



Fostering R&D intensity in the European Union: policy experiences and lessons learned

Case study contribution to the OECD TIP project on R&D intensity

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COUNTRY CASE STUDY: European Union¹

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Executive summary

The EU's target of investing 3% of EU GDP in R&D was set at the 2002 Barcelona European Council² and then subsequently confirmed in the Europe 2020 strategy (2010). Whilst acknowledging that research and innovation (R&I) together with education and skills are the foundation for a knowledge-based society, the Europe 2020 Strategy also recalled that Europe was not progressing fast enough relative to the rest of the world. In particular, policy-makers needed to address the lower levels of private R&D investment in the EU compared to our competitors, by improving the conditions for private R&D. As a result, the great majority of Member States³ defined national R&D intensity targets for 2020, which largely reflected the level of maturity of their R&I systems and their industrial specialisation.

Although the EU has not fulfilled its R&D investment ambition⁴, the 3% target has proven to have had a clear mobilising effect as almost all⁵ Member States have set their own national targets. It has also stimulated reflections across Member States on their policy mix in support of R&I and the contribution of R&I to economic growth. The 3% target is widely known target, enhancing the visibility and recognition of R&I policy. Additionally, R&D intensity is a simple indicator that can, to a certain extent, be easily measured, analysed and communicated. To this respect, it is a powerful indicator for R&I policy, but needs to be complemented by other indicators.

At the EU level, the main policy initiative supporting the achievement of Europe 2020 Strategy, including the 3% R&D target, is the European Semester⁶. The European Semester is the EU's cycle for the coordination of Member States' economic and employment policies. By closely monitoring Member States' progress and issuing Country Specific Recommendations, the Commission supports Member States' structural reforms and investment policies towards the achievement of their national R&D targets. Furthermore, the **Horizon Policy Support Facility** provides policy advice to Member States and Associated Countries (to Horizon 2020) in the design, implementation and evaluation of R&I reforms to improve the quality and impact of their R&I systems, investments and policies. Finally, the

¹ The EU R&D intensity case study is the result of a co-creation process among the European Commission services. The preparation of the document was coordinated by Ruzica Rakic and Ana Correia, under the guidance of Román Arjona, Chief Economist and Head of Unit "R&I Strategy and Foresight" of DG Research and Innovation, and Jessica Larsson, Deputy Head of Unit. Beñat Bilbao Osorio, Lukas Borunsky, Nelly Bruno, Lars de Nul, Anca Dumitrescu, Olimpia Fabbri, Martina Kadunc, Kathrin Kapfinger, Athina Karvounaraki, Roberto Martino, Konstantinos Niakaras, Tiago Pereira, Heiko Prange-Gstöhl, Julien Ravet, Doris Schroecker, Pauline Sentis, Frank Smit, Katarzyna Szkuta, Marta Truco, and Pierre Vigier co-drafted the document.

² Presidency Conclusions, Barcelona 15 and 16 March 2002, SN 100/1/02 REV 1

³ The Czech Republic only defined a target for its public R&D intensity.

⁴ The EU R&D intensity has increased by 1% annually, from 1.81% in 2000 to 2.18% in 2018. Still, to meet 3% target by 2020, the EU R&D intensity would have to increase by more than EUR 110 billion per year (Borunsky et al., 2020).

⁵ The Czech Republic has only public R&D intensity target.

⁶ https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester_en

European Research Area⁷ (ERA) helps countries be more effective together, by aligning their research and innovation policies and programmes. The free circulation of researchers and knowledge enables better cross-border cooperation, building of critical mass, and continent-wide competition.

Considering funding instruments at the EU level, the most important is the Framework Programme⁸ that offers a seven-year financial perspective, which greatly helps academia, centres, and enterprises in their recruitment plans and thus increases the overall absorption capacity and leverages additional investment from the public and private sector. This gives a paramount role to the Framework Programme in the European context. **Horizon 2020** represents 6-8% of total public⁹ investment in R&I in Europe. New avenues are opened up with **Horizon Europe**, especially through the **R&I Missions**, **European Partnerships**, and the **European Innovation Council**. The proposed European Innovation Council aims to support innovators, start-ups, small companies and researchers to develop and scale-up risky breakthrough innovation in products, services or business models.

⁷ https://ec.europa.eu/info/research-and-innovation/strategy/era_en

⁸ <https://ec.europa.eu/programmes/horizon2020/en>

⁹ https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-national-research-and-innovation-policy-making/srip-report_en

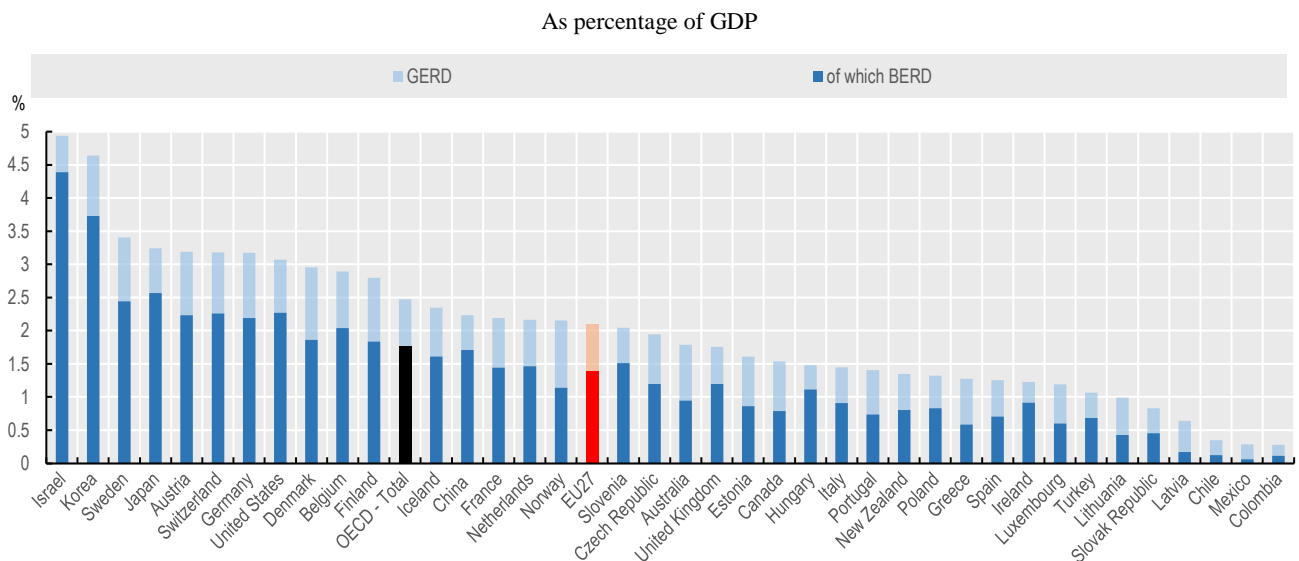
Introduction

This case study explores the European Union’s policy experience in fostering public and private investments in R&D. It is part of a series of 11 case studies developed in the context of the OECD [project on R&D intensity](#) (2019-20), conducted by the OECD Working Party on Innovation and Technology Policy (TIP). The 11 case studies were developed by Australia, Finland, France, Germany, Greece, Hungary, Ireland, Korea, the Netherlands, Poland and the EU. The R&D intensity levels and policy experiences differ significantly across those countries (Figure 1), making cross-country analysis particularly insightful.

