, but might also be reflected in the future ERA Policy Agendas.

ANNEXES SHOWING LATEST INDICATOR VALUES AND CHANGES OVER TIME FOR EACH OF THE ERA-SCOREBOARD INDICATORS

Annex 1 Gross Domestic Expenditure on R&D as a percentage of GDP

Country	Latest (2021)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	2.26	0.29	0.14	0.04	-0.04
Belgium	3.22	1.16	0.79	0.06	-0.13
Bulgaria	0.77	0.21	-0.18	-0.06	-0.08
Czechia	2.00	0.67	0.08	0.07	0.01
Denmark	2.81	-0.11	-0.25	-0.12	-0.15
Germany	3.13	0.40	0.20	-0.04	0.00
Estonia	1.75	0.17	0.28	0.12	0.00
Ireland	1.06	-0.53	-0.12	-0.17	-0.17
Greece	1.45	0.85	0.48	0.17	-0.06
Spain	1.43	0.07	0.21	0.18	0.02
France	2.21	0.03	-0.02	0.02	-0.09
Croatia	1.24	0.51	0.41	0.16	0.00
Italy	1.48	0.26	0.14	0.02	-0.03
Cyprus	0.87	0.43	0.39	0.16	0.03
Latvia	0.69	0.08	0.07	0.05	0.00
Lithuania	1.11	0.33	0.07	0.12	-0.03
Luxembourg	1.02	-0.40	-0.23	-0.16	-0.07
Hungary	1.65	0.52	0.31	0.18	0.06
Malta	0.64	0.05	-0.08	0.08	-0.01
Netherlands	2.25	0.55	0.10	0.07	-0.06
Austria	3.19	0.46	0.14	0.06	-0.01
Poland	1.44	0.72	0.44	0.12	0.05
Portugal	1.68	0.14	0.44	0.28	0.07
Romania	0.47	0.02	-0.02	-0.01	0.00
Slovenia	2.14	0.09	-0.06	0.10	0.00
Slovakia	0.93	0.32	-0.23	0.11	0.03
Finland	2.99	-0.72	0.12	0.19	0.08
Sweden	3.35	0.18	0.13	-0.04	-0.14
Armenia	0.21	-0.04	-0.04	0.03	0.00
Georgia	0.25	-0.05	-0.05	-0.03	-0.05
Iceland	2.81	0.41	0.63	0.49	0.34
Israel	5.56	1.69	1.34	0.34	-0.15
Montenegro	0.50	0.19	0.13	0.00	0.00
Norway	1.94	0.30	0.02	-0.20	-0.30
Serbia	0.99	0.29	0.18	0.10	0.08
Türkiye	1.13	0.34	0.25	0.07	0.04

Annex 2 Researchers (in full-time equivalent) per million inhabitants

Country	Latest (2021)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	4,483	1,429	955	333	264
Belgium	6,604	2,838	1,872	1,313	1,045
Bulgaria	2,347	867	370	-73	-55
Czechia	4,581	1,788	968	591	448
Denmark	7,708	945	142	15	57
Germany	5,538	1,528	760	109	118
Estonia	4,037	980	853	267	201
Ireland	4,593	1,477	-159	-207	-227
Greece	4,150	1,932	954	506	143
Spain	3,252	355	616	184	180
France	5,025	1,259	820	361	249
Croatia	2,356	705	849	192	110
Italy	2,916	1,168	845	227	284
Cyprus	1,814	709	803	156	74
Latvia	2,391	553	571	499	256
Lithuania	3,941	1,204	1,145	494	296
Luxembourg	5,051	-154	415	-41	128
Hungary	4,452	2,321	1,884	431	143
Malta	2,060	642	195	157	95
Netherlands	6,069	2,829	1,129	415	205
Austria	6,163	1,783	1,089	203	333
Poland	3,585	1,888	1,412	404	302
Portugal	5,473	1,546	1,746	592	309
Romania	995	21	117	102	47
Slovenia	5,249	1,486	1,420	200	75
Slovakia	3,209	392	551	94	43
Finland	7,871	130	1,014	624	322
Sweden	9,640	4,361	2,794	1,954	1,885
Armenia	N/A	N/A	N/A	N/A	N/A
Georgia	1,624	343	343	-75	-89
Iceland	6,944	-146	1,037	707	354
Israel	N/A	N/A	N/A	N/A	N/A
Montenegro	4,763	659	377	0	0
Norway	7,162	1,718	1,233	425	397
Serbia	789	253	-73	0	0
Türkiye	2,207	703	147	120	57

Data are not available for Armenia and Israel.