EU’s R&D performance in the OECD context

In 2019, the EU’s R&D intensity (i.e. the gross domestic expenditure on R&D as a percentage of GDP) stood at 2.1% of GDP¹⁰, which is below the OECD average (2.47%) (Figure 1). The business sector accounted for 66% of total R&D expenditure.

Figure 1. Total R&D expenditures (of which business expenditures) in selected economies, 2019



Note: 2019 or latest year available. The graph illustrates the Gross domestic expenditure on R&D (GERD) and the Business expenditure on R&D (BERD) as a percentage of GDP.

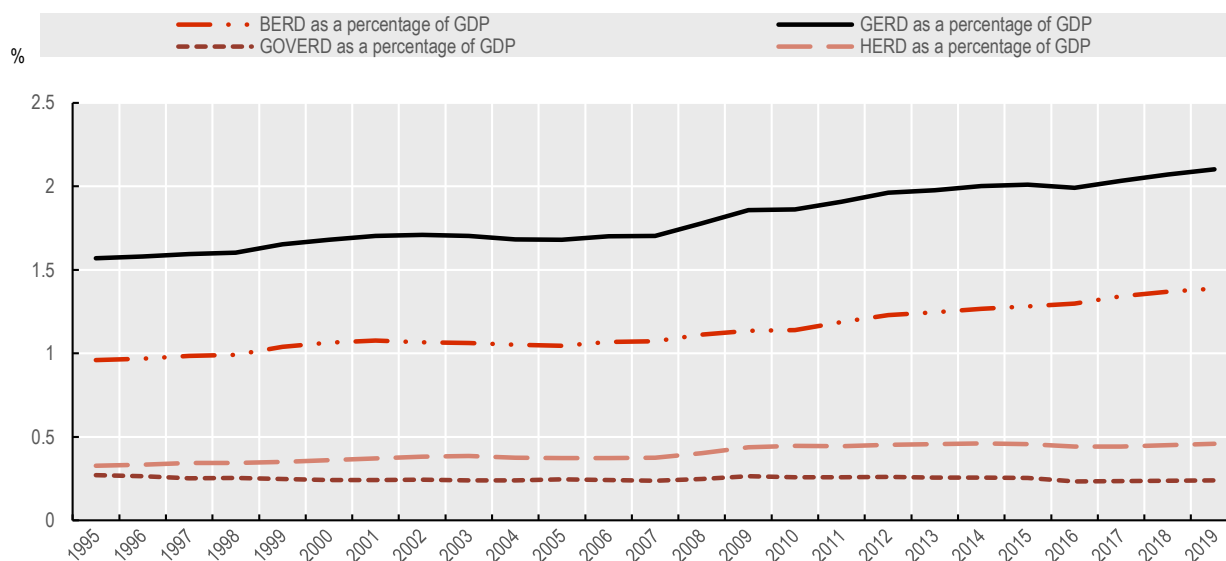
Source: OECD (2021), "Main Science and Technology Indicators", OECD Science, Technology and R&D Statistics (database), <https://doi.org/10.1787/data-00182-en> (accessed on 01 April 2021).

¹⁰ The R&D intensity figure is based on data from the OECD MSTI Database, which uses USD PPP underlying data when calculating such ratios (see the methodological explanations on page 5 [here](#)). According to Eurostat data, which uses EUR to calculate such ratios, the EU’s R&D intensity stood at 2.2% of GDP in 2019.

The EU's R&D intensity has slowly increased over time, from 1.6% of GDP in 1995 to 2.1% in 2019 (Figure 2). Businesses expenditures in R&D (BERD) have been a significant driver of GERD over time.

Figure 2. R&D intensity by performing sector, European Union

As percentage of GDP



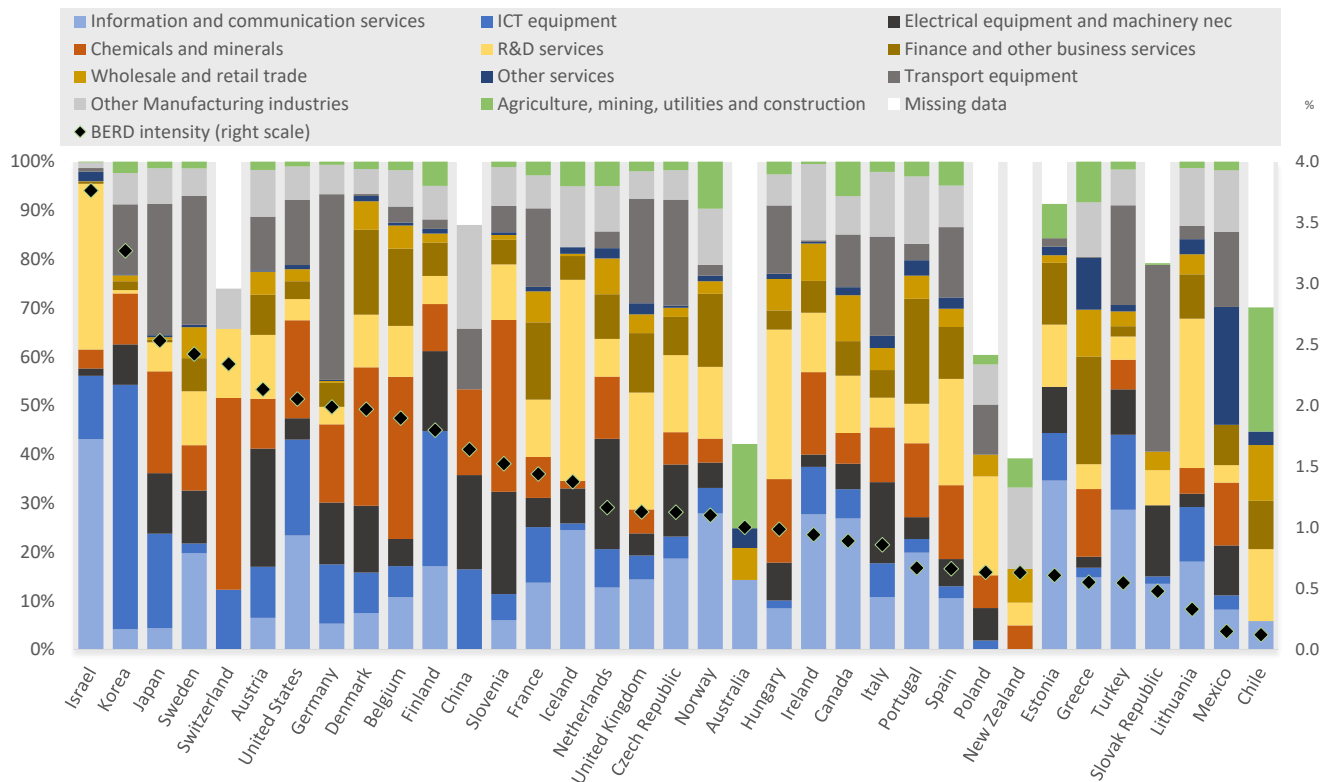
Note: The figure illustrates the evolution of the gross domestic expenditure on R&D (GERD) in the European Union (as a share of GDP) by performing sector: business enterprise sector (BERD), government sector (GOVERD) and the higher education sector (HERD).