Annex 3 Share of publications available in open access

Country	Latest (2019)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	39.2	5.2	N/A	N/A	N/A
Belgium	43.2	3.7	N/A	N/A	N/A
Bulgaria	25.7	-5.1	N/A	N/A	N/A
Czechia	34.1	0.6	N/A	N/A	N/A
Denmark	48.1	8.6	N/A	N/A	N/A
Germany	39.9	6.3	N/A	N/A	N/A
Estonia	40.4	1.2	N/A	N/A	N/A
Ireland	44.1	3.4	N/A	N/A	N/A
Greece	34.5	2.1	N/A	N/A	N/A
Spain	44.8	6.6	N/A	N/A	N/A
France	39.5	3.5	N/A	N/A	N/A
Croatia	50.7	-2.2	N/A	N/A	N/A
Italy	37.8	4.1	N/A	N/A	N/A
Cyprus	38.3	6.3	N/A	N/A	N/A
Latvia	28.9	-0.9	N/A	N/A	N/A
Lithuania	44.3	3.7	N/A	N/A	N/A
Luxembourg	42.0	10.4	N/A	N/A	N/A
Hungary	54.3	20.1	N/A	N/A	N/A
Malta	39.3	-4.4	N/A	N/A	N/A
Netherlands	58.3	13.2	N/A	N/A	N/A
Austria	49.0	14.4	N/A	N/A	N/A
Poland	40.9	7.2	N/A	N/A	N/A
Portugal	39.5	0.4	N/A	N/A	N/A
Romania	25.1	1.4	N/A	N/A	N/A
Slovenia	44.3	8.1	N/A	N/A	N/A
Slovakia	30.8	-3.7	N/A	N/A	N/A
Finland	48.6	13.9	N/A	N/A	N/A
Sweden	52.9	14.7	N/A	N/A	N/A
Armenia	N/A	N/A	N/A	N/A	N/A
Georgia	N/A	N/A	N/A	N/A	N/A
Iceland	51.4	10.1	N/A	N/A	N/A
Israel	36.7	-3.4	N/A	N/A	N/A
Montenegro	40.8	-9.2	N/A	N/A	N/A
Norway	53.7	17.4	N/A	N/A	N/A
Serbia	42.1	-1.5	N/A	N/A	N/A
Türkiye	29.8	-2.6	N/A	N/A	N/A

Data are not available for Armenia and Georgia.

Annex 4 Share of women in grade A positions in higher education

Country	Latest (2018)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year	Data available for years and variable	Data imputed for years
European Union	27.2	4.9	1.8	N/A	0.5	--	--
Belgium	20.3	7.0	2.7	N/A	1.1	#2: 2011-18	2010
Bulgaria	39.7	13.8	5.8	N/A	1.5	#1: 2010-18	--
Czechia	N/A	N/A	N/A	N/A	N/A	--	--
Denmark	22.6	6.5	2.5	N/A	1.2	#1: 2010-18	--
Germany	20.5	5.8	2.0	N/A	0.5	#1: 2010-18	--
Estonia	N/A	N/A	N/A	N/A	N/A	--	--
Ireland	25.6	7.0	5.1	N/A	1.6	#1: 2014-18	2010-12
Greece	22.3	2.6	0.8	N/A	0.0	#1: 2012-13, 15-17	2010-11, 14, 18
Spain	23.9	5.4	3.0	N/A	1.4	#1: 2010-18	--
France	27.4	8.1	1.7	N/A	0.0	#1: 2012, 15, 17	2010-11, 13-14, 16, 18
Croatia	33.3	5.3	3.5	N/A	0.0	#1: 2014, 17, 19	2010-13, 15-16, 18
Italy	23.7	3.7	2.2	N/A	0.7	#1: 2010-18	--
Cyprus	13.3	3.6	0.3	N/A	0.0	#2: 2010-17	2018
Latvia	41.4	9.2	2.3	N/A	0.0	#1: 2010-16	2017-18
Lithuania	40.4	1.2	1.2	N/A	-4.1	#1: 2017-18	2010-16
Luxembourg	17.7	0.0	0.0	N/A	0.0	#1: 202016	2010-15, 17-18
Hungary	21.6	1.1	1.5	N/A	1.0	#2: 2010-18	--
Malta	19.3	-25.3	-13.3	N/A	-0.7	#1: 2014, 16, 18	2010-13, 15, 17
Netherlands	22.3	9.2	4.2	N/A	2.1	#1: 2010-18	--
Austria	25.1	4.8	2.3	N/A	0.0	#2: 2011, 13, 15, 17	2010, 12, 14, 16, 18
Poland	24.6	2.8	1.3	N/A	0.9	#1: 2012-18	2010-11
Portugal	27.2	4.6	1.5	N/A	0.2	#2: 2010-18	--
Romania	40.6	15.0	1.0	N/A	1.6	#1: 2010-18	--
Slovenia	33.0	10.4	4.0	N/A	1.3	#1: 2013-15, 18	2010-12, 16-17
Slovakia	27.2	4.7	2.5	N/A	0.9	#1: 2012-13, 16, 18	2010-11, 14-15, 17
Finland	30.3	5.6	1.9	N/A	0.2	#2: 2011-18	2010
Sweden	28.2	5.9	2.9	N/A	1.2	#1: 2011, 13, 15, 17-18	2010, 12, 14, 16
Armenia	N/A	N/A	N/A	N/A	N/A	--	--
Georgia	N/A	N/A	N/A	N/A	N/A	--	--
Iceland	26.3	2.1	0.0	N/A	0.0	#1: 2010-12	2013-18
Israel	19.5	5.7	5.2	N/A	0.8	#1: 2014-18	2010-13
Montenegro	N/A	N/A	N/A	N/A	N/A	--	--
Norway	30.9	8.0	3.8	N/A	1.3	#2: 2011-18	2010
Serbia	N/A	N/A	N/A	N/A	N/A	--	--
Türkiye	30.5	0.4	0.4	N/A	0.1	#1: 2016-18	2010-15

Data are available for two variables: #1 Proportion (%) of women among grade A staff, by age group - Academic staff, and #2 Proportion (%) of women among grade A staff, by age group - Researchers. Not for all countries data are available for both variables. The table shows which data have been used for each country. Data for the EU have been calculated as the unweighted average of the shares for the individual Member States, with all countries receiving the same weight irrespective of differences in absolute number of researchers and academic staff between countries. Data are not available for Estonia, Armenia, Georgia, Montenegro and Serbia.

Annex 5 Job-to-job mobility of Human Resources in Science & Technology

Country	Latest (2020)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	6.8	1.3	0.9	-0.5	-0.8
Belgium	6.5	0.7	0.8	-0.4	-0.6
Bulgaria	2.8	0.1	0.0	0.4	0.0
Czechia	4.3	-0.7	0.4	-0.9	-0.4
Denmark	10.7	1.4	0.2	0.1	0.0
Germany	8.8	1.9	1.9	-0.7	-1.1
Estonia	9.5	4.2	2.9	-0.7	-1.1
Ireland	N/A	N/A	N/A	N/A	N/A
Greece	4.8	1.4	1.3	0.5	-0.5
Spain	6.9	1.7	0.7	-0.8	-0.9
France	7.4	2.3	1.4	-0.3	-1.1
Croatia	6.9	3.3	2.1	-0.8	0.5
Italy	4.4	0.4	0.6	0.2	0.0
Cyprus	10.5	3.1	3.1	0.2	0.3
Latvia	6.2	0.4	0.3	0.8	1.1
Lithuania	10.8	3.1	3.7	0.1	0.2
Luxembourg	9.4	2.5	1.1	-0.9	-0.6
Hungary	6.7	3.4	2.5	1.7	0.4
Malta	7.6	1.3	0.5	-3.1	-1.4
Netherlands	8.7	0.9	0.8	-0.8	-1.1
Austria	7.3	1.2	0.9	0.3	-1.1
Poland	6.8	1.0	0.0	-0.6	-0.9
Portugal	7.0	1.0	0.9	-0.6	-2.1
Romania	1.4	-0.8	-1.0	-0.6	-0.2
Slovenia	7.3	1.0	1.5	1.3	0.7
Slovakia	3.4	0.3	0.1	-0.7	0.1
Finland	8.4	1.2	1.3	0.2	-0.2
Sweden	4.0	-0.2	-1.2	-2.1	-2.4
Armenia	N/A	N/A	N/A	N/A	N/A
Georgia	N/A	N/A	N/A	N/A	N/A
Iceland	8.9	1.0	-0.5	-2.2	-1.2
Israel	N/A	N/A	N/A	N/A	N/A
Montenegro	3.4	N/A	-0.9	-0.4	-0.2
Norway	9.2	0.6	0.1	-0.2	-0.5
Serbia	5.7	2.7	1.1	0.3	-0.4
Türkiye	7.1	0.9	-1.3	-2.5	-1.3

Data are not available for Ireland, Armenia, Georgia and Israel.

Annex 6 Share of innovating firms collaborating with HEI/PRO out of all innovative firms

Country	Latest (2020)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	13.3	2.4	0.7	-1.9	N/A
Belgium	19.6	1.3	-3.0	-1.0	N/A
Bulgaria	5.0	-0.7	1.9	-0.8	N/A
Czechia	11.7	-0.4	-1.0	-1.2	N/A
Denmark	15.3	1.1	0.8	-29.7	N/A
Germany	15.8	2.2	0.9	-3.0	N/A
Estonia	14.9	6.7	-0.2	-2.2	N/A
Ireland	23.0	12.5	11.9	-13.3	N/A
Greece	13.6	-2.3	3.6	-2.0	N/A
Spain	9.0	0.1	-3.3	-0.5	N/A
France	13.2	1.7	1.3	-1.0	N/A
Croatia	10.2	-2.2	3.3	-1.1	N/A
Italy	9.9	5.3	3.1	-0.1	N/A
Cyprus	4.7	-8.9	-1.8	-2.4	N/A
Latvia	11.2	3.7	5.8	3.2	N/A
Lithuania	11.7	2.1	2.9	1.1	N/A
Luxembourg	12.0	1.6	1.5	1.3	N/A
Hungary	12.9	-2.8	2.5	0.5	N/A
Malta	8.1	4.8	4.2	1.7	N/A
Netherlands	11.7	2.0	-3.9	-1.6	N/A
Austria	23.2	2.7	1.8	2.2	N/A
Poland	9.7	1.3	-1.6	-3.2	N/A
Portugal	8.5	0.2	-1.2	-4.2	N/A
Romania	7.6	3.8	-0.5	3.1	N/A
Slovenia	19.3	-1.2	-0.2	-2.5	N/A
Slovakia	8.7	-5.6	-1.3	-3.1	N/A
Finland	24.6	-10.1	-3.4	-6.2	N/A
Sweden	15.5	1.4	-1.7	-0.7	N/A
Armenia	N/A	N/A	N/A	N/A	N/A
Georgia	N/A	N/A	N/A	N/A	N/A
Iceland	14.1	1.7	-2.8	0.0	N/A
Israel	N/A	N/A	N/A	N/A	N/A
Montenegro	N/A	N/A	N/A	N/A	N/A
Norway	14.3	-1.4	-2.8	1.6	N/A
Serbia	16.9	2.1	5.4	0.0	N/A
Türkiye	15.9	8.2	10.1	-10.0	N/A