Source: OECD (2021), "Main Science and Technology Indicators", OECD Science, Technology and R&D Statistics (database), <https://doi.org/10.1787/data-00182-en> (accessed on 01 April 2021).

EU countries differ significantly in terms of industry structures, and thus also in the BERD distribution by industry. In some countries, such as Germany, manufacturing sectors account for a high share of total BERD, while in others such as Estonia, the Netherlands and the UK services sectors are the largest contributors to BERD (Figure 3).

Figure 3. BERD distribution by industry, 2017

Industry shares (left scale) and total BERD intensity (right scale)



Note: 2017 or latest year available. ISIC Rev.4 divisions are as follows: Agriculture, mining, utilities and construction: 01-03, 05-09, 35-39 and 41-43; Chemicals and minerals: 19-23; Electrical equipment and machinery nec: 27-28; Finance and other business services: 64-66 and 69-82 excluding 72; ICT equipment: 26; Information and communication services: 58-63; Other Manufacturing industries: 10-12, 13-15, 16-18, 24-25 and 31-33; Other services: 49-53, 55-56 and 84-99; ISIC R&D services: 72; Transport equipment: 29-30; and Wholesale and retail trade: 45-47.

Source: OECD ANBERD database, <http://oe.cd/anberd>, November 2019, and OECD, Main Science and Technology Indicators Database, <http://oe.cd/msti>, July 2019.

Structure of the report

The remainder of the case study is structured around four sections that explore:

1. The EU experience in setting targets to improve R&D performance;
2. The implementation of R&D policies at the EU level over time, focusing on lessons from successful and less successful policies, implementation challenges faced over time and how they have been addressed, and the role of policy versus other contextual factors as drivers of R&D performance;
3. How R&D and innovation at the EU level addresses disparities across sectors and regions/countries;
4. How R&D and innovation policy at EU level addresses the opportunities and challenges brought about by digital and AI-driven innovation.

1. Setting R&D targets

1) R&D intensity targets at EU level.

The EU's R&D intensity target is to increase combined public and private investment in R&D to 3% of EU GDP by 2020. It was set in the Europe 2020 strategy adopted in 2010¹¹.

In the Communication¹² adopted on 30 September 2020, the Commission proposes that Member States re-affirm the 3% EU GDP R&D investment target and update it to reflect new EU priorities (to ensure increased directionality to deliver on the green and digital transitions), including a new 1.25% EU GDP public effort target to be achieved by Member States by 2030 in an EU coordinated manner, to leverage and incentivise private investments.

2) Target changes. Have the targets changed over time?

- Barcelona Summit (2002)¹³: "The European Council agrees that overall spending on R&D and innovation in the Union should be increased with the aim of **approaching 3% of GDP by 2010**. Two-thirds of this new investment should come from the private sector"¹⁴
- Europe 2020 Strategy (2010): The 3% target was reset in the Europe 2020 Strategy with a focus to "increase **combined public and private investment** in R&D to 3% of GDP" by 2020¹⁵.

3) Targets at country level.

The targets set at national level in all EU Member States are specified in Table 1. R&D intensity increased over the 2000-2018 period in 24 Member States, with national R&D intensity ranging from 0.5% in Romania to 3.3% in Sweden. Three countries have already reached their 2020 target: Germany (3.13%, with a target of 3%), Denmark (3.03%, with a target of 3%) and Cyprus (0.55, with a target 0.5%).

In the Communication¹⁶ adopted on 30. September 2020, the European Commission proposes that Member States lagging behind the EU average R&D intensity direct their investment efforts to increase their total investment in R&D by 50% in the next 5 years, in order to promote stronger and faster catch up towards the EU average. The Commission will support Member States to reform their R&I policies, by reinforcing dialogue in the context of the European Semester and national Recovery and Resilience Plans and by providing support and technical assistance to this end. It will facilitate the coordination and complementarity of national and EU programmes, and contribute to the deployment of the recovery package.

¹¹ Link to Europe 2020 Strategy:

<https://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf>

<https://ec.europa.eu/eurostat/web/europe-2020-indicators>

¹² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:628:FIN>

¹³ https://www.europarl.europa.eu/bulletins/pdf/01s2002_en.pdf

¹⁴ <https://www.consilium.europa.eu/media/20939/71025.pdf>

¹⁵ <https://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf>

¹⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:628:FIN>

Table 1. Situation of each Member State with regard to its R&D intensity target ⁽⁶⁾⁽⁸⁾

	R&D intensity 2018	R&D intensity target 2020	R&D intensity Compound annual growth (%) 2000-2018 ⁽¹⁾	R&D intensity compound annual growth (%) 2010-2018	R&D intensity Compound annual growth (%) required to meet the 2020 target 2018-2020
Belgium	2.67	3.00	1.8	3.3	5.9
Bulgaria	0.76	1.50	2.4	3.7	40.9
Czechia ⁽⁷⁾	1.90	: ⁽²⁾	3.0	4.5	:
Denmark	3.02	3.00	1.7	0.4	Target reached
Germany ⁽⁷⁾	3.12	3.00	1.4	1.7	Target reached
Estonia	1.41	3.00	4.9	-1.3	45.9
Ireland	0.99	2.00 ⁽³⁾	-0.5	-5.8	42.2
Greece	1.21	1.30	4.8	9.2	3.5
Spain	1.24	2.00	1.9	-1.1	26.9
France	2.19	3.00	0.5	0.1	17.0
Croatia	0.97	1.40	0.1	3.3	20.4
Italy	1.42	1.53	2.0	2.0	3.6
Cyprus	0.62	0.50	5.8	4.3	Target reached
Latvia	0.64	1.50	2.1	0.6	53.2
Lithuania	0.94	1.90	2.7	2.2	42.4
Luxembourg	1.21	2.30 - 2.60 ⁽⁴⁾	-1.1	-1.1	42.2
Hungary	1.51	1.80	3.7	2.3	9.2
Malta	0.60	2.00	1.0	-0.2	83.0
Netherlands	2.14	2.50	0.4	1.8	8.1
Austria	3.14	3.76	2.9	1.8	9.4
Poland	1.21	1.70	3.6	6.7	18.6
Portugal	1.35	2.70 - 3.30 ⁽⁵⁾	2.2	-1.6	49.1
Romania	0.50	2.00	1.3	0.1	99.8
Slovenia	1.95	3.00	0.4	-3.0	24.1
Slovakia	0.84	1.20	1.5	4.0	19.6
Finland	2.76	4.00	-0.9	-3.6	20.5
Sweden	3.32	4.00	-0.5	0.6	9.7
EU	2.18	3.00	1.1	1.3	17.2

Source: DG Research and Innovation, Chief Economist - R&I Strategy & Foresight Unit based on Eurostat (online data code: rd_e_gerdtot and t2020_20). Notes: (1)HR: 2002-2018; EL, LU, SE: 2003-2018; MT: 2004-2018. HU: 2000-2017. (2)CZ: A target (of 1.0%) is available only for the public sector. (3)IE: The national target of 2.5% of GNP has been estimated to equal 2.0% of GDP. (4)LU: A 2020 target of 2.45% was assumed. (5)PT: A 2020 target of 3.0% was (6)DK, EL, FR, IT, LU, HU, MT, NL, PT, RO, SI, SE: Breaks in series occur between 2000 and 2018; when there is a break in series the growth calculation takes into account annual growth before the break in series and annual growth after the break in series. (7)DE: new 2025 target of 3.5%. CZ: new 2030 target of 3.0%. (8)Values in italics are estimated or provisional.