Trend results for the last year are not available as these would be the same as those for the last 3 years for which the difference between 2018 and 2020 has been used. Data are not available for Armenia, Georgia, Israel and Montenegro.

Annex 7 Number of scientific publications among the top-10% most cited publications worldwide as a percentage of all publications

Country	Latest (2020)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	9.8	-0.3	-0.3	0.0	0.0
Belgium	11.9	-1.1	-1.8	-0.4	-0.3
Bulgaria	2.4	-0.7	0.0	-0.1	-0.3
Czechia	5.2	0.3	0.6	0.2	0.2
Denmark	12.2	-2.6	-2.2	-1.2	-1.6
Germany	10.4	-0.9	-0.9	-0.1	-0.1
Estonia	8.8	1.1	0.9	-0.6	0.1
Ireland	11.3	-0.4	-1.2	-0.3	-0.1
Greece	9.2	0.8	0.1	0.3	0.4
Spain	9.2	-0.3	-0.1	0.0	-0.1
France	8.9	-1.3	-0.7	0.1	0.1
Croatia	4.8	1.9	1.2	0.5	0.3
Italy	12.2	1.9	1.2	1.2	1.0
Cyprus	10.4	1.4	1.8	1.3	2.0
Latvia	5.0	3.6	1.1	0.8	1.6
Lithuania	5.9	2.6	1.4	1.2	0.7
Luxembourg	12.8	-0.4	0.2	1.7	-1.2
Hungary	5.9	0.9	1.1	0.5	-0.7
Malta	8.8	2.0	-0.4	3.1	3.4
Netherlands	13.9	-2.1	-1.4	-1.1	-1.0
Austria	10.3	-0.7	-1.0	-0.4	-0.4
Poland	5.5	2.3	1.0	0.5	0.6
Portugal	8.8	-1.1	-0.5	-0.4	-0.5
Romania	6.3	2.9	2.8	1.4	0.7
Slovenia	7.9	1.6	1.0	0.1	0.2
Slovakia	4.5	1.6	0.9	0.7	0.4
Finland	11.8	0.2	0.4	0.0	-0.6
Sweden	11.7	-1.1	-1.4	-1.2	-0.9
Armenia	2.1	1.1	1.0	-0.3	0.0
Georgia	3.7	0.4	1.5	0.5	0.0
Iceland	10.7	-3.9	1.1	0.6	2.6
Israel	8.6	-2.6	-1.5	-0.8	-0.3
Montenegro	4.2	1.5	2.0	-2.0	1.2
Norway	10.9	-1.5	-1.7	-1.0	-0.6
Serbia	5.3	0.8	1.2	0.6	0.5
Türkiye	7.4	1.8	2.3	1.3	1.1

Annex 8 International co-publications with non-EU (or foreign) partners per million population

Country	Latest (2021)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	358.7	141.3	74.1	38.0	18.6
With all foreign partners					
European Union	*1,279.0*	*618.8*	*360.0*	*85.4*	*-5.5*
Belgium	2247.5	978.6	499.2	142.9	-37.8
Bulgaria	404.7	178.1	157.6	27.6	9.2
Czechia	1316.8	767.9	440.5	76.9	-45.1
Denmark	3698.4	2035.6	1081.1	208.9	-33.1
Germany	1207.5	475.7	247.4	62.4	-21.9
Estonia	2136.2	1415.4	953.6	206.9	-63.7
Ireland	2373.9	1226.7	916.5	293.3	5.1
Greece	1184.3	630.5	409.9	176.1	55.4
Spain	1178.0	604.5	344.0	63.1	-8.7
France	993.3	293.0	111.1	-19.2	-41.0
Croatia	1090.5	729.6	529.4	192.1	81.2
Italy	1136.7	614.6	394.7	92.1	6.8
Cyprus	3743.8	2676.8	2282.1	827.1	358.7
Latvia	781.6	625.9	421.0	61.3	-35.0
Lithuania	922.7	668.0	449.6	44.0	-48.1
Luxembourg	3495.5	2125.2	1086.8	595.1	269.0
Hungary	757.4	374.4	249.2	90.8	14.0
Malta	1575.9	1223.3	773.1	433.2	155.6
Netherlands	2475.6	1110.8	625.3	156.8	-25.5
Austria	2266.0	1088.2	617.9	166.9	-37.4
Poland	591.6	372.4	268.4	80.1	22.1
Portugal	1729.3	1079.7	648.2	165.8	27.5
Romania	395.2	233.7	160.5	68.5	36.5
Slovenia	1941.5	1016.7	568.6	166.5	-79.4
Slovakia	827.8	437.1	273.0	-31.8	-50.4
Finland	2776.6	1415.6	798.9	240.0	41.2
Sweden	2975.9	1365.1	681.2	168.7	-9.1
Armenia	256.1	130.3	45.2	14.9	0.0
Georgia	269.8	192.9	106.2	19.9	0.0
Iceland	4348.2	1741.4	1042.2	517.2	188.7
Israel	1271.0	338.5	163.8	0.0	0.0
Montenegro	736.6	515.3	392.6	-40.1	-99.5
Norway	3358.2	1842.8	1244.6	345.1	93.9
Serbia	697.2	457.2	294.4	118.3	23.3
Türkiye	203.1	132.2	96.2	32.0	0.0