- 4) **Target criteria.** What were the criteria used to determine the specific target?

The target was set based on the country's level of R&D performance with respect to that of OECD/EU/other countries, with the objective of improving its position in international benchmarking.

One of the criteria for choosing the first EU R&D intensity target¹⁷, was to close the gap between the EU and other major economies. Back in 2002, Japan had the highest intensity among these competitors, which was about 3%.

The target was set based on scenarios developed taking into account past R&D performance.

In the context of the second R&D intensity target¹⁸: In 2010 the Member States engaged in bilateral discussions with the Commission in order to set their national targets for 2020 that would bring the EU as a whole closer to the 3% target. The Commission created different scenarios for each Member State, based on statistical projections, the structure of the economy, the level of maturity of its national R&D system and sectoral R&D intensities, and comparisons with similar Member States or third countries. In addition, the discussions with individual Member States took account of Member States' starting positions, national policy objectives, the potential for increasing R&D expenditure, and other national circumstances. As a result, most Member States set their national R&D intensity targets.

- 5) **The indicator.** To what extent do you think that R&D intensity provides a good indicator of innovation activity in the EU?

Somewhat agree:

- We acknowledge that R&D intensity is to a large extent an input indicator, but it also correlates strongly with scientific and innovation performance and with the ability to leverage funding for R&D activities, hence it is a valuable proxy to quantify innovation activity. It has thus an output dimension.
- R&D intensity is a simple indicator that can, to a certain extent, be easily measured, analysed and communicated. To this respect, it is a powerful indicator for R&I policy, but needs to be complemented by other indicators.
- The 3% target is widely known, enhancing the visibility and recognition of R&I policy.
- R&D intensity does not capture all aspects of research and innovation activities, especially regarding how the nature of innovation is evolving over time and the increasing need to deliver scientific, economic and societal value from these activities. A lot has changed since the introduction of the target: we have seen a growing role of intangibles, digitalization and the service sector. Digitalization and new technologies are changing the way innovation is happening, with investments in R&D and innovation more easily translated into competitive innovative services than innovative goods¹⁹.
- It does not highlight the need for supportive conditions for ensuring the success of such investments, including to spur technological development and all forms of innovation for the benefits of the economy and society, but also for scientific progress. As such, it cannot inform policy making about the quality and impact of the R&D systems. For that, a wider

¹⁷ Set at the 2002 Barcelona European Council.

¹⁸ Set in 2010 in the Europe 2020 strategy.

¹⁹ https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-national-research-and-innovation-policy-making/srip-report_en

set of R&I indicators is needed, as the ones presented in the European Innovation Scoreboard.

6) **Indicator challenges.** What have you found to be the main issues of using R&D to measure business-led innovation in the EU?

- **The role of innovative start-up companies is not captured in standard R&D statistics:**

BERD is only available by size and not by the age of companies. Hence, BERD cannot help us to identify start-ups.

- **The role of R&D in low and medium technology sectors tends to be underestimated:**

Perhaps there is a bias in surveys towards high-tech sectors because those are the ones that invest most in R&D, but some of the biggest R&D investors, notably in Europe, are registered under medium tech sectors (for example, oil and gas producing companies or media companies). Even the manufacture of motor vehicles sector is medium-high tech, but it contains some of the biggest R&D investors in Europe, such as Volkswagen and BMW. This is why objective data which capture private R&D investments, such as in the Industrial R&D Investment Scoreboard, are important to complement BERD.

Also, R&D is playing an important role in the achievement of the SDGs which cover a large number of areas, not always linked to high-tech sectors, such as agriculture, or society. Monitoring these R&I investments calls for reviewing the use of industry classifications and investment indicators.

- **R&D is concentrated in a small number of firms, sectors and/or regions but the aggregate R&D measure does not capture this trend:**

R&D intensity is an aggregate measure, hence to get a better picture, it is important to look at the distribution across all these dimensions. At the EU level, we see the following trends:

At the **country** level: EU R&D intensity is largely influenced by a limited number of big countries. Namely, 61 % of the EU's R&D expenditure in 2018 was performed in Germany, France and Italy. Germany alone still accounts for almost the same amount of R&D spending as the other 24 Member States combined. Hence, to a large extent, the overall EU R&D intensity is determined by its value in these three countries.

At the **regional** level: The EU's most R&D-intensive regions are all located in western and northern Europe and the degree of concentration confirms the described trends. The average intensity of the top 30 EU regions is more than twice the average intensity of the EU as a whole. In some cases, the regional R&D intensity is heavily influenced by presence of a single large tech company. An example is Braunschweig, the EU NUTS2 region with the highest R&D intensity, where the biggest European R&D spender Volkswagen has its headquarters.

Business R&D expenditure is even more concentrated in more-developed regions with a strong concentration in relatively few internationally active technology intensive companies. Currently, more-developed regions represent about 85% of R&D expenditure in the EU, transition regions about 10% and less-developed regions about 5%. One example is Baden-Württemberg, which has about 2% of the EU population but an 8% concentration of the EU's business R&D.

At the **company** level: When looking to the top 1000 R&D investors in the EU, an unequal distribution of R&D expenditure among companies can be observed. The top 25 R&D investors in the EU account for half of the group's R&D expenditure²⁰.

According to the latest Industrial R&D Investment Scoreboard²¹, industrial R&D is very concentrated by country and sector in the EU. Among the EU 1,000 sample, there are 903 companies based in the top 10 Member States accounting for 97% of the total R&D. Just three broad sectors (automotive, health and ICT) account for 72% of the EU1000's total R&D. The report also compares EU performance with the rest of the world, namely the top 2,500 R&D spenders in the world, of which 551 are European.

- **Service innovation is not captured by indicators that are readily available:**

Most of the innovation indicators are linked to patents. While patents are mostly linked to new (manufacturing) products, the companies providing services tend to patent less. Hence the service innovation tends to be underestimated.

To capture innovation in services, it is necessary to look closer into non-tech intellectual property and employment/R&D statistics.

7) **Other targets.** Do your innovation strategies or other strategic documents include other quantitative targets to foster innovation?

According to the new European Research Area (ERA) Communication²², the Commission proposes to support Member States in the coordination and prioritisation of national R&I funding and reforms, between countries and with the EU, through dialogue and a dedicated ERA Forum for Transition. This will focus **Member States common efforts, to voluntarily commit 5% of national public R&D funding to joint programmes and European partnerships by 2030**. In doing so, this target aims at further stimulating the knowledge flows and collaborations across European stakeholders and boost innovation diffusion.