Results for the EU in the first row only include co-publications with co-authors outside the EU are not comparable to the results of the other countries as these include co-publications with all foreign co-authors, also including co-authors in other Member States. Comparable results for the EU are shown in the third row in italics.

Annex 9 Environmentally related government R&D budget as percentage of total government R&D

Country	Latest (2020)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	2.5	-0.2	-0.5	0.0	0.1
Belgium	0.6	-1.5	-1.4	-0.2	-0.4
Bulgaria	N/A	N/A	N/A	N/A	N/A
Czechia	2.1	0.0	-0.2	0.0	0.0
Denmark	1.2	-0.4	-0.8	0.1	0.3
Germany	2.7	-0.3	-0.2	0.0	0.0
Estonia	1.3	-4.7	-6.3	-0.2	0.6
Ireland	2.0	0.8	1.0	0.7	0.7
Greece	4.2	1.5	1.1	0.9	-1.6
Spain	3.1	-0.4	-0.7	-0.8	-0.8
France	1.8	0.1	-1.5	0.1	0.4
Croatia	N/A	N/A	N/A	N/A	N/A
Italy	2.9	0.0	0.4	0.1	0.4
Cyprus	N/A	N/A	N/A	N/A	N/A
Latvia	5.9	0.2	-2.0	1.7	1.0
Lithuania	0.3	-1.7	-1.9	0.2	0.2
Luxembourg	2.0	-2.1	-0.6	-0.4	-0.5
Hungary	4.3	1.3	2.1	1.8	0.4
Malta	N/A	N/A	N/A	N/A	N/A
Netherlands	0.7	0.2	0.1	0.1	0.1
Austria	2.7	1.8	2.0	2.1	2.2
Poland	N/A	N/A	N/A	N/A	N/A
Portugal	4.3	1.0	-0.4	0.3	-0.3
Romania	N/A	N/A	N/A	N/A	N/A
Slovenia	5.3	2.0	-0.9	-0.3	-0.5
Slovakia	2.9	-0.3	0.0	0.1	-0.1
Finland	3.0	1.9	1.9	0.4	0.7
Sweden	1.8	-0.2	0.3	0.4	0.0
Armenia	N/A	N/A	N/A	N/A	N/A
Georgia	N/A	N/A	N/A	N/A	N/A
Iceland	N/A	N/A	N/A	N/A	N/A
Israel	N/A	N/A	N/A	N/A	N/A
Montenegro	N/A	N/A	N/A	N/A	N/A
Norway	3.1	0.4	0.6	0.5	0.4
Serbia	N/A	N/A	N/A	N/A	N/A
Türkiye	0.8	-0.1	-1.1	-0.1	0.0

Data are not available for 5 Member States (Bulgaria, Croatia, Cyprus, Malta, Poland and Romania) and for 6 Horizon Europe Associated Countries.

Annex 10 Share of researchers receiving transferable skills training

Country	Latest (2020)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	46.3	N/A	-3.2	N/A	N/A
Belgium	61.0	N/A	-3.5	N/A	N/A
Bulgaria	31.0	N/A	-36.2	N/A	N/A
Czechia	44.7	N/A	-16.0	N/A	N/A
Denmark	70.3	N/A	9.4	N/A	N/A
Germany	35.1	N/A	-8.5	N/A	N/A
Estonia	59.8	N/A	6.6	N/A	N/A
Ireland	46.0	N/A	-24.8	N/A	N/A
Greece	54.0	N/A	0.0	N/A	N/A
Spain	45.8	N/A	-20.6	N/A	N/A
France	50.8	N/A	6.1	N/A	N/A
Croatia	54.2	N/A	-5.5	N/A	N/A
Italy	66.7	N/A	17.0	N/A	N/A
Cyprus	N/A	N/A	N/A	N/A	N/A
Latvia	45.5	N/A	-24.4	N/A	N/A
Lithuania	46.5	N/A	1.2	N/A	N/A
Luxembourg	32.7	N/A	-32.8	N/A	N/A
Hungary	72.8	N/A	22.3	N/A	N/A
Malta	80.3	N/A	0.0	N/A	N/A
Netherlands	54.9	N/A	-6.9	N/A	N/A
Austria	66.7	N/A	43.6	N/A	N/A
Poland	41.4	N/A	-10.0	N/A	N/A
Portugal	44.5	N/A	4.3	N/A	N/A
Romania	89.4	N/A	42.8	N/A	N/A
Slovenia	40.5	N/A	-32.2	N/A	N/A
Slovakia	42.7	N/A	-14.0	N/A	N/A
Finland	41.7	N/A	-14.9	N/A	N/A
Sweden	48.8	N/A	-15.9	N/A	N/A
Armenia	N/A	N/A	N/A	N/A	N/A
Georgia	N/A	N/A	N/A	N/A	N/A
Iceland	70.5	N/A	0.0	N/A	N/A
Israel	N/A	N/A	N/A	N/A	N/A
Montenegro	N/A	N/A	N/A	N/A	N/A
Norway	50.9	N/A	-21.1	N/A	N/A
Serbia	N/A	N/A	N/A	N/A	N/A
Türkiye	N/A	N/A	N/A	N/A	N/A