Moreover, the ERA Communication proposes to speed up the transfer of research results into the real economy and support the implementation of the new Industrial Strategy, and with it e.g. the European Green Deal goals. Concretely, the Commission proposes to develop **common technology roadmaps with industry and Member States by 2022**, linking key partnerships under Horizon Europe with industrial ecosystems and aiming at crowding in private investments. Europe's R&I ecosystems will be strengthened and dedicated actions will also target knowledge valorisation and smart use of intellectual property.

As part of its initiatives to support the recovery and build a green and digital Europe, the Commission, in addition to the new ERA Communication, adopted a new **Digital Education Action Plan**²³, to adapt education and training systems to the digital age, as well as a **Communication on the European Education Area**²⁴ as a driver for job creation and growth.

²⁰ The reference for the whole answer is "Science, Research and Innovation performance of the EU, 2020 (SRIP) Report" https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-national-research-and-innovation-policy-making/srip-report_en. For the data see the Industrial R&D Investment Scoreboard 2019 <https://iri.jrc.ec.europa.eu/scoreboard/2019-eu-industrial-rd-investment-scoreboard>.

²¹ Industrial R&D Investment Scoreboard 2019 <https://iri.jrc.ec.europa.eu/scoreboard/2019-eu-industrial-rd-investment-scoreboard>

²² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:628:FIN>

²³ One of the targets from the Digital Education Plan is the EU target for student digital competence to reduce the share of 13-14 year old students who underperform in computer and information literacy to under 15% by 2030.

²⁴ Some targets from the Communication on the European Education Area include: (1) The share of low-achieving 15-year-olds in reading, mathematics and science should be less than 15%. (2) The share of low-achieving eight-graders in computer and information literacy should be less than 15%. (3) At least 98% of children between 3 years old and the

By creating synergies between these policies, Europe is showing a new level of ambition, towards strengthening of a knowledge space, with a transformative agenda for research, higher education, and a pipeline of talents and skills.

In addition, there are important targets at the EU level regarding the **European Green Deal**²⁵. For instance, achieving climate neutrality by 2050 and increasing the EU's greenhouse gas emission reductions target for 2030 to at least 50% and towards 55% compared with 1990 levels in a responsible way. Achieving the economic, social and environmental transitions set by the European Green Deal requires investments in social and technological research and innovation. **Beyond setting targets, the European Green Deal is expected to mobilise R&I investments and to set priorities for research and innovation avenues.**

2. Implementing R&D targets and policies

- 8) **Policy initiatives in place.** What are the main policy initiatives implemented at EU level with the aim of achieving the R&D intensity target?

A) Non-funding instruments:

The **European Semester** is a key policy initiative supporting the achievement of Europe 2020 Strategy, including of the 3% target in R&D. The European Semester is the EU's cycle for the coordination of Member States' economic and employment policies and provides annual Country Specific Recommendations addressed to EU Member States. By closely monitoring Member States' progress and issuing Country Specific Recommendations, the Commission supports Member States' structural reforms and investment policies towards the achievement of their national R&D targets.

The **European Research Area**²⁶ (ERA) is a multi-level governance initiative launched in 2000 with the idea to create a single, borderless market for research, innovation and technology across the EU. It helps countries be more effective together, by strongly aligning their research policies and programmes. Furthermore, it aimed to reduce disparities of regulatory and administrative frameworks²⁷. ERA, together with the 3% Barcelona objective and the accompanying 3% action plan, was part of the new Lisbon Strategy, which aimed to turn the EU into the most competitive and dynamic knowledge based economy of the world.

The **Horizon Policy Support Facility** (in operation since 2015) provides policy advice to MSs and Associated Countries (to Horizon 2020) in the design, implementation and evaluation of R&I reforms to improve the quality and impact of their R&I systems, investments and policies.

B) Funding instruments:

In line with the EU multiannual budget, the Framework Programmes offer a seven-year financial perspective, which greatly helps academia, centres, and enterprises in their

starting age for compulsory primary education should participate in early childhood education. (4) The share of people aged 20-24 with at least an upper secondary qualification should be 90%. (5) The share of 30-34 year-olds with tertiary educational attainment should be at least 50%.

²⁵ https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

²⁶ COM(2000) 6. For the historical background see also European Parliamentary Research Service (2016), European Research Area - Cost of Non-Europe Report; European Parliamentary Research Service (2016), The European Research Area - Evolving concept - implementation challenge, In-depth Analysis.

²⁷ Council Resolution of 15 June 2000 on establishing a European area of research and innovation; Lisbon European Council conclusions (24/3/2000).

recruitment plans and thus increases the overall absorption capacity and leverages additional investment from the public and private sector. This gives a paramount role to the Framework Programme in the European context. [Horizon 2020](#) represents 6-8% of total public²⁸ investment in R&I in Europe.

New avenues are opened up with [Horizon Europe](#), especially through the [R&I Missions](#), [European Partnerships](#), and the [European Innovation Council](#). The proposed European Innovation Council aims to support innovators, start-ups, small companies and researchers to develop and scale-up risky breakthrough innovation in products, services or business models.

The R&I funding policy in Europe goes beyond the Framework Programme: it encompasses other EU instruments such as InvestEU, the Innovation Fund, Digital Europe, EU Structural and Investment Funds, LIFE, Agricultural and Maritime Fund as well as national instruments.

European Commission is in charge of the implementation and monitoring of the initiatives²⁹.

- 9) **Successful policies.** What policies have been most successful (currently or in the past) in driving R&D intensity? What are considered the main factors of success?

Although the EU has not fulfilled its R&D investment ambition, the 3% target has proven to have had a clear aspirational and mobilising effect as all Member States have set their own national targets. It has also stimulated reflections across Member States on their economic model and policy mix. It is a strong indicator within the European Semester that has provided a stimulus to the EU's R&I, growth and competitiveness policy. It is also an essential compass that if accompanied with other targets can help accelerate the transition towards an environmentally, socially and economically sustainable Europe.

The **European Semester** has increasingly recognised the role of R&I to stimulate productivity, economic growth and job creation in Europe. In 2019, all EU Member States received for the first time a recommendation that calls for stronger investments in R&I and identifies clear R&I investment needs for all countries. In addition, a number of countries received a **country specific recommendation (CSR)** that calls for policy action to promote the quality and efficiency of national R&I systems (i.e. quality of R&I policies and systems, stronger science business links, support to breakthrough innovations and scale up of high growth firms, and sound framework conditions for business R&D).

European structural and investment funds (ESIF) together with **smart specialisation strategies** were important for capacity building. ESIF was crucial in new Member States as it improved performance of the public science base. Other tools that support reforms in R&I include the H2020 Policy Support Facility and the Structural Support Reform Programme.

The **European Research Area (ERA)** has become an established and well-recognised political framework for a coordinated approach to increase R&D investments. Some of its most prominent achievements include the work of the European Strategy Forum on Research Infrastructures (ESFRI), jointly addressing common challenges through coordination and

²⁸https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-national-research-and-innovation-policy-making/srip-report_en

²⁹ Link to 'Horizon 2020 programme analysis':

https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-eu-research-and-innovation-policy-making/evaluation-impact-assessment-and-monitoring/horizon-2020_en

Link to 'Science, Research and Innovation Performance of the EU (SRIP) report': https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-national-research-and-innovation-policy-making/srip-report_en

Link to 'European innovation scoreboard': https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en

Link to ERA progress report 2018: https://ec.europa.eu/info/publications/era-progress-report-2018_en

pooling of resources, the progresses made in removing the geographical barriers to researchers' mobility, and enhanced access to open, free of charge, re-usable scientific information through the Open Science initiative³⁰ and the European Open Science Cloud (EOSC).