Data are not available for Cyprus and for 6 Horizon Europe Associated Countries (Armenia, Georgia, Israel, Montenegro, Serbia and Türkiye).

Annex 11 Direct government support and Indirect government support through R&D tax incentives as a percentage of GDP

Country	Latest (2020)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	0.182	0.031	0.021	0.006	0.005
Belgium	0.319	0.103	0.083	0.039	-0.022
Bulgaria	0.006	-0.001	-0.004	-0.003	-0.002
Czechia	0.119	-0.023	-0.015	-0.011	-0.009
Denmark	0.085	0.027	0.012	0.016	0.010
Germany	0.067	-0.015	-0.001	0.000	-0.003
Estonia	0.055	-0.033	-0.001	0.021	0.008
Ireland	0.208	0.029	-0.103	0.061	0.000
Greece	0.081	0.063	0.048	0.038	0.036
Spain	0.102	-0.042	0.013	0.012	0.008
France	0.421	0.027	0.011	0.026	0.023
Croatia	0.114	-0.135	0.112	0.106	0.095
Italy	0.145	0.102	0.051	-0.103	-0.067
Cyprus	0.030	0.016	0.024	0.022	0.012
Latvia	0.013	0.005	0.008	0.007	0.006
Lithuania	0.040	0.016	0.012	0.011	0.008
Luxembourg	0.031	-0.014	-0.014	-0.010	-0.006
Hungary	0.230	-0.027	-0.108	-0.013	-0.004
Malta	0.004	-0.028	-0.025	-0.036	-0.026
Netherlands	0.258	0.064	0.038	0.029	0.024
Austria	0.356	0.133	0.095	0.091	0.083
Poland	0.147	0.120	0.100	0.019	0.011
Portugal	0.296	0.175	0.154	0.087	0.053
Romania	0.023	-0.036	-0.013	0.002	0.003
Slovenia	0.195	-0.075	0.005	0.007	-0.020
Slovakia	0.060	0.033	0.037	0.021	0.018
Finland	0.072	0.005	0.002	0.021	0.025
Sweden	0.139	0.017	0.007	0.017	0.019
Armenia	N/A	N/A	N/A	N/A	N/A
Georgia	N/A	N/A	N/A	N/A	N/A
Iceland	0.106	0.053	0.000	0.000	0.000
Israel	0.104	-0.031	-0.011	0.004	0.010
Montenegro	0.001	0.001	-0.002	0.000	0.000
Norway	0.235	0.105	0.051	0.015	0.008
Serbia	0.023	0.015	0.000	-0.001	-0.004
Türkiye	0.202	0.126	0.108	0.049	0.012

Data are not available for Armenia and Georgia.

Annex 12 Research on social innovation per million population

Country	Latest (2021)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	1.75	1.39	0.50	0.01	-0.01
Belgium	1.99	1.26	0.30	-0.89	-0.53
Bulgaria	1.16	1.16	1.02	-0.56	-0.28
Czechia	0.86	0.19	-0.38	-0.08	-0.36
Denmark	4.62	3.54	0.91	-0.20	-2.59
Germany	0.66	0.50	0.22	0.05	-0.13
Estonia	0.75	-2.26	-1.53	-0.76	0.00
Ireland	0.40	0.40	-0.24	-0.62	-0.61
Greece	1.03	1.03	0.85	0.19	0.19
Spain	2.87	2.55	1.64	1.34	1.01
France	0.86	0.58	0.21	-0.18	0.23
Croatia	7.68	6.51	-0.13	-2.13	-1.44
Italy	1.94	1.72	0.67	-0.37	-0.39
Cyprus	4.46	4.46	4.46	1.04	-1.17
Latvia	5.28	4.80	1.25	1.12	2.66
Lithuania	2.50	1.52	-1.26	0.36	-1.43
Luxembourg	1.58	1.58	-0.20	-0.05	-0.02
Hungary	0.82	0.82	0.72	0.21	-0.20
Malta	1.94	-0.47	1.94	1.94	-7.78
Netherlands	6.35	4.67	0.49	0.45	0.78
Austria	3.69	3.10	2.65	-0.82	0.77
Poland	0.37	0.13	-0.13	0.21	-0.18
Portugal	5.53	4.78	1.39	-1.08	0.48
Romania	0.10	0.05	-0.30	-0.20	-0.36
Slovenia	2.84	2.36	-0.55	-1.00	-1.93
Slovakia	0.37	0.37	0.18	-0.18	-0.37
Finland	5.06	3.76	1.04	0.17	-0.73
Sweden	2.31	1.57	0.57	0.06	0.57
Armenia	0.34	0.34	0.34	0.34	0.34
Georgia	0.00	0.00	0.00	0.00	0.00
Iceland	2.71	2.71	2.71	-0.09	-0.03
Israel	0.11	0.11	0.11	0.11	0.11
Montenegro	0.00	0.00	0.00	0.00	0.00
Norway	8.16	7.55	7.19	4.60	4.25
Serbia	0.29	0.02	0.29	0.00	0.00
Türkiye	0.30	0.23	0.17	-0.09	0.03