- 10) **Unsuccessful policies.** Are there any examples of policies implemented in the past to drive R&D intensity that did not reach the intended objectives? What were the factors that hindered their success?

As previously mentioned, **the EU as a whole did not achieve the combined public and private 3% R&D investment target which was set in the Europe 2020 Strategy.** Amongst those factors that influence the achievement of the target are national specificities and framework conditions, such as the level of ambition of national R&D targets, the economic structure, and the availability of venture capital in a country. Some divergence still exists between countries in terms of evolution of public support to R&D, with some countries not prioritizing R&D in their agenda as much as others. Moreover, improvements in R&D intensity can require structural changes in some Member States, which go beyond the timeframe set out in the Europe 2020 Strategy.

European Research Area (ERA) monitoring³¹ reveals that ERA has been lacking most so far in reforming national R&I policies, in attuning national and EU policies, and in ensuring co-evolution of all R&I policies towards common objectives. Moreover, ERA still needs to improve the translation of R&I results into the economy, gender equality, and the involvement of citizens and society in designing and implementing R&I policies and programmes. That is why in the recently adopted ERA Communication,³² the Commission lays out how a revamped ERA will also help to frame the necessary investments, regulations and reforms to deliver ground-breaking research and innovation in Europe and further contribute to sustainable growth and stimulate R&D&I investment.

The Commission aims at continuous improvement of the European actions and regularly [evaluates and monitors EU Research and Innovation Framework Programmes](#) in line with the European [Better Regulation agenda](#). While acknowledging the multifold achievements of the programme, the [Interim Evaluation of Horizon 2020](#) also identified areas for improvement³³. A major policy lesson was a need to go beyond the 3% funding target to ensure a greater strategic focus of these large-scale investments with the strategic EU and citizen priorities for more impact. While the programme is very attractive to stakeholders and faces a high oversubscription rate compared to the funding available, the translation of high-level challenges and objectives into specific calls, topics and projects was assessed as not always straightforward. A greater impact orientation and outreach to citizen is not only important for improving the communication on the role of these long-term investments to tackling societal and technological challenges; involving citizens, customers and end-users in the agenda-setting (co-design) and the implementation (co-creation) leads also to more innovation by stimulating user-driven innovation and the demand for innovative solutions, including through public procurement of innovation.

To respond to the need for adopting a more impact-focused, mission-oriented approach, novel features are introduced in **Horizon Europe**. For instance, the first [Strategic Plan](#) has been

³⁰ <https://ec.europa.eu/research/openscience/index.cfm?pg=openaccess>

³¹ https://ec.europa.eu/info/publications/era-progress-report-2018_en

³² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:628:FIN>

³³ Link to Interim Evaluation of Horizon 2020: https://ec.europa.eu/info/publications/interim-evaluation-horizon-2020-book_en

developed through a co-design process so that the future investment targets issues that matter most. So far, over 9000 people have taken part in this process, making it one of the largest co-design exercises that the Commission has ever led. Another novelty is the launch of co-designed [European research and innovation missions](#) which aim to deliver solutions to some of the greatest challenges facing our world through targeted cooperation across sectors and disciplines in the areas of cancer; adaptation to climate change; health oceans, seas coastal and inland waters; climate-neutral and smart cities; and soil health and food. Also following lessons from the interim evaluation, the European Partnerships landscape is being rationalised with less but more open, targeted and focussed instruments to go beyond setting long-term agendas, structuring R&I cooperation and leveraging additional investments, to also provide clear contributions to policies at EU and national level along strategic agendas in critical areas such as clean energy, transport, health, food and circularity

11) **Implementation challenges.** What have been the main challenges when implementing policies aimed at increasing R&D performance?

Regarding **EU 3% R&D intensity target**, the European Commission can only provide recommendations to the Member States. The achievement of the target relies on the efforts of the Member States.

The **European Research Area (ERA)** was launched mainly to reduce fragmentation and overlap in the R&I system of the European Union. Twenty years later, Europe faces a number of challenges in its quest to achieve the twin green and digital transitions and with an urgent need to recover from the COVID-19 crisis. In order to address today's multiple challenges, ERA needs to accelerate the transitions, strengthen resilience to future crises, while sustaining competitiveness. Against this backdrop, the Commission proposal³⁴ for a new ERA is based on 4 strategic objectives:

1. **Prioritising investments and reforms** via a number of new targets on investment, in particular by Member States, joint programmes, missions and partnerships and the new Recovery and Resilience Facility.
2. **Improving access to excellence** is targeted towards the less R&I performing Member States and will support them in reforming their R&I systems, including through a continuation of the Widening measures, a better use of cohesion policy, technical assistance and new ERA4YOU mobility schemes.
3. **Translating R&I results into economic value.** The EIC and InvestEU are the flagship initiatives in Horizon Europe, complemented through ERA with the development of industrial roadmaps, a stronger focus on knowledge valorisation, ERA Hubs and a specific action on intellectual property.
4. **Deepening the ERA** aims at completing the single market for knowledge through making further progress on open science, infrastructures, careers of researchers, universities and gender.

Regarding **EU Horizon 2020 Programme**, one of the main implementation challenge identified in the Interim evaluation of Horizon 2020 relates to the interest it generates that is reflected in the very high level of oversubscription. Since its launch in 2014, nearly 250 000 eligible proposals have been received in response to over 700 calls for proposals — this is twice as many per year than under the predecessor programme (FP7). Given limited EU resources, Horizon 2020 has been able to provide funding for only one in eight proposals

³⁴ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:628:FIN>

(11.9%) submitted under the programme. Unfortunately, of every four of the proposals evaluated by 36 000 independent experts as being ‘of high quality’, three could not be funded. One of the remedies to tackle oversubscription is the expansion of the ‘seal of excellence’, a quality label to open doors for other opportunities. Nearly 25 000 individual entities that could not receive funding due to budget limitations have been awarded a ‘seal of excellence’, that helps them access alternative financing, e.g. from the European Structural and Investment Funds or from private sources. Some 139 entities have already received a new COVID-19 seal of excellence in 2020.

- 12) **The role of policy and other factors.** To what extent was the evolution of R&D performance in the EU driven by policy or by other contextual factors?

Horizon 2020 represents less than 0.1% of the cumulative GDP of all Member States and 6-8% of their public expenditure in R&D. Horizon 2020 monitoring data also indicate that the more a country invests nationally in its R&D capacity, the more funding it receives from the Framework Programme³⁵. Complementary to the Framework Programme, Member States and regions - singly and in variable-geometry groupings – continue to invest in their own capacities according to their strategies and areas of interest or specialisation. Differences in R&I performance among Member States are determined by a whole range of factors beyond the control of the Framework Programme, including national priorities, the level of private and public investment, the availability and quality of infrastructure, human capital and skills, access to finance, the support measures in place, the regulatory framework, etc. As shown in the Interim Evaluation of Horizon 2020 (2017), the Programme and the wider efforts to strengthen the European Research Area have however still a positive structuring effect on national R&I systems and framework conditions, such as infrastructure, regulatory environment, human resources policies, but also for research funding.

As an illustration, the **European Research Council** providing support to top researchers for frontier research has become a global beacon of excellence, inducing national and institutional changes in national research councils’ quality standards and proposal review processes. Still, complementary efforts at EU, national and regional levels are further needed to ensure well-functioning, efficient and impactful national research and innovation systems within a truly **European Research Area**. The need to consider wider framework conditions towards the 3% target of GDP is reflected in the renewed European Research Area to which Horizon Europe will contribute.

While building the ground for **Europe’s long-term recovery, preparedness and resilience**, the Framework programmes has also demonstrated its capacity to react and rapidly mobilise funding in times of crisis or when needs arise. As an illustration, Horizon 2020 was quick to respond with targeted R&I investment to crisis such as the COVID-19, Ebola and Zika outbreaks as well as during the migration crisis. For instance in 2020, with Horizon 2020 flexible funding instruments adapted to dealing with emergencies, about €500 million were mobilised within six months for research and innovation support. Since then, the EU has committed to invest around €1 billion through Horizon 2020 to tackle COVID-19 and its consequences.

³⁵ Link to Monitoring Flashes – From Horizon 2020 to Horizon Europe: https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/shaping-eu-research-and-innovation-policy/evaluation-impact-assessment-and-monitoring/horizon-2020_en#monitoring

13) **Policy lessons.** What are the main policy lessons learned during the implementation of policies for increasing R&D intensity? What would be your concrete advice to countries intending to set R&D targets and policies to achieve them for the first time?

- **Funding targets should be accompanied with a strategic vision and direction:** clear objectives and direction should be set for R&I investments to create scientific, societal, environmental and/or economic impact based on a sound identification of current and future needs through consultation/co-creation exercises, strategic foresight, evaluations/impact assessment, etc. Moving from a funding and technology push approach to a more use- and demand-oriented approach will eventually reinforce the contribution of such investments to wider political objectives, allow for greater pool of investments, while ensuring a reinforced uptake of R&I solutions.
- **Target indicators should be set in a realistic manner, linked to the intervention, as of the planning stage:** Indicators should be defined that are attributable to the intervention, with clear milestones and targets over specific timeframes. The monitoring system should be planned as of the design phase to ensure the availability and reliability of data to monitor progress towards the expected impact over time. This will allow to identify specific barriers and drivers to progress early on and take corrective action if needed. Furthermore this will support the wider communication of the results of R&I investment and their scientific, technological, economic and societal impacts for the end-users and citizens.
- **The wider ecosystem for R&D support should be considered when designing R&D intensity strategies:** The framework conditions beyond R&D funding should be factored in to ensure the full effectiveness of R&D investments, including market uptake of innovative solutions. This includes the early identification of potential barriers and drivers to research and innovation (e.g. regulations, standards, access to finance, customer acceptance), the synergies between different instruments for R&I, but also the global evolution of the socio-economic, technological and scientific context. Involving end-users, standardisation bodies, regulators and citizens in co-designing the R&I agenda and co-creating solutions should stimulate greater up-take and attract additional investments.

3. R&D targets and innovation disparities

14) **Innovation disparities.** Which distributional aspects have received more innovation policy attention at EU level? What evidence are you using to explore the geographical and sectoral distribution of R&D performance in the EU?

The European Commission is using and providing the following evidence in the area of R&D performance:

- **Science, Research and Innovation performance of the EU Report**³⁶ analyses Europe's performance in science, research and innovation and the driving factors behind that performance in a global context.
- The **European innovation scoreboard**³⁷ provides a comparative analysis of innovation performance in EU countries, other European countries, and regional

³⁶ https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-national-research-and-innovation-policy-making/srip-report_en

³⁷ https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en

neighbours. It assesses relative strengths and weaknesses of national innovation systems and helps countries identify areas they need to address.

- The **EU industrial R&D investment scoreboard**³⁸ analyses data on R&D investment of the top 2500³⁹ companies in terms of R&D spending in the world. This includes an analysis on those companies' R&D and economic indicators as well as patent-based analyses, and aims at benchmarking EU industry innovation performance to help shape EU policy.
- **Eurostat**⁴⁰ is the statistical office of the European Union. Eurostat's statistics in the fields of **science, technology and innovation** cover a range of issues divided into four main domains: 1. **Research and development (R&D)** includes statistics on expenditure, personnel and government budget allocations for R&D. Data are available by performing and funding sectors, types of costs or economic activities. 2. **Community Innovation Survey** provides statistics about enterprises that have product and business process innovations, their strategies, knowledge management and innovation activities, as well as about factors that facilitate or hinder innovation ('innovation environment'). 3. **High-tech** includes statistics on high-tech industries and products, high-tech trade as well as knowledge-intensive services. 4. **Human resources in science and technology (HRST)** includes statistics on the current stock of HRST and on the current and future supply of highly skilled persons.

In addition, Eurostat provides data on **digital economy and society**, such as mobile internet access, social media use, e-commerce, internet security, cloud services, digital skills and employment of ICT specialists just give you a small taste of the information and statistics you can find here.

- 15) **Territorial disparities.** Are territorial inequalities in innovation performance explicitly addressed by policies discussed in question 8 or other policies aimed at improving R&D performance?

European Structural and Investment Funds (ESIF) fund regional R&I activities. Their accessibility is not based on R&D performance of regions, but levels of economic development.

There are Europe-wide efforts to improve competitive R&D funding rates through targeted efforts at underperforming states. These include set of policy measures with three main actions, i.e. '**Teaming, Twinning and ERA Chairs**'. There is a dedicated section in the Horizon 2020 Framework Programme Work Programme 2018-2020 '15. Spreading Excellence and Widening Participation'⁴¹.

At the regional level, the new structural policy improves regional coordination of investment. For instance, there is foreseen '**Interregional Innovation Investments**' programme⁴². Regions with matching 'smart specialisation' assets will be given more financial support to

³⁸ <https://iri.jrc.ec.europa.eu/scoreboard/2019-eu-industrial-rd-investment-scoreboard>

³⁹ These companies, based in 44 countries, each invested over €30 million in R&D for a total of €823.4bn which is approximately 90% of the world's business-funded R&D.

⁴⁰ <https://ec.europa.eu/eurostat/web/main/home>

⁴¹ Find more on Widening actions here: <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/spreading-excellence-and-widening-participation>

⁴² https://ec.europa.eu/commission/presscorner/detail/en/MEMO_18_3866

work together and involve further policy-makers, researchers, businesses and other innovation actors. The aim is to scale up 'bankable' interregional projects⁴³.

- 16) **Sectoral disparities.** Are sectoral disparities in innovation performance explicitly addressed by policies discussed in question 8 or other policies aimed at improving R&D performance?

By drawing up **Smart Specialisation Strategy** (national and/or regional level) and competitiveness operational programmes, national authorities de facto identify and prioritise R&I investments in economic sectors/broad economic areas, with a view to addressing existing regional and socio-economic disparities.