Data on the number of publications for each country have been extracted from EU OpenAIRE (https://explore.openaire.eu/search/advanced/research-outcomes) by searching for the number of publications with the following keywords: ‘social innovation’ or ‘social entrepreneurship’.

Annex 13 Increase in total R&D expenditure, expressed as a percentage of GDP

Country	Latest (2020)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
Widening countries *	0.02	-0.04	-0.03	-0.03	-0.07
European Union	-0.04	-0.09	-0.05	-0.03	-0.08
Belgium	-0.19	-0.30	-0.25	-0.49	-0.41
Bulgaria *	-0.04	-0.01	-0.20	-0.12	-0.06
Czechia *	0.01	-0.20	0.05	-0.02	-0.05
Denmark	-0.15	-0.17	-0.30	-0.11	-0.18
Germany	0.00	-0.08	-0.05	-0.06	0.04
Estonia *	0.01	-0.72	-0.03	-0.20	-0.15
Ireland	-0.17	-0.13	0.17	-0.23	-0.17
Greece *	-0.07	-0.15	-0.20	-0.14	-0.30
Spain	0.02	0.05	0.04	0.01	-0.14
France	-0.09	-0.10	-0.09	-0.08	-0.20
Croatia *	0.02	0.02	-0.04	-0.11	-0.15
Italy	-0.02	0.00	-0.02	-0.06	-0.07
Cyprus *	0.04	0.03	0.07	-0.05	-0.10
Latvia *	0.00	-0.11	0.07	0.00	-0.07
Lithuania *	-0.02	-0.14	-0.03	-0.07	-0.17
Luxembourg	-0.06	-0.06	-0.09	-0.07	0.05
Hungary *	0.04	-0.01	0.04	0.07	-0.08
Malta *	-0.01	-0.09	-0.04	0.00	-0.10
Netherlands	-0.06	-0.24	-0.04	-0.10	-0.19
Austria	0.00	0.06	0.03	-0.04	-0.09
Poland *	0.05	0.02	-0.01	-0.06	-0.02
Portugal *	0.07	0.15	0.12	0.02	-0.15
Romania *	0.01	-0.03	-0.10	0.03	0.02
Slovenia *	0.00	-0.36	0.17	-0.10	-0.10
Slovakia *	0.04	-0.01	-0.24	0.05	-0.04
Finland	0.07	0.16	0.35	0.03	-0.04
Sweden	-0.14	-0.16	-0.26	-0.21	-0.24
Armenia	0.00	0.00	0.00	0.01	-0.03
Georgia	-0.05	-0.05	-0.05	-0.05	-0.07
Iceland	0.32	0.32	0.08	0.00	0.17
Israel	-0.15	-0.22	-0.25	-0.59	-0.64
Montenegro	0.00	0.00	-0.01	0.00	0.00
Norway	-0.31	-0.29	-0.53	-0.42	-0.43
Serbia	0.08	0.10	-0.01	0.11	0.06
Türkiye	0.00	0.00	-0.02	-0.03	-0.03

Annex 14 Share of public R&D expenditures financed by the private sector

Country	Latest (2020)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	7.9	-0.7	-0.4	-0.1	0.2
Belgium	9.9	0.6	-0.9	0.2	0.0
Bulgaria	10.8	4.9	4.1	4.3	0.2
Czechia	3.2	-0.1	-0.2	-1.1	-0.5
Denmark	2.6	-0.4	0.2	-0.1	0.6
Germany	11.6	-0.1	-1.1	-0.4	-0.3
Estonia	6.6	2.8	1.9	0.7	0.0
Ireland	3.7	1.5	1.1	0.2	0.0
Greece	5.2	-2.9	-1.1	-1.0	-0.8
Spain	6.3	-1.3	0.5	0.2	-0.2
France	4.7	0.3	-0.1	-0.1	0.2
Croatia	4.6	-2.7	-3.5	3.3	3.2
Italy	5.2	2.9	2.9	0.0	-0.1
Cyprus	1.9	0.7	1.4	0.9	0.1
Latvia	7.7	-5.5	-3.2	1.6	1.3
Lithuania	7.2	-7.7	-4.8	-0.9	0.0
Luxembourg	2.2	0.6	1.0	0.1	-0.4
Hungary	2.2	-10.9	-6.2	-3.7	-0.7
Malta	1.7	0.2	1.0	0.5	0.3
Netherlands	7.9	-2.7	0.1	-0.9	-0.4
Austria	6.0	1.0	0.6	0.0	0.0
Poland	2.9	-1.7	-0.6	-1.0	-0.5
Portugal	2.4	1.3	0.5	0.0	0.2
Romania	12.7	-0.4	0.7	2.3	2.3
Slovenia	6.6	-5.9	-2.8	-1.8	-0.5
Slovakia	2.0	-5.9	-2.4	-0.3	-0.1
Finland	3.8	-3.1	-1.1	-0.3	-0.3
Sweden	3.2	-1.0	-0.8	-0.8	0.0
Armenia	N/A	N/A	N/A	N/A	N/A
Georgia	N/A	N/A	N/A	N/A	N/A
Iceland	4.8	-2.9	0.9	1.8	2.6
Israel	N/A	N/A	N/A	N/A	N/A
Montenegro	14.9	12.4	-16.2	-16.2	9.5
Norway	3.8	-2.1	-0.7	0.2	0.2
Serbia	0.1	-9.3	0.0	0.0	0.0
Türkiye	1.1	-8.1	-4.9	-3.5	-0.2

Data are not available for Armenia, Georgia and Israel.

Annex 15 Government budget allocations for R&D allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per FTE researcher

Country	Latest (2021)	Change since 2010	Change since 2015	Change in last 3 years	Change since last year
European Union	1,788.8	-147.1	-184.7	-0.5	-159.1
Belgium	3,918.1	-488.5	-545.0	141.3	-700.2
Bulgaria	139.4	82.6	100.6	7.3	12.1
Czechia	597.2	-241.6	-148.8	66.7	40.6
Denmark	503.0	-375.3	-475.5	25.4	-146.8
Germany	2,185.1	91.8	29.6	101.6	92.9
Estonia	1,751.6	1,084.3	877.9	1,379.2	1,172.9
Ireland	1,288.8	294.6	462.1	320.1	373.5
Greece	518.5	-660.1	-22.0	172.0	-94.8
Spain	2,134.6	-71.4	359.7	173.9	-377.4
France	N/A	N/A	N/A	N/A	N/A
Croatia	849.8	267.1	129.2	-43.2	278.0
Italy	3,784.3	55.7	-807.1	-65.6	-777.5
Cyprus	2,684.3	674.5	923.7	-879.1	-447.7
Latvia	715.9	535.7	17.9	-578.2	-143.7
Lithuania	506.7	410.7	297.4	295.5	382.0
Luxembourg	3,567.7	2,902.2	1,791.0	996.3	1,163.1
Hungary	153.0	104.5	-205.0	-41.1	7.5
Malta	287.4	248.5	142.3	86.1	111.3
Netherlands	1,037.2	-1,359.2	-368.8	-64.0	-251.4
Austria	2,069.3	-333.7	-177.8	-344.9	-283.1
Poland	383.7	-55.2	-247.7	-84.2	-73.6
Portugal	283.2	-81.0	-475.2	-125.8	-140.9
Romania	339.6	-360.5	-992.9	-729.1	-41.2
Slovenia	1,156.0	304.8	518.8	137.6	79.6
Slovakia	341.1	309.9	132.0	196.1	120.8
Finland	998.9	-586.5	-672.3	-314.1	-439.7
Sweden	1,733.1	-699.0	-330.3	-417.9	-495.0
Armenia	N/A	N/A	N/A	N/A	N/A
Georgia	N/A	N/A	N/A	N/A	N/A
Iceland	N/A	N/A	N/A	N/A	N/A
Israel	N/A	N/A	N/A	N/A	N/A
Montenegro	N/A	N/A	N/A	N/A	N/A
Norway	2,075.1	-423.5	-103.1	-72.0	43.6
Serbia	1,374.6	1,301.1	843.7	865.5	1,328.0
Türkiye	N/A	N/A	N/A	N/A	N/A

Data are not available for France, Armenia, Georgia, Iceland, Israel, Montenegro and Türkiye.

Annex 16 Country abbreviations

Member States		Horizon Associated countries	
AT	Austria	AR	Armenia
BE	Belgium	GE	Georgia
BG	Bulgaria	IS	Iceland
CY	Cyprus	IL	Israel
CZ	Czechia	ME	Montenegro
DE	Germany	NO	Norway
DK	Denmark	RS	Serbia
EL	Greece	TR	Türkiye
EE	Estonia		
ES	Spain		
FI	Finland		
FR	France		
HR	Croatia		
HU	Hungary		
IE	Ireland		
IT	Italy		
LT	Lithuania		
LU	Luxembourg		
LV	Latvia		
MT	Malta		
NL	Netherlands		
PL	Poland		
PT	Portugal		
RO	Romania		
SE	Sweden		
SI	Slovenia		
SK	Slovakia		

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This report provides the results of the 2023 edition of the ERA Scoreboard. The ERA Scoreboard is one of the components of the new ERA Monitoring Mechanism, covering 18 indicators, including two general indicators measuring progress in the European Research & Innovation (R&I) system and 16 specific indicators, one for each Pact for R&I priority.

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