Through **R&I partnerships**, we encourage greater private investment in R&I and support the further development of strategic value chains: the Framework Programmes since 2002 pool resources between the EU, the private sector (and also Member States) to tackle big challenges, support competitiveness and jobs, and incentivize investments from the industry.

- 17) **Other country characteristics.** How are other specific characteristics of countries (e.g. sectoral structure, R&D strengths) taken into account when designing innovation policies aimed at improving R&D performance at EU level?

European structural and investment funds (ESIF) funding precisely aims at supporting R&I capacity building for those countries and regions which need to catch up (lower R&D intensity and performance) and strengthening the human resources base. Hence, it provides support to investments in research infrastructure, training of graduates, support to SMEs, support to knowledge transfer between the public science base and the private sector, etc.

4. R&D targets in the digital age

- 18) **Policy strategies.** Do current R&D and innovation policy debates and/or policy strategies at EU level address the opportunities and challenges of digital and AI-driven innovation?

According to the OECD⁴⁴, in 2017 the EU28 only accounted for 8% of the global share in AI private equity investments. With the Declaration on Cooperation on Artificial Intelligence (2018) and the **Coordinated Plan on Artificial Intelligence 'Made in Europe'** (2018), the EU and the Member States demonstrated their ambition to align priorities and maximise the impact of public and private investments in AI to enable innovation and collectively ensure that the EU as a whole can compete globally. The EU Digital Strategy wants to ensure not only that Europe is a global digital player but also that the EU leads in making sure that technology works for all, and that we live in an open, democratic and sustainable digital society.

The 'White Paper on **Artificial Intelligence – A European approach to excellence and trust**'⁴⁵ outlines the Commission's vision for a European approach to AI, building on its

⁴³Thematic Smart Specialisation Platforms have brought together 100 regions working in 20 interregional partnerships in a broad range of areas (Marine Renewable Energy, Sustainable Buildings, Bio-energy, Smart Grids, Solar Energy, High-Technology Farming, Traceability and Big Data, Smart Electronic Systems, Bio-economy applied to the agri-food sector, Advanced Manufacturing for Energy Applications, Bio-economy applied to the industrial sector, Efficient and Sustainable Manufacturing, High Performance Production through 3D Printing, New nano-enabled Products, Industry 4.0 for SMEs, Innovative Textile, Medical Technologies, Sports, Tourism and Photonics) to foster innovation, business linkages along value chains in view of developing joint investments. https://ec.europa.eu/regional_policy/en/newsroom/news/2017/07/18-07-2017-commission-acts-to-help-regions-build-resilient-economies-in-the-era-of-globalisation

⁴⁴OECD (2018). Private Equity Investment in Artificial Intelligence. December 2018

⁴⁵https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf

existing strengths (research, robotics, manufacturing, EU research funding, coordinated plan with the MS), respecting European values (ethics, privacy protection) and presenting the main challenges. In order to overcome these challenges, the White Paper describes actions to build an ‘ecosystem of excellence’ to encourage investment, on the one hand, and an ‘ecosystem of trust’ through a regulatory framework, on the other. For AI ‘made in Europe’, the ethics-by design approach will play a key role in ensuring that ethical and legal principles are embedded at the very outset of system development.

- 19) **Policy initiatives.** Have specific policy initiatives to foster R&D been created or adjusted in view of changes in research and innovation practices brought about by digital technologies?

On 19 February 2020, the Commission published a White Paper and two Communications pertaining to the Digital Single Market, together referred to as the ‘**Digital Package**’. In ‘**Shaping Europe’s digital future**’⁴⁶, the Commission presents its overall vision and goals for the development and use of digital technologies in Europe, as well as a roadmap for future actions, Communications and regulatory initiatives. The aim of ‘**A European strategy for data**’⁴⁷ is for Europe to have a genuine single market for data so that the EU’s share of the data economy could correspond to its economic weight. The strategy includes setting up a governance framework (including regulatory action), increasing investment, and creating sector-specific common European data spaces. Data spaces for industry (manufacturing), the Green Deal and health data, are among those being proposed, as well as the European Open Science Cloud.

In the context of **COVID-19**, all over the world, ambitious R&I projects and collaborations to track, monitor and contain the COVID-19 pandemic are increasingly being carried out, including AI-powered solutions. AI-related applications have enabled population screening, tracking the spread of the infection, and the detection and diagnosis of COVID-19. The new Pan European Privacy- Preserving Proximity Tracing initiative, comprising more than 130 members across eight European countries, is one of several endeavours to set up a tracking system using mobile phones and anonymised data in compliance with the European GDPR. An important challenge in this respect would be to ensure the compatibility of such national systems across the EU.

The European Commission has launched an initiative to collect ideas about deployable AI and robotics solutions as well as information on other initiatives that could help us to face the ongoing COVID-19 crisis⁴⁸. To date, this inventory has shown that the R&I community and enterprises have been very active in coming up with such solutions. At the same time, openly accessible, machine-readable, interoperable data is needed to track, monitor and forecast the spread of COVID-19 and is essential for the “success” of AI. Key datasets include clinical, epidemiological and laboratory data. At the EU level, the **Action Plan - Research data-sharing platform for the SARS-CoV-2 and COVID-19 disease**, launched by the EMBL’s European Bioinformatics Institute (EMBL-EBI) and the **European Open Science Cloud** intends to speed up and improve the sharing, storage, processing of and access to research data and metadata on the SARS-CoV-2 and COVID-19 diseases.

- 20) **New targets.** Do the abovementioned digital/AI-related innovation strategies or initiatives include quantitative targets?

⁴⁶ https://ec.europa.eu/info/sites/info/files/communication-shaping-europes-digital-future-feb2020_en_3.pdf

⁴⁷ https://ec.europa.eu/info/sites/info/files/communication-european-strategy-data-19feb2020_en.pdf

⁴⁸ <https://ec.europa.eu/digital-single-market/en/news/join-ai-robotics-vs-covid-19-initiative-european-ai-alliance>

The Recovery and Resilience Facility⁴⁹ offers an unprecedented opportunity to speed up the recovery in Europe and reinforce the commitment to the twin transitions: green and digital. To ensure effective implementation, the Commission proposes that each recovery and resilience plan should include a **minimum level of 20% of expenditure to foster digital transition**. This includes, for instance, investing in the deployment of 5G and Gigabit connectivity, developing digital skills through reforms of education systems and increasing the availability and efficiency of public services using new digital tools.

In the Communication “Artificial Intelligence for Europe”⁵⁰, the Commission proposed

- The EU as a whole (public and private sectors combined) should aim to increase **research and development investment in AI** to at least EUR 20 billion by the end of 2020. It should then aim for more than EUR 20 billion per year over the following decade (this objective does not pre-empt any decision to be taken with respect to the next EU multiannual financial framework).
- To support joint efforts, the Commission is increasing **investments in AI under the research and innovation framework programme Horizon 2020** to around EUR 1.5 billion by the end of 2020 (this works out as an average of EUR 500 million per year and represents an increase of around 70%). Under the existing public-private partnerships (for example in robotics and big data), this investment will trigger an additional EUR 2.5 billion over the same period.

⁴⁹ https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en

⁵⁰ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018%3A237%3AFIN